



## Instructions and Maintenance Manual

Compact Rotary Actuator  
Series 56-C(D)RQ2



II 3G

60°C (T6) Ta 0°C to 40°C  
80°C (T6) Ta 40°C to 60°C

Read this manual before using this product.

For future reference, please keep this manual in a safe place.

The information within this document is to be used by pneumatically trained personnel only.

This manual should be read in conjunction with the current catalogue.

Marking description

II 3G

60°C (T6) Ta 0°C to 40°C  
80°C (T6) Ta 40°C to 60°C

Group II

Category 3

Suitable for Gas environment

Max surface temperature 60°C and temperature class T6 when ambient temperature is from 0°C to 40°C

Max surface temperature 80°C and temperature class T6 when ambient temperature is from 40°C to 60°C

## 1 SAFETY RECOMMENDATION

### 1.1 General recommendation

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by label of "Caution", "Warning" or "Danger". To ensure safety, be sure to observe ISO4414 (Note1), JIS B 8370 (Note2) and other safety practices.

Note1: ISO 4414: Pneumatic fluid power - General rules relating to systems. Note 2:JIS B 8370:Pneumatic system axiom.



**CAUTION:** Operator error could result in injury or equipment damage.



**WARNING:** Operator error could result in injury or loss of life.



**DANGER:** In extreme conditions, there is possible result of serious injury or loss of life.



### WARNING

- The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**  
Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.
- Only trained personnel should operate pneumatically operated machinery and equipment.**  
Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.
- Do not service machinery/equipment or attempt to remove component until safety is confirmed.**
  - Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
  - When equipment is to be removed, confirm the safety process as mentioned above. Switch off air and electrical supplies and exhaust all residual compressed air in the system.
  - Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of cylinders etc. (Bleed air into the system gradually to create backpressure, i.e. incorporate a soft-start valve).
- Contact SMC if the product is to be used in any of the following conditions:**
  - Conditions and environments beyond the given specifications, or if product is used outdoors.
  - Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
  - Applications, which have the possibility of having negative effects on people, properties or animals, requiring special safety analysis.

### 1.2 Conformity to standard

This product if certified to and complies with the following standards:

- Directive 94/9/EC
- EN 13463-1:2001  
Non-electrical equipment for potentially explosive atmospheres  
Part 1: Basic method and requirements

## 2 INTENDED CONDITIONS OF USE

Size	10	15	20	30	40
Fluid	Air				
Max. operating pressure	0.7 MPa		1.0 MPa		
Min. operating pressure	0.15 MPa		0.1 MPa		
Ambient temp. and operating fluid temp.	0° to 60°C (No freeze)				
Lubrication	Not required				
Cushion	Rubber cushion		None, air cushion		
Angle adjustment	±5°				
Rotation angle (°)	80°~100°, 170°~190°				
Safe adjustment range of rotating time	0.2~0.7 (s/90°)		0.2~1.0 (s/90°)		
Supporting style	Basic type				
Effective torque (Conditions: 0.5 MPa)	0.3 Nm	0.75 Nm	1.8 Nm	3.1 Nm	5.3 Nm
Explosive atmosphere	Gas				
Zone	2				

Size	Allowable kinetic energy (J)			Cushion angle
	No cushion	Rubber cushion	Air cushion	
10	-	2.5 x 10 <sup>-4</sup>	-	-
15	-	3.9 x 10 <sup>-4</sup>	-	-
20	0.025	-	0.12	40°
30	0.048	-	0.25	40°
40	0.081	-	0.40	40°



### WARNING

- Select a speed within the product's allowable values.
- Provide a shock absorber if the kinetic energy of the system connected to the product exceeds the allowable value. Do not generate any impacts between metal parts when the shock absorber is set up.
- Do not stop or hold the product in an intermediate position by keeping air pressure in the product.
- Allowable kinetic energy of cushion type is the max. adsorbed energy when the cushion needle adjustment is optimum.
- If the product is used in the low speed range below the specified speed adjustment range, it could cause the product to stick, slip, or to stop its movement.

### 2.1 Production batch code

The production batch code printed on the label indicates the month and year of production as per the following table:

Production batch codes								
Year Month	2003	2004	2005	...	2021	2022	2023	...
	H	I	J	...	Z	A	B	...
Jan	O	HO	IO	JO	...	ZO	AO	BO
Feb	P	HP	IP	JP	...	ZP	AP	BP
Mar	Q	HQ	IQ	JQ	...	ZQ	AQ	BQ
Apr	R	HR	IR	JR	...	ZR	AR	BR
May	S	HS	IS	JS	...	ZS	AS	BS
Jun	T	HT	IT	JT	...	ZT	AT	BT
Jul	U	HU	IU	JU	...	ZU	AU	BU
Aug	V	HV	IV	JV	...	ZV	AV	BV
Sep	W	HW	IW	JW	...	ZW	AW	BW
Oct	X	HX	IX	JX	...	ZX	AX	BX
Nov	Y	HY	IY	JY	...	ZY	AY	BY
Dec	Z	HZ	IZ	JZ	...	ZZ	AZ	BZ

## 3 INSTALLATION



### WARNING

- Do not install unless the safety instructions have been read and understood.
- Do not loosen the angle adjustment screw beyond the allowable adjustment range.
- Do not enlarge the fixed throttle by modifying the pipe connectors.
- Do not place a magnetic object near the product.
- Do not modify the product.
- If shaft couplings are to be used, use those which are free to rotate.

### 3.1 Environment



### WARNING

- Do not use in an environment where the product is directly exposed to corrosive gases, chemicals, salt water, water or steam.
- Do not use the rotary actuator in an area that contains a large amount of dust, or an area in which water or oil could be splashed on the rotary actuator.
- The product should not be exposed to prolonged sunlight such to generate surface temperature higher than the value given for temperature class. Use a protective cover.
- Do not mount the product in a location where it is subjected to strong vibrations such to generate surface temperature higher than the value given for temperature class. Avoid any kind of shock or impact.
- Do not mount the product in a location where it is exposed to radiant heat.

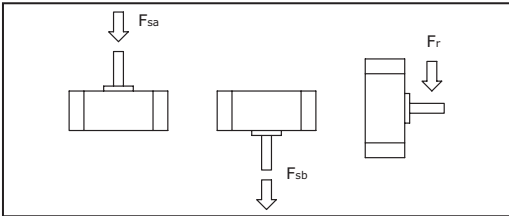
### 3.2 Mounting

#### 3.2.1 - Restrictions on the load applied to the shaft

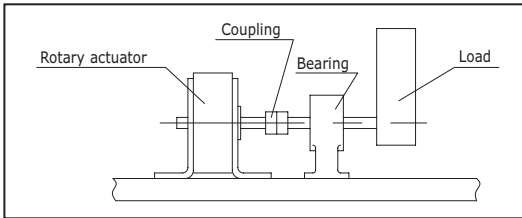
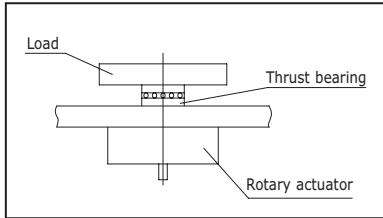
A static load, up to the values shown in the table below, can be applied to the actuator shaft, provided that a dynamic load is not generated. However, applications in which a load is directly applied to the shaft should be avoided as far as possible.

Size	Load direction		
	Fsa (N)	Fsb (N)	Fr (*) (N)
10	15.7	7.8	14.7
15	19.6	9.8	19.6
20	49	29.4	49
30	98	49	78
40	108	59	98

(\*) The point of application of the force Fr is the centre of the shaft flat or of the longer dimension of the key.

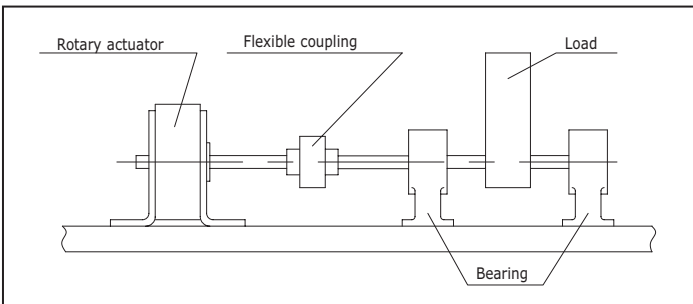


In operating conditions, radial and axial load should be avoided. In order to improve operating conditions and to avoid direct loads on the shaft, a method such as that shown in the drawing below is recommended.



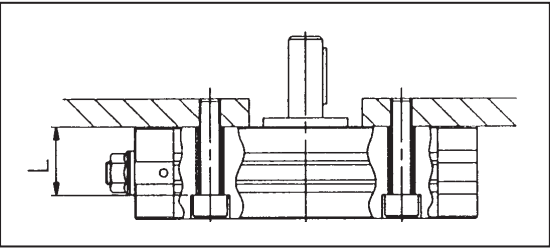
#### 3.2.2 - Axis fitting instruction

Alignment of the rotary actuator and the mating axis is necessary when the rotary actuator is used with its axis lengthened. If misaligned, partial load becomes high and the axis is applied with excessive bending moment. Under this condition, stable operation is not possible and the axis could be damaged. In this case, flexible joint (as specified by JIS) becomes necessary.



3.2.3 - Flange application

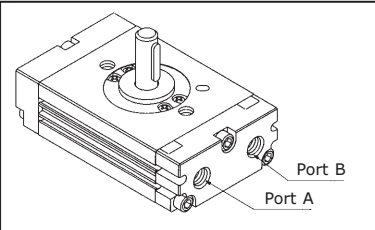
See the following table for L dimension of the body. JIS hexagon socket head bolt neatly fits in the counter bore of the rotary actuator.



Size	L (mm)	Bolt used
10	13	M 4
15	16	M 4
20	22.5	M 6
30	24.5	M 8
40	28.5	M 8

3.2.4 - Piping and operating direction

Piping ports and port sizes are shown below.

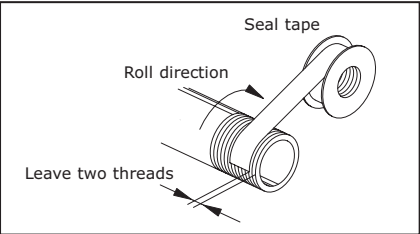


Size	Port Size
10	M5x0.8
15	
20	
30	Rc1/8, G1/8, NPT1/8, NPTF1/8
40	

The rotary actuator port is equipped with a fixed size orifice. Do not enlarge the hole. Enlarging the hole will increase the operation speed of the actuator and the consequent impact at the end of each stroke could lead to the actuator failure.

The shaft rotates clockwise when pressurized from port A. Perform the following operation before piping:

- Flush or clean the piping to eliminate metal swarf, cutting oil and dust; prevent piping swarf and sealing material from entering into the tubing when screwing in piping and fitting.
- When using the seal tape, leave 1.5~threads free.



3.2.5 - Operating air

Ensure that air supplied to the rotary actuator is filtered. CRQ2 series is lubrication free.

3.3 Electrical connection

⚠ WARNING

- Provide grounding connection to the actuator to avoid any spark arising from potential differences.

4 AIR-CUSHION ADJUSTMENT

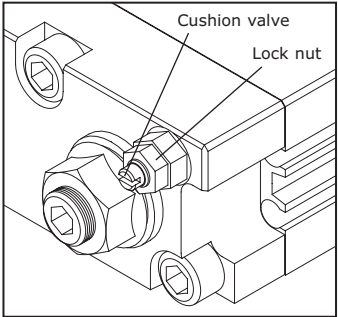
- To make a speed adjustment, gradually adjust starting from the low speed end.
- The cushion needle is not adjusted at the time of shipment. Therefore, an adjustment must be made in accordance with the operating speed and the moment of inertia of the load.
- Do not use the rotary actuator with its cushion needle in the fully closed state.
- Do not apply excessive force to loose the cushion needle.

Rotary actuator is not adjusted so that the cushions work during shipment. Rotating the cushion valve in clockwise direction reduces the orifice diameter and increases cushion effect, rotating it in counter-clockwise direction increases orifice diameter and reduces cushion effect.

Tighten the cushion valve lock nut properly. A loose lock nut could lead the cushion valve to move from its initially set. Cushion packing wears out during long periods of operation, and cushioning becomes weaker. Re-adjustment is necessary.

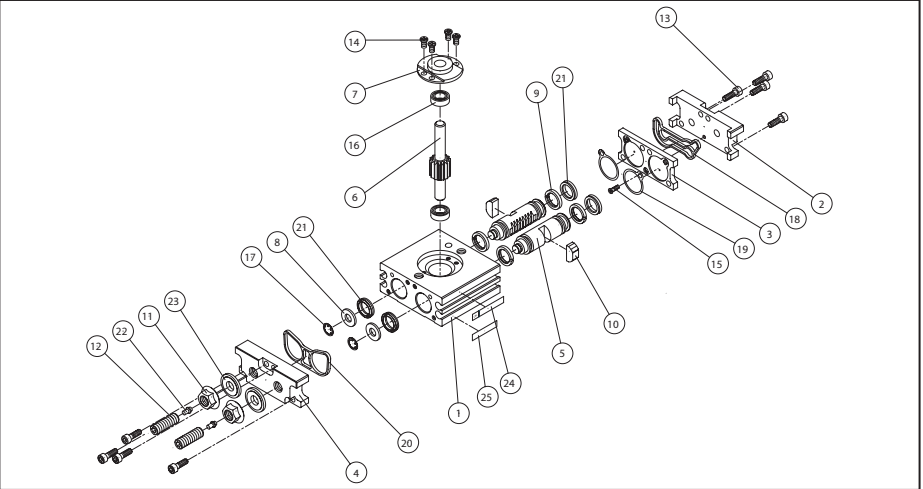
Don't operate the actuator with the cushion valve orifice completely closed. The piston may impact into the stroke ends, not fully travel, and the pressure could exceed the proof pressure of the cushion packing.

Don't start the actuator with the cushion valve orifice completely open. Since this means an actuator without a cushion, the impact is large. If the actuator operates with kinetic energy in this condition, the rotary actuator may break.



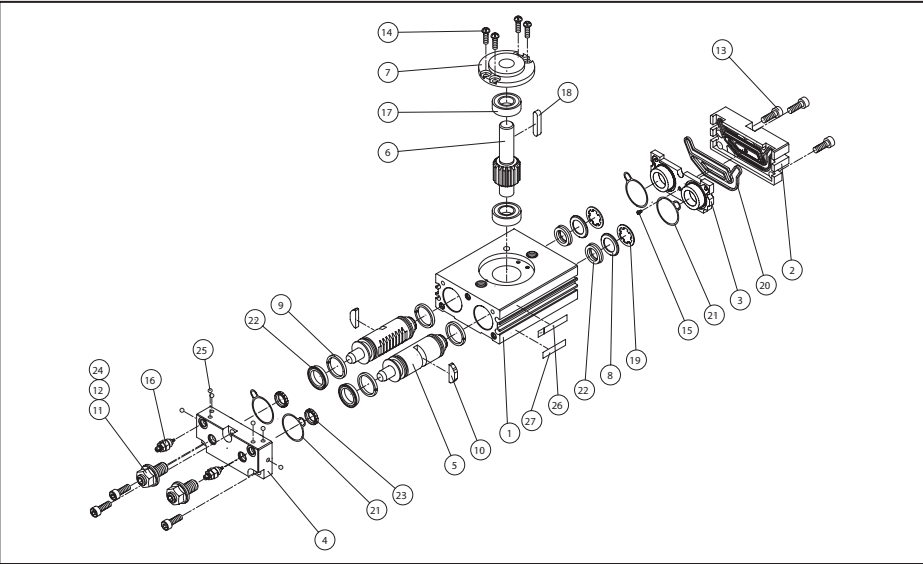
5 INTERNAL STRUCTURE AND PARTS DESCRIPTION

5.1 Size 10, 15



25	ATEX label	1	For ATEX category 2
24	Product label	1	
23	Seal washer	2	
22	Cushion pad	2	
21	Piston seal	4	
20	End cover gasket	1	
19	Cover gasket	2	
18	Seal	1	
17	C S type snap ring	2	
16	Bearing	2	
15	Round head No.0 Phillips screw	1	
14	Round head No.0 Phillips screw	4	
13	Hexagon socket head cap screw	8	
12	Hexagon socket head set screw	2	
11	Hexagon nut with flange	2	
10	Magnet	2	With magnet built-in type only
9	Wear ring	4	
8	Seal retainer	2	
7	Bearing retainer	1	
6	Shaft	1	
5	Piston	2	
4	End cover	1	
3	Plate	1	
2	Cover	1	
1	Body	1	
No.	Description	Qty.	Note

5.2 Size 20, 30, 40



27	ATEX label	1	For ATEX category 2
26	Product label	1	
25	Steel balls	4	No cushion type Cushion type
24	Seal washer	2	
23	Cushion seal	2	With cushion type only
22	Piston seal	4	
21	Gasket	4	
20	Seal	1	
19	C S type snap ring	2	
18	Parallel key	1	
17	Bearing	2	
16	Cushion valve assembly	2	With cushion type only
15	Round head No.0 Phillips screw	1	
14	Round head Phillips screw	4	
13	Hexagon socket head cap screw	6	
12	Hexagon socket head set screw	2	
11	Hexagon nut with flange	2	
10	Magnet	2	With magnet built-in type only
9	Wear ring	4	
8	Seal retainer	2	
7	Bearing retainer	1	
6	Shaft	1	
5	Piston	2	
4	End cover	1	
3	Plate	1	
2	Cover	1	
1	Body	1	
No.	Description	Qty.	Note

6 MAINTENANCE

Do not dismantle the product. Products dismantled and re-assembled by end-users are not covered by guarantee. Please send it back to the factory when exchange and repairing of parts are necessary.

7 LIMITATIONS OF USE

⚠ WARNING

- Do not exceed any of the specifications laid out in section 2 of this document or the specific product catalogue.
- Do not modify the product.

⚠ DANGER

- Air equipment has standard air leakage within certain limits.
- Do not use this equipment when the air itself can lead to danger of explosion.

⚠ CAUTION

- Do not install and use this equipment in case of vibration, which could lead to equipment failure. Contact SMC for this specific situation.

⚠ WARNING

- External impact on the rotary actuator body could result in spark and/or rotary actuator damage. Avoid any application where foreign objects can hit the rotary actuator. In such situations install suitable guard to prevent such impacts.
- Use only ATEX certified auto-switch. Order them separately.
- Do not use in presence of strong magnetic fields, which could generate surface temperature higher than the value given for the temperature class.

8 EUROPEAN CONTACT LIST

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Finland	(358) 9-859 580	Portugal	(351) 22 610 89 22
France	(33) 1-64 76 1000	Spain	(34) 945-18 4100
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Greece	(30) 1- 342 6076	Switzerland	(41) 52-396 3131
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