

Shock Absorber: Short Type

Series *RBQ*

Allowable eccentric angle is 5°

Ideal for absorption of rotating energy

Specifications

Specifications	Model	Basic type	RBQ1604	RBQ2007	RBQ2508	RBQ3009	RBQ3213
	With bumper	RBQC1604	RBQC2007	RBQC2508	RBQC3009	RBQC3213	
Max. energy absorption (J)			1.96	11.8	19.6	33.3	49.0
Stroke absorption (mm)			4	7	8	8.5	13
Collision speed (m/s)	0.05 to 3						
Max. operating frequency * (cycle/min)			60	60	45	45	30
Max. allowable thrust (N)			294	490	686	981	1177
Ambient temperature (C°)	-10 to 80						
Spring force (N)	Extended		6.08	12.75	15.69	21.57	24.52
	Retracted		13.45	27.75	37.85	44.23	54.23
Weight (g)			28	60	110	182	240
Option/Stopper nut			RBQ16S	RB20S	RBQ25S	RBQ30S	RBQ32S

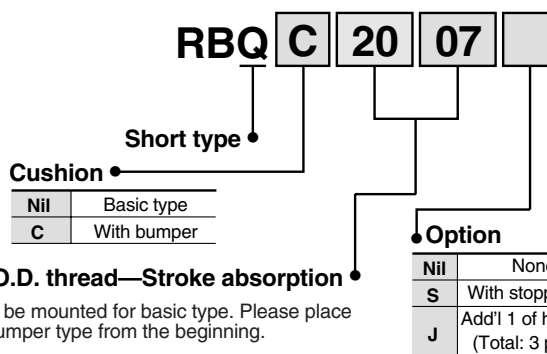
* It denotes the values at the maximum energy absorption per one cycle. Therefore, the operating frequency can be increased according to the energy absorption.



With bumper
Series RBQC

Basic type
Series RBQ

How to Order



Replacement part no./Bumper

RBQC 16 C

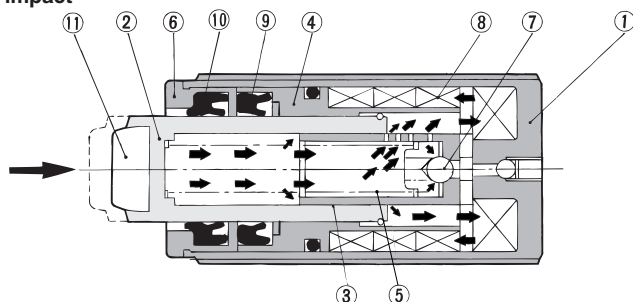
Applicable model

16-RBQC1604
20-RBQC2007
25-RBQC2508
30-RBQC3009
32-RBQC3213

* 2 mounting hexagon nuts are attached as standard.

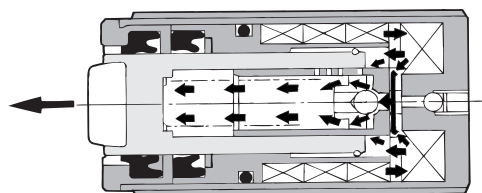
Construction

At impact



An impact object that strikes against the piston rod end pressurizes oil inside the piston. Thus, pressurized oil jets out through the orifice inside the piston, thereby generating hydraulic resistance to absorb the energy of the impacting object. The oil jetted out through the orifice is collected inside the outer tube by means of the stretching action of the accumulator.

At returning



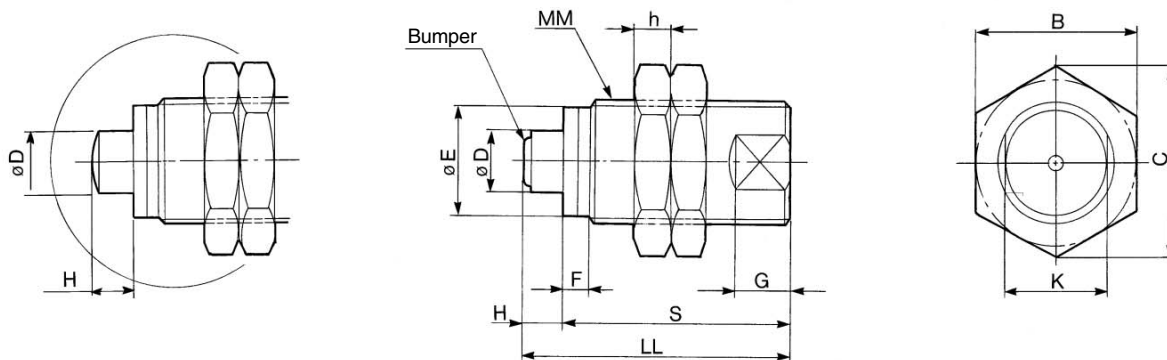
When the impact object is removed, the return spring pushes out the piston rod, and negative pressure, generated at the same time, opens the check ball to permit oil to return to the shock absorber ready for the next impact.

Component Parts

No.	Description	Material	Treatment
①	Outer tube	Rolled steel	Black nickel plated
②	Piston rod	Special steel	Heat treated, Hard chrome plated
③	Piston	Special steel	Heat treated
④	Bearing	Special bearing material	
⑤	Return spring	Piano wire	Zinc chromated
⑥	Stopper	Carbon steel	Zinc chromated

No.	Description	Material	Treatment
⑦	Check ball	Bearing steel	
⑧	Accumulator	Fluoro rubber	Foam rubber
⑨	Rod seal	NBR	
⑩	Scraper	NBR	
⑪	Bumper	Polyurethane	Only with bumper

Dimensions



Series RBQ
Basic type

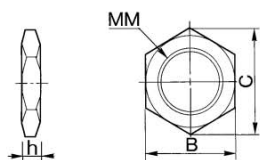
Series RBQC
With bumper

Model		Shock absorber									Hexagon nut			
Basic type	With bumper	D	E	F	H	K	G	LL	MM	S	B	C	h	
RBQ1604	RBQC1604	6	14.2	3.5	4	14	7	31	M16 x 1.5	27	22	25.4	6	
RBQ2007	RBQC2007	10	18.2	4	7	18	9	44.5	M20 x 1.5	37.5	27	31.2	6	
RBQ2508	RBQC2508	12	23.2	4	8	23	10	52	M25 x 1.5	44	32	37	6	
RBQ3009	RBQC3009	16	28.2	5	8.5	28	12	61.5	M30 x 1.5	53	41	47.3	6	
RBQ3213	RBQC3213	18	30.2	5	13	30	13	76	M32 x 1.5	63	41	47.3	6	

(mm)

Hexagon Nut

(2 pcs. standard equipment)

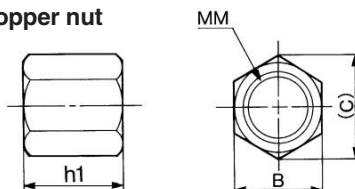


Part no.	MM	h	B	C
RBQ16J	M16 x 1.5	6	22	25.4
RB20J ⁽¹⁾	M20 x 1.5	6	27	31.2
RBQ25J	M25 x 1.5	6	32	37
RBQ30J	M30 x 1.5	6	41	47.3
RBQ32J	M32 x 1.5	6	41	47.3

Note 1) In the case of RB20J, RB and RBQ are common.

Option

Stopper nut

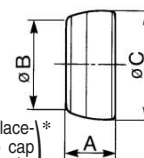


Part no.	B	C	h1	MM
RBQ16S	22	25.4	12	M16 x 1.5
RB20S ⁽²⁾	27	31.2	16	M20 x 1.5
RBQ25S	32	37	18	M25 x 1.5
RBQ30S	41	47.3	20	M30 x 1.5
RBQ32S	41	47.3	25	M32 x 1.5

Note 2) In the case of RB20S, RB and RBQ are common.

Replacement Parts

Bumper



(These are the replacement part for the cap type. Not available for the basic type.)*

Part no.	A	B	C
RBQC16C	3.5	4	4.7
RBQC20C	4.5	8	8.3
RBQC25C	5	8.3	9.3
RBQC30C	6	11.3	12.4
RBQC32C	6.6	13.1	14.4

RE^A_B

REC

C□X

C□Y

MQ^Q_M

RHC

MK(2)

RS^Q_G

RS^H_A

RZQ

MI^W_S

CEP1

CE1

CE2

ML2B

C^J_G5-S

CV

MVGQ

CC

RB

J

D-

-X

20-

Data

Series RBQ/Shock Absorber: Short Type Technical Data:

Model Selection

Model Selection Step

1. Type of impact

- Cylinder stroke at load (Horizontal)
- Cylinder stroke at load (Downward)
- Cylinder stroke at load (Upward)
- Conveyor stroke at load (Horizontal)
- Free dropping impact
- Rotating impact (With torque)

2. Enumeration of operating conditions

Symbol	Operating conditions	Unit
m	Impacting object weight	kg
v	Collision speed	m/sec
h	Dropping height	m
ω	Angle speed	rad/sec
r	Distance between axis of cylinder and impact point	m
d	Bore size	mm
p	Cylinder operation pressure	MPa
F	Thrust	N
T	Torque	N·m
n	Operation cycle	cycle/min
t	Ambient temperature	°C
μ	Friction coefficient	—

3. Specifications and operational instructions

Ensure that the collision speed, thrust, operation cycle, the ambient temperature and atmosphere fall within the specifications.
*Be aware of the min. installation radius in the case of rotating impacts.

4. Calculation of kinetic energy E₁

Using the equation suitable for the classification of impact.

In the case of cylinder stroke at load and free horizontal impact, substitute respective figures for **Data A** in order to calculate E₁.

5. Calculation of thrust energy E₂

Select any shock absorber as a provisional model.

In the case of thrust energy of cylinder E₂, substitute respective figures for **Data B** or **Data C**.

6. Calculation of corresponding weight of impacting object Me

Absorbed energy $E = E_1 + E_2$

Corresponding weight of impacting object $M_e = \frac{2}{v^2} \cdot E$

Substitute both absorbed energy E and collision speed v for **Data A** in order to calculate the corresponding weight of the impacting object.

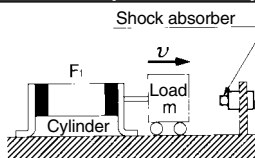
7. Selection of applicable model

Taking into consideration the corresponding weight of the impacting object Me, calculated using **Data D** and collision speed v, check provisional model compatibility with the condition of application. If this is satisfactory, then the said provisional model will be the applicable one.

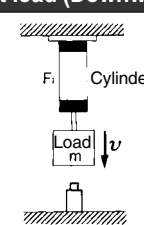
Caution on Selection

In order for the shock absorbers to operate accurately for long hours, it is necessary to select a model that is well-suited to your operating conditions. If the impact energy is smaller than 5% of the maximum energy absorption, select a model that is one class smaller.

Selection Example

Cylinder stroke at load (Horizontal)	
1. Type of impact	
Collision speed ⁽¹⁾ v	v
Kinetic energy E ₁	$\frac{1}{2} \cdot m \cdot v^2$
Thrust energy E ₂	F ₁ · S
Absorbed energy E	E ₁ + E ₂
Corresponding ⁽²⁾ weight of impacting object Me	$\frac{2}{v^2} \cdot E$
2. Operating conditions	m = 20 kg v = 0.7 m/s d = 40 mm p = 0.5 MPa n = 20 cycle/min t = 25°C
3. Specifications and operational instructions	<ul style="list-style-type: none"> ● Confirmation of specifications v ... 0.7 < 3 (max.) t ... -10 (min.) < 25 < 80 (max.) F ... F₁ - 628 < 686 (max.) <p style="text-align: center;">YES</p>
4. Calculation of kinetic energy E₁	<ul style="list-style-type: none"> ● Kinetic energy E₁ Use Formula to calculate E₁. Suitable 20 for m and 0.7 for v. <p style="text-align: center;">E₁ ≒ 4.9 J</p>
5. Calculation of thrust energy E₂	<ul style="list-style-type: none"> ● Thrust energy E₂ Provisionally select a model RBQ2508 and make the use of Data B. According to d = 40, E₂ is obtained. <p style="text-align: center;">E₂ ≒ 5.0 J</p>
6. Calculation of corresponding weight of impacting object Me	<ul style="list-style-type: none"> ● Corresponding weight of impacting object Me Use the formula "Absorbed energy E = E₁ + E₂ = 4.9 + 5.0 = 9.9 J" to calculate Me. Substitute 9.9 J for E and 0.7 for v. <p style="text-align: center;">Me ≒ 40 kg</p>
7. Selection of applicable model	<ul style="list-style-type: none"> ● Selection of applicable model According to Data D, the tentatively selected RBQ2508 satisfies Me = 40 kg < 60 kg at v = 0.7. Ultimately, it will result in an operating frequency of n ... 30 < 45, without causing a problem. <p style="text-align: center;">YES</p> <p style="text-align: center;">Select RBQ2508</p>

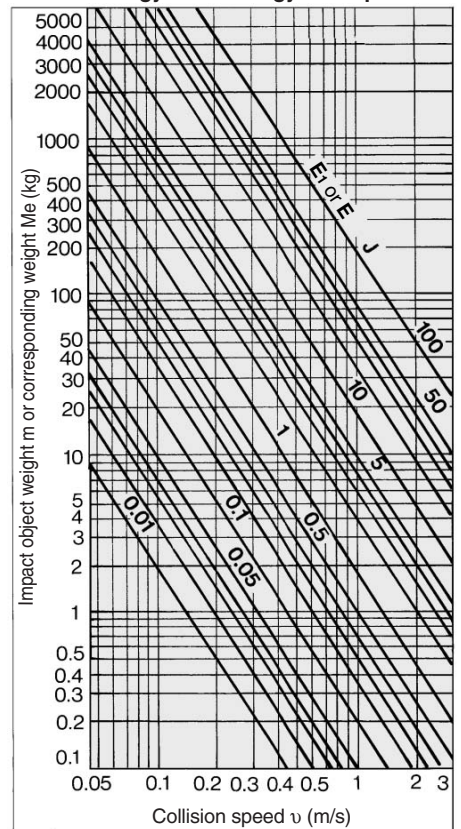
1. Type of Impact

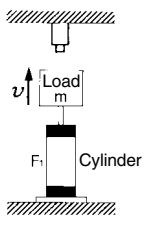
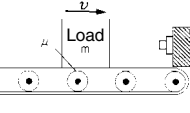
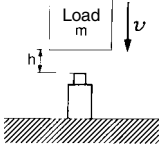
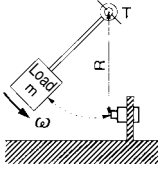
Cylinder stroke at load (Downward)	
Type of impact	
Collision speed ⁽¹⁾ v	v
Kinetic energy E ₁	$\frac{1}{2} \cdot m \cdot v^2$
Thrust energy E ₂	F ₁ · S + m · g · S
Absorbed energy E	E ₁ + E ₂
Corresponding ⁽²⁾ weight of impacting object Me	$\frac{2}{v^2} \cdot E$

Note 1) Collision speed is momentary velocity at which object is impacting against shock absorber.

Data A

Kinetic Energy E₁ or Energy Absorption E



Cylinder stroke at load (Upward)	Conveyor stroke at load (Horizontal)	Free dropping impact	Rotating impact (Weight torque)
			
v	v	$\sqrt{2gh}$	$\omega \cdot R$
$\frac{1}{2} \cdot m \cdot v^2$	$\frac{1}{2} \cdot m \cdot v^2$	$m \cdot g \cdot h$	$\frac{1}{2} \cdot I \cdot \omega^2$
$F_1 \cdot S - m \cdot g \cdot S$	$m \cdot g \cdot \mu \cdot S$	$m \cdot g \cdot S$	$T \cdot \frac{S}{R}$
$E_1 + E_2$	$E_1 + E_2$	$E_1 + E_2$	$E_1 + E_2$
$\frac{2}{v^2} \cdot E$	$\frac{2}{v^2} \cdot E$	$\frac{2}{v^2} \cdot E$	$\frac{2}{v^2} \cdot E$

Symbol

Symbol	Specifications	Unit
d	Bore size	mm
E	Absorbed energy	J
E₁	Kinetic energy	J
E₂	Thrust energy	J
F₁	Cylinder thrust	N
g	Acceleration of gravity (9.8)	m/s ²
h	Dropping height	m
I⁽³⁾	Moment of inertia around the center of gravity	kg·m ²
n	Operating frequency	cycle/min
p	Cylinder operation pressure	MPa
R	Distance between axis of cylinder and impact point	m
S	Shock absorber stroke	m
T	Torque	N·m
t	Ambient temperature	°C
v	Collision speed	m/s
m	Impact object weight	kg
Me	Corresponding weight of impact object	kg
ω	Angle speed	rad/s
μ	Friction coefficient	—

Note 2) An "Impact body equivalent weight" is the weight of an impact object without involving thrust, into which an object's total energy has been converted.), refer to the catalog of rotary actuator. Hence, $E = \frac{1}{2} \cdot Me \cdot v^2$

Note 3) For the formula of moment of inertia I (kg·m²), refer to the catalog of rotary actuator.

Data B (Operating pressure 0.5 MPa)

Thrust Energy of Cylinder F₁S (J)

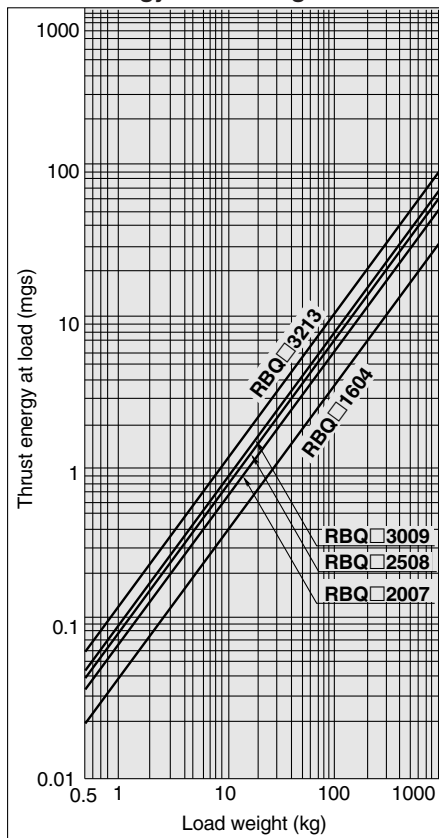
Model	RBQ□1604	RBQ□2007	RBQ□2058	RBQ□3009	RBQ□3213	
Stroke absorption (mm)	4	7	8	8.5	13	
Bore size d (mm)	6	0.057	0.099	0.113	0.120	0.184
	10	0.157	0.274	0.314	0.334	0.511
	15	0.353	0.619	0.707	0.751	1.15
	20	0.628	1.10	1.26	1.34	2.04
	25	0.982	1.72	1.96	2.09	3.19
	30	1.41	2.47	2.83	3.00	4.59
	40	2.51	4.40	5.03	5.34	8.17
	50	3.93	6.87	7.85	8.34	12.8
	63	6.23	10.9	12.5	13.2	20.3
	80	10.1	17.6	20.1	21.4	32.7
	100	15.7	27.5	31.4	33.4	51.1
	125	24.5	43.0	49.1	52.2	79.8
	140	30.8	53.9	61.6	65.4	100
	160	40.2	70.4	80.4	85.5	131
	180	50.9	89.1	102	108	165
200	62.8	110	126	134	204	
250	98.2	172	196	209	319	
300	141	247	283	300	459	

■ Operating pressure other than 0.5 MPa:
Multiply by the following coefficient.

Operating pressure (MPa)	1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Coefficient	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8

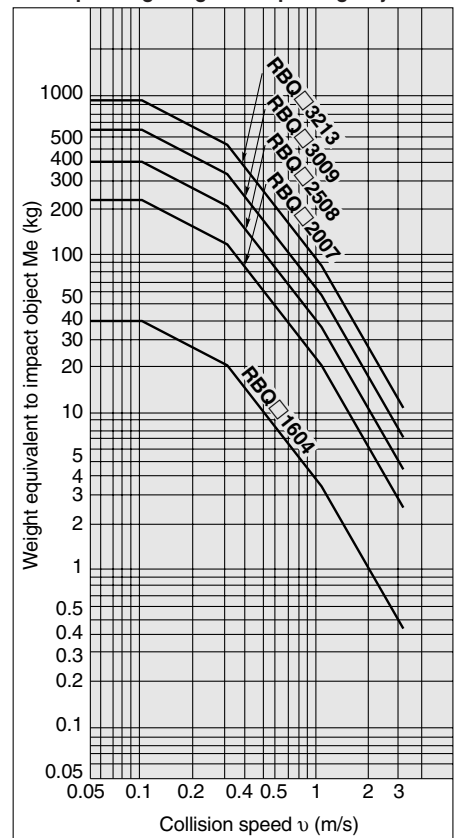
Data C

Thrust Energy at Load m·g·s



Data D

Corresponding Weight of Impacting Object Me



RE_B^A
REC
C□X
C□Y
MQ_M^Q
RHC
MK(2)
RS_G^Q
RS_A^H
RZQ
MI_S^W
CEP1
CE1
CE2
ML2B
C_G^J5-S
CV
MVGQ
CC
RB
J
D-
-X
20-
Data

⚠ Precautions

Be sure to read before handling. Refer to pages 10-24-3 to 10-24-6 for Safety Instructions and Actuator Precautions.

Selection

⚠ Danger

- 1. Energy absorption**
Select a model so that the aggregated energy of impact object should not exceed the maximum absorption energy. Otherwise, it could cause changes in properties or result in damaging the shock absorber.
- 2. Corresponding weight of impacting object**
Make a model selection, so that the corresponding weight of impacting object does not exceed the allowable range. Pulsation will occur in buffer and deceleration force, thus making it difficult to absorb shock smoothly.
- 3. Collision speed**
Use it in the conditions that collision speed is within the specified range. It could cause the changes in buffer characteristics or lead to damage a shock absorber.

⚠ Warning

- 1. Static load**
Design the system, so that any other forces than the buffer capacity or impacts should not be applied to the piston rod which is stopped at the retracted state.

⚠ Caution

- 1. Maximum operating frequency**
Design the system in the conditions under which it is not used at the frequency exceeding the specified maximum operating frequency. (But, the maximum operating frequency will vary depending on the absorbed energy.)
- 2. Stroke**
The maximum absorption energy in the specifications cannot be exerted unless the full stroke is used.
- 3. Work surface of an impact object**
The contact surface of the impact object with which the piston rod comes into contact must be highly rigid.
In the case without a cap, a high surface compression load is applied to the contact surface of the impact body with which the piston rod comes into contact. Therefore, the contact surface must be highly rigid (hardness of HRC35 or more).
- 4. Be aware of the return force of the impact object.**
If used in a conveyor drive, after the shock absorber has absorbed energy, it could be pushed back by the spring that is built-in. For the spring force in the specifications, refer to the column (page 10-18-10).
- 5. Selection of size**
As the number of operation proceeds, the maximum absorption energy of shock absorbers will be decreased by the following reasons such as abrasion, or deterioration, etc. of the internal working fluid. Taking this into consideration, selecting a size which is 20 to 40% affordable against the amount of absorption energy is recommended.
- 6. Drag characteristics**
In general, the values of drag (reactive force generated during operation) generated by the operating speed will vary in hydraulic shock absorber. And then, by adopting "Porous orifice construction", the RB series can adapt to such this fast/slow speed and can absorb shock smoothly in a wide range of speed.
But, the speed reduction (speed reduction G) would be larger around the stroke terminal, depending upon the operating conditions. Please note that it might be encountered that stroke time is long, motion is not smooth, etc. If this would be a problem, we recommend that stroke amount should be restricted by using our optional component like "Stopper nut", etc. Including this case, if the data on operational status (stroke time, reactive force, deceleration, etc.) are required, please consult with SMC.

Operating Environment

⚠ Danger

- 1. Operation in an environment which requires explosion-proof**
 - When mounting in places where static electricity is accumulated, implement a distribution of electrical energy by grounding.
 - Do not use the materials for buffer face which might cause to spark by collision.

⚠ Warning

- 1. Pressure**
Do not use it in the vacuum state, which is substantially different from the atmospheric pressure (above sea level) and in the atmosphere under being pressurized.

- 2. Using inside a clean room**

Do not use the shock absorber in a clean room, as it could contaminate the clean room.

⚠ Caution

- 1. Temperature range**
Do not use it, exceeding the specified allowable temperature range. Seal could be softened or hardened or worn out, or leading to leak a working fluid, deterioration, or impact characteristic changes.
- 2. Deterioration by atmosphere**
Do not use in an atmosphere such as salt damage, sulfurous acid gas which makes the metal corroded, or having solvent, etc. which makes seal deteriorated.
- 3. Deterioration by ozone**
Do not use it under the direct sunlight on the beach, or by the mercury lamp, or the ozone generator, because the rubber material will be deteriorated by ozone.
- 4. Cutting oil, water, blown dust**
Do not use the product under the condition, where the liquid such as cutting oil, water, blown dust, solvent, etc. is exposed either directly or in atomized form to the piston rod, or where blown dust could be adhered around the piston rod. This could cause malfunction.
- 5. Vibration**
When vibrations are applied on impact objects, implement a secure guide on impact objects.

Mounting

⚠ Warning

- 1. Before performing installation, removal, or stroke adjustment, make sure to cut the power supply to the equipment and verify that the equipment has stopped.**
- 2. Installation of protective cover**
We recommend the protective cover should be installed in the case workers might be getting close during the operation.
- 3. The rigidity of the mounting frame must be taken into consideration**
If the mounting frame lacks strength, the shock absorber will vibrate after an impact, causing bearing wear and damage.
Load on mounting plate can be calculated as follows.

$$\text{Load on mounting plate } N \cong 2 \frac{E (\text{Absorbed energy J})}{S (\text{Stroke m})}$$

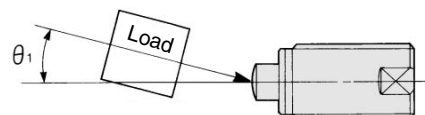
⚠ Warning

- 1. Tightening torque of mounting nut should be as follows.**
When threading on a mounting frame in order to mount a shock absorber directly, prepared hole dimensions are referred to the table below.
For tightening torque of a nut for shock absorber, kindly abide by the table below.
If the tightening torque that is applied to the nut exceeds the value given below, the shock absorber itself could become damaged.

Model	RBQ(C)1604	RBQ(C)2007	RBQ(C)2508	RBQ(C)3009	RBQ(C)3213
O.D. thread (mm)	M16 x 1.5	M20 x 1.5	M25 x 1.5	M30 x 1.5	M32 x 1.5
Thread prepared bore (mm)	ø14.7 ^{+0.1} / ₀	ø18.7 ^{+0.1} / ₀	ø23.7 ^{+0.1} / ₀	ø28.7 ^{+0.1} / ₀	ø30.7 ^{+0.1} / ₀
Tightening torque (N·m)	14.7	23.5	34.3	78.5	88.3

- 2. Deviation of impact**

The installation must be designed so that the impact body is perpendicular to the shock absorber's axial center. An angle of deviation that exceeds 5° will place an excessive load on the bearings, leading to oil leaks within a short period of operation.



Allowable eccentric angle $\theta_1 < 5^\circ$

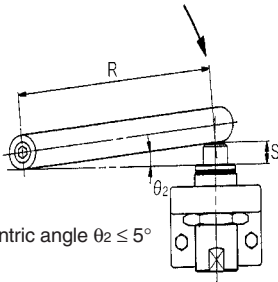
⚠ Precautions

Be sure to read before handling. Refer to pages 10-24-3 to 10-24-6 for Safety Instructions and Actuator Precautions.

Mounting

3. Rotating angle

If rotating impacts are involved, the installation must be designed so that the direction in which the load is applied is perpendicular to the shock absorber's axial center.
The allowable rotating eccentric angle until the stroke end must be $\theta_2 \leq 5^\circ$.



Allowable rotating eccentric angle $\theta_2 \leq 5^\circ$

Installation Conditions for Rotating Impact (mm)

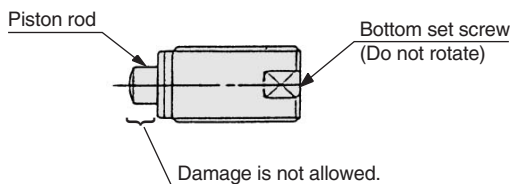
Model	S (Stroke)	θ_2 (Allowable rotating angle)	R (Min. installation radius)
RBQ□1604	4	5°	46
RBQ□2007	7		80
RBQ□2508	8		92
RBQ□3009	8.5		98
RBQ□3213	13		149

4. Do not scratch the sliding portion of the piston rod or the outside threads of the outer tube.

Failure to observe this precaution could scratch or gouge the sliding portion of the piston rod, or damage the seals, which could lead to oil leakage and malfunction. Furthermore, damage to outside threaded portion of the outer tube could prevent the shock absorber from being mounted onto the frame, or its internal components could deform, leading to a malfunction.

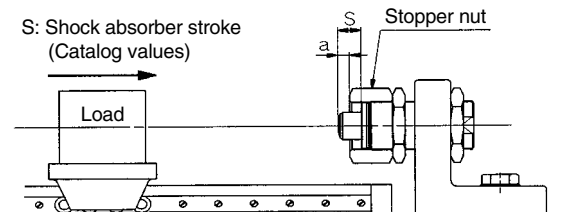
5. Never turn the screw on the bottom of the body.

This is not an adjusting screw. Turning it could result in oil leakage.



6. Adjust the stopping time through the use of the stopper nut, as follows:

Control the stopping time of the impact object by turning the stopper nut in or out (thus changing length "a"). After establishing the stopper nut position, use a hexagon nut to secure the stopper nut in place.



Maintenance

⚠ Caution

1. Check the mounting nut is not loosen.

The shock absorber could become damaged if it is used in a loose state.

2. Pay attention to any abnormal impact sounds or vibrations.

If the impact sounds or vibrations have become abnormally high, the shock absorber may have reached the end of its service life. If this is the case, replace the shock absorber. If use is continued in this state, it could lead to equipment damage.

3. Confirm that abnormality, oil leakage, etc. in the outward surface.

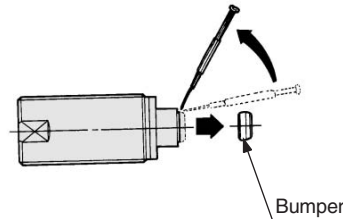
When a large amount of oil is leaking, replace the product, because it is believed to be happening something wrong with it. If it keeps on using, it may cause to break the equipment which is mounted by this product.

4. Inspect the bumper for any cracks or wear.

If the shock absorber comes with a bumper, the damper could wear first. To prevent bumper to the impact object, replace the bumper often.

5. How to replace bumper

The bumper inserted into the piston rod can be removed easily by a small screwdriver. When reassembling, push the smaller end of the bumper inside the piston.



RE^A_B

REC

C□X

C□Y

MQ^Q_M

RHC

MK(2)

RS^Q_G

RS^H_A

RZQ

MI^W_S

CEP1

CE1

CE2

ML2B

C^J_{5-S}

CV

MVGQ

CC

RB

J

D-

-X


20-


Data




Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labels of "Caution", "Warning" or "Danger". To ensure safety, be sure to observe ISO 4414 ^{Note 1)}, JIS B 8370 ^{Note 2)} and other safety practices.

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

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

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

Note 1) ISO 4414: Pneumatic fluid power--General rules relating to systems.

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

Warning

1. 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. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

2. 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.

3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.

1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driver objects have been confirmed.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc.

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.



Actuator Precautions 1

Be sure to read before handling.
For detailed precautions on every series, refer to main text.

Caution on Design

Warning

- 1. There is a possibility of dangerous sudden action by air cylinders if sliding parts of machinery are twisted due to external forces, etc.**

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be adjusted to operate smoothly and designed to avoid such dangers.

- 2. A protective cover is recommended to minimize the risk of personal injury.**

If a stationary object and moving parts of a cylinder are in close proximity, personal injury may occur. Design the structure to avoid contact with the human body.

- 3. Securely tighten all stationary parts and connected parts so that they will not become loose.**

Especially when a cylinder operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

- 4. A deceleration circuit or shock absorber may be required.**

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the impact. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact.

In this case, the rigidity of the machinery should also be examined.

- 5. Consider a possible drop in circuit pressure due to a power outage, etc.**

When a cylinder is used in a clamping mechanism, there is a danger of workpieces dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc. Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

- 6. Consider a possible loss of power source.**

Measures should be taken to protect against bodily injury and equipment damage in the event that there is a loss of power to equipment controlled by pneumatics, electricity, or hydraulics.

- 7. Design circuitry to prevent sudden lurching of driven objects.**

When a cylinder is driven by an exhaust center type directional control valve or when starting up after residual pressure is exhausted from the circuit, etc., the piston and its driven object will lurch at high speed if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder. Therefore, equipment should be selected and circuits designed to prevent sudden lurching, because there is a danger of human injury and/or damage to equipment when this occurs.

- 8. Consider emergency stops.**

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

Caution on Design

- 9. Consider the action when operation is restarted after an emergency stop or abnormal stop.**

Design the machinery so that human injury or equipment damage will not occur upon restart of operation.

When the cylinder has to be reset at the starting position, install manual safety equipment.

Selection

Warning

- 1. Confirm the specifications.**

The products featured in this catalog are designed for use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are outside the range of specifications, damage and/or malfunctions may occur. Do not use in these conditions. (Refer to the specifications.)

Please consult with SMC if you use a fluid other than compressed air.

- 2. About intermediate stop**

In the case of 3 position closed center of a valve, it is difficult to make a piston stop at the required position as accurately and precisely as with hydraulic pressure due to compressibility of air.

Furthermore, since valves and cylinders, etc. are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Please contact SMC in the case it is necessary to hold a stopped position for an extended period.

Caution

- 1. Operate within the limits of the maximum usable stroke.**

Refer to the selection procedures for the air cylinder to be used for the maximum usable stroke.

- 2. Operate the piston within a range such that collision damage will not occur at the stroke end.**

The operation range should prevent damage from occurring when a piston, having inertial force, stops by striking the cover at the stroke end. Refer to the cylinder model selection procedure for the maximum usable stroke.

- 3. Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.**

- 4. Provide intermediate supports for long stroke cylinders.**

An intermediate support should be provided in order to prevent damage to a cylinder having a long stroke, due to problems such as sagging of the rod, deflection of the cylinder tube, vibration and external load.



Actuator Precautions 2

Be sure to read before handling.
For detailed precautions on every series, refer to main text.

Mounting

⚠ Caution

1. **Be certain to match the rod shaft center with the load and direction of movement when connecting.**

When not properly matched, problems may arise with the rod and tube, and damage may be caused due to friction on areas such as the inner tube surface, bushings, rod surface, and seals.

2. **When an external guide is used, connect the rod end and the load in such a way that there is no interference at any point within the stroke.**
3. **Do not scratch or gouge the sliding portion of the cylinder tube or the piston rod by striking it with an object, or squeezing it.**

The tube bore is manufactured under precise tolerances. Thus, even a slight deformation could lead to a malfunction.

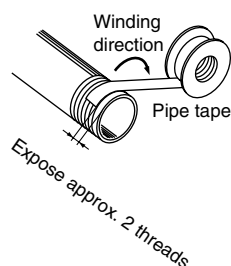
Moreover, scratches or gouges, etc. in the piston rod may lead to damaged seals and cause air leakage.

4. **Prevent the seizure of rotating parts.**
Prevent the seizure of rotating parts (pins, etc.) by applying grease.
5. **Do not use until you verify that the equipment can operate properly.**
After mounting, repairs, or modification, etc., connect the air supply and electric power, and then confirm proper mounting by means of appropriate function and leak tests.
6. **Instruction manual**
Install the products and operate them only after reading the instruction manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

Piping

⚠ Caution

1. **Before piping**
Before piping, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.
2. **Wrapping of pipe tape**
When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not get inside the piping.
Also, when the pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



Cushion

⚠ Caution

1. **Readjust with the cushion needle.**
Cushions are adjusted at the time of shipment, however, the cushion needle on the cover should be readjusted when the product is put into service, based upon factors such as the size of the load and the operating speed. When the cushion needle is turned clockwise, the restriction becomes smaller and the cushion's effectiveness is increased. Tighten the lock nut securely after adjustment is performed.
2. **Do not operate the actuator with the cushion needle fully closed.**
This could damage the seals.

Lubrication

⚠ Caution

1. **Lubricating the lube style cylinder.**
Install a lubricator in the circuit, and use Class 1 turbine oil (with no additive) ISO VG32.
Do not use machine oil or spindle oil.
2. **Lubrication of cylinder**
The cylinder has been lubricated for life at the factory and can be used without any further lubrication.
However, in the event that it is lubricated additionally, be sure to use Class 1 turbine oil (with no additive) ISO VG32.
Stopping lubrication later may lead to malfunctions because the new lubricant will cancel out the original lubricant. Therefore, lubrication must be continued once it has been started.

Air Supply

⚠ Warning

1. **Use clean air.**
Do not use compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as this can cause damage or malfunction.

⚠ Caution

1. **Install air filters.**
Install air filters close to valves at their upstream side. A filtration degree of 5 μm or less should be selected.
2. **Install an aftercooler, air dryer, or water separator (Drain Catch).**
Air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer, aftercooler or water separator, etc.
3. **Use the product within the specified range of fluid and ambient temperature.**
Take measures to prevent freezing when below 5°C, since moisture in circuits can freeze and cause damage to seals and lead to malfunctions.
For compressed air quality, refer to "Air Preparation Equipment" catalog.



Actuator Precautions 3

Be sure to read before handling.

For detailed precautions on every series, refer to main text.

Operating Environment

Warning

1. **Do not use in atmospheres or locations where corrosion hazards exist.**

Refer to the construction drawings regarding cylinder materials.

2. **In dusty locations or where water or oil, etc., splash on the equipment, take suitable measures to protect the rod.**

Use the heavy duty scraper type (-XC4) in situations where there is a lot of dust. Use a water resistant cylinder when there is splash or spray of liquids.

3. **When using auto switches, do not operate in an environment with strong magnetic fields.**

Maintenance

Warning

1. **Perform maintenance procedures as shown in the instruction manual.**

If it is handled improperly, malfunction or damage of machinery or equipment may occur.

2. **Removal of equipment, and supply/exhaust of compressed air**

Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.

When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent cylinders from sudden movement.

Caution

1. **Drain flushing**

Remove drainage from air filters regularly. (Refer to the specifications.)

Air-hydro

Caution on Design

Warning

1. **Do not use air-hydro cylinder near flames, or in equipment or machinery that exceeds an ambient temperatures of 60°C.**

There is a danger of causing a fire because the air-hydro cylinder uses a flammable hydraulic fluid.

Caution

1. **Do not use it in an environment, equipment, or machine that is not compatible with oil mist.**

Air-hydro cylinders generate an oil mist during operation which may affect the environment.

2. **Be sure to install an exhaust cleaner on the directional control valve for the air-hydro cylinder.**

A very small amount of hydraulic fluid is discharged from the exhaust port of the air-hydro cylinder's directional control valve, and this may contaminate the surrounding area.

3. **Install an air-hydro cylinder in locations where it can be serviced easily.**

Since the air-hydro cylinder requires maintenance, such as refilling of hydraulic fluid and bleeding of air, ensure sufficient space for these activities.

Selection

Caution

1. **Select an air-hydro cylinder in combination with an air-hydro unit.**

Since good operation of an air-hydro cylinder depends on combination with an air-hydro unit, be sure to select an appropriate air-hydro unit.

2. **Set the load of the air-hydro cylinder to be 50% or less of the theoretical force.**

For an air-hydro cylinder to obtain constant speed and stopping accuracy close to that of a hydraulic cylinder, it is necessary to keep the load at 50% or less of the theoretical output.

Piping

Caution

1. **For air-hydro cylinder piping, use self-aligning fittings.**

Do not use One-touch fittings in the piping for an air-hydro cylinder, as oil leakage may occur.

2. **For air-hydro cylinder piping, use hard nylon tubing or copper piping.**

As in the case of hydraulic circuits, surge pressures greater than the operating pressure may occur in an air-hydro cylinder's piping, making it necessary to use safer piping materials.

Lubrication

Warning

1. **Make sure to completely discharge the compressed air in the system before filling the air-hydro unit with hydraulic oil.**

When supplying hydraulic fluid to the air-hydro unit, first confirm that safety measures are implemented to prevent dropping of driven objects and release of clamped objects, etc. Then, shut off the air supply and the equipment's electric power, and exhaust the compressed air in the system.

If the air-hydro unit is supply port is opened with compressed air still remaining in the system, there is a danger of hydraulic fluid being blown out.

Maintenance

Caution

1. **Bleed air from the air-hydro cylinder on a regular basis.**

Since air may accumulate inside an air-hydro cylinder, bleed air from it at times such as before starting work. Bleed air from a bleeder valve provided on the air-hydro cylinder or the piping.

2. **Verify the oil level of the air hydro system on a regular basis.**

Since a very small amount of hydraulic fluid is discharged from the air-hydro cylinder and air-hydro unit circuit, the fluid will gradually decrease. Therefore, check the fluid regularly and refill as necessary. The oil level can be checked with a level gauge in the air-hydro converter.

Quality Assurance Information (ISO 9001, ISO 14001)

Reliable quality of products in the global market

To enable our customers throughout the world to use our products with even greater confidence, SMC has obtained certification for international standards “ISO 9001” and “ISO 14001”, and created a complete structure for quality assurance and environmental controls. SMC products pursue to meet its customers’ expectations while also considering company’s contribution in society.

Quality management system ISO 9001

This is an international standard for quality control and quality assurance. SMC has obtained a large number of certifications in Japan and overseas, providing assurance to our customers throughout the world.



Environmental management system ISO 14001

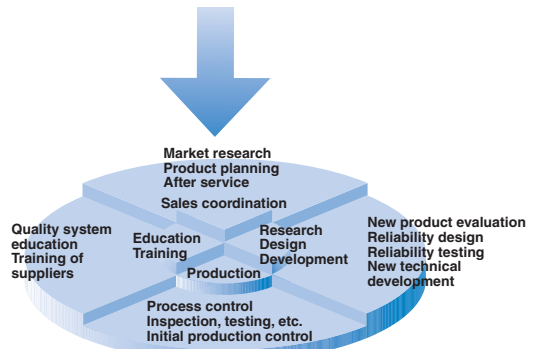
This is an international standard related to environmental management systems and environmental inspections. While promoting environmentally friendly automation technology, SMC is also making diligent efforts to preserve the environment.



SMC’s quality control system



Quality policies



Quality control activities

SMC Product Conforming to Inter

SMC products complying with EN/ISO, CSA/UL standards are supporting



The CE mark indicates that machines and components meet essential requirements of all the EC Directives applied.

It has been obligatory to apply CE marks indicating conformity with EC Directives when machines and components are exported to the member Nations of the EU.

Once "A manufacturer himself" declares a product to be safe by means of CE marking (declaration of conformity by manufacturer), free distribution inside the member Nations of the EU is permissible.

■ CE Mark

SMC provides CE marking to products to which EMC and Low Voltage Directives have been applied, in accordance with CETOP (European hydraulics and pneumatics committee) guide lines.

■ As of February 1998, the following 18 countries will be obliged to conform to CE mark legislation

Iceland, Ireland, United Kingdom, Italy, Austria, Netherlands, Greece, Liechtenstein, Sweden, Spain, Denmark, Germany, Norway, Finland, France, Belgium, Portugal, Luxembourg

■ EC Directives and Pneumatic Components

• Machinery Directive

The Machinery Directive contains essential health and safety requirements for machinery, as applied to industrial machines e.g. machine tools, injection molding machines and automatic machines. Pneumatic equipment is not specified in Machinery Directive. However, the use of SMC products that are certified as conforming to EN Standards, allows customers to simplify preparation work of the Technical Construction File required for a Declaration of Conformity.

• Electromagnetic Compatibility (EMC) Directive

The EMC Directive specifies electromagnetic compatibility. Equipment which may generate electromagnetic interference or whose function may be compromised by electromagnetic interference is required to be immune to electromagnetic affects (EMS/immunity) without emitting excessive electromagnetic affects (EMI/emission).

• Low Voltage Directive

This directive is applied to products, which operate above 50 VAC to 1000 VAC and 75 VDC to 1500 VDC operating voltage, and require electrical safety measures to be introduced.

• Simple Pressure Vessels Directive

This directive is applied to welded vessels whose maximum operating pressure (PS) and volume of vessel (V) exceed 50 bar/L. Such vessels require EC type examination and then CE marking.

national Standards

you to comply with EC directives and CSA/UL standards.



■ CSA Standards & UL Standards

UL and CSA standards have been applied in North America (U.S.A. and Canada) symbolizing safety of electric products, and are defined to mainly prevent danger from electric shock or fire, resulting from trouble with electric products. Both UL and CSA standards are acknowledged in North America as the first class certifying body. They have a long experience and ability for issuing product safety certificate. Products approved by CSA or UL standards are accepted in most states and governments beyond question.

Since CSA is a test certifying body as the National Recognized Testing Laboratory (NRTL) within the jurisdiction of Occupational Safety and Health Administration (OSHA), SMC was tested for compliance with CSA Standards and UL Standards at the same time and was approved for compliance with the two Standards. The above CSA NRTL/C logo is described on a product label in order to indicate that the product is approved by CSA and UL Standards.

■ TSSA (MCCR) Registration Products

TSSA is the regulation in Ontario State, Canada. The products that the operating pressure is more than 5 psi (0.03 MPa) and the piping size is bigger than 1 inch. fall into the scope of TSSA regulation.

Products conforming to CE Standard

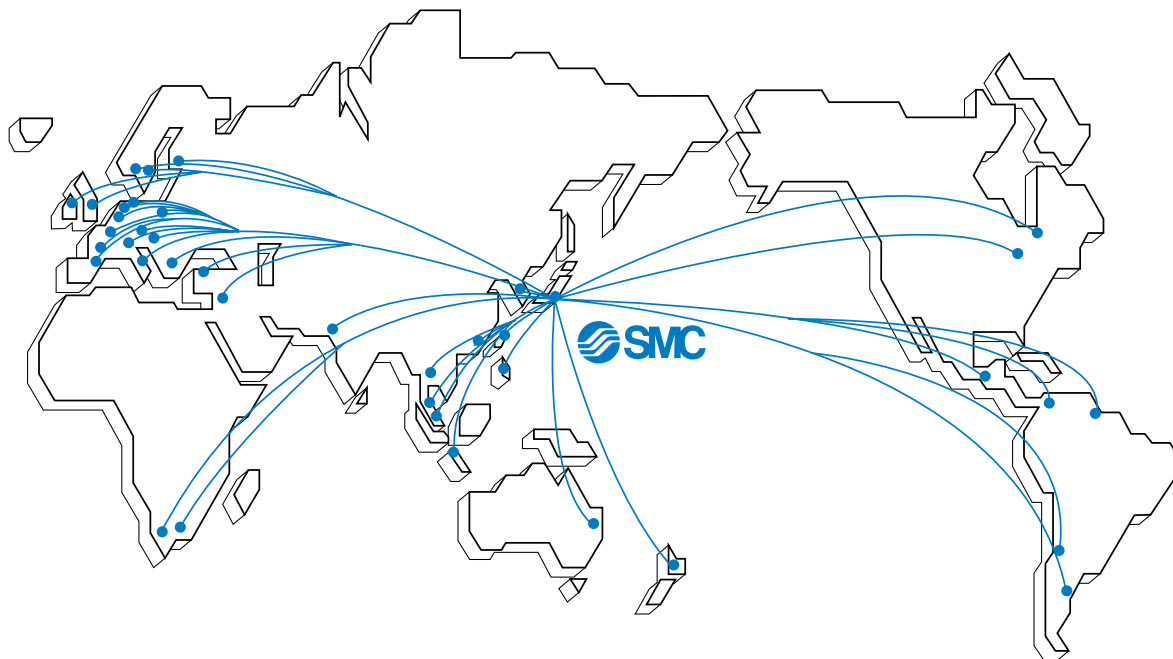


With CE symbol for simple visual recognition

In this catalog each accredited product series is indicated with a CE mark symbol. However, in some cases, every available models may not meet CE compliance. Please visit our web site for the latest selection of available models with CE mark.

<http://www.smcworld.com>

SMC's Global Service Network



America

U.S.A. **SMC Corporation of America**

3011 North Franklin Road Indianapolis, IN 46226, U.S.A.
TEL: 317-899-4440 FAX: 317-899-3102

CANADA **SMC Pneumatics (Canada) Ltd.**

6768 Financial Drive Mississauga, Ontario, L5N 7J6 Canada
TEL: 905-812-0400 FAX: 905-812-8686

MEXICO **SMC Corporation (Mexico), S.A. DE C.V.**

Carr. Silao-Trejo K.M. 2.5 S/N, Predio San Jose del Duranzo
C.P. 36100, Silao, Gto., Mexico
TEL: 472-72-2-55-00 FAX: 472-72-2-59-44/2-59-46

CHILE **SMC Pneumatics (Chile) S.A.**

Av. La Montaña 1,115 km. 16.5 P. Norte Parque
Industrial Valle Grande, Lampa Santiago, Chile
TEL: 02-270-8600 FAX: 02-270-8601

ARGENTINA **SMC Argentina S.A.**

Teodoro Garcia 3860 (1427) Buenos Aires, Argentina
TEL: 011-4555-5762 FAX: 011-4555-5762

BOLIVIA **SMC Pneumatics Bolivia S.R.L.**

Avenida Beni Numero 4665
Santa Cruz de la Sierra-Casilla de Correo 2281, Bolivia
TEL: 591-3-3428383 FAX: 591-3-3449900

VENEZUELA **SMC Neumatica Venezuela S.A.**

Apartado 40152, Avenida Nueva Granada, Edificio Wanlac,
Local 5, Caracas 1040-A, Venezuela
TEL: 2-632-1310 FAX: 2-632-3871

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TEL: 1-471-6002 FAX: 1-471-0935

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Galicia 1650 esq. Gaboto C.P. 11200, Montevideo, Uruguay
TEL: 2-401-6603 FAX: 2-409-4306

BRAZIL **SMC Pneumaticos Do Brasil Ltda.**

Rua. Dra. Maria Fidelis, nr. 130, Jardim Piraporinha-Diadema-S.P.
CEP: 09950-350, Brasil
TEL: 11-4051-1177 FAX: 11-4071-6636

COLOMBIA (Distributor) **Airmatic Ltda.**

Calle 18 69-05 Apart. Aereo 081045 Santa Fe de Bogotá, Colombia
TEL: 1-424-9240 FAX: 1-424-9260

Europe

U.K. **SMC Pneumatics (U.K.) Ltd.**

Vincent Avenue, Crownhill, Milton Keynes, MK8 0AN, Buckinghamshire, U.K.
TEL: 01908-563888 FAX: 01908-561185

GERMANY **SMC Pneumatik GmbH**

Boschring 13-15 D-63329 Egelsbach, Germany
TEL: 06103-4020 FAX: 06103-402139

ITALY **SMC Italia S.p.A.**

Via Garibaldi 62 I-20061 Carugate Milano, Italy
TEL: 02-9271365 FAX: 02-9271365

FRANCE **SMC Pneumatique S.A.**

1 Boulevard de Strasbourg, Parc Gustave Eiffel, Bussy Saint Georges, F-77600
Marne La Vallee Cedex 3 France
TEL: 01-64-76-10-00 FAX: 01-64-76-10-10

SWEDEN **SMC Pneumatics Sweden AB**

Ekhagsvägen 29-31, S-141 05 Huddinge, Sweden
TEL: 08-603-07-00 FAX: 08-603-07-10

SWITZERLAND **SMC Pneumatik AG**

Dorfstrasse 7, Postfach 117, CH-8484 Weisslingen, Switzerland
TEL: 052-396-3131 FAX: 052-396-3191

AUSTRIA **SMC Pneumatik GmbH (Austria)**

Girakstrasse 8, A-2100 Korneuburg, Austria
TEL: 0-2262-6228-0 FAX: 0-2262-62285

SPAIN **SMC España, S.A.**

Zuazobidea 14 Pol. Ind. Júndiz 01015 Vitoria, Spain
TEL: 945-184-100 FAX: 945-184-510

IRELAND **SMC Pneumatics (Ireland) Ltd.**

2002 Citywest Business Campus, Naas Road, Saggart, Co. Dublin, Ireland
TEL: 01-403-9000 FAX: 01-466-0385

NETHERLANDS (Associated company) **SMC Pneumatics BV**

De Ruyterkade 120, NL-1011 AB Amsterdam, Netherlands
TEL: 020-5318888 FAX: 020-5318880

GREECE (Distributor) **S.Parianopoulos S.A.**

7, Konstantinoupoleos Street 11855 Athens, Greece
TEL: 01-3426076 FAX: 01-3455578

DENMARK **SMC Pneumatik A/S**

Knudsminde 4 B DK-8300
Odder, Denmark
TEL: 70252900 FAX: 70252901

Europe

FINLAND SMC Pneumatics Finland OY

PL72, Tiistiniityntie 4, SF-02231 ESP00, Finland
TEL: 09-8595-80 FAX: 09-8595-8595

NORWAY SMC Pneumatics Norway A/S

Vollsvæien 13C, Granfoss Næringspark N-1366 LYSAKER, Norway
TEL: 67-12-90-20 FAX: 67-12-90-21

BELGIUM (Distributor) SMC Pneumatics N.V./S.A.

Nijverheidsstraat 20 B-2160 Wommelgem Belgium
TEL: 03-355-1464 FAX: 03-355-1466

POLAND SMC Industrial Automation Polska Sp.z.o.o.

ul. Konstruktorska 11A, PL-02-673 Warszawa, Poland
TEL: 022-548-5085 FAX: 022-548-5087

TURKEY (Distributor) Entek Pnömatik San.ve Tic. Ltd. Sti

Perpa Tic. Merkezi Kat:11 No.1625 80270 Okmeydani Istanbul, Türkiye
TEL: 0212-221-1512 FAX: 0212-221-1519

RUSSIA SMC Pneumatik LLC.

36/40 Sredny prospect V.O. St. Petersburg 199004, Russia
TEL: 812-118-5445 FAX: 812-118-5449

CZECH SMC Industrial Automation CZ s.r.o.

Hudcova 78a, CZ-61200 Brno, Czech Republic
TEL: 05-4121-8034 FAX: 05-4121-8034

HUNGARY SMC Hungary Ipari Automatizálási kft.

Budafoki ut 107-113 1117 Budapest
TEL: 01-371-1343 FAX: 01-371-1344

ROMANIA SMC Romania S.r.l.

Str. Frunzei, Nr. 29, Sector 2, Bucharest, Romania
TEL: 01-3205111 FAX: 01-3261489

SLOVAKIA SMC Priemyselná automatizácia, s.r.o.

Nova 3, SK-83103 Bratislava
TEL: 02-4445-6725 FAX: 02-4445-6028

SLOVENIA SMC Industrijska Avtomatila d.o.o.

Grajski trg 15, SLO- 8360 Zuzemberk, Slovenia
TEL: 07388-5240 FAX: 07388-5249

LATVIA SMC Pneumatics Latvia SIA

Šmerļa ielā 1-705, Rīga LV-1006
TEL: 777 94 74 FAX: 777 94 75

SOUTH AFRICA (Distributor) Hyflo Southern Africa (Pty.) Ltd.

P.O.Box 240 Paardeneiland 7420 South Africa
TEL: 021-511-7021 FAX: 021-511-4456

EGYPT (Distributor) Saadani Trading & Ind. Services

15 Sebaai Street, Miami 21411 Alexandria, Egypt
TEL: 3-548-50-34 FAX: 3-548-50-34

Oceania/Asia

AUSTRALIA SMC Pneumatics (Australia) Pty.Ltd.

14-18 Hudson Avenue Castle Hill NSW 2154, Australia
TEL: 02-9354-8222 FAX: 02-9894-5719

NEW ZEALAND SMC Pneumatics (New Zealand) Ltd.

8C Sylvia Park Road Mt.Wellington Auckland, New Zealand
TEL: 09-573-7007 FAX: 09-573-7002

TAIWAN SMC Pneumatics (Taiwan) Co.,Ltd.

17, Lane 205, Nansan Rd., Sec.2, Luzhu-Hsiang, Taoyuan-Hsien, TAIWAN
TEL: 03-322-3443 FAX: 03-322-3387

HONG KONG SMC Pneumatics (Hong Kong) Ltd.

29/F, Clifford Centre, 778-784 Cheung, Sha Wan Road, Lai Chi Kok, Kowloon, Hong Kong
TEL: 2744-0121 FAX: 2785-1314

SINGAPORE SMC Pneumatics (S.E.A.) Pte. Ltd.

89 Tuas Avenue 1, Jurong Singapore 639520
TEL: 6861-0888 FAX: 6861-1889

PHILIPPINES SHOKETSU SMC Corporation

Unit 201 Common Goal Tower, Madrigal Business Park, Ayala Alabang Muntinlupa, Philippines
TEL: 02-8090565 FAX: 02-8090586

MALAYSIA SMC Pneumatics (S.E.A.) Sdn. Bhd.

Lot 36 Jalan Delima1/1, Subang Hi-Tech Industrial Park, Batu 3 40000 Shah Alam Selangor, Malaysia
TEL: 03-56350590 FAX: 03-56350602

SOUTH KOREA SMC Pneumatics Korea Co., Ltd.

Woolim e-BIZ Center (Room 1008), 170-5, Guro-Dong, Guro-Gu, Seoul, 152-050, South Korea
TEL: 02-3219-0700 FAX: 02-3219-0702

CHINA SMC (China) Co., Ltd.

7 Wan Yuan St. Beijing Economic & Technological Development Zone 100176, China
TEL: 010-67882111 FAX: 010-67881837

THAILAND SMC Thailand Ltd.

134/6 Moo 5, Tiwanon Road, Bangkok, Amphur Muang, Patumthani 12000, Thailand
TEL: 02-963-7099 FAX: 02-501-2937

INDIA SMC Pneumatics (India) Pvt. Ltd.

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