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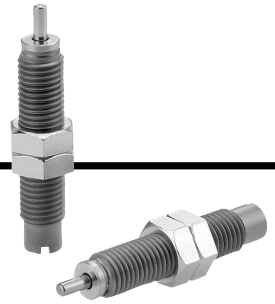
SMC Information

Shock Absorber
RB0604



RB Series Shock Absorber with a M6 O.D. thread

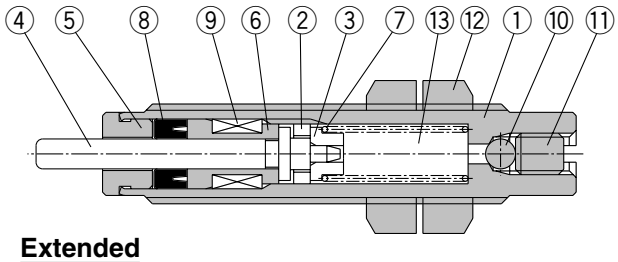
How to Order

Shock absorber **RB 06 04**

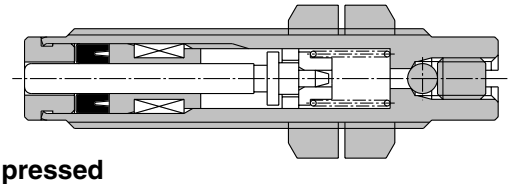
O.D. thread (M6 x 0.75) **Stroke**

Model		RB0604
Max. energy absorption (J)		0.5
Stroke absorption (mm)		4
Max. equivalent mass (kg)		3
Impact speed (m/s)		0.3 to 1.0
Max. operation (cycle/min)		80
Max. allowable thrus energy (N)		150
Allowable temp. range (°C)		–10 to 80 (No freezing)
Spring force (N)	Extended	3.05
	Compressed	5.59
Allowable eccentric angle		±3° or less
Weight (g)		5.5

Construction



Extended



Compressed

Component Parts

Number	Description	Material	Note
1	Outer tube	Shaving steel	Tufftride
2	Piston	Copper alloy	—
3	Spring guide	Stainless steel	—
4	Piston rod	Carbon steel	Tufftride
5	Stopper	Stainless steel	—
6	Bearing	Copper alloy	—
7	Return spring	Piano wire	Trivalent chromated
8	Rod seal	NBR	—
9	Accumulator	NBR	—
10	Steel ball	Bearing steel	—
11	Hexagon socket head set screw	Special steel	Nickel plating
12	Hexagon nut	Carbon steel	Nickel plating
13	Lubricating oil	Mineral oil	—

How to Select

Selection Procedure

1 Classification of impact

- ☐Cylinder stroke at load (horizontal)
- ☐Cylinder stroke at load (downward)
- ☐Cylinder stoke at load (upward)
- ☐Conveyor stroke at load (horizontal)
- ☐Free horizontal impact
- ☐Free dropping impact
- ☐Rotation impact (with torque)

2 Details of applications

Symbol	Condition of application	Unit
m	Impacting object/weight	kg
υ	Impacting object/speed	m/s
h	Dropping height	m
ω	Angle/speed	rad/s
r	Distance between axis of cylinder and impact point	m
d	Bore size	mm
p	Cylinder operating pressure	MPa
F	Thrust energy	N
T	Torque	Nm
n	Operation cycle	cycle/min
t	Ambient temperature	°C
μ	Friction coefficient	–

3 Specifications and Operational instructions

Ensure that the impact speed, thrust energy, operation cycle, ambient temperature and atmosphere are within the specifications.

∗Be aware of the min. installation radius in the case of oscillating impacts.

4 Calculation of kinetic energy E_1

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 E_1.

5 Calculation of thrust energy E_2

Calculation of the thrust energy E_2 of RB0604.

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

6 Calculation of corresponding weight of impacting object Me

Energy absorption $E=E_1+E_2$

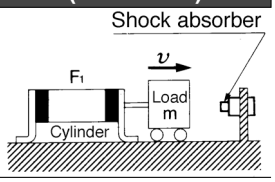
Corresponding weight of impacting object $Me=\frac{2}{\upsilon^2}E$

Substitute both energy absorption E and impacting object speed V for Data A in order to calculate the corresponding weight of the impacting object.

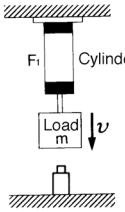
7 Selection of applicable model

Confirm selection of the RB0604.

Example of Selection

	Cylinder stroke at load (Horizontal)
1 Classification of impact	
Impact object /speed U (1)	υ
Kinetic energy E_1	$\frac{1}{2}m\upsilon^2$
Thrust energy E_2	F_1S
Energy absorption E	E_1+E_2
Impacting object/ corresponding weight Me (2)	$\frac{2}{\upsilon^2}E$
2 Details of applications	m=1kg υ=0.5m/s d=10mm p=0.5MPa n=30cycle/min t =25°C
3 Specifications Operational instructions	Comfirmation of specifications υ ····· 0.5<1.0 (max.) t ····· –10 (min.)<25<80 (max.) F ····· F1···39.3 **YES**
4 Calculation of kinetic energy E_1	Use Formula to calculate E_1. Substitute 1.0 for m and 0.5 for υ. **$E_1 \cong 0.125$**
5 Calculation of thrust energy E_2	Use RB0604 Data B to calculate E_2. Calculate E_2 by substituting 10 for d. **$E_2 \cong 0.157$**
6 Calculation of corresponding weight of impacting object Me	Use the formula "Energy absorption $E=E_1+E_2=0.125+0.157=0.282$" to calculate Me. Substitute 0.282 for E and 0.5 for υ. **Me ≅ 2.3**
7 Confirm selection of RB0604	Confirm selection of RB0604 Calculated equivalent quantity Me=2.3<3kg (Max. equivalent quantity) The result satisfies <3kg condition, and operating frequency is 30<80. No problem is found. **YES**

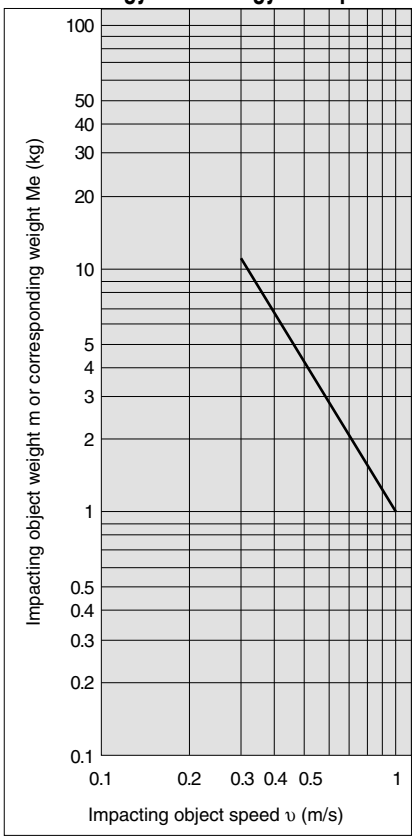
1 Classification of Impact

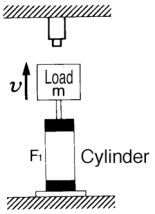
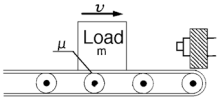
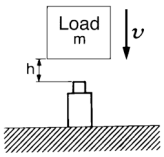
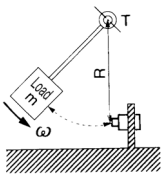
Classification of impact	Cylinder stroke at load (Downward) 
Impact object /speed υ (1)	υ
Kinetic energy E_1	$\frac{1}{2}m\upsilon^2$
Thrust energy E_2	F_1S+mgs
Energy absorption E	E_1+E_2
Impacting object/ corresponding weight Me (2)	$\frac{2}{\upsilon^2}E$

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

Data A

Kinetic energy E_1 or Energy absorption E



	Cylinder stroke at load (Upward)	Conveyor driving at load (Horizontal)	Free dropping impact	Rotation impact (With torque)
				
	υ	υ	$\sqrt{2gh}$	ωR
	$\frac{1}{2}m\upsilon^2$	$\frac{1}{2}m\upsilon^2$	mgh	$\frac{1}{2}I\omega^2$
	F_1S-mgS	$mg\mu S$	mgS	$T\frac{S}{R}$
	E_1+E_2	E_1+E_2	E_1+E_2	E_1+E_2
	$\frac{2}{\upsilon^2}E$	$\frac{2}{\upsilon^2}E$	$\frac{2}{\upsilon^2}E$	$\frac{2}{\upsilon^2}E$

Note 2) An "Impact body equivalent weight" is the weight of an impact body without involving thrust, into which an object's total energy has been converted.
Note 3) Refer to the catalog of rotary actuator for the formula of moment of inertia (Kgm^2).

«Symbol table»

Symbol	Specifications	Unit
d	Bore size	mm
E	Energy absorption	J
E_1	Kinetic energy	J
E_2	Thrust energy	J
F_1	Cylinder thrust	N
g	Acceleration of gravity (9.8)	m/s^2
h	Dropping height	m
I Note3)	Moment of inertia around the center of gravify	kgm^2
n	Operation cycle	cycle/min
p	Cylinder operation pressure	MPa
R	Distance between axis of cylinder and impact point	m
S	Shock absorber stroke	m
T	Torque	Nm
t	Ambient temperature	°C
υ	Impacting object speed	m/s
m	Impacting object weight	kg
Me	Corresponding weight of impacting object	kg
ω	Angle speed	rad/s
μ	Friction coefficient	—

Data B

Thrust energy of cylinder F_1S (Operating pressure 0.5MPa) Unit: J

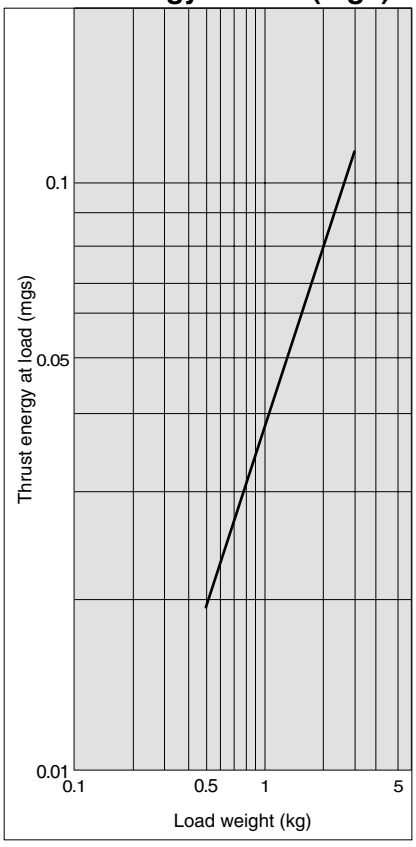
Stroke absorption (mm)		4
Bore I.D. d (mm)	6	0.057
	10	0.157
	15	0.353
	20	0.628
	25	0.981

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

Operating pressure (MPa)	0.1	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

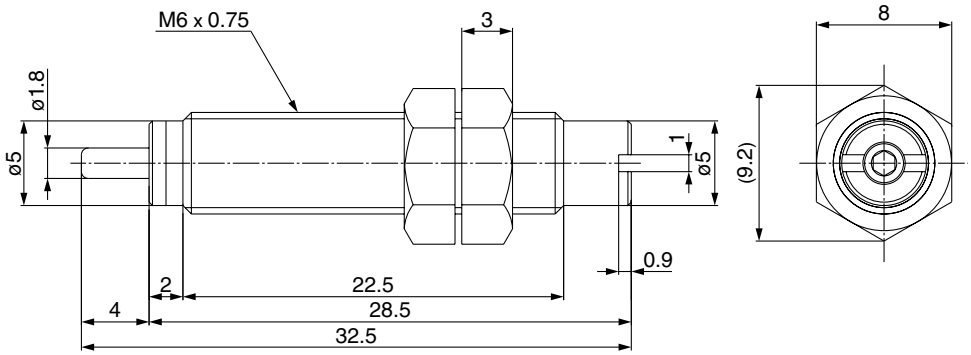
Data C

Thrust energy at load (mgs)

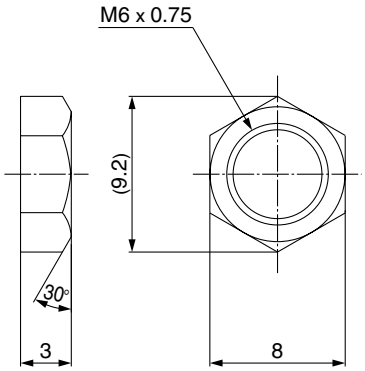


Dimension

RB0604



Hexagon Nut
(2 pcs. as standard)



⚠ Precautions

Read carefully before use. Contact SMC in case operating condition is out of the listed specifications.

Selection

⚠ Danger

①**Energy absorption**

Make a selection so that the total energy of the collided materials is under the indicated maximum energy absorption.

If the selection is over the maximum energy absorption, it will cause a change in characteristics and damage to the shock absorber.

②**Equivalent mass**

Make a selection so that the equivalent mass does not exceed allowable Range. If the selection is over the allowable range, pulsation will occur.

This will affect the buffering and speed reduction performance, resulting in the difficulty in smooth buffering performance.

③**Impact speed**

Use the device in the condition of specified impact speed range, and do not select any speed that exceeds this condition.

If the selection is over the allowable range, it will cause changes of the buffering characteristics and damage to the shock absorber.

⚠ Warning

①**Static load**

Design the system under the condition that the piston rod does not receive any other force than the buffering force or impact when the piston rod is stopped with its spring extended.

⚠ Caution

①**Maximum operating frequency**

Design under the condition that the operation frequency does not exceed the indicated max. operation number. (Note that the max. operating frequency changes depending on the absorbed energy.)

②**The maximum absorption energy indicated in the specifications for both RB0604 cannot be brought into full play unless the entire stroke is used.**

③**The contact surface of the impact body with which the piston rod comes in 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 in contact. Therefore, the contact surface must be highly rigid (hardness of HRC35 or more).

④**Be aware of the return force of the impact body.**

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. Refer to the column for the spring force in the specifications.

⑤**Selection of the model size**

As a shock absorber is constantly used, the max. energy absorption volume decreases due to chemical breakdown and deterioration of the internal hydraulic fluid.

Therefore, it is recommended that one selects a model size with 20 to 40% larger energy absorption ability than what is actually required.

⑥**Drag characteristics**

Generally speaking, a hydraulic type shock absorber changes its drag force (repelled force generated in operation) value depending on its operation speed.

With RB0604, smooth shock absorption in wide range of high and low speed is realized by introducing “taper shaped ditch” inside the tube.

However, speed reduction degree (speed reduction G) increases at the end of the stroke depending on operating condition. Please note in such condition, that the stroke time may take longer, and the motion of the product may not be as smoothed as anticipated.

Operating Environment

⚠ Danger

①**Usage under the condition which requires explosion proof environment.**

·In case the static electricity accumulates at the installed site of the product, ground all electrical conducting materials.

·Do not use any sparkling materials for collision buffering.

⚠ Warning

①**Pressure**

Do not use in an environment that has a widely different vacuum pressure condition than the atmospheric pressure or, under an environment in which pressure is applied.

②**Do not use the shock absorber in a clean room.**

As it could contaminate the clean room.

⚠ Caution

①**Operating temperature range**

Do not use in an environment in which the temperature is over allowable temperature range.

It will cause softening and hardening of the seals as well as wearing out, hydraulic fluid leakage, deterioration, and a change in the shock absorbing characteristics.

②**Do not operate the shock absorber in an environment that poses the risk of corrosion.**

Refer to the respective structural drawing for the type of material that is used in the shock absorber.

③**Degrading by ozone**

Do not use the product in direct sunlight, near a mercury lamp, or near an ozone generating equipment because all will cause deterioration of the rubber material.

④**Do not expose the shock absorber to machining oil, water, or dust.**

RB0604 cannot be used under conditions in which fluids such as machining oil or water are present in atomized form or come in direct contact with the piston rod, or in which dust could adhere to the piston rod. Such conditions would cause malfunction.

⑤**A guide is necessary if the impact body involves vibrations.**

If the impact body involves vibrations and if a force that is perpendicular to the axis is applied to the piston rod, a secure guide must be provided for the impact body.

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**Protection cover placement**

In case of possible human contact when the product is in operation, placing a protection cover over the product is recommended.

③**The rigidity of the mounting frame must be taken into consideration.**

If the mounting frame lacks rigidity, the shock absorber will vibrate after an impact, causing bearing wear and damage. Apply the following formula to calculate the force that is applied to the mounting frame:

$$\text{Force applied to the mounting frame} \quad N \cong 2\,\frac{E\ (\text{absorption energy J})}{S\ (\text{stroke m})}$$

⚠ Precautions

Read carefully before use. Contact SMC in case operating condition is out of the listed specifications.

Mounting

⚠ Caution

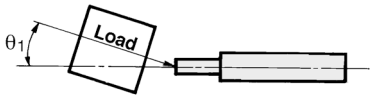
①**Tightening torque of mounting nut should be as follows.**

If the tightening torque that is applied to the nut exceeds the value given above, the shock absorber itself could become damaged.

Model	RB0604
O.D. thread (mm)	M6 x 0.75
Thread prepared bore (mm)	ø5.3 $^{+0.1}_{0}$
Tightening torque (Nm)	0.85

②**The installation must be designed so that the impact body is perpendicular to the shock absorber's axial center.**

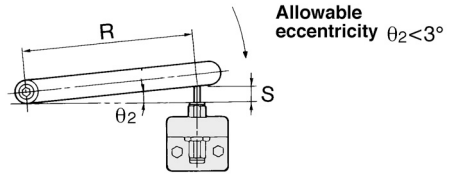
An angle of deviation that exceeds 3° will place an excessive load on the bearings, leading to oil leaks within a short period of operation.



Allowable eccentricity $\theta_1 < 3°$

③**If oscillating 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 oscillating angle until the stroke end must be $\theta_2 < 3°$.



Installation conditions for rotation impact (mm)

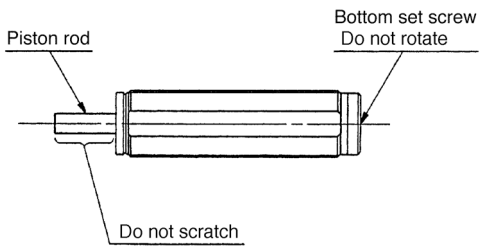
Model	S (Stroke)	θ2 (Allowable rotation angle)	R (Min. installation radius)
RB0604	4	3°	76

④**Do not scratch the sliding portion of the piston rod or the outside**

Failure to observe this precaution could scratch or gouge the sliding potion 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**

It is not an adjustment screw, as this will cause oil leakage.



Maintenance

⚠ Caution

①**Make sure that the retaining nut is not loose.**

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**Please confirm that external abnormalities are not present, such as leaking oil, etc.**

If a large amount of oil is found, please replace the shock absorber to avoid damage to the surrounding equipment.