CAUTION
Read these instructions before use

1. Definition of Warning "Warning" applies to situations in which death or serious injuries may occur to the user, etc. if the potential dangers of the products are not avoided.

2. Definition of "Caution" "Caution" applies to situations in which minor injuries or property damage may result if the operation or maintenance procedures are not strictly followed.

⚠ Warning

■Do not throw into a fire

- As the products contain oil, throwing them into a fire may cause them to ignite, resulting in injuries.
- Do not throw them into fire.

⚠ Caution

■Do not operate without sufficient mounting strength

- Operating with insufficient mounting strength may damage the main machine and cause injuries.
- Ensure sufficient mounting strength of maximum drag x safety factor (Regarding maximum drag, please refer to the catalogue or contact our sales department.)

Colliding object

Breakage or bending due to insufficient strength
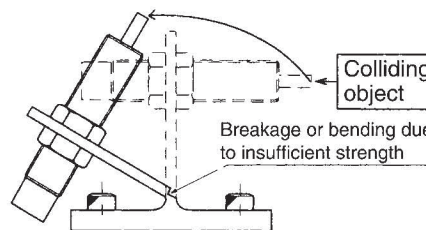
■Do not operate without an external stopper

- Without an external stopper, the main machine may become damaged due to bottoming (Note 1).
- Ensure that an external stopper is set in the prescribed location for each type before operating the product. (For the locations of external stoppers, please refer to the catalogue or to the owner's manual.)

■Do not attach using incorrect tightening torque

- Using an incorrect tightening torque when attaching may cause operational failure and damage to the main machine.
- When tightening an attachment screw for a soft absorber, please use the tightening torque as listed below.

External diameter of the screw (mm)	M4X0.5	M6X0.75	M8X0.75	M10X1	M12X1 M12X1.75	M14X1.5 M14X2.0	M16X1.5 M16X2.0	M20X1.5	M25X1.5 M25X2	M27X1.5 M27X3	M30X1.5	M36X1.5	M42X1.5
Tightening torque for the bolt (N·m)	0.35	0.85	3.9	7.8	7.8	9.8	14.7	29.4	49	58.8	78.4	98	392

* Using an adhesive is an effective way to prevent loosening.
*Tightening torque: 1.5Nm (excluding FA-1212C)

■Dislodged retaining ring

- Failure to adhere to the specifications listed in the catalogue may cause the internal pressure of the inner tube to raise to a dangerous level where the retaining ring may become dislodged and interior parts may shoot out, causing injuries.
- Do not bring your face close to a soft absorber that has a retaining ring while it is operating.

■Do not discard oil more than is necessary

- Discarding the oil contained in soft absorbers more than is necessary will pollute the environment.
- Dispose the oil according to laws concerning waste management and cleaning.

■Scattering pieces due to cap damage

- Failure to adhere to the specifications listed in the catalogue may cause the cap to break, resulting in scattering pieces that may cause injuries.
- Please install an anti-scattering cover.
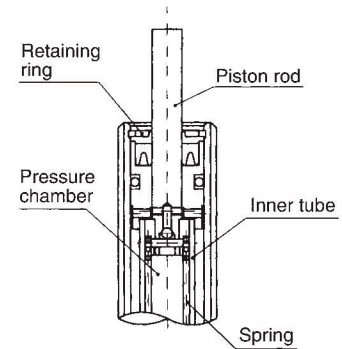
■Eccentric load and eccentric angle

- When a load collides at an eccentric angle of ±2.5° or larger, recovery failure due to a bent piston rod and performance degradation due to eccentric friction on the sliding part may occur, causing damage to the main machine.
- Please ensure that it collides along the midline of the piston rod. (If the eccentric angle is going to exceed ±2.5° when using this product, please contact our sales department.)
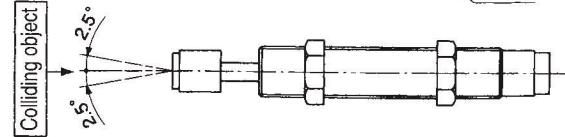
■Operating temperature

- When using a soft absorber, ensure that it is used within the operating temperature.
- Failure to do so will have adverse effects on the packing and accumulator that will reduce the product life, which may damage the main machine. (For the appropriate operating temperature, please refer to the catalogue or to the owner's manual.)

■Usage environment

- This product cannot be used in a vacuum or under high pressure, as this will cause damage to the main machine.
- Do not use in an environment where chips, cutting oil, water, etc. can come in contact with the piston rod. This will damage the packing, resulting in oil leakage, which leads to operational failure and damage to the main machine.

Note1) Effective force occurring in mechanical collisions at stroke end

Bansbach is not responsible for any secondary accidents caused by a soft absorber.
The following are two examples of such secondary accidents caused by a soft absorber:
(Example 1) An overload causes the piston rod to break, resulting in a facial injury.
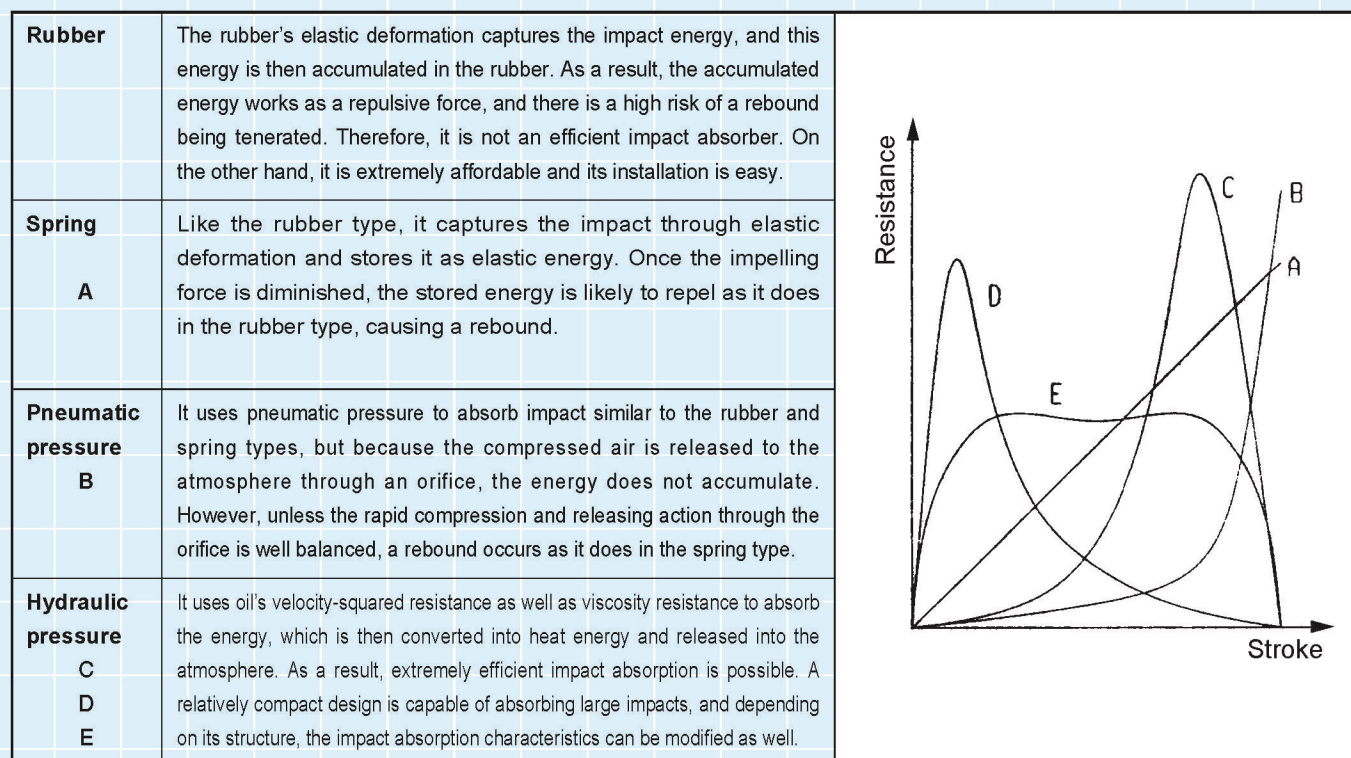Countermeasure – install a cover.
(Example 2) The drag causes the cap to break. The cap then gets lodged inside the machine, damaging it. Countermeasure – install a tray, etc. under the soft absorber.
The user should implement preventative measures against such secondary accidents.

Principles of Soft Absorbers

What is a Soft Absorber?

In order to increase the productivity of industrial machines, such as automatic assembling machines, various transportation machines, machines tools, and so on, their operating parts have been made to work faster. However, the resulting impact, vibration, and noise have caused adverse effects on the machine's performance and on the working environment. A soft absorber is an extremely convenient hydraulic buffer that can solve such problems. There are similar devices made of rubber, springs, or devices that use pneumatic pressure, but none of them rival the impact absorption characteristics of the hydraulic type, as illustrated below.
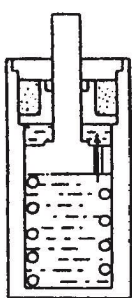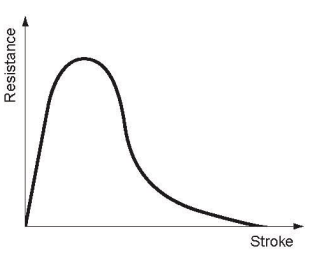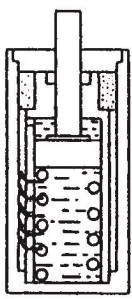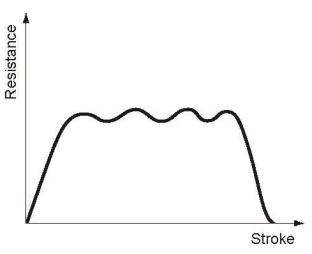
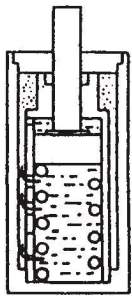|		
Rubber	The rubber's elastic deformation captures the impact energy, and this energy is then accumulated in the rubber. As a result, the accumulated energy works as a repulsive force, and there is a high risk of a rebound being tenerated. Therefore, it is not an efficient impact absorber. On the other hand, it is extremely affordable and its installation is easy.	
Spring **A**	Like the rubber type, it captures the impact through elastic deformation and stores it as elastic energy. Once the impelling force is diminished, the stored energy is likely to repel as it does in the rubber type, causing a rebound.	
Pneumatic pressure **B**	It uses pneumatic pressure to absorb impact similar to the rubber and spring types, but because the compressed air is released to the atmosphere through an orifice, the energy does not accumulate. However, unless the rapid compression and releasing action through the orifice is well balanced, a rebound occurs as it does in the spring type.	
Hydraulic pressure **C** **D** **E**	It uses oil's velocity-squared resistance as well as viscosity resistance to absorb the energy, which is then converted into heat energy and released into the atmosphere. As a result, extremely efficient impact absorption is possible. A relatively compact design is capable of absorbing large impacts, and depending on its structure, the impact absorption characteristics can be modified as well.	

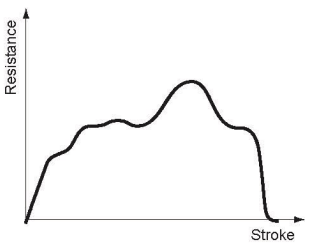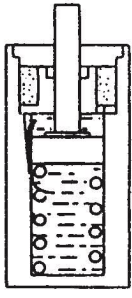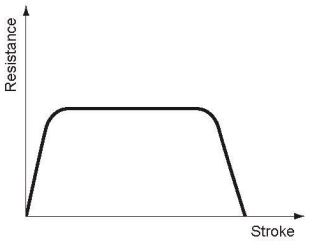## <Principles of Energy Absorption>

As shown below, when an object hits the piston rod, the motion is transferred to the oil in the pressure chamber through the piston rod. As a result, the oil inside the pressure chamber flows out of the orifices located in the inner tube. This causes compression in the pressure chamber. The product of this hydraulic pressure and the pressure-applied area of the piston is resistance, which acts on the colliding object. Soft absorbers use this resistance to apply the brake to the colliding object, slowing it down. The hydraulic pressure generated inside the pressure chamber is proportional to the square velocity of the colliding object, as long as the orifice size, oil viscosity, etc. are constant. This is called velocity-squared resistance.

Structural Absorption Characteristics of Soft Absorbers

Soft Silent Safety
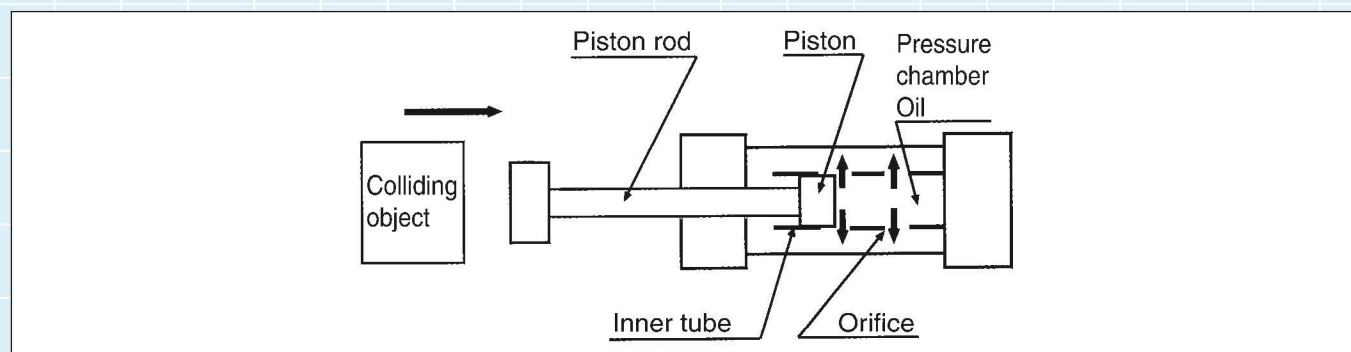
Soft absorbers are divided into two major categories based on how the orifice area changes, and they are further divided into four groups according to their absorption characteristics. Each of the absorption characteristics is described below.

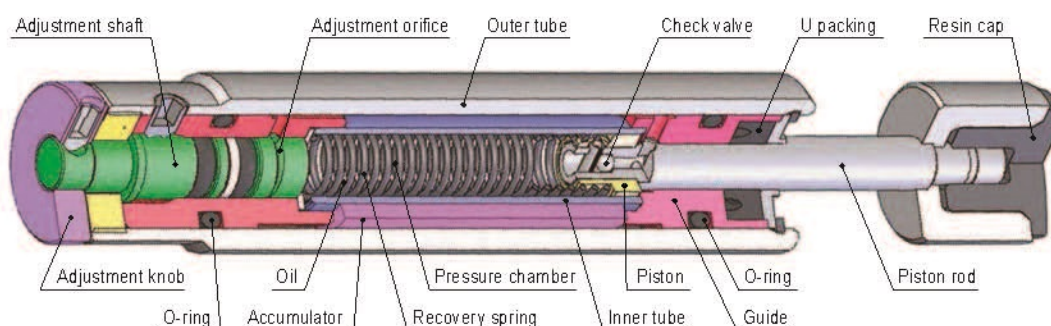| Constant orifice	Single-orifice type		There are three structures in a single-orifice type: a dashpot structure that utilizes the space between the piston and cylinder tube; a single tube structure in which orifices are provided in the piston; and a double tube type single orifice structure (adjustable). Their resistance characteristics are shown in the graph to the right. When the piston moves within the cylinder tube, the product of the pressure generated in the inner tube and the piston area becomes the resistance. Throughout the entire stroke, the orifice area is constant. The resistance spikes immediately after the impact, and as the stroke advances, the speed decreases and the resistance decreases with it.	
Stroke-dependent orifice	Multiple-orifice type		It has a double structure comprising an outer tube and an inner tube. Similar to the single-orifice type, the resistance is the product of the pressure generated inside the inner tube when the piston is stroking and the piston area. The orifice area at the moment of impact is larger compared to the single type, and because it gradually decreases as the stroke advances, it can suppress the overall resistance. Theoretically, the resistance during a stroke can be maintained constant. Depending on the orifice design, the resistance characteristics can be modified according to the impact conditions.	
	Multiple varying orifice type		Although it has the same structure as the multiple-orifice type, resistance characteristics that are suitable for the intended use can be obtained rather than a constant damping force. FWM series is designed to absorb the kinetic energy in the first half of the stroke and to perform speed control during the last half of the stroke. Because of this, ideal energy absorption with respect to the air-cylinder thrust can be obtained.	
	Groove-orifice type		Through a single tube system, the orifice groove provided on the inside wall of the tube changes as the stroke advances. Similarl to the multiple type, it has a large orifice area at the beginning of the stroke. As the stroke advances, the orifice area becomes smaller, suppressing the resistance. In addition, because the orifice area can be changed on a continuous basis, the resistance fluctuates less compared to the multiple type. Because of this, optimal energy absorption can be realized.	

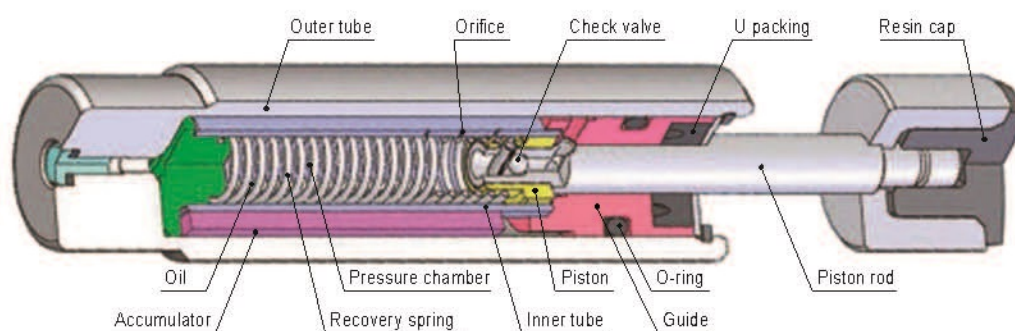Soft Silent Safety

Structures of Soft Absorbers (1)

Soft absorbers have two types of structure: an adjustable type in which the absorption characteristics can be adjusted, and a fixed type, which is non-adjustable. Each structure is shown below.

Adjustable Type

Adjustment shaft · Adjustment orifice · Outer tube · Check valve · U packing · Resin cap · Adjustment knob · Oil · Pressure chamber · Piston · O-ring · Piston rod · O-ring · Accumulator · Recovery spring · Inner tube · Guide

By rotating the adjustment knob (adjustment shaft) located towards the rear of the main body, the amount of oil flowing out of the pressure chamber can be adjusted, which in turn adjusts the absorption characteristics. For the multiple types, the adjustment can only be made with the final orifice; therefore, the range of adjustment is limited. The adjustment range is wider in the single types. Because the orifice area changes in an analog manner, fine-tuning of the absorption characteristics is possible.
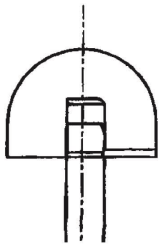
Fixed Type

Outer tube · Orifice · Check valve · U packing · Resin cap · Oil · Pressure chamber · Piston · O-ring · Piston rod · Accumulator · Recovery spring · Inner tube · Guide
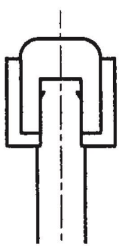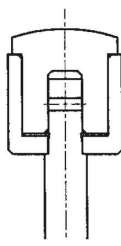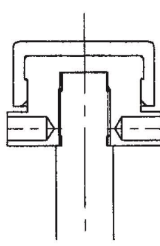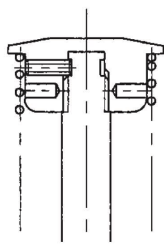
Because it has no adjustment mechanism, the overall length is shorter than the adjustable type. By customizing your orifice design, optimal absorption characteristics can be obtained. In addition, because the characteristics are fairly uniform, more than two of them can be used in parallel. For the fixed type FK series, high-speed, mid-speed, and low-speed types are generally available to accommodate various speeds.

Structures of Soft Absorbers (2)

Soft Silent Safety

Purpose of the Accumulator

Here, the purpose of the accumulator, which is shown on the previous page, shall be described. As shown below, when work collides with a soft absorber, the piston rod initiates a stroke, causing the oil to flow into the other side of the piston through the orifices. In short, the capacity of oil chamber B is reduced by the piston rod, and not all of the oil in oil chamber A is able to flow into the oil chamber B. In order to secure the capacity reduced by the piston rod, a self-foaming nitrile rubber is provided. The pressure of the oil compresses the rubber so that it absorbs the capacity that is equivalent to the piston rod. This is the role of an accumulator. Although silicone oil is used in a soft absorber, there are certain types of hydraulic oils that do not work well with certain types of accumulator. Using improper hydraulic oil causes the nitrile rubber to harden, reducing the durability of the soft absorber.
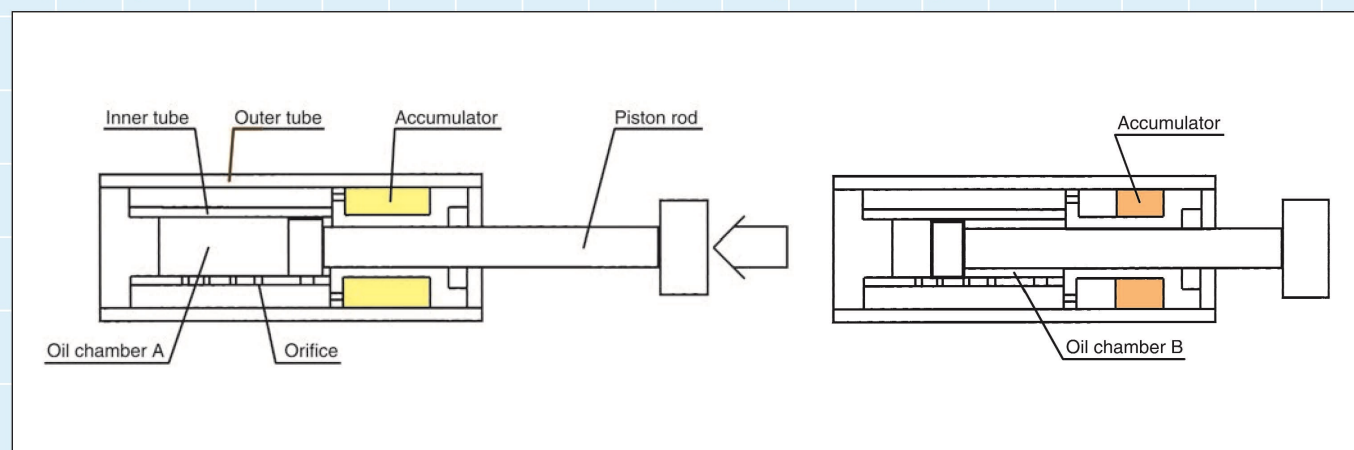
Soft Absorber's Cap: Securing Method and Materials

Diagrams illustrating how the caps are secured					
Cap material	Resin	Resin	Resin	Polyurethane rubber	Metal
Securing method	Directly press-fit onto the rod	Press-fit on the metal holder	Press-fit on the metal holder	Press-fit on the metal holder	Screwed into the piston rod
Applicable models	FA-1212 series FA-1010 series FA-1215 series	FA-0805 series FA-1005 series FA-1008 series FWM-1008 series FK-1008 series FK-1417 series	FA/FWM-1210 FA/FWM-1410 FA/FWM-1612 FA/FWM-2016 FA/FWM-2530 FA/FWM-2725 FK-1210 FK-1412 FK-1612 FK-2016 FK-2530 FK-2725	FA/FWM-2540 FK-2540 FA/FWM-3035 FA/FWM-3650	FA/FWM-4250 FA/FWM-4280

Soft Silent Safety

Selection Method for Soft Absorbers

1. Verifying the Type of Motion

Impact conditions can be divided into following categories. When making a selection, it is necessary to calculate the energy for the relevant category and then consider the attachment method.

| Horizontal motion without thrust | Thrusting motion | Falling motion | Rotating motion |
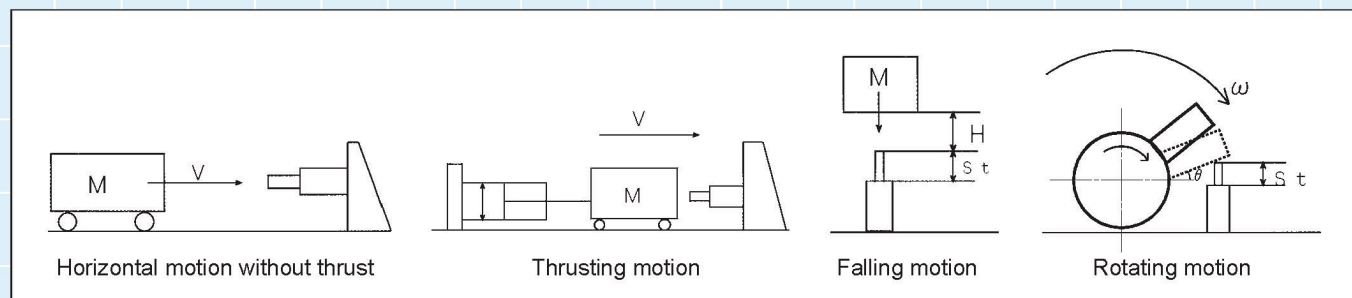
2. Energy Calculation

2-1. Linear motion

<Specifications to be verified>

☐ Mass of the colliding object : M (kg)
☐ Impact rate : V (m/s)
☐ Thrust : F (N) (air cylinder, thrust of the motor, friction, gravity, etc.)
☐ Number of soft absorber receivers : N
☐ Falling height : H (m) (Only if a falling motion is applicable. The soft absorber's stroke is not included.)
☐ Soft absorber stroke : St (m)

<Equations>

Horizontal motion without thrust

$$E = \frac{1}{2} \times M \times V^2$$

Thrusting motion

$$E = \frac{1}{2} \times M \times V^2 + F \times St$$

Falling motion

$$E = M \times g \times (H + St) \quad \text{(g: Acceleration due to gravity = 9.8m/s}^2\text{)}$$

2-2. Rotating motion

<Specifications to be verified>

☐ Mass of the colliding object : M (kg)
☐ Angular velocity of the impact : ω (rad/s)
☐ Torque : T (N·m)
☐ Moment of inertia : I (kg·m²)
☐ Stopping angle : θ (rad)

<Equations>

Thrusting motion

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

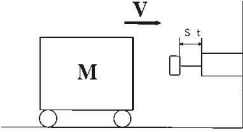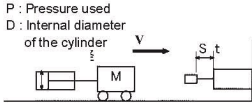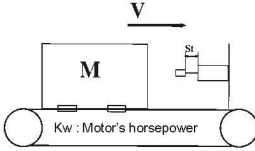### 2-3. Other equations (the following equations indicate the minimum values; the actual values will be larger)
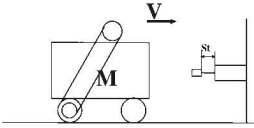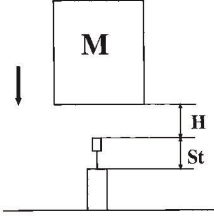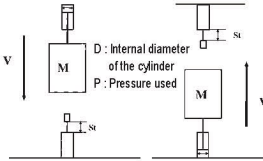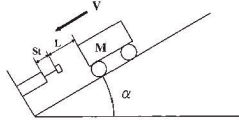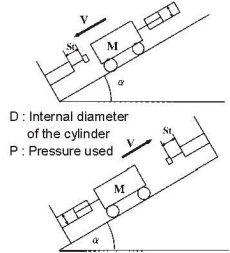
☐ Deceleration (G value)
$$G = \frac{0.051 \times V^2}{St}$$
This indicates the degree of impact at the time of collision. (Smaller value means smaller impact)

☐ Braking force
$$F = \frac{E}{St}$$
This indicates the resistance that is generated in the soft absorber at the moment of collision. This value is required for confirming the strength of attachment parts.

☐ Braking time
$$t = \frac{2 \times St}{V}$$
This indicates the time it takes for the colliding object to come to a complete stop after colliding with a soft absorber.

Soft Silent Safety — Selection Procedure for Soft Absorbers

<Selection Procedure>

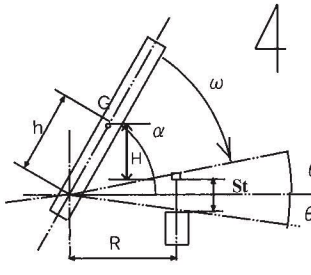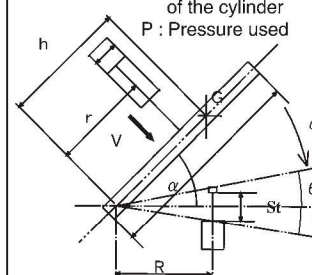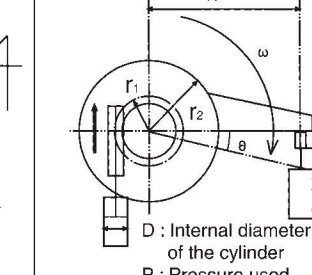| Item	Details
1 Verification of the operating conditions	Verification of the types of motion: determine if it is a linear motion or a rotating motion, and whether thrust is present or not. Identify the specifications required for the selection. Verification of the colliding object's mass: Determine the maximum mass M (kg) of the colliding object. Verification of the impact rate: Determine the velocity V (m/s) just before it collides with the absorber. If the impact rate is not clear because the colliding object is cylindrical, the impact rate is determined by doubling the average velocity.
2 Calculation of the colliding object's kinetic energy	Based on the equation, calculate the kinetic energy, E_1 $E_1 = \dfrac{1}{2} \times M \times V^2$
3 Verification of thrust	Verify if thrust F is present, and if so, refer to the sample selection equation to determine the thrust. Based on these, select a tentative soft absorber.
4 Tentative determination of the absorber's stroke	Based on the tentatively selected soft absorber, the tentative stroke St is determined.
5 Calculation of thrusting energy	Determine Energy E_2 due to thrust. $E_2 = F \times St$
6 Calculation of the total energy E and selection of the soft absorbe	Determine the total energy E. $E = E_1 + E_2$
7 Checking the maximum absorption energy per minute	Based on the operating cycle C (times/min) and the total energy, determine the amount of energy per minute and confirm that it is within the specifications. $$E_3 \geqq E \times C$$
8 Checking the equivalent mass	When an impact is accompanied by thrust, always verify the equivalent mass, particularly for low-speed impacts (0.3m/s or slower). $Me = \dfrac{2 \times E}{V^2}$ Me must be smaller than the catalogue specifications. Me = M (mass of the colliding object) in horizontal impact without thrust.
9 Checking the operating temperature	Operating temperature must be within an acceptable range.
10 Other	Model selection can also be done on a computer using automatic selection software. Please contact our sales department for inquiries. You can also download information from our homepage. http://www.fujilatex.co.jp

Soft Silent Safety — Equations for the Selection of Soft Absorbers (1)

	Inertial impact (horizontal)	Cylindrical thrust (horizontal)	Motor-driven dolly (horizontal)	Friction-driven dolly (horizontal)
Impact (examples)		P : Pressure used D : Internal diameter of the cylinder 	Kw : Motor's horsepower	Kw : Motor's horsepower N1 : Total number of wheels N2 : Number of driving wheels
Mass of the colliding object (kg)	M	M	M	M
Impact rate (m/s)	V	V	V	V
Kinetic energy (J)	$E_1 = \dfrac{1}{2}M \cdot V^2$	$E_1 = \dfrac{1}{2}M \cdot V^2$	$E_1 = \dfrac{1}{2}M \cdot V^2$	$E_1 = \dfrac{1}{2}M \cdot V^2$
Thrust (N)	————	$F = \dfrac{\pi D^2}{4} \times P \times 10^6$ *1	$F = \dfrac{kw \times 2.5 \times 10^3}{V}$ *2	$\left(\begin{array}{l} F = 0.25 \cdot M \cdot g \cdot N1/N2 \\ F = \dfrac{kw \times 2.5 \times 10^3}{V} \end{array} \right.$ *3
Thrusting energy (J)	————	$E_2 = F \cdot St$	$E_2 = F \cdot St$	$E_2 = F \cdot St$
Total energy (J)	$E = \dfrac{E_1}{N}$ (N: Number of soft absorber receivers)	$E = \dfrac{E_1 + E_2}{N}$ (N: Number of soft absorber receivers)	$E = \dfrac{E_1 + E_2}{N}$ (N: Number of soft absorber receivers)	$E = \dfrac{E_1 + E_2}{N}$ (N: Number of soft absorber receivers)
Equivalent mass (kg)	$Me = \dfrac{M}{N}$	$Me = \dfrac{2 \cdot E}{V^2}$	$Me = \dfrac{2 \cdot E}{V^2}$	$Me = \dfrac{2 \cdot E}{V^2}$

	Free-fall (vertical)	Cylindrical thrust (up and down)	Free-fall (slope)	Cylindrical thrust (slope; up and down)
Impact (examples)		D : Internal diameter of the cylinder P : Pressure used		D : Internal diameter of the cylinder P : Pressure used
Mass of the colliding object (kg)	M	M	M	M
Impact rate (m/s)	$V = \sqrt{19.6H}$	V	$V = \sqrt{19.6L \cdot \sin\alpha}$	V
Kinetic energy (J)	$E_1 = M \cdot g \cdot H$	$E_1 = \dfrac{1}{2}M \cdot V^2$	$E_1 = M \cdot g \cdot L \cdot \sin\alpha$	$E_1 = \dfrac{1}{2}M \cdot V^2$
Thrust (N)	$F = M \cdot g$	$F = F_1 + M \cdot g$ (Descending) $F = F_1 - M \cdot g$ (Ascending) (F₁: Cylindrical thrust)	$F = M \cdot g \cdot \sin\alpha$	$F = F_1 + M \cdot g \cdot \sin\alpha$ (Descending) $F = F_1 - M \cdot g \cdot \sin\alpha$ (Ascending) (F₁: Cylindrical thrust)
Thrusting energy (J)	$E_2 = M \cdot g \cdot St$	$E_2 = F \cdot St$	$E_2 = F \cdot St$	$E_2 = F \cdot St$
Total energy (J)	$E = \dfrac{E_1 + E_2}{N}$ (N: Number of soft absorber receivers)	$E = \dfrac{E_1 + E_2}{N}$ (N: Number of soft absorber receivers)	$E = \dfrac{E_1 + E_2}{N}$ (N: Number of soft absorber receivers)	$E = \dfrac{E_1 + E_2}{N}$ (N: Number of soft absorber receivers)
Equivalent mass (kg)	$Me = \dfrac{2 \cdot E}{V^2}$	$Me = \dfrac{2 \cdot E}{V^2}$	$Me = \dfrac{2 \cdot E}{V^2}$	$Me = \dfrac{2 \cdot E}{V^2}$

Soft Silent Safety — # Equations for the Selection of Soft Absorbers (2)

	Free-fall (rotating)	Cylindrical thrust (rotating)	Cylindrical thrust (horizontally rotating)
Impact (examples)		D : Internal diameter of the cylinder P : Pressure used	D : Internal diameter of the cylinder P : Pressure used
Mass of the colliding object (kg)	M	M	M
Impact rate (m/s)	$V=\sqrt{\dfrac{2E_1}{I}\cdot R^2}$	$V=R\cdot\omega$	$V=R\cdot\omega$
Kinetic energy (J)	$E_1=M\cdot g\cdot H$	$E_1=\dfrac{1}{2}I\cdot\omega^2$	$E_1=\dfrac{1}{2}I\cdot\omega^2$
Thrust (N)	$F=\dfrac{M\cdot g\cdot h}{R}$	$F=\left(\dfrac{\pi D^2 P}{4}\times10^6+Mg\right)\times\dfrac{r}{R}$	$F=\dfrac{r_1}{R}\left(\dfrac{\pi D^2 P}{4}\right)\times10^6$
Thrusting energy (J)	$E_2=F\cdot St$	$E_2=F\cdot St$	$E_2=F\cdot St$
Total energy (J)	$E=\dfrac{E_1+E_2}{N}$ (N: Number of soft absorber receivers)	$E=\dfrac{E_1+E_2}{N}$ (N: Number of soft absorber receivers)	$E=\dfrac{E_1+E_2}{N}$ (N: Number of soft absorber receivers)
Equivalent mass (kg)	$Me=\dfrac{2\cdot E}{V^2}$	$Me=\dfrac{2\cdot E}{V^2}$	$Me=\dfrac{2\cdot E}{V^2}$

Explanation of the symbols

Symbol	Unit	Explanation	Symbol	Unit	Explanation
E	J	Total energy (per soft absorber)	α	rad	Sloping angle
E_1	J	Kinetic energy	θ	rad	Vibrational angle within the soft absorber stroke
E_2	J	Thrusting energy	R	m	Distance between the centre of rotation and absorber
P	MPa	Pressure used by the driving cylinder	r_1	m	Pitch circle radius of pinion gear
D	m	Internal diameter of the driving cylinder	r_2	m	Radius of turntable
M	kg	Mass of the colliding object	h	m	Distance between the centre of rotation and centre of gravity
V	m/s	Impact rate	T	N·m	Driving torque
F	N	Thrust	ω	rad/s	Angular velocity
F_1	N	Air cylinder's thrust	I	kg·m²	Moment of inertia around the rotating shaft
St	m	Soft absorber stroke	N	Units	Number of soft absorber receivers
H	m	The distance an object falls until it hits the soft absorber	kw	kw	Motor capacity
L	m	Travelling distance on slope	N_1		Total number of wheels
g	m/s²	Acceleration due to gravity: 9.8m/s²	N_2		Number of driving wheels
G		Centre of gravity			

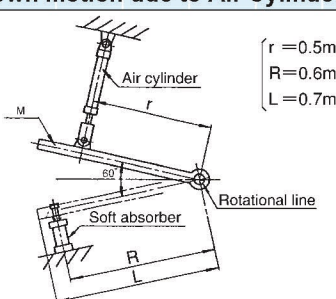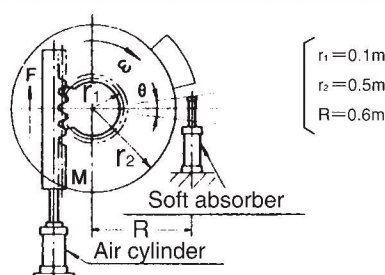*1 Includes empty weight and external force of a cylinder, etc.
*2 Includes torque due to empty weight and torque due to motor, etc.
*3 Use whichever value is smaller.
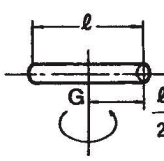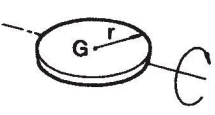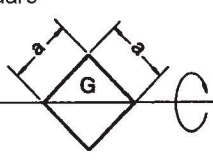
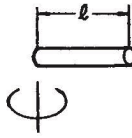# Sample Calculations for Selecting Soft Absorbers 1
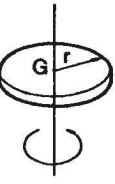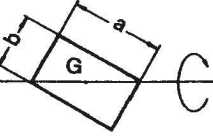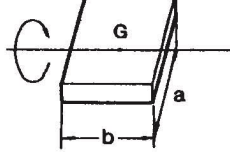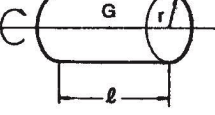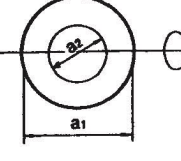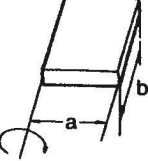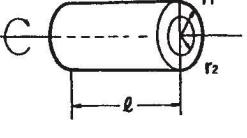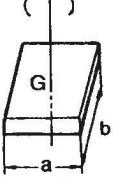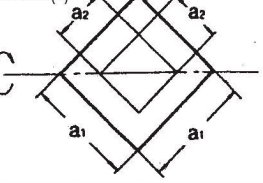
1. Thrusting Motion due to Air Cylinder Thrust	2. Thrusting Energy due to Motor-Driven Dolly

Case Examples

Soft absorber

Air cylinder
Internal diameter ø63 Pressure 0.5MPa
$V=0.7m/s$
$M=100kg$

Soft absorber

M

Specifications

☐ Mass of the colliding object M : 100kg
☐ Impact rate V : 0.7m/s
☐ Operation frequency C : 1 time/min
☐ Ambient temperature T : 0~25°C
☐ Thrust F : Varies with the air cylinder
     Cylinder diameter···63mm
     Air pressure···0.5MPa
☐ Number of soft absorber receivers N : 1 unit

☐ Mass of the colliding object M : 1500kg
☐ Impact rate V : 0.5m/s
☐ Operation frequency C : 1 time/min
☐ Ambient temperature T : 0~25°C
☐ Thrust F : Varies with the motor
     Motor output···3.7kw

☐ Number of soft absorber receivers N : 1 unit

Sample Calculations

1. Calculating kinetic energy
$$E1=1/2MV^2=1/2\times100\times0.7^2$$
$$=24.5 (J)$$

2. Calculating thrusting energy
$$E2=F\times St$$
Here, the soft absorber's stroke must be determined tentatively. In essence, because the absorber must have an absorption capacity larger than the calculated kinetic energy, tentatively select an absorber that has a capacity that is at least 24.5(J) higher than the catalogue specifications. Because the thrusting energy due to air cylinder must also be taken into consideration, tentatively select an absorber that has a capacity that is at least twice the kinetic energy. Here, FWM-2725FBD-* with a maximum absorption capacity of 79.4J is tentatively selected from the catalogue. Thrusting energy is determined as follows.
$$E2=\frac{3.14\times0.063^2\times10^6}{4}\times0.5\times0.025$$
$$=38.9 (J)$$

3. Determine the total energy.
$$E=E1+E2=24.5+38.9J$$
$$=63.4 (J)$$

4. Feasibility check
4-1. Using absorption energy to check
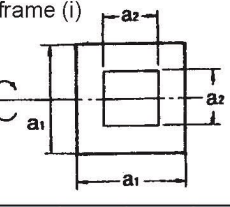   As the absorption energy of FWM-2725FBD-* is 79.4(J), it does not pose a problem.
4-2. Using equivalent mass to check
$$Me=2E/V^2=\frac{2\times63.4}{0.7^2}$$
$$=259 (kg)$$
As the equivalent mass of FWM-2725FBD-* is 450(kg), it does not pose a problem.
Based on these, FWM-2725FBD-* is selected.

1. Calculating kinetic energy
$$E1=1/2MV^2=1/2\times1500\times0.5^2$$
$$=187.5 (J)$$

2. Calculating thrusting energy
Here, the trust is first calculated. For a motor-driven dolly, the smaller calculated value based on the following two equations is used as thrust.
(1)
$$F=\frac{102\times kw\times2.5\times g}{V}=\frac{102\times3.7\times2.5\times9.8}{0.5}$$
$$=18492.6 (N)$$
(2) $F=M\times g\times\mu\times n1/n2$ (n1: Number of driving wheels, n2: Total number of wheels)
$$=1500\times9.8\times0.25\times1/2$$
$$=1837.5 (N)$$
Therefore, 1837.5N is used as thrust. At this point, a tentative absorber is selected.
FMA3350M is selected as the tentative soft absorber based on the kinetic energy.
Thrusting energy $E2=F\times St=1837.5\times0.05$
$$=91.9 (J)$$

3. Determine the total energy.
$$E=E1+E2=187.5+91.9$$
$$=279.4 (J)$$

4. Feasibility check
4-1. Using absorption energy to check
     As the absorption energy of FMA3350M is 310(J), it does not pose a problem.
4-2. Using equivalent mass to check
$$Me=2E/V^2=\frac{2\times279.4}{0.5^2}$$
$$=2235 (kg)$$
As the equivalent mass of FMA3350M is 2500(kg), it does not pose a problem. Based on these, FMA3350M is selected.

Soft Silent Safety

Sample Calculations for Selecting Soft Absorbers 2

	3. Up-and-Down Motion due to Air Cylinder Thrust	4. Rotating Motion due to Air Cylinder Thrust
Case Examples	Air cylinder / M / 60 / Soft absorber / Rotational line / R / L / $\begin{cases} r = 0.5m \\ R = 0.6m \\ L = 0.7m \end{cases}$	F / r₁ / θ / M / r₂ / Soft absorber / R / Air cylinder / $\begin{cases} r_1 = 0.1m \\ r_2 = 0.5m \\ R = 0.6m \end{cases}$

Specifications

3. Up-and-Down Motion

☐ Mass of the colliding object　M : 260kg
☐ Air Cylinder rate　v : 0.5m/s
☐ Operation frequency　C : 1 time/min
☐ Ambient temperature　T : 0~25°C
☐ Thrust　F : Varies with the air cylinder
　　　　　　Cylinder diameter···50mm
　　　　　　Air pressure···0.5MPa
☐ Number of soft absorber receivers　N : 1 unit

4. Rotating Motion

☐ Mass of the colliding object　M : 200kg
☐ Air Cylinder rate　v : 0.5m/s
☐ Operation frequency　C : 1 time/min
☐ Ambient temperature　T : 0~25°C
☐ Thrust　F : Varies with the air cylinder
　　　　　　Cylinder diameter···80mm
　　　　　　Air pressure···0.5MPa
☐ Number of soft absorber receivers　N : 1 unit

Sample Calculations

3. Up-and-Down Motion due to Air Cylinder Thrust

1. Calculating kinetic energy

$$E_1 = \frac{1}{2}I\omega^2 = \frac{1}{2}\times M\times\frac{L^2}{3}\times\left(\frac{v}{r}\right)^2$$

$$= \frac{1}{2}\times 260\times\frac{0.7^2}{3}\times\left(\frac{0.5}{0.5}\right)^2 = 21.2\,(J)$$

$$\left(\text{Impact rate } V = v\times\left(\frac{R}{r}\right) = 0.5\times\frac{0.6}{0.5} = 0.6\,(m/s)\right)$$

2. Calculating thrusting energy

$$E_2 = T\Theta = \left(\frac{\pi D^2 P}{4}\times 10^6\times r + Mg\times\frac{L}{2}\right)\times\frac{St}{R}$$

$$= \left(\frac{3.14\times 0.05^2\times 0.5}{4}\times 10^6\times 0.5 + 260\times 9.8\times\frac{0.7}{2}\right)$$

$$\times\frac{St}{0.6}$$

As in previous examples, the soft absorber's stroke is tentatively determined. Here, FWM-3035TBD-* with a maximum absorption capacity of 196(J) is tentatively selected from the catalogue. Thrusting energy is determined as follows.

$$E_2 = \left(\frac{3.14\times 0.05^2\times 0.5}{4}\times 10^6\times 0.5 + 260\times 9.8\times\frac{0.7}{2}\right)$$

$$\times\frac{0.035}{0.6} = 80.6\,(J)$$

3. Determine the total energy.

$$E = E_1 + E_2 = 21.2 + 80.6 = 101.8\,(J)$$

4. Feasibility check

4-1. Using absorption energy to check
　　As the absorption energy of FWM-3035TBD-* is 196(J), it does not pose a problem.

4-2. Using equivalent mass to check

$$Me = \frac{2E}{V^2} = \frac{2\times 101.8}{0.6^2} = 565.6\,(kg)$$

As the equivalent mass of FWM-3035TBD-* is 1300(kg), it does not pose a problem. Based on these, FWM-3035TBD-* is selected.

4. Rotating Motion due to Air Cylinder Thrust

1. Calculating kinetic energy

$$E_1 = \frac{1}{2}I\omega^2 = \frac{1}{2}\times M\times\frac{r_2^2}{2}\times\left(\frac{v}{r_1}\right)^2$$

$$= \frac{1}{2}\times 200\times\frac{0.5^2}{2}\times\left(\frac{0.5}{0.1}\right)^2 = 312.5\,(J)$$

$$\left(\text{Impact rate } V = v\times\left(\frac{R}{r_1}\right) = 0.5\times\left(\frac{0.6}{0.1}\right) = 3\,(m/s)\right)$$

2. Calculating thrusting energy

$$E_2 = T\Theta = F\times r\times\frac{St}{R}$$

$$= \frac{3.14\times 0.08^2\times 0.5}{4}\times 10^6\times 0.1\times\frac{St}{0.6}$$

At this point, the soft absorber's stroke must be determined tentatively. FA-4250YD-C with a maximum absorption capacity of 441(J) is tentatively selected from the catalogue. Thrusting energy is determined as follows.

$$E_2 = \frac{3.14\times 0.08^2\times 0.5}{4}\times 10^6\times 0.1\times\frac{0.05}{0.6} = 20.9\,(J)$$

3. Determine the total energy.

$$E = E_1 + E_2 = 312.5 + 20.9 = 333.4\,(J)$$

4. Feasibility check

4-1. Using absorption energy to check
　　As the absorption energy of FA-4250YD-C is 441(J), it does not pose a problem.

4-2. Using equivalent mass to check

$$Me = \frac{2E}{V^2} = \frac{2\times 333.4}{3^2} = 37\,(kg)$$

As the equivalent mass of FA-4250YD-C is 390(kg), it does not pose a problem. Based on these, FA-4250YD-C is selected.

Soft Silent Safety

Calculation Reference for Selecting Soft Absorbers 1

Quick Reference for Moment of Inertia

Unit: kg·m2

Shape	Slim rod	Thin disc	Thin square
Rotating shaft	It is perpendicular to the rod and passes through the centre of gravity	It is parallel to the plain and passes through the centre of gravity	The axis passes through the centre of gravity and the opposing corner
Moment of inertia	$M \cdot \dfrac{\ell^2}{12}$	$M \cdot \dfrac{r^2}{4}$	$M \cdot \dfrac{a^2}{12}$
Shape	Slim rod	Thin disc	Thin rectangle
Rotating shaft	It is perpendicular to the rod at one of the ends	It is perpendicular to the plain and passes through the centre of gravity	It is an axis that is parallel to the plain and passes through the centre of gravity
Moment of inertia	$M \cdot \dfrac{\ell^2}{3}$	$M \cdot \dfrac{r^2}{2}$	$M \cdot \dfrac{b^2 a^2}{6(b^2 + a^2)}$
Shape	Thin rectangle	Cylinder	Thin donut shape
Rotating shaft	It is parallel to side b and passes through the centre of gravity	It is a central axis that passes through the centre of gravity	It is an axis that is parallel to the plain and passes through the central axis
Moment of inertia	$M \cdot \dfrac{a^2}{12}$	$M \cdot \dfrac{r^2}{2}$	$M \cdot \dfrac{(a_1{}^2 + a_2{}^2)}{16}$
Shape	Thin rectangle	Hollow cylinder	Square frame (i)
Rotating shaft	It is parallel to side b and is on one side	It is a central axis that passes through the mutual center	It is an axis that is parallel to the plain and passes through the central axis
Moment of inertia	$M \cdot \dfrac{a^2}{3}$	$M \cdot \dfrac{r_1{}^2 + r_2{}^2}{2}$	$M \cdot \dfrac{(a_1{}^2 + a_2{}^2)}{12}$
Shape	Rectangle	Sphere (filled)	Square frame (ii)
Rotating shaft	It is perpendicular to the plain and passes through the centre of gravity	It is an axis that passes through the centre of gravity	It is parallel to the plain and passes through the opposing corner
Moment of inertia	$M \cdot \dfrac{a^2 + b^2}{12}$	$M \cdot \dfrac{2r^2}{5}$	$M \cdot \dfrac{(a_1{}^2 + a_2{}^2)}{12}$

Soft Silent Safety — Calculation Reference for Selecting Soft Absorbers 2

Quick Reference for Thrust due to Air Cylinder and Thrusting Energy

DInternal diameter of the cylinder (mm)	Pushing side — Thrusting energy due to cylinder F (N)	Pressure P (MPa)	Thrusting energy E2 (J) = F·St — Soft absorber's absorption stroke St						
			8 (mm)	10 (mm)	12 (mm)	15 (mm)	16 (mm)	25 (mm)	25.4 (mm)
φ 12	33.9	0.3	0.271	0.339	0.407	0.509	0.542	0.848	0.861
	56.5	0.5	0.452	0.565	0.678	0.848	0.904	1.41	1.44
	79.2	0.7	0.634	0.792	0.950	1.19	1.27	1.98	2.01
φ 16	60.3	0.3	0.482	0.603	0.724	0.905	0.965	1.51	1.53
	101	0.5	0.808	1.01	1.21	1.52	1.62	2.53	2.57
	141	0.7	1.13	1.41	1.69	2.12	2.26	3.53	3.58
φ 20	94.2	0.3	0.754	0.942	1.13	1.41	1.51	2.36	2.39
	157	0.5	1.26	1.57	1.88	2.36	2.51	3.93	3.99
	220	0.7	1.76	2.20	2.64	3.30	3.52	5.50	5.59
φ 25	147	0.3	1.18	1.47	1.76	2.21	2.35	3.68	3.73
	245	0.5	1.96	2.45	2.94	3.68	3.92	6.13	6.22
	344	0.7	2.75	3.44	4.13	5.16	5.50	8.60	8.74
φ 32	241	0.3	1.93	2.41	2.88	3.60	3.84	6.00	6.10
	402	0.5	3.21	4.01	4.81	6.02	6.42	10.0	10.2
	563	0.7	4.49	5.61	6.73	8.42	8.98	14.0	14.2
φ 40	377	0.3	3.02	3.78	4.54	5.67	6.05	9.45	9.60
	628	0.5	5.04	6.30	7.56	9.45	10.1	15.8	16.0
	880	0.7	7.06	8.82	10.6	13.2	14.1	22.1	22.4
φ 50	589	0.3	4.70	5.88	7.06	8.82	9.41	14.7	14.9
	982	0.5	7.84	9.80	11.8	14.7	15.7	24.7	24.9
	1374	0.7	11.0	13.7	16.4	20.6	21.9	34.3	34.8
φ 63	935	0.3	7.51	9.39	11.3	14.1	15.0	23.5	23.9
	1560	0.5	12.6	15.7	18.8	23.6	25.1	39.3	39.9
	2180	0.7	17.5	21.9	26.3	32.9	35.0	54.8	55.6
φ 80	1510	0.3	12.1	15.1	18.1	22.7	24.2	37.8	38.4
	2510	0.5	20.1	25.1	30.1	37.7	40.2	62.8	63.8
	3520	0.7	28.1	35.1	42.1	52.7	56.2	88.0	89.2

Cautions for Using Soft Absorbers 1

Soft Silent Safety

1. Parallel Use of Small Absorbers

1–1. Fixed soft absorbers

Fixed soft absorbers can be used in parallel, as they perform in a similar manner.

1–2. Adjustable soft absorbers

Parallel use of adjustable soft absorbers is not recommended, as some cannot be adjusted to perform equally. However, please contact our sales department when the following conditions apply.

1. The colliding work is guided and there is no risk of eccentric load.

2. When N is the number of receiving units and A is the required absorption energy capacity, A/N (absorption energy capacity per one unit) is sufficiently lower than the absorption capacity of the soft absorber to be used.

2. Operating Environment of Soft Absorbers

2-1. Do not use in an environment where oil mist, cutting oil, etc. may come in contact with a soft absorber. This is because oil can penetrate through the piston rod, disabling the stroke. When using under such circumstances, the soft absorber must be liquid-proofed.

1. Using absorbers with coolant specifications
   There are models with triple packing.
   (This does not protect against all damages.)

2. Covering the piston rod with eccentric angle adaptors, etc.
   Although it will protect against direct oil contact, oil may still penetrate through a gap between the eccentric angle adaptor and the cap.
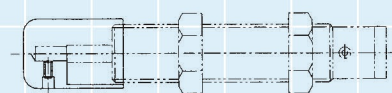   (This does not protect against all damages.)

(Eccentric angle adaptor)

3. Using absorbers with liquid-proof cap specifications
   Although it is effective when the rod is facing upward, it cannot be used when the rod is facing sideways or downward. It may also not be effective against oil mist.
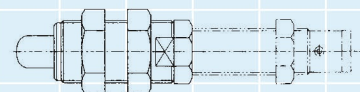
(Liquid-proof cap)

2-2. Using soft absorbers in a vacuum

Soft absorbers cannot be used in a vacuum. The absorber itself must be used outside the vacuum environment.

2-3. Using soft absorbers in dusty environments

Please use absorbers with dust seals. (However, depending on the environment, they may not be fully effective for ensuring durability.)

3. Protecting soft absorbers from eccentric load

Ensure that the angle of impact with respect to the soft absorber is 2.5° or less. A rod guide that acts as an eccentric load adaptor is required for an eccentric load with an angle of impact of over 2.5°. In principle, an adaptor that undergoes a rotating motion must be set in a location where the distance from the rotational centre of work is at least 12 times the stroke length, as well as where the collision occurs at a right angle at 1/2 of the stroke length. In the event that it is perpendicular at the stroke end, please secure a distance that is at least 24 times the stroke length from the work's rotational centre.

2.5°
2.5°

At least 12 times the stroke
1/2 of the stroke
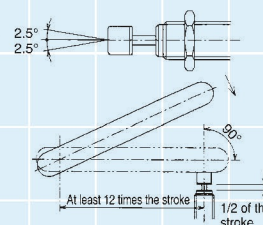
4. Mounting strength of soft absorbers

The impact absorption of a soft absorber requires sufficient mounting strength. A good guideline is to secure a mounting strength that is 2 to 3 times larger than the max. drag based on the absorber specifications.

Colliding object

Breakage or bending due to insufficient strength
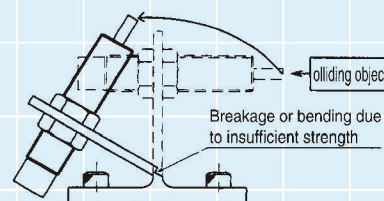
5. Adjusting soft absorbers

When using an adjustable soft absorber, turn the adjustment knob to make the necessary adjustment. A smaller number on the indicator means a smaller equivalent mass. Turn to a smaller number for high-speed impact, and turn to a larger

Indicator
Adjustment reference point
Adjustment knob

Soft Silent Safety
Cautions for Using Soft Absorbers 2
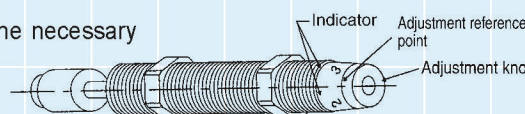
number for slow-speed impact. The adjustment knob can also be set between two integers. The adjustment knob can rotate more than 360°. Once the adjustment is complete, secure it firmly with a lock screw. (Please note that certain types do not come with a lock screw.)

6. Cautions for attaching a holder with a switch

1. When attaching a holder with no stopper function, ensure that there is a gap between the switch and the cap's tip when the piston rod is pressed all the way down to the stroke end. Otherwise, the switch may become damaged by the impact.
2. Set the holder's position so that the switch's tip and the edge of the metallic ring on the rod cap are at least 0.5mm apart. Otherwise, it will not work properly.
3. When attaching a holder with a switch to an adaptor, please be extremely careful not to screw it into the adaptor more than is necessary. This may cause the adaptor to press against the switch's sensor, damaging the switch. (When attaching, please ensure that the absorber's edge is not protruding out of the holder's edge.)
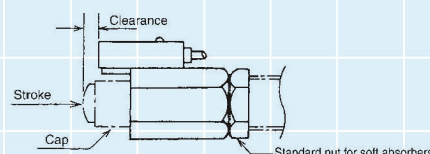
7. Cautions for Using the Switch

1. Do not use when it is in a transient state after the power is turned on (approx. 10ms).
2. Keep the cables as short as possible when using in places with a lot of noise. Also, please take all precautions, such as avoiding the parallel wiring of electric lines and power lines, as well as wiring within the same conduit.
3. Ensure that the switch does not come into direct contact with thinner-type chemicals.
4. Because it does not have a short-protection circuit, wiring must be done correctly.

8. Equivalent Mass of Soft Absorbers

During the soft absorber selection process, sometimes the absorption energy alone is considered without confirming the equivalent mass, or the maximum mass of the colliding object is confused with the equivalent mass. In order to make the most appropriate selection, the equivalent mass conditions must be satisfied. But why is satisfying the equivalent mass conditions so vital to securing optimal impact absorption? Selecting the best soft absorber means selecting the soft absorber that can generate the optimal drag. What are the factors that determine the optimal drag? Let us review the principles of soft absorbers.
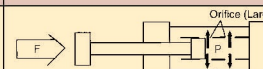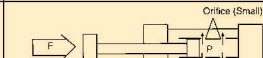
Model GXL-8F specifications   Manufactured by SUNX

Item	Summary	Specification
Detection distance	Standard detected object 15X15X1 (Iron)	1.8mm
Power voltage		12~24VDC±10%
Consumption current		15mA or lower
	Behaviour form	NO type
	Output form	NPN open collector
	Output capacity (with 24VDC power voltage)	100mA or lower
	Protection feature	Comes with a surge absorption circuit
Residual voltage	At 100mA inflowing current	1V or lower
	At 60mA inflowing current	0.4V or lower
	Input/Output circuit diagram	Operation indicator light Red LED (lights up when the output is ON)
Response frequency		500Hz
Ambient operating temperature		0~55°C
Ambient storage temperature		-30~80°C
Ambient operating humidity		45~85%RH
Ambient storage humidity		35~95%RH
Lead wire length		Approx. 1m
Mass	Including cable	Approx. 11g

$F = P \times A$ (P: Generated internal pressure of the absorber, A: Pressure-receiving piston area)

Based on the above equation, it is clear that if an appropriate P (Pressure) can be generated, the appropriate drag F can be obtained. One of the factors that determines the pressure P is the orifice area. An overview of the relationship between the orifice area, equivalent mass, and internal pressure is shown below. Considering the relationship between impact rate and orifice area, using an absorber with a small orifice area to receive an impact from a high-speed collision results in an excessive increase in the internal pressure, causing a jolt. On the other hand, using an absorber with a large orifice area to receive a low-speed impact does not generate enough internal pressure, which in turn prevents the necessary drag from being generated.

Orifice area	Equivalent mass Me	Generated internal pressure P	
Large	Small	Small	
Small	Large	Large	

An adjustable absorber can adjust the size of the orifice area, allowing the absorber to generate the appropriate hardness, in another words, the drag, according to the impact rate. Consequently, maximum equivalent mass can be defined as the smallest possible orifice area in an adjustable absorber based on the relationship between equivalent mass and impact rate. In other words, it is the adjustable state in which the slowest impact rate under the operating conditions can be handled. Therefore, if the energy calculation and equivalent mass calculation based on the operating conditions result in a value that exceeds the maximum equivalent mass, the orifice area of the absorber cannot be set to the ideal size. In other words, it will not be able to decelerate the impact rate properly. The maximum absorption energy capacity of a soft absorber is a crucial factor in preventing the absorber from being damaged, and confirming the equivalent mass is therefore vital to the rate control for impact absorption. Therefore, both conditions must be satisfied for the absorber to function properly.

Soft Silent Safety

Soft Absorber Line-up

Model	Fixed Type								
Series	FPD-1012	FPD-1030	FPD-1050	FPD-1060	FPD-1070	FA-1212	FA-1010	FA-1215	FA-0805
Orifice type	Single orifice type	Available Soon				Dashpot structure	Groove-orifice type		Single orifice type
Exterior									
Absorption energy (J)	1.0	—	—	—	—	0.29~1.0	0.98~3.23	7.84~11.7	0.39~0.68
Stroke (mm)	11~12	30	50	60	70	12	10	15	5
Max. equivalent mass (kg)	3~15	—	—	—	—	1.5~3.0	10~20	30~40	3~5
Range of impact rate (m/s)	0.1~1	—	—	—	—	0.1~1	0.1~1	0.1~1.5	0.3~1
Featuring page	78~79	80~81	80~81	80~81	80~81	82~83	84~85	84~85	86~87

Model	Fixed Type			Adjustable Type					
Series	FA-1005	FA-1008	FA-1210	FA-0806	FA/FWM-1008	FA/FWM-1210	FA/FWM-1410	FA/FWM-1612	FA/FWM-2016
Orifice type	Single orifice type			Single orifice type	Single-, Multiple-, Multiple varying-orifice type				
Exterior									
Absorption energy (J)	0.68~0.98	0.98~1.47	1.96~2.45	1.4	1.47~1.76	2.94~4.9	3.92~5.88	9.8	29.4
Stroke (mm)	5	8	10	6	8	10	10	12	16
Max. equivalent mass (kg)	5~8	7~10	15~30	15	2.5~10	4~30	4.5~35	10~50	120~300
Range of impact rate (m/s)	0.3~1	0.3~1	0.3~1	0.3~2	0.3~3	0.3~3	0.3~3	0.3~3	0.3~3
Featuring page	86~87	86~87	86~87	88~89	90~91	92~93	94~95	96~97	98~99

Soft Absorber Line-up

Soft Silent Safety
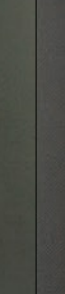
Model	Adjustable Type								
Series	FA/FWM-2530	FA/FWM-2540	FA/FWM-2725	FA/FWM-3035	FA-3625	FA/FWM-3650	FA-4225	FA-4250	.FA-4275
Orifice type	Single-, Multiple-, Multiple varying-orifice type								
Exterior									
Absorption energy (J)	49	63.7	79.3	196	150～192	392	260	520	780
Stroke (mm)	30	40	25	35	25	50	25	50	75
Max. equivalent mass (kg)	150～400	200～400	300～650	700～1300	680～2000	1400～2700	3400	6500	9700
Range of impact rate (m/s)	0.3～3	0.3～3	0.3～3	0.3～3	0.3～3	0.3～3	0.3～3	0.3～3	0.3～3
Featuring page	102～103	104～105	106～107	108～109	110～111	112～113	114～115	114～115	114～115

Model	Adjustable Type				Fixed Type				
Series	FA/FWM-4250	FA/FWM-4280	FA-2016EA	FA-2725FA	FK-0404	FK-0604	FK-1008	FK-1210	FK-1412
Orifice type	Single-, Multiple-, Multiple varying-orifice type				Groove-orifice type		Multiple-orifice type		
Exterior									
Absorption energy (J)	441	720	25.4	79.3	0.1～0.3	0.1～0.5	2.94	6.86	9.8
Stroke (mm)	50	80	16	25	4	4	8	10	12
Max. equivalent mass (kg)	390～3500	640～5500	200	500	1～3	1～3	2.5～20	6～50	8～75
Range of impact rate (m/s)	0.3～3	0.3～3	0.15～3	0.15～3	0.3～1	0.3～1	0.3～3	0.3～3	0.3～3
Featuring page	116	117	118～119	118～119	124～125	124～125	124～125	124～125	124～125

Soft Silent Safety — Soft Absorber Line-up

Model	Fixed Type							
Series	FK-1417	.FK-1612	FK-2016	FK-2022	FK-2050	FK-2530	FK-2540	FK-2550
Orifice type	Multiple-orifice type							
Exterior								
Absorption energy (J)	14.7	14.7	29.4	44.1	98	88.2	117	147
Stroke (mm)	17	12	16	22	50	30	40	50
Max. equivalent mass (kg)	13〜110	13〜110	25〜230	15〜73	8〜30	75〜390	30〜480	30〜100
Range of impact rate (m/s)	0.3〜3	0.3〜3	0.3〜3	0.3〜3	0.3〜3	0.3〜3	0.3〜3	0.3〜3
Featuring page	124〜125	124〜125	126〜127	126〜127	126〜127	126〜127	126〜127	126〜127

Model	Fixed Type				Adjustable Type		
Series	FK-2725	FK-3035	FK-3625	FK-3650	FL-1214	FL-1417	FL-1620
Orifice type	Multiple-orifice type				Multiple-orifice type		
Exterior							
Absorption energy (J)	79	196	150〜200	392	5.4	14.7	17.6
Stroke (mm)	25	35	25	50	14	17	20
Max. equivalent mass (kg)	47〜420	173〜1560	150〜2000	306〜3137	30	50	60
Range of impact rate (m/s)	0.3〜3	0.3〜3	0.3〜3	0.3〜3	0.3〜3	0.3〜3	0.3〜3
Featuring page	128〜129	128〜129	128〜129	128〜129	134〜135	134〜135	134〜135

Soft Absorber Line-up

Soft Silent Safety

Model	Adjustable Type			Fixed Type			
Series	FS-2006	FS-2506	FS-2706	FV-2008	FV-2508	FV-2708	FW-1212L
Orifice type	Single orifice type			Multiple-orifice type			
Exterior							
Absorption energy (J)	7.8	11.7	15.6	8.8	13.7	19.6	4.9
Stroke (mm)	6	6	6	8	8	8	12
Max. equivalent mass (kg)	60	90	120	70	110	150	39
Range of impact rate (m/s)	0.3～1	0.3～1	0.3～1	0.3～1	0.3～1	0.3～1	0.3～1
Featuring page	138	138	138	139	139	139	136～137

Model	Fixed Type							
Series	FW-1616M	FW-2025M	FW-2530M	FED-2010	FED-3020	FSB-1205	FSB-1407	FSB-1609
Orifice type	Multiple-orifice type			Groove-orifice type		Single orifice type	Multiple-orifice type	
Exterior								
Absorption energy (J)	13.7	39.2	62.7	19.6	98	0.68	2.5	6
Stroke (mm)	16	25	30	10	20	5	7	9
Max. equivalent mass (kg)	30	87	140	30	140	5	20	50
Range of impact rate (m/s)	0.3～2	0.3～2	0.3～2	0.5～2	0.5～2	0.3～1	0.3～1	0.3～1
Featuring page	136～137	136～137	136～137	140	141	142～143	142～143	142～143

Soft Silent Safety FPD-1012 Series

U Packing Seal Type, Single Orifice Structure, Fixed

Model Description

F P D — 1 0 1 2　　A 1 — S B
① ② ③ ④ ⑤

①Base model
②External diameter, Stroke
③Symbols indicating characteristics
　　A1: Low-load specifications
　　A3: Medium-load specifications
　　A5: High-load specifications
④Symbols indicating form
　　S: S type (Standard)
　　C: C type (Cap)
　　R: R type (Elastomer cap)
　　D: D type (Eccentric angle cap)
　　* Please refer to the external dimensions.
⑤Color symbols　W: White
　　　　　　　　　B: Black

<External Dimensions>

FPD-1012A1-S (S type)

FPD-1012A1-R (R type)

FPD-1012A1-C (C type)

FPD-1012A1-D (D type)

<Specifications>
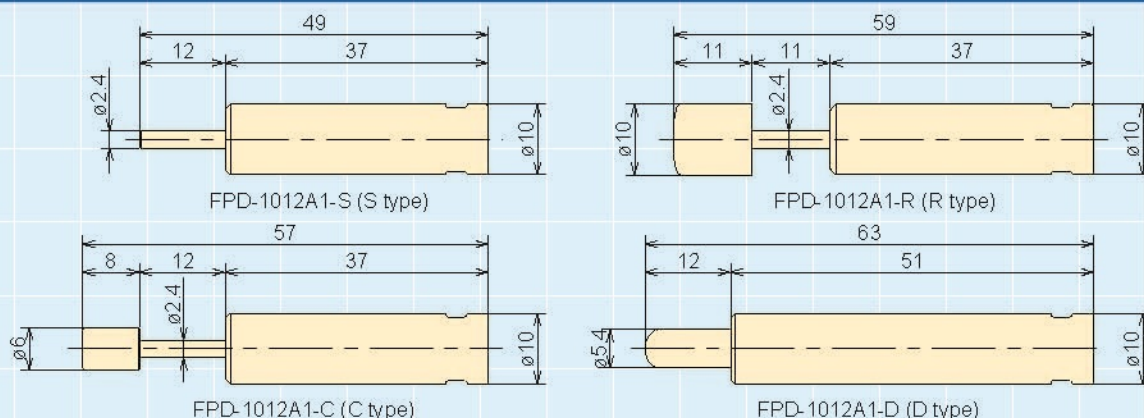
Model	Load [kg]	Max. absorption energy [J (kgf·m)]	Speed range [m/s]	Cylinder cap colour
FPD-1012A1	1	0.5 (0.05)	0.5 or lower	Black
FPD-1012A3	3	0.8 (0.08)	0.5 or lower	White
FPD-1012A5	5	1.0 (0.10)	0.5 or lower	Blue

*Please refer to next page for motion time at each load.

<Impact rate and mass of the colliding object in freefall>

FPD–1012A1

FPD–1012A3

FPD–1012A5

<Common Specifications>
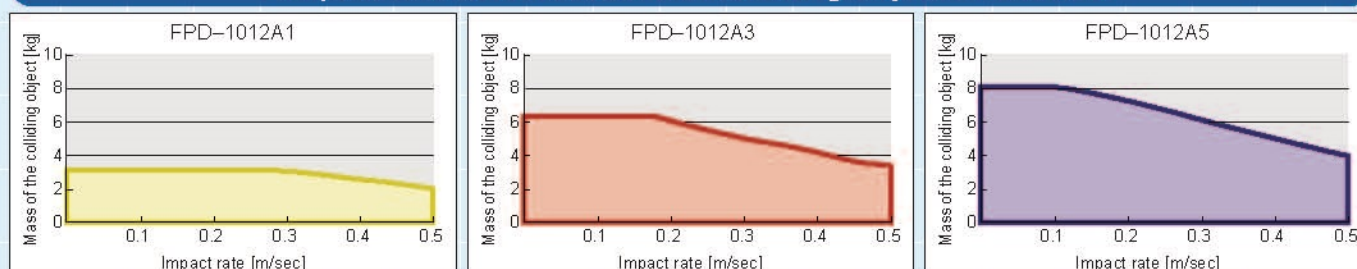
Stroke (S/C/D type)	mm	12	Mass　g	S type=4.5g, C type=5.0g, R type=5.7g, D type=6.0g
Stroke (R type)	mm	11	Main unit material	Resin
Recovering power of the piston rod　N (kgf)	3 (0.3) or less		Operating temperature　°C	5~40°C

Soft Silent Safety

FPD-1012 Series

RoHS Compliant

<Characteristics Graph>

Changes in Operating Time for Each Load

Motion-time T[sec] vs Load [kg]

Legend: A1, A3, A5

Impact rate V=0m/sec

<Optional Parts>
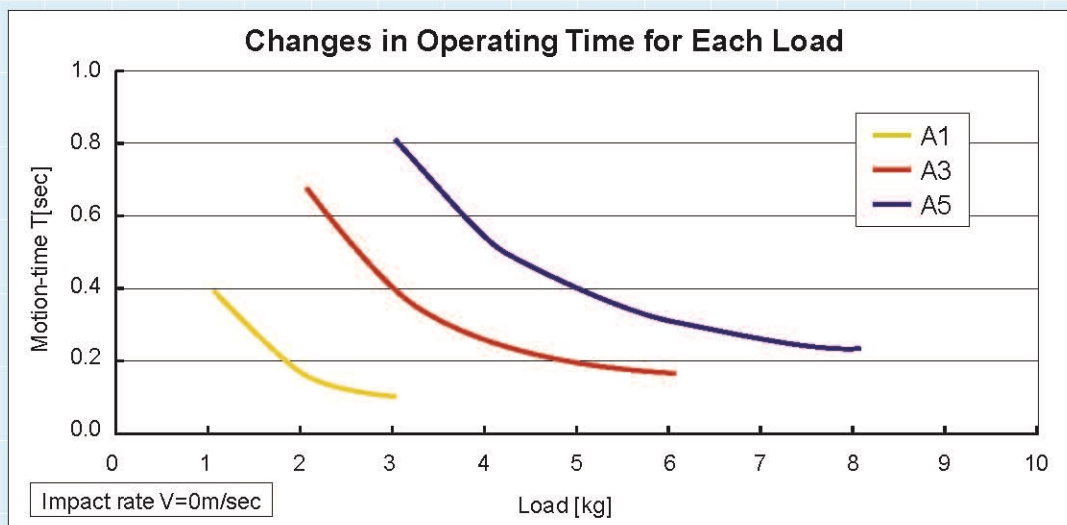
OP-200-01B/W S/C/R type
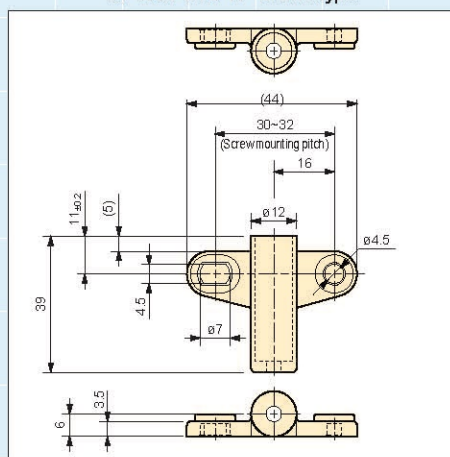
Screw: M4 (Truss screw)
Recommended tightening torque : 0.5N·m

OP-200-02B/W D type
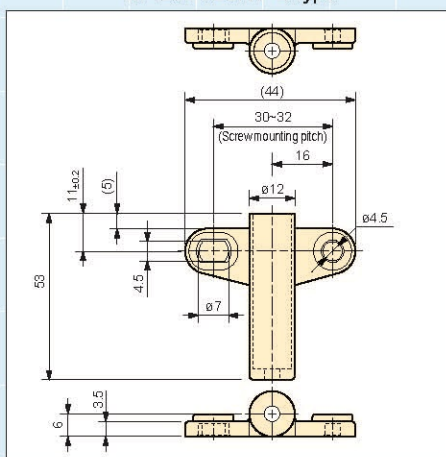
Screw: M4 (Truss screw)
Recommended tightening torque : 0.5N·m

OP-200-03B/W S/C/R/D type
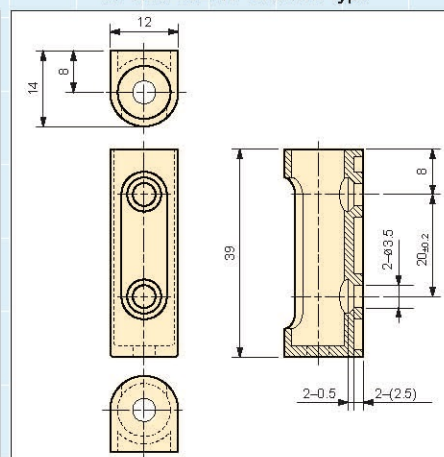
Screw: M3 (Flat head screw)
Recommended tightening torque : 0.3N·m

*These adaptors are dedicated for FPD-1012A series
*They make it easy to install absorbers.
*There are 2 colors: white and black.
*Material : Polyacetal (POM)

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Use with an external stopper.
* Ensure that sufficient mounting strength is secured for this product.
* 2 or more of this product can be used in parallel.
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber.
   • S/C/R type ⋯ Allowable eccentric angle: ±2.5° or less
   • D type ⋯⋯⋯ Allowable eccentric angle: ±6° or less
* Do not pull the piston rod of the soft absorber.
   (This will cause air to get inside the soft absorber, causing ineffective stroke, abnormal sounds, and other damage to the soft absorber.)
*The difference between the speed of stroke and return of piston rod might influence the durability of the damper. So, please confirm sufficient performance on actual machine before use.
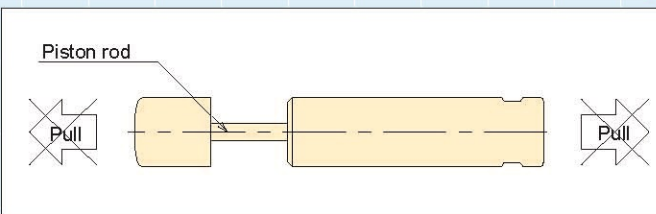
Piston rod

Pull   Pull

Soft Silent Safety
FPD-1070/1060/1050/1030 Series

U-Packing Seal Type

RoHS Compliant

Fixed

Model Description

F P D — 1 0 7 0 B 1 — S W
   ①   ②   ③ ④   ⑤

①Base model
②External diameter, stroke
③Self-return presence A:With returning spring
                        B:Without returning spring
④Symbols indicating characteristics
                        1: Low load (low thrust) specifications
                        2: Medium load (medium thrust) specifications
                        3: High load (high thrust) specifications
⑤Symbols indicating shape   SW: Without cap
                            CW: With cap

<Motion performance>

Model	Load [kg]	Thrust [N]	Impact rate [m/sec]	Motion time [sec]	Recovering power of the piston rod [N]	Bottom color *
FPD-1070B1-□W	10	5	0.5	0.3~2.0	1.5 or less	Black
FPD-1070B2-□W	15	8	0.5	0.4~2.2	1.5 or less	White
FPD-1070B3-□W	15	13	0.5	0.5~2.5	1.5 or less	Gray
FPD-1060A1-□W	10	8	0.5	0.3~2.0	6.0 or less	Black
FPD-1060A2-□W	10	10	0.5	0.4~2.2	6.0 or less	White
FPD-1060A3-□W	10	15	0.5	0.5~2.5	6.0 or less	Gray
FPD-1050A1-□W	10	8	0.5	0.3~2.0	6.0 or less	Black
FPD-1050A2-□W	10	10	0.5	0.4~2.2	6.0 or less	White
FPD-1050A3-□W	10	15	0.5	0.5~2.5	6.0 or less	Gray
FPD-1050B1-□W	10	5	0.5	0.3~2.0	1.5 or less	Black
FPD-1050B2-□W	15	8	0.5	0.4~2.2	1.5 or less	White
FPD-1050B3-□W	15	13	0.5	0.5~2.5	1.5 or less	Gray
FPD-1030A1-□W	10	6	0.3	0.2~1.5	5.0 or less	Black
FPD-1030A2-□W	10	8	0.3	0.2~1.5	5.0 or less	White
FPD-1030A3-□W	10	13	0.3	0.3~1.6	5.0 or less	Gray
FPD-1030B1-□W	10	5	0.3	0.2~1.2	1.5 or less	Black
FPD-1030B2-□W	10	8	0.3	0.2~1.2	1.5 or less	White
FPD-1030B3-□W	10	13	0.3	0.3~1.3	1.5 or less	Gray

The above performance was measured using Fuji Latex's instruments. So, please select dampers accordingly, and confirm operation on actual machines before selecting final models.

[Measurement conditions]

Mass = m [kg]
Impact rate = v [m/sec], Thrust = F [N]
Damper

Bottom color *
Bottom

<Specifications>
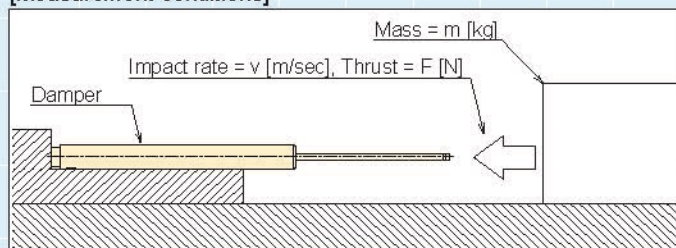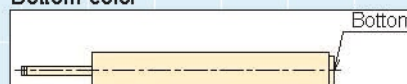
Stroke [mm]	FPD-1070=70mm,FPD-1060=60mm,FPD-1050=50mm,FPD-1030=30mm
External diameter [mm]	ø10
Mass [g]	FPD-1070-SW=13.5g,FPD-1070-CW=14g,FPD-1060-SW=13.5g,FPD-1060-CW=14g FPD-1050-SW=12g,FPD-1050-CW=12.5g,FPD-1030-SW=8g,FPD-1030-CW=8.5g
Main unit material	Resin
Operating temperature [℃]	5~40

Soft Silent Safety

FPD-1070/1060/1050/1030 Series

<External dimensions>
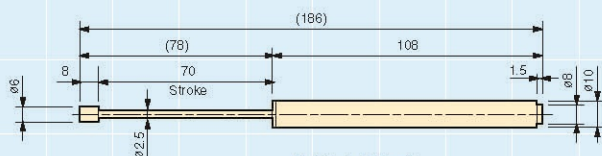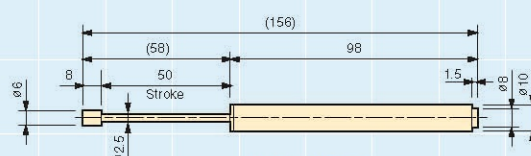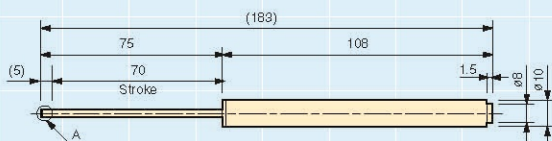
FPD–1070–C
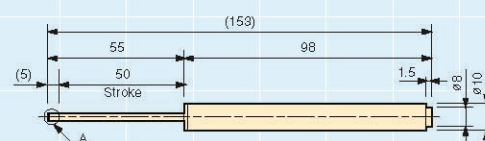
FPD–1070–S

FPD–1060–C

FPD–1060–S

FPD–1050–C

FPD–1050–S
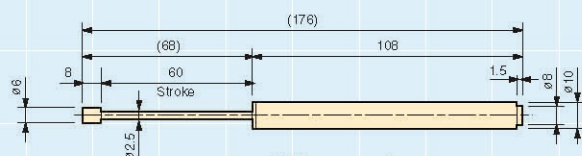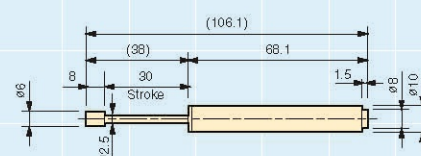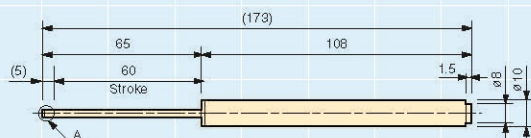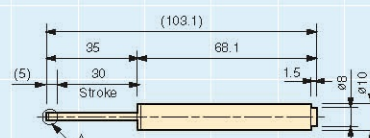
FPD–1030–C

FPD–1030–S

Close up to A
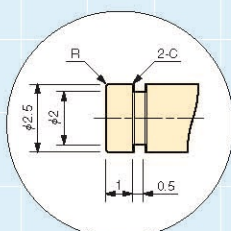
*The FPD-1070B series can be sold only without the spring.
*The FPD-1060A series can be sold only with the spring.
*E-type retaining ring (nominal 2) can be attached to top of S type (A in above drawing).

<Precautions in Use>

*Do not use this product without carefully reading the attached owner's manual.
*Use with an external stopper.
*Ensure that sufficient mounting strength is secured for this product.
*2 or more of this product can be used in parallel.
*Do not use this product in a vacuum or a location where it may come in contact with oil.
*Ensure that an eccentric load (lateral load) is not applied to the soft absorber.
*Do not pull the piston rod of the soft absorber more than stroke.
 (This will cause air to get inside the soft absorber, causing ineffective stroke, abnormal sounds, and other damage to the soft absorber.)
*Do not push the piston rod of the soft absorber more than stroke.
*(This will cause recovery failure and other damage to the soft absorber.)

FA-1212C Series

Soft Silent Safety

RoHS Compliant

Bellofram Seal Type, Dashpot Structure, Fixed

<Specifications>
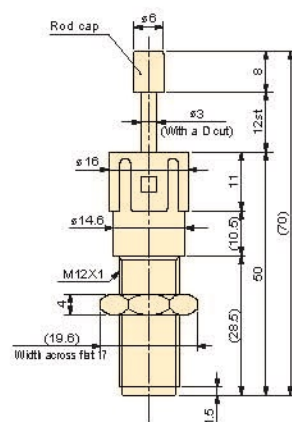
Model	Max. absorption energy J (kgf·m)	Speed range m/s	Max. equivalent mass kg (kgf)	Max. drag N (kgf)	Absorption energy per minute J/min (kgf·m/min)	Max. cycle rate cycle/min	Rod cap colour
FA-1212C1-C	0.29 (0.03)	0.3~1.0	1.5 (1.5)	245 (25)	14.7 (1.5)	45	White
FA-1212C2-C	0.49 (0.05)		3 (3)				Black
FA-1212C3-C			5 (5)	294 (30)	5.0 (0.5)	5	Yellow
FA-1212C4-C	1.0 (0.10)	0.1~0.7	7.5 (7.5)				Green
FA-1212C5-C		0.1~0.5	10 (10)				Red

<Common Specifications>

Stroke	mm	12
Recovering power of the piston rod	N (kgf)	2.45 (0.25) or less
Operating temperature	°C	-10~50
Mass	g	15
Main unit material		Resin

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Use with an external stopper.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)

* Do not turn the oil inlet screw located at the bottom of the main unit.
* 2 or more of this product can be used in parallel
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber.

(Allowable eccentric angle: within ±2.5°)
* Do not over-tighten the main unit and nuts.
Please use the tightening torque (1.5N·m) listed in the owner's manual.
If anchoring the absorber against the ø14.6 unit, please use a tightening torque of 1.0N·m.

Soft Silent Safety **FA-1212C** Series

RoHS Compliant

<Optional Parts>

Muting cap OP-090-M12B/C/D	Small hexagon nut M12B
■A muting cap reduces the collision noise. ■To use, place it over a rod cap in the FA-1212C series. ■Stroke length is 11mm.	■It is ideal for tight spaces, as it is smaller than the conventional hexagon nuts.

ø10
11
2
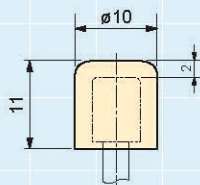
B: Black
C: White
D: Gray

Material: Elastomer

M12X1
(16.2)
14
4
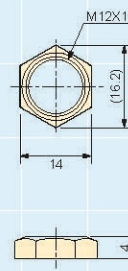
*Standard nuts are sold separately as well.
For FA-1212: FA-1212C nut
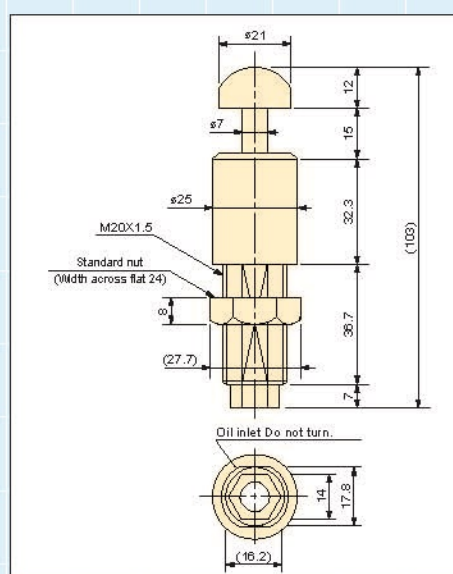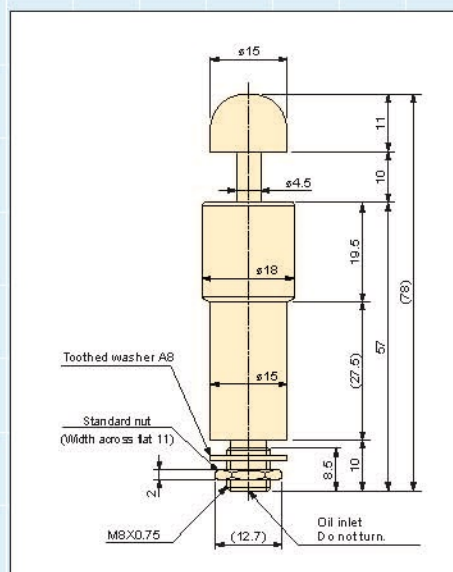
Soft Silent Safety

FA-1010D/FA-1215B Series

RoHS Compliant

FA-1010D□-C
(Groove orifice)

FA-1215B□-C
(Groove orifice)

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Max. drag N (kgf)	Absorption energy per minute J/min (kgf·m/min)	Recovering power of the piston rod N (kgf)	Mass g
FA-1010D2-C	10	0.98 (0.1)	10 (10)	980 (100)	44.1 (4.5)	5.88 (0.6) or lower	41.5
FA-1010D3-C		2.05 (0.21)	15 (15)		78.4 (8.0)		
FA-1010D4-C		3.23 (0.33)	20 (20)				
FA-1215B1-C	15	7.84 (0.8)	30 (30)	1470 (150)	245 (25)	11.8 (1.2) or lower	116
FA-1215B2-C		11.7 (1.2)	40 (40)	1960 (200)			

<Common Specifications>

Operating speed range	m/s	0.1~1.0 (0.1 to 0.5 for the FA-1215 series)
Max. cycle rate	cycle/min	45 (30 for the FA-1215 series)
Operating temperature	°C	-10~50

84

Soft Silent Safety

FA-1010D/FA-1215B Series

RoHS Compliant

<Optional Parts>

| Liquid-proof cap -060 | Bracket OP-1012A |

Liquid-proof cap -060

■ Ideal for use in environments where oil splatter poses a problem.

■ Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.
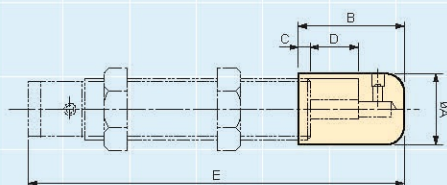
Model	øA	B	C	D	E	Mass g
FA-1010D□-C-060	22	30	9	10	78	9
FA-1215B□-C-060	30	35	8	15	103	17

Model indication 1, 2, 3 or 4 is inserted in □.

*Standard nuts are sold separately as well.
For FA-1010: FA-1010D M08 nut
For FA-1215: M20 nut

Bracket OP-1012A

■ This is a mounting fixture for FA-1010D.

Mass 25g

<Bellofram Seal Type>

Unlike the conventional U packing type, it uses a Bellofram seal, as shown below. Because it does not generate sliding resistance between the piston rod and the packing, the spring power required to recover the piston rod can be reduced. The Bellofram also acts as an accumulator based on its ability to change shape. In principle, as long as the Bello is not damaged, oil will never leak.

Piston rod

Bellofram

Oil

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Use with an external stopper.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)

* Do not turn the oil inlet screw located at the bottom of the main unit.
* 2 or more of this product can be used in parallel.
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)

Soft Silent Safety

FA-0805/FA-1005/FA-1008/FA-1210 Series

RoHS Compliant

Single-Orifice Structure

Fixed

FA-1210KB*-*

FA-1008PB*-*

FA-1005PMB*-*

FA-0805SB*-*

Standard nut
(Width across flat M)

<Dimensions>
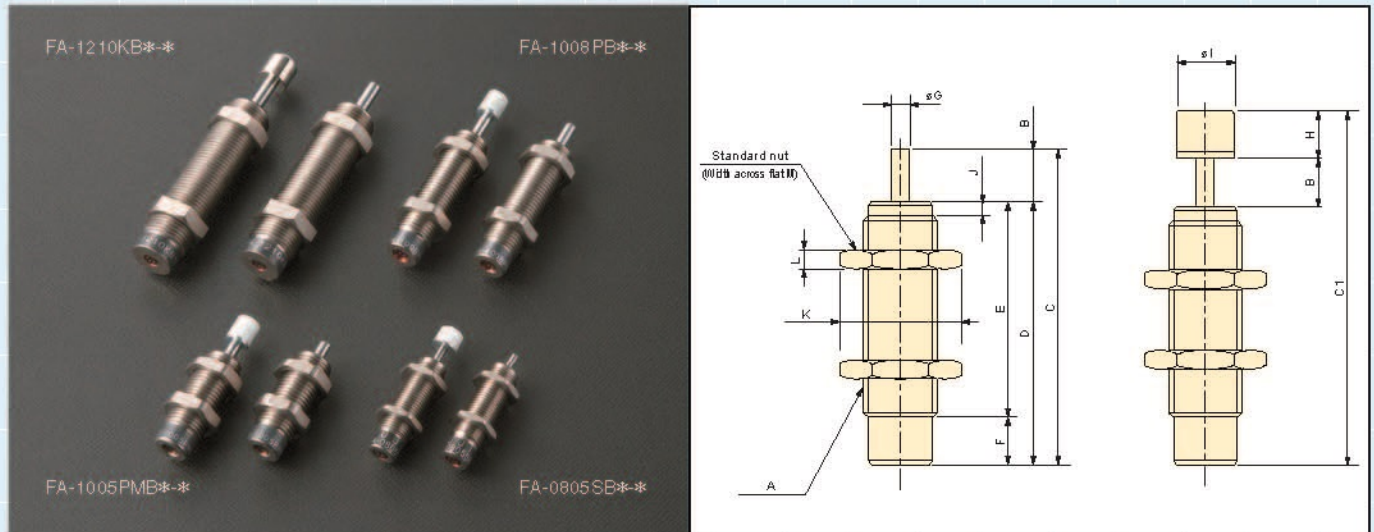
Model	A	B	C	C1	D	E	F	øG	H	øl	J	K	L	M
FA-0805SB*-S/C	M8X0.75	5	32	37	27	22	5	2	5	6	1.5	12.7	2	11
FA-1005PMB*-S/C	M10X1	5	32	39	27	22	5	3	7	6	1.5	14.2	3	13
FA-1008PB*-S/C	M10X1	8	46	53	38	33	5	3	7	6	1.5	14.2	3	13
FA-1210KB*-S/C	M12X1	10	60	68	50	45	5	3.5	8	8	1.5	16.2	4	14

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Max. drag N (kgf)	Absorption energy per minute J/min (kgf·m/min)	Recovering power of the piston rod N (kgf)	Mass g Without cap/With cap
FA-0805SB1-S/C	5	0.39 (0.04)	3 (3)	490 (50)	17.6 (1.8)	4.9 or lower (0.5)	8.6 / 8.8
FA-0805SB2-S/C		0.68 (0.07)	5 (5)	588 (60)	22.5 (2.3)		
FA-1005PMB1-S/C	5	0.68 (0.07)	5 (5)	735 (75)	41.1 (4.2)	5.88 or lower (0.6)	13.2 / 14.2
FA-1005PMB2-S/C		0.98 (0.1)	8 (8)				
FA-1008PB1-S/C	8	0.98 (0.1)	7 (7)	735 (75)	58.8 (6.0)	5.88 or lower (0.6)	17.2 / 18.2
FA-1008PB2-S/C		1.47 (0.15)	10 (10)				
FA-1210KB1-S/C	10	1.96 (0.2)	15 (15)	1470 (150)	98 (10)	9.8 or lower (1.0)	30.6 / 32.6
FA-1210KB2-S/C		2.45 (0.25)	30 (30)				

<Common Specifications>

Range of impact rate	m/s	0.3~1.0
Max. cycle rate	cycle/min	60 (45 for the FA-0805 series)
°degrees	℃	−5~70

Note) MB X 1.0 is also available as the main body's screw pitch specifications for the FA-0805 series. Please order using the model number FA-0805SB□-S-P1.0 or FA-0805SB□-C-P1.0. However, please note that there are no optional parts for it.

Note) To place an order without a cap, put −S, and to place an order with a cap, put −C.

Note) Cap colour: **1 is white and **2 is black.

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that an external stopper (Stopper nut OP-020**) is also used.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)

Soft Silent Safety — FA-0805/FA-1005/FA-1008/FA-1210 Series

Single-Orifice Structure — Fixed

RoHS Compliant

\<Optional Parts\>

Eccentric angle adaptor OP-010SB, PMB, PB, KB

■ Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■ Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■ The main unit can also be used as a stopper.

■ Use it with a capless soft absorber.

■ The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010□B-1)
Guide for eccentric angle (OP-010□B-2)
Standard nut (Width across flat H)
Width across flat J

Note) Material of cap for eccentric angle: POM

Model	A	B	C	øD	E	F
OP-010SB	28	23	5	6	4	44.5
OP-010PMB	28	23	5	8	6	44.5
OP-010PB	38	30	8	8	6	69.8
OP-010KB	48	38	10	10	5	89.8

Model	G	H	I	J	Mass g
OP-010SB	M12X1	14	16.2	10	13
OP-010PMB	M16X1.5	19	20	13	29
OP-010PB	M16X1.5	19	20	13	35
OP-010KB	M18X1.5	21	24.3	14	48

Stopper nut OP-020SB, PB, KB

■ Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020**-S (Without cap)   OP-020**-C (With cap)

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Model		A	B	C	D	E	F	Mass g	
OP-020SB-*	S	10	12.7	15	12.7	11	M8X0.75	5	
	C							7	
OP-020PB-*	S	10	15	16	15	13	M10X1	6	
	C							9	
OP-020KB-*	S	12	16.2	16	16.2	14	M12X1	6	
	C							8	

Liquid-proof cap -060

■ Ideal for use in environments where oil splatter poses a problem.

■ Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

Model	øA	B	C	D	E	Mass g
FA-1005PMB□-C-060	13	15	3	5	39	9
FA-1008PB□-C-060	13	18	3	8	53	10
FA-1210KB□-C-060	17	28	9.5	10	68.5	25

■ Liquid-proof caps are not sold separately.

■ Model indication 1 or 2 is inserted in □.

Square flange OP-040SB, PB, KB

■ Once the attachment site is determined, use the main unit's nut to securely fasten in place.

Model	A	B	C	D	E	Mass g
OP-040SB					M8X0.75	17
OP-040PB	25	18	3.2	4	M10X1	16
OP-040KB					M12X1	15

Holder with switch OP-030KB-2

Switch specifications
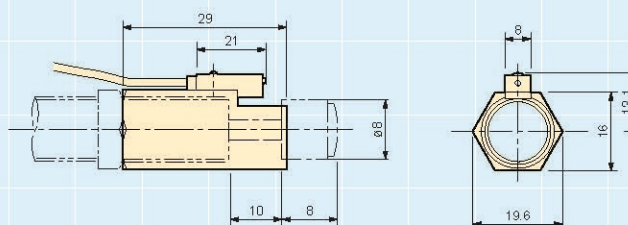
Mass 38g

■ Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

■ For switch specifications and precautions for use, please refer to page 73. ☞

*Standard nuts are sold separately as well.
For FA-0805SB: M08 nut
        M08-P1 nut
For FA-1005PMB: M10 nut
For FA-1008PB: M10 nut
For FA-1210KB: M12 nut

FA-0806 Series

RoHS Compliant   (For Low to Medium Speed)   Adjustable
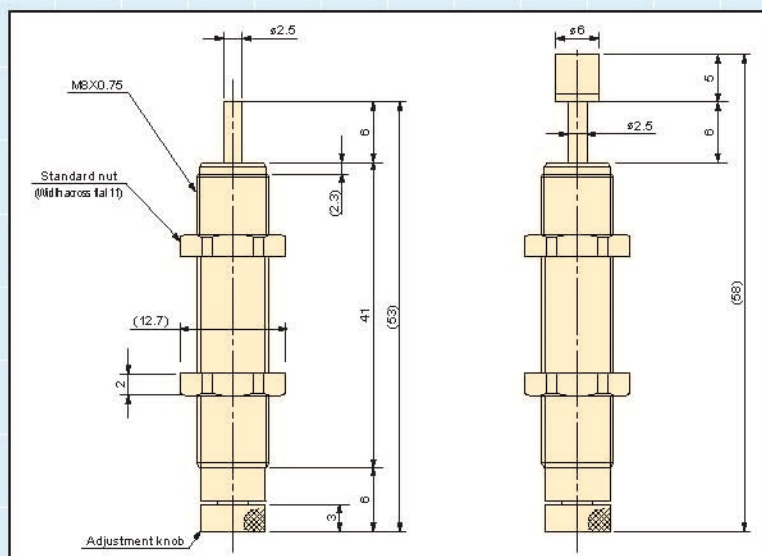
<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-0806-S	6	1.4 (0.14)	15 (15)	0.3~2	Single-orifice type
FA-0806-C					

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	670 (68.3)	Operating temperature	°C	–5~70
Max. cycle rate	cycle/min	45	Mass: S type	g	13.8
Max. absorption energy per minute	J/min (kgf·m/min)	36.7 (3.74)	: C type	g	14.1
Recovering power of the piston rod	N (kgf)	9 or lower (0.92)			

<Absorption characteristics>

Orifice type	Single-orifice type
Model number	FA-0806 Series
Application	For low to medium speed
Absorption characteristics	Resistance vs Stroke

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020SB).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* It does not have a lock screw for locking the adjusted setting

Soft Silent Safety FA-0806 Series

(For Low to Medium Speed)   Adjustable

RoHS Compliant

<Optional Parts>

Eccentric angle adaptor OP-010M8	Stopper nut OP-020SB	Square flange OP-040SB

Eccentric angle adaptor OP-010M8

■Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■The main unit can also be used as a stopper.

■Use it with FA-0806-S.

■The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010M8-1)
Guide for eccentric angle (OP-010SB-2)
M12X1 (M12 nut)
ø6
16.2
6
29
23
4
66.5 (Total length)
Standard nut (Width across flat 14)
Width across flat 10

Mass 13g

10° 10°

Note) Material of cap for eccentric angle: POM

Stopper nut OP-020SB

■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020SB-S (For FA-0806-S)   OP-020SB-C (For FA-0806-C)

12.7   12.7

10   15

M8X0.75

11
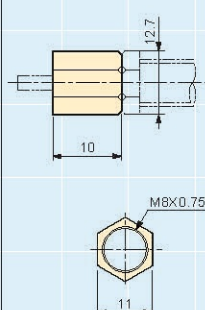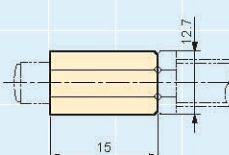
Mass 5g   Mass 7g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Square flange OP-040SB

■Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M8X0.75

□18
□25
4-ø3.2

4
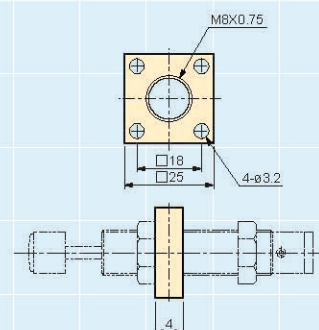
Mass 17g

*Standard nuts are sold separately as well.
 For FA-0806: M08 nut

Soft Silent Safety — FA-1008VB/FA-1008VD/FWM-1008VBD Series

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

RoHS Compliant

M10X1

Standard nut
(Width across flat 13)

ø2.4

(14.2)

3

8.7

Adjustment knob

<Specifications>
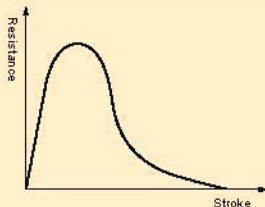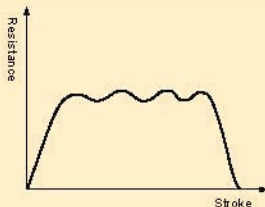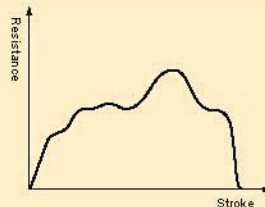
Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-1008VB-S/C		1.47 (0.15)	10 (10)	0.3~1	Single-orifice type
FA-1008VD-S/C	8	1.76 (0.18)	2.5 (2.5)	0.7~3	Multiple-orifice type
FWM-1008VBD-S/C			10 (10)	0.3~2	Multiple-varying orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	637 (65)	Operating temperature	°C	-5~70
Max. cycle rate	cycle/min	60	Mass: S type	g	26.5
Max. absorption energy per minute	J/min (kgf·m/min)	58.8 (6)	:C type	g	27
Recovering power of the piston rod	N(kgf)	5.88 (0.6) or lower			

<Selection Guideline> The FA-1008 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Single-orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-1008VB series	FA-1008VD series	FWM-1008VBD series
Application	For low-speed	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics			

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that an external stopper (Stopper nut OP-020PB) is also used.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
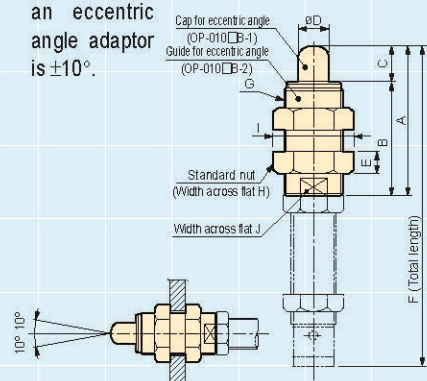* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* It does not have a lock screw for locking the adjusted setting

Soft Silent Safety FA-1008VB/FA-1008VD/FWM-1008VBD Series

RoHS Compliant

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

<Optional Parts>

Eccentric angle adaptor OP-010PB	Stopper nut OP-020PB-□	Square flange OP-040PB

Eccentric angle adaptor OP-010PB

■Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■The main unit can also be used as a stopper.

■Use it with a capless soft absorber.

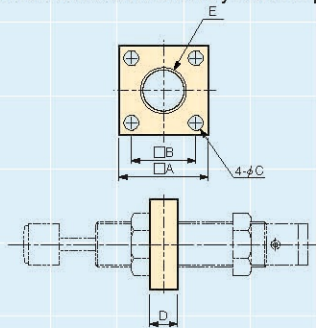■The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010□B-1)
Guide for eccentric angle (OP-010□B-2)
M16X1.5 (M16 nut)
ø8
Standard nut (Width across flat 19)
Width across flat 13
20, 2, 8, 6, 28, 38
75.7 (Total length)

Mass 35g

10° 10°

Note) Material of cap for eccentric angle: POM

Stopper nut OP-020PB-□

■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020PB-S (Without cap)

OP-020PB-C (With cap)

15, 10

15, 16

M10X1
13
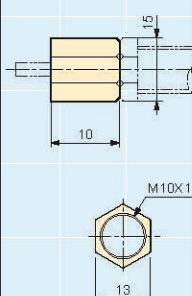
Mass 6g
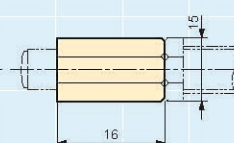
Mass 9g

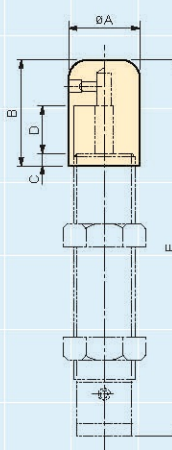Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Square flange OP-040PB

■Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M10X1
□18
□25
4-ø3.2
4
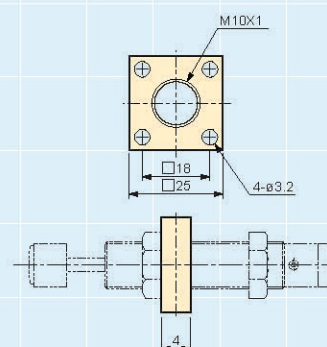
Mass 16g

*Standard nuts are sold separately as well.
 For FA-1008VB/FA-1008VD/FWM-1008VBD: M10 nut

Soft Silent Safety

FA-1210MB/FA-1210MD/FWM-1210MBD Series

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

RoHS Compliant

Standard nut
(Width across flat 14)

16.2

M12X1

Adjustment screw

ø3.5

10

1.5

(81)

66

76

4

5

ø8

8

ø3.5

10

(84)

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-1210MB-S/C		2.94 (0.3)	30 (30)	0.3~1	Single-orifice type
FA-1210MD-S/C	10	4.9 (0.5)	4 (4)	0.7~3	Multiple-orifice type
FWM-1210MBD-S/C			30 (30)	0.3~2	Multiple-varying orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	1470 (150)	Operating temperature	°C		−5~70
Max. cycle rate	cycle/min	60	Mass: S type		g	44
Max. absorption energy per minute	J/min (kgf·m/min)	98 (10)	:C type		g	47
Recovering power of the piston rod	N (kgf)	9.8 (1.0) or lower				

<Selection Guideline> The FA-1210 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Single-orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-1210MB series	FA-1210MD series	FWM-1210MBD series
Application	For low-speed	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics			

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that an external stopper (Stopper nut OP-020KB) is also used.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob with a slotted screw driver
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* It does not have a lock screw for locking the adjusted setting

Soft Silent Safety — FA-1210MB/FA-1210MD/FWM-1210MBD Series

RoHS Compliant

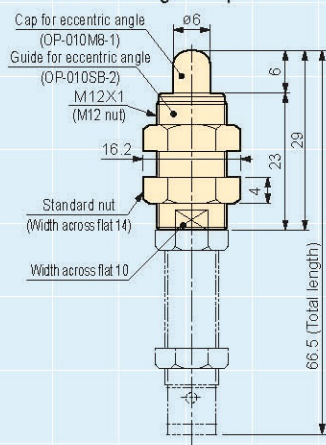### (For Low Speed) (For High Speed) (For Medium Speed) Adjustable
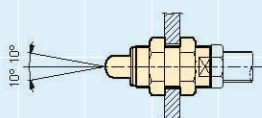
<Optional Parts>

Eccentric angle adaptor OP-010KB

■ Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■ Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■ The main unit can also be used as a stopper.

■ Use it with a capless soft absorber.

■ The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010□B-1)
Guide for eccentric angle (OP-010□B-2)
M18X1.5 (M18 nut)
ø10
10
3
48
35
5
24.3
Standard nut (Width across flat 21)
Width across flat 14
97.8 (Total length)

10° 10°

Mass 48g

Note) Material of cap for eccentric angle: POM

Stopper nut OP-020KB-□

■ Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020KB-S (Without cap)

OP-020KB-C (With cap)

16.2
12

16.2
16

M12X1
14
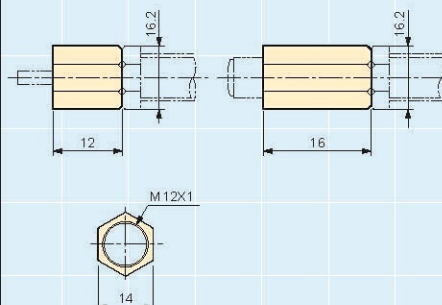
Mass 6g   **Mass 8g**

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Liquid-proof cap F□□-1210M□□-C-060

■ Ideal for use in environments where oil splatter poses a problem.

■ Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

■ F□□-1210M□□-C-060
 • Model indication A or WM is inserted in □ of F□□.
 • Model indication B, D or BD is inserted in □ of M□□.

ø17
28
10
9.5
84.5
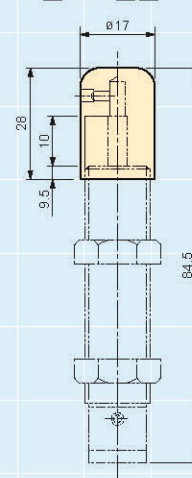
Mass 25g

Note) Liquid-proof caps are not sold separately.

Square flange OP-040KB

■ Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M12X1
□18
□25
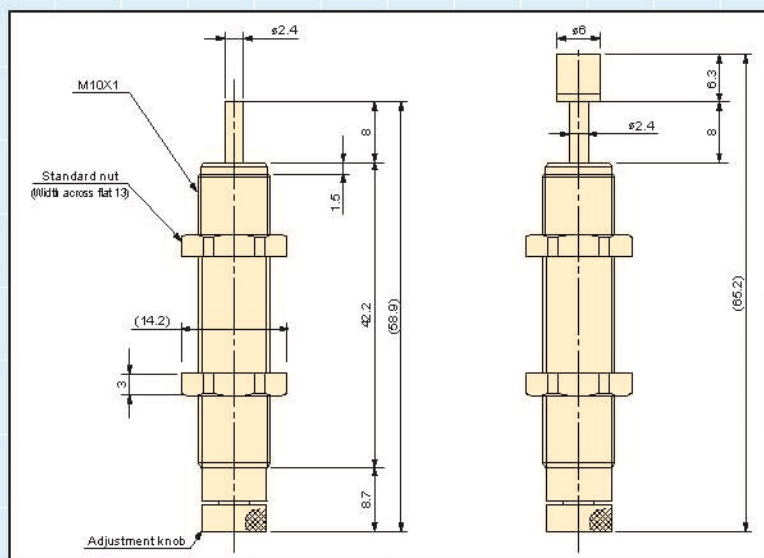4-ø3.2
4
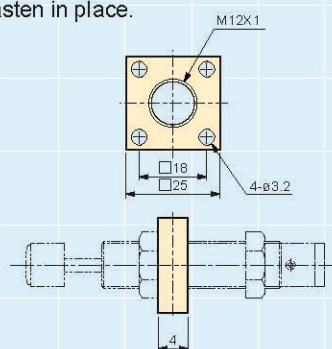
Mass 15g

Holder with a switch OP-030KB-2 (With a stopper function)
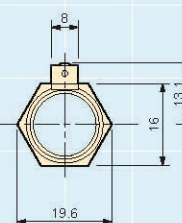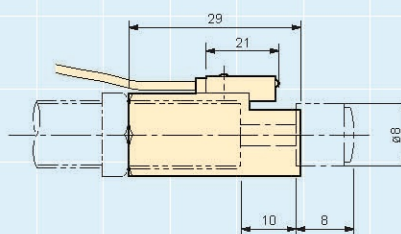
29
21
ø8
10   8

8
13.1
16
19.6

Mass 38g

■ Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

■ For switch specifications and precautions for use, please refer to page 73. ☞

*Standard nuts are sold separately as well.
 For FA-1210MB/FA-1210MD/FWM-1210MBD: M12 nut

Soft Silent Safety — FA-1410RB/FA-1410RD/FWM-1410RBD Series

RoHS Compliant

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

M14X1.5

Standard nut (Width across flat 17)

ø3.5

ø10

Adjustment screw

<Specifications>
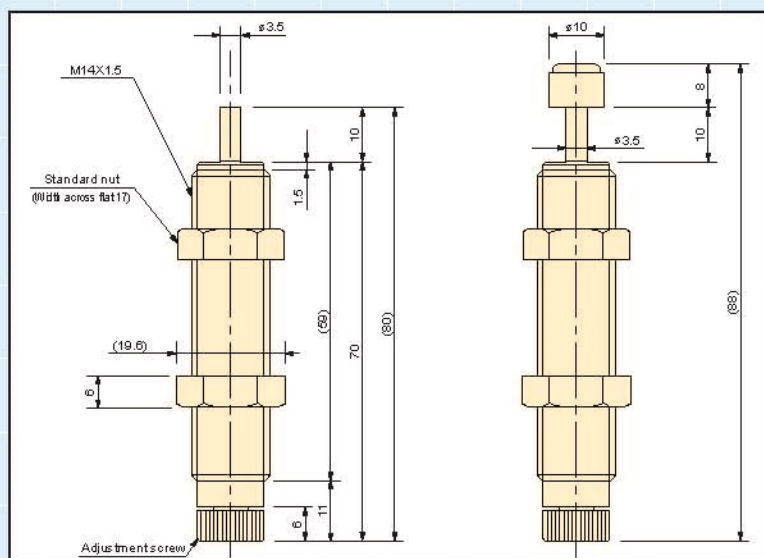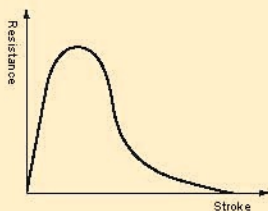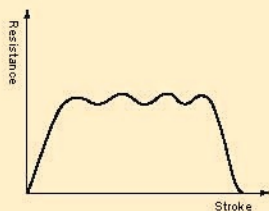
Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-1410RB-S/C		3.92 (0.4)	30 (30)	0.3~1	Single-orifice type
FA-1410RD-S/C	10	5.88 (0.6)	4.5 (4.5)	0.7~3	Multiple-orifice type
FWM-1410RBD-S/C			35 (35)	0.3~2	Multiple-varying orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	1813 (185)	Operating temperature	°C	−5~70
Max. cycle rate	cycle/min	60	Mass: S type	g	68
Max. absorption energy per minute	J/min (kgf·m/min)	147 (15)	:C type	g	73
Recovering power of the piston rod	N (kgf)	9.8 (1.0) or lower			

<Selection Guideline>

The FA-1410 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Single-orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-1410RB series	FA-1410RD series	FWM-1410RBD series
Application	For low-speed	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics			

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that an external stopper (Stopper nut OP-020RB) is also used.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)

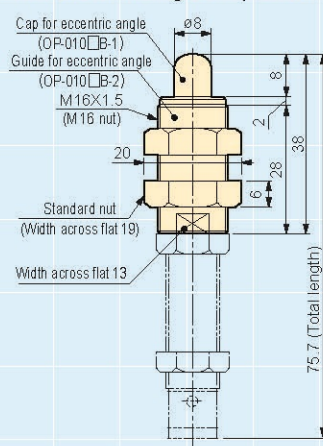## <Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using a hex wrench.

Soft Silent Safety

FA-1410RB/FA-1410RD/FWM-1410RBD Series

RoHS Compliant

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

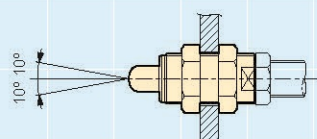### <Optional Parts>

Eccentric angle adaptor OP-010RB

■ Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■ Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■ The main unit can also be used as a stopper.

■ Use it with a capless soft absorber.

■ The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010□B-1)
Guide for eccentric angle (OP-010□B-2)
M22X1.5 (M22 nut)
Standard nut (Width across flat 24)
Width across flat 19
ø11
10
3
51
38
7
27.7
103 (Total length)
10° 10°

Mass 83g

Note) Material of cap for eccentric angle: POM

| Stopper nut OP-020RB-□ |
| --- |

■ Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020RB-S (Without cap)
OP-020RB-C (With cap)

19.6
19.6
12
20

M14X1.5
17
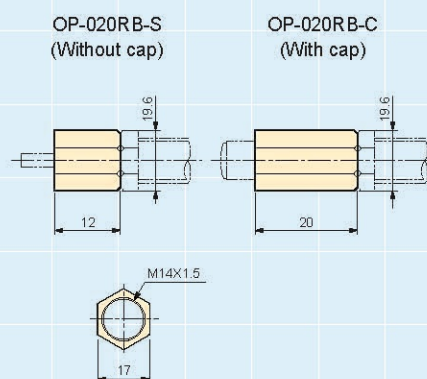
Mass 10g   Mass 17g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Liquid-proof cap F□□-1410R□□-C-060

■ Ideal for use in environments where oil splatter poses a problem.

■ Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

■ F□□-1410R□□-C-060
• Model indication A or WM is inserted in □ of F□□.
• Model indication B, D or BD is inserted in □ of R□□.

ø19
30
10
11.5
88.5
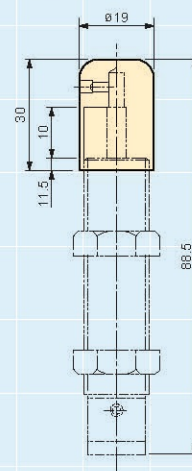
Mass 31g

Note) Liquid-proof caps are not sold separately.

Square flange OP-040RB

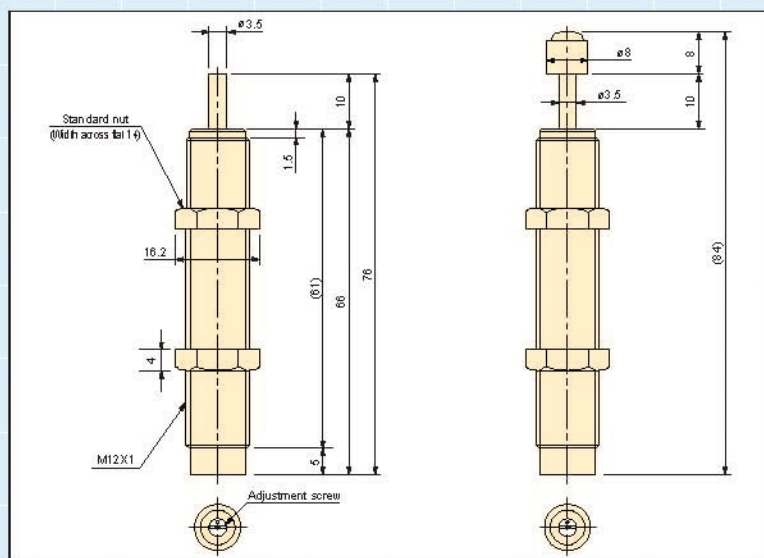■ Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M14X1.5
□24
□34
4-ø4.5
4
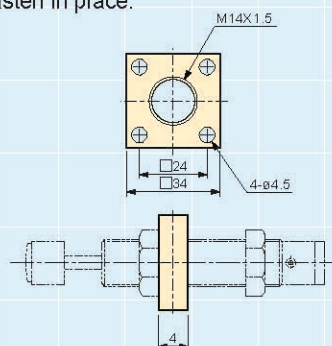
Mass 30g

Holder with a switch OP-030RB-2 (With a stopper function)

29
21
ø8
10
8
8
14.1
17
19.6
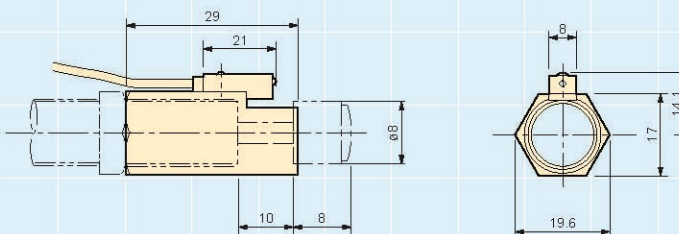
Mass 34g

■ Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

■ For switch specifications and precautions for use, please refer to page 73. ☞

*Standard nuts are sold separately as well.
For FA-1410RB/FA-1410RD/FWM-1410RBD: M14 nut

Soft Silent Safety FA-1612XB/FA-1612XD/FWM-1612XBD Series

RoHS Compliant (For Low Speed) (For High Speed) (For Medium Speed) Adjustable

Standard nut (Width across flat 19)

M16X1.5

Lock screw

Adjustment screw

<Specifications>
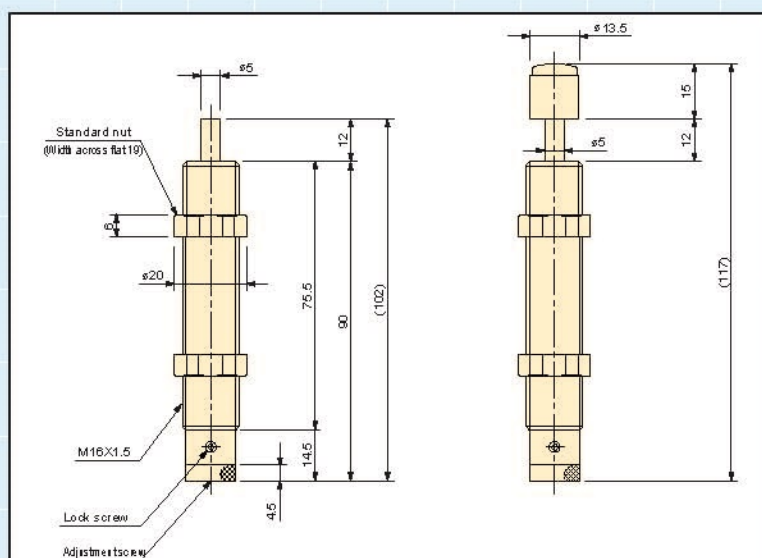
Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-1612XB-S/C			50 (50)	0.3~1	Single-orifice type
FA-1612XD-S/C	12	9.8 (1.0)	10 (10)	0.7~3	Multiple-orifice type
FWM-1612XBD-S/C			50 (50)	0.3~2	Multiple-varying orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	2646 (270)	Operating temperature	°C	−5~70
Max. cycle rate	cycle/min	60	Mass: S type	g	108
Max. absorption energy per minute	J/min (kgf·m/min)	235 (24)	:C type	g	117
Recovering power of the piston rod	N (kgf)	14.7 (1.5) or lower			

<Selection Guideline>
The FA-1612 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Single-orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-1612XB series	FA-1612XD series	FWM-1612XBD series
Application	For low-speed	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics			

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that an external stopper (Stopper nut OP-020HB) is also used.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)

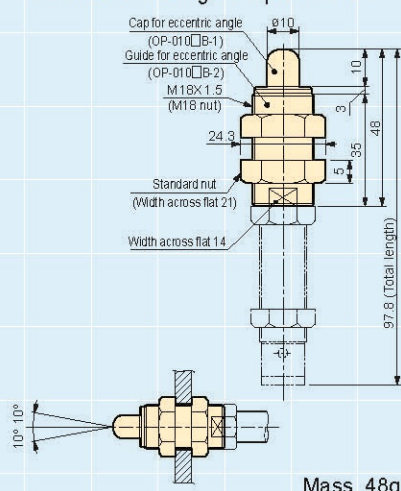### <Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using a hex wrench.

Soft Silent Safety
FA-1612XB/FA-1612XD/FWM-1612XBD Series

RoHS Compliant

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

<Optional Parts>

Eccentric angle adaptor OP-010XB

■ Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■ Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■ The main unit can also be used as a stopper.

■ Use it with a capless soft absorber.

■ The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010□B-1)
Guide for eccentric angle (OP-010□B-2)
M22X1.5 (M22 nut)
Standard nut (Width across flat 24)
Width across flat 19

ø12
12
3
60
45
7
27.7
129 (Total length)

10° 10°

Mass 81g

Note) Material of cap for eccentric angle: POM

Stopper nut OP-020HB

■ Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020HB-S (Without cap)   OP-020HB-C (With cap)

21.9
15

21.9
30

M16X1.5
19
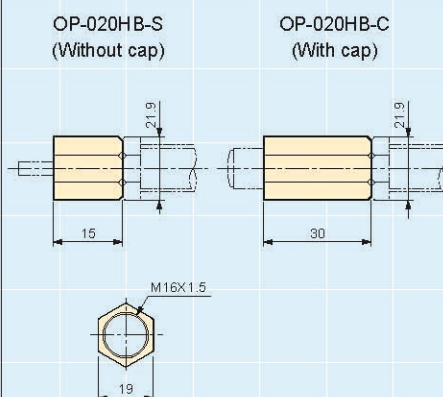
Mass 15g   Mass 28g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Liquid-proof cap F□□-1612X□□-C-060

■ Ideal for use in environments where oil splatter poses a problem.

■ Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

■ F□□-1612X□□-C-060
  • Model indication A or WM is inserted in □ of F□□.
  • Model indication B, D or BD is inserted in □ of X□□.

ø21
34
12
9.5
114.5
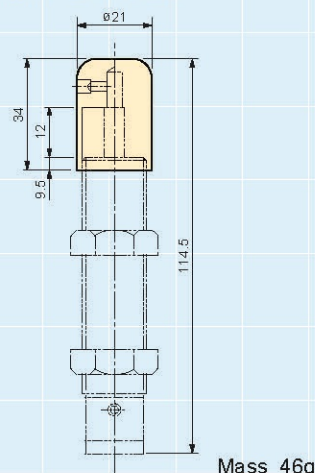
Mass 46g

Note) Liquid-proof caps are not sold separately.

### Square flange OP-040XB

■ Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M16X1.5
□24
□34
4-ø4.5

4

Mass 29g

*Standard nuts are sold separately as well.
For FA-1612XB/FA-1612XD/FWM-1612XBD: M16 nut

Holder with a switch OP-030HB-□

OP-030HB-1

25
9
21
ø13.5
12
15

8
15.5
19
21.9
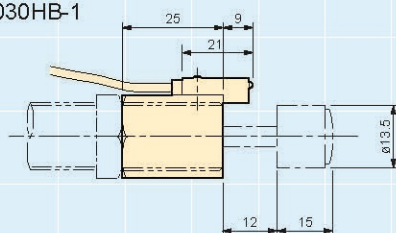
Mass 36g

OP-030HB-2 (With a stopper function)

40
21
ø13.5
12
15

Clearance
Stroke
Cap
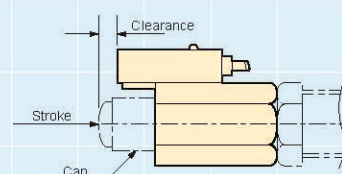
Mass 46g

■ When attaching a holder with no stopper function, ensure that there is a gap between the switch and the cap's tip when the piston rod is pressed all the way down to the stroke end. Otherwise, the switch may become damaged by the impact.

■ Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

■ For switch specifications and precautions for use, please refer to page 73. ☞

Soft Silent Safety — FA-2016EB/FA-2016ED/FWM-2016EBD Series

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

RoHS Compliant

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-2016EB-S/C			300 (300)	0.3~1	Single-orifice type
FA-2016ED-S/C	16	29.4 (3.0)	120 (120)	0.7~3	Multiple-orifice type
FWM-2016EBD-S/C			200 (200)	0.3~2	Multiple-varying orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	3528 (360)	Operating temperature	°C	−5~70
Max. cycle rate	cycle/min	60	Mass: S type	g	180
Max. absorption energy per minute	J/min (kgf·m/min)	343 (35)	: C type	g	202
Recovering power of the piston rod	N (kgf)	18.1 (1.84) or lower			

<Selection Guideline> The FA-2016 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Single-orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-2016EB series	FA-2016ED series	FWM-2016EBD series
Application	For low-speed	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics			

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that an external stopper (Stopper nut OP-020EB) is also used.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)
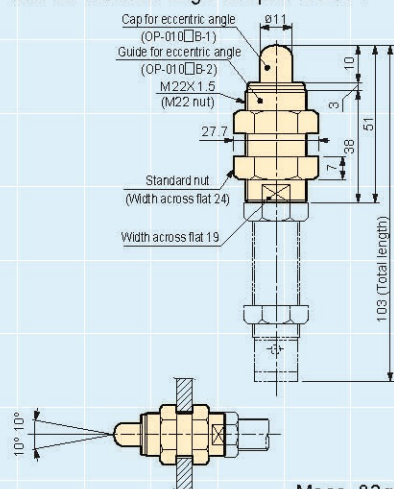
<Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety

FA-2016EB/FA-2016ED/FWM-2016EBD Series

RoHS Compliant

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

<Optional Parts>

Eccentric angle adaptor OP-010EB

■ Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■ Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■ The main unit can also be used as a stopper.

■ Use it with a capless soft absorber.

■ The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Mass 209g

Note) Material of cap for eccentric angle: Metal

Stopper nut OP-020EB-□

■ Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020EB-S (Without cap)

OP-020EB-C (With cap)

Mass 46g   Mass 68g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Liquid-proof cap FA-2016E□-C-060

■ Ideal for use in environments where oil splatter poses a problem.

■ Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

■ F□□-2016E□□-C-060
  • Model indication A or WM is inserted in □ of F□□.
 • Model indication B, D or BD is inserted in □ of E□□.
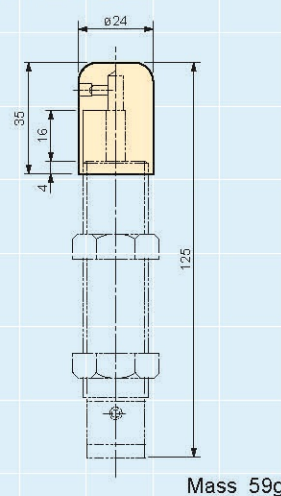
Mass 59g

Note) Liquid-proof caps are not sold separately.

Square flange OP-040EB

■ Once the attachment site is determined, use the main unit's nut to securely fasten in place.

Mass 109g

*Standard nuts are sold separately as well.
For FA-2016E: M20 nut

Holder with a switch OP-030EB-□

OP-030EB-1

OP-030EB-2 (With a stopper function)

Mass 59g

Mass 80g

■ When attaching a holder with no stopper function, ensure that there is a gap between the switch and the cap's tip when the piston rod is pressed all the way down to the stroke end. Otherwise, the switch may become damaged by the impact.

■ Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

Soft Silent Safety

FA-2016E Series

RoHS Compliant

Minor Change

Adjustable

Standard nut
(Width across flat 26)

(27.7)

M20X1.5

Lock screw

ø6

16

(80)

94

(110)

14

ø18
ø17

14

17

ø6

16

(127)

\<Specifications\>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-2016E1-S/C	16	35 (3.57)	300 (300)	0.3~1	Single-orifice type
FA-2016E2-S/C			200 (200)	0.3~2	Multiple-varying orifice type
FA-2016E3-S/C			120 (120)	0.7~3	Multiple-orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

\<Common Specifications\>

Max. drag	N (kgf)	6370 (650)	Operating temperature	°C	–5~70
Max. cycle rate	cycle/min	60	Mass: S type	g	185
Max. absorption energy per minute	J/min (kgf·m/min)	343 (35)	:C type	g	207
Recovering power of the piston rod	N (kgf)	18.1 (1.84) or lower			

The FA-2016 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Single-orifice type	Multiple-varying orifice type	Multiple-orifice type
Model number	FA-2016E1 series	FA-2016E2 series	FA-2016E3 series
Application	For low-speed	For medium speed, in particular with a pneumatic cylinder	For high-speed
Absorption characteristics			

\<Precautions for Use\>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that an external stopper (Stopper nut OP-020EB) is also used.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: within ±2.5°)
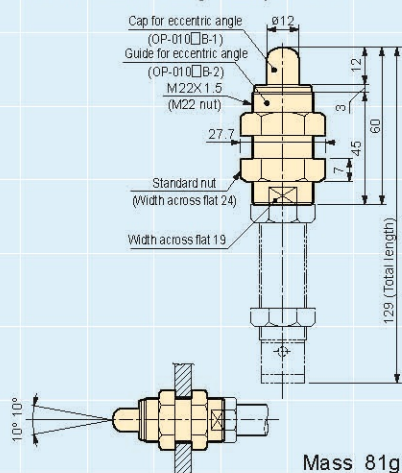
\<Adjustment Method\>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety

FA-2016E Series

RoHS Compliant

Minor Change

Adjustable

<Optional Parts>

Eccentric angle adaptor OP-010EB

■ Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■ Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■ The main unit can also be used as a stopper.

■ Use it with a capless soft absorber.

■ The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle
(OP-010□B-1)
Guide for eccentric angle
(OP-010□B-2)
M27×1.5
(M27 nut)

ø14
16
3
68
49
10
37

Standard nut
(Width across flat 32)

Width across flat 24

146 (Total length)

10° 10°

Mass 209g

Note) Material of cap for eccentric angle: Metal

Stopper nut OP-020EB-□

■ Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020EB-S
(Without cap)

OP-020EB-C
(With cap)

27.7

27.7

30

47

M20×1.5

24

Mass 46g

Mass 68g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Liquid-proof cap FA-2016E□-C-060

■ Ideal for use in environments where oil splatter poses a problem.

■ Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

■ FA-2016E□-C-060
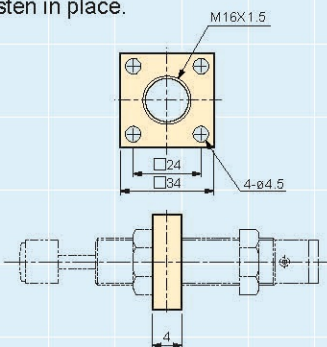• Model indication 1, 2 or 3 is inserted in E□.

ø24

35
16
4

125

Mass 59g

Note) Liquid-proof caps are not sold separately.

Square flange OP-040EB

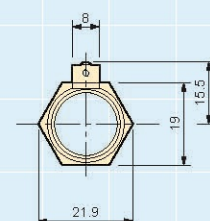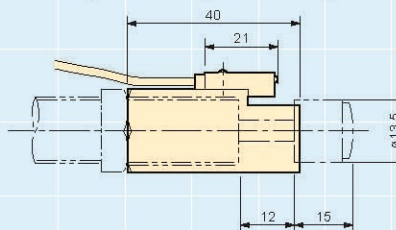■ Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M20×1.5

□28
□40
4-ø6.5

12

Mass 109g

Holder with a switch OP-030EB-□

OP-030EB-1

30
9
21
ø18

16
17

8
18
24

28

Mass 59g

OP-030EB-2 (With a stopper function)

50
21
ø18

16
17

Clearance

Stroke

Cap

Mass 80g

■ When attaching a holder with no stopper function, ensure that there is a gap between the switch and the cap's tip when the piston rod is pressed all the way down to the stroke end. Otherwise, the switch may become damaged by the impact.

■ Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

■ For switch specifications and precautions for use, please refer to page 73. 👉
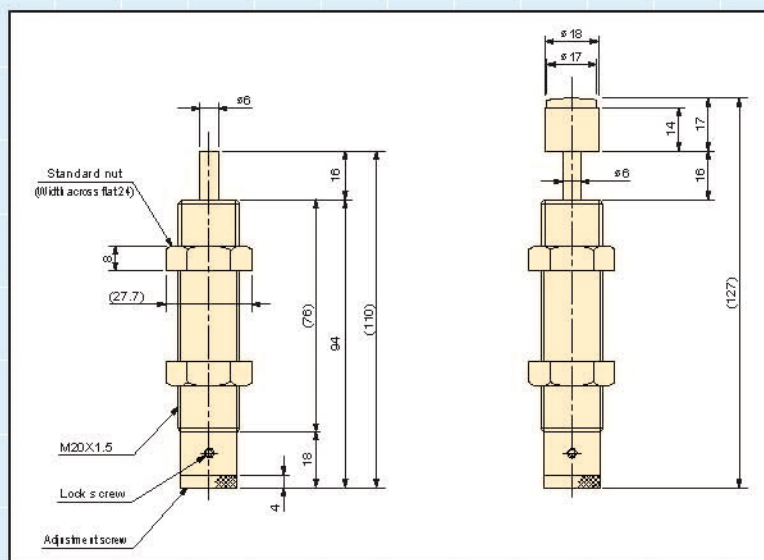
*Standard nuts are sold separately as well.
For FA-2016E: M20 nut

Soft Silent Safety

FA-2530GB/FA-2530GD/FWM-2530GBD Series

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

RoHS Compliant

Standard nut
(Width across flat 32)

M25×1.5

Lock screw

Adjustment screw

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-2530GB-S/C	30	49 (5.0)	400 (400)	0.3~1	Single-orifice type
FA-2530GD-S/C			150 (150)	0.7~3	Multiple-orifice type
FWM-2530GBD-S/C			300 (300)	0.3~2	Multiple-varying orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	3920 (400)	Operating temperature	°C	–5~70
Max. cycle rate	cycle/min	60	Mass: S type	g	406
Max. absorption energy per minute	J/min (kgf·m/min)	490 (50)	:C type	g	436
Recovering power of the piston rod	N (kgf)	33.2 (3.38) or lower			

Note) M25 X 2.0 is also available as the main unit's screw pitch specifications for the FA-2530 series. Please your order using the model number FA-2530G*-S-P2.0 or FA-2530G*-C-P2.0.

<Selection Guideline> The FA-2530 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Single-orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-2530GB series	FA-2530GD series	FWM-2530GBD series
Application	For low-speed	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics			

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020GB).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

<Adjustment Method>
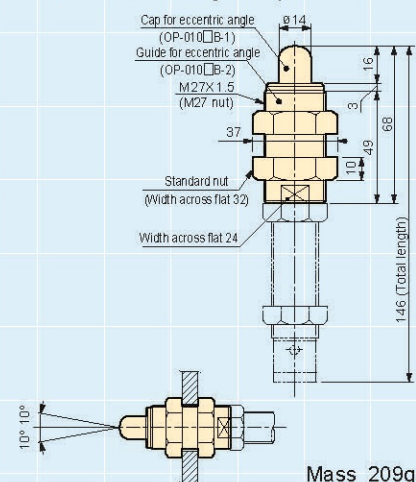
* To adjust, turn the adjustment knob with a slotted screw driver
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety FA-2530GB/FA-2530GD/FWM-2530GBD Series

RoHS Compliant

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

<Optional Parts>
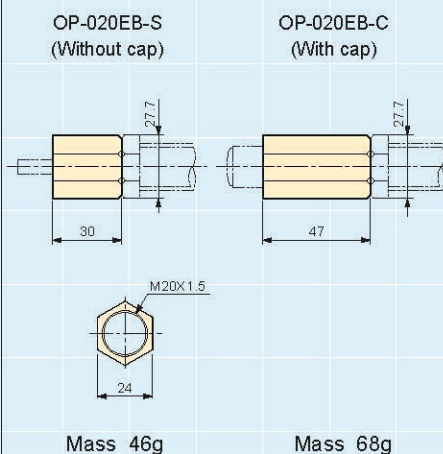
Eccentric angle adaptor OP-010GB

■Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■The main unit can also be used as a stopper.

■Use it with a capless soft absorber.

■The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010□B-1)
Guide for eccentric angle (OP-010□B-2)
M36X1.5 (M36 nut)
Ø16
53.1
30 / 10 / 67.5 / 107.5
15
212 (Total length)
Standard nut (Width across flat 46)
Width across flat 32

10° 10°

Mass 639g
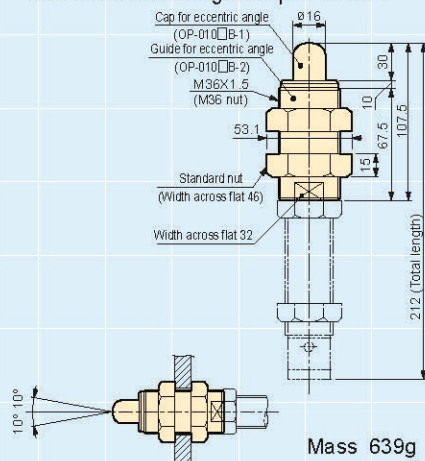
Note) Material of cap for eccentric angle: Metal

Stopper nut OP-020GB-□

■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020GB-S (Without cap)   OP-020GB-C (With cap)

37 / 20   37 / 32

M25X1.5
32

Mass 65g   **Mass 102g**
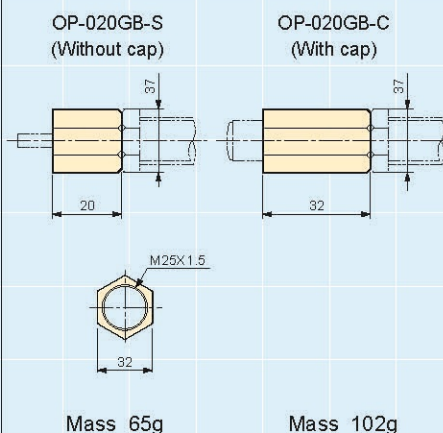
Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.
M25 X 2.0 is also available as a screw pitch specification.
Model number is either OP-020GB-S or C-P2.0
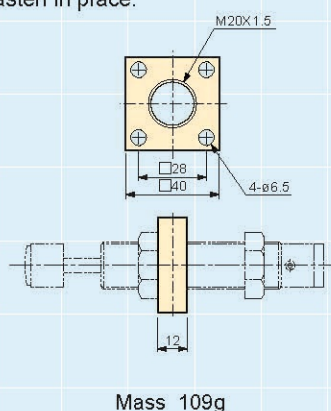
Liquid-proof cap F□□-2530G□□-C-060

■Ideal for use in environments where oil splatter poses a problem.

■Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

■F□□-2530G□□-C-060
• Model indication A or WM is inserted in □ of F□□.
• Model indication B, D or BD is inserted in □ of G□□.

Ø28
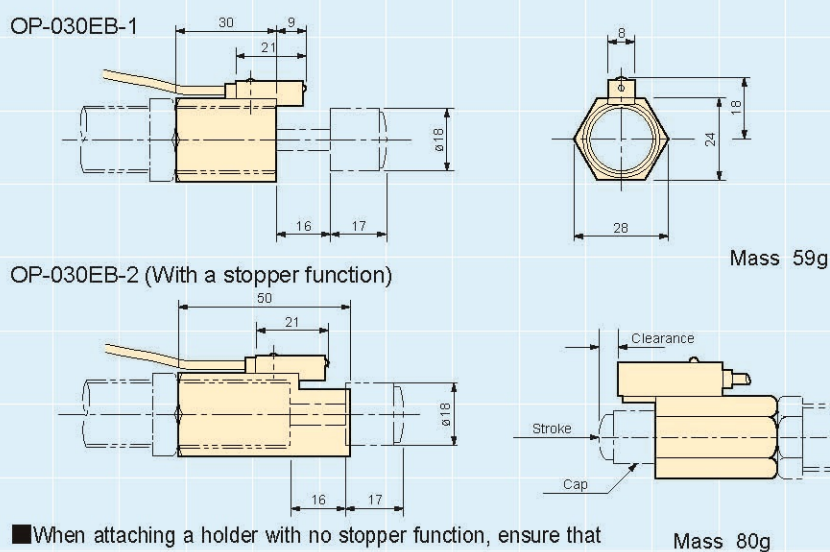51 / 30
6.5
169.5

Mass 77g
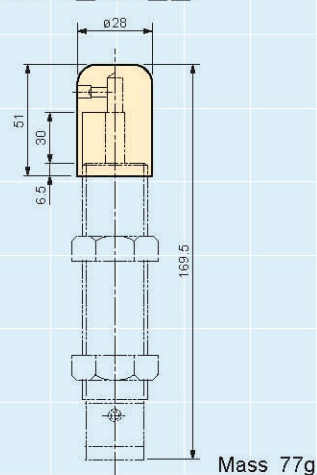
Note) Liquid-proof caps are not sold separately.

Square flange OP-040GB

■Once the attachment site is determined, use the main unit's nut to securely fasten in place.
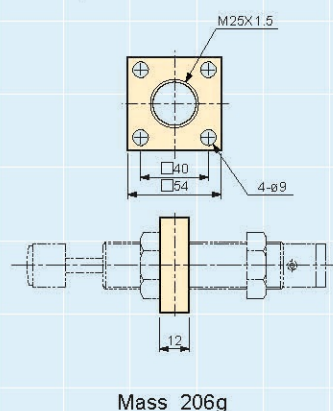
M25X1.5
□40
□54
4-ø9
12

Mass 206g

*Standard nuts are sold separately as well.
For FA-2530GB/FA-2530GD/FWM-2530GBD
 : M25 nut
   M25-P2 nut

Holder with a switch OP-030GB-□

OP-030GB-1

20 / 9 / 21
30 / 18
ø22

8
20.5 / 29
32

Mass 51g

OP-030GB-2 (With a stopper function)

37 / 21
30 / 18
ø22

Clearance
Stroke
Cap

Mass 82g

■When attaching a holder with no stopper function, ensure that there is a gap between the switch and the cap's tip when the piston rod is pressed all the way down to the stroke end. Otherwise, the switch may become damaged by the impact.

■Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

■For switch specifications and precautions for use, please refer to page 73. ☞

■M25 X 2.0 is also available as a screw pitch specification. Model number is either OP-030GB-1 or 2-P2.0

Soft Silent Safety FA-2540LB/FA-2540LD/FWM-2540LBD Series

RoHS Compliant (For Low Speed) (For High Speed) (For Medium Speed) Adjustable

Standard nut
(Width across flat 32)

M25X1.5

Adjustment screw

Lock screw

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-2540LB-C			500 (500)	0.3~1	Single-orifice type
FA-2540LD-C	40	63.7 (6.5)	200 (200)	0.7~3	Multiple-orifice type
FWM-2540LBD-C			350 (350)	0.3~2	Multiple-varying orifice type

<Common Specifications>

Max. drag	N (kgf)	3920 (400)	Operating temperature	°C	−5~70
Max. cycle rate	cycle/min	60	Mass: C type	g	475.1
Max. absorption energy per minute	J/min (kgf·m/min)	637 (65)			
Recovering power of the piston rod	N (kgf)	71.4 (7.29) or lower			

Note) M25 X 2.0 is also available as the main unit's screw pitch specifications for the FA-2540 series. Please order using the model number FA-2540L*-C-P.2.0. However, please note that there are no optional parts for it.

<Selection Guideline> The FA-2540 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Single-orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-2540LB series	FA-2540LD series	FWM-2540LBD series
Application	For low-speed	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics			

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020LB).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
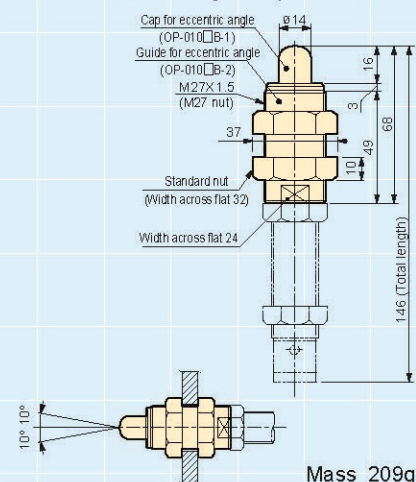* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob with a slotted screw driver
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety

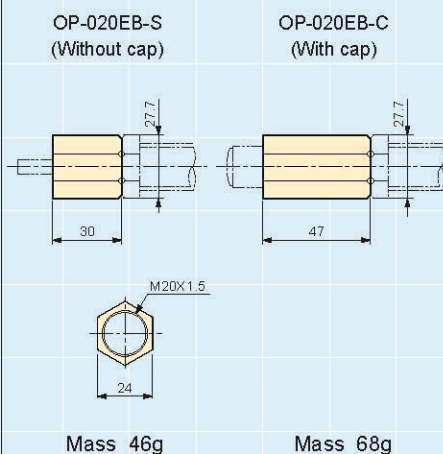# FA-2540LB/FA-2540LD/FWM-2540LBD Series

RoHS Compliant

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

<Optional Parts>

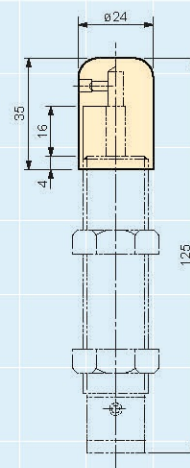| Stopper nut OP-020LB	Square flange OP-040GB
■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.	■Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M25X1.5

37

50

32

Mass 153g

M25X1.5

□40
□54
4-ø9

12

Mass 206g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

*Standard nuts are sold separately as well.
For FA-2540LB/FA-2540LD/FWM-2540LBD: M25 nut
M25-P2 nut

Soft Silent Safety

FA-2725FB/FA-2725FD/FWM-2725FBD Series

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

RoHS Compliant

Standard nut (Width across flat 32)

M27X1.5

Lock screw

Adjustment knob

ø8

ø23

ø8

<Specifications>
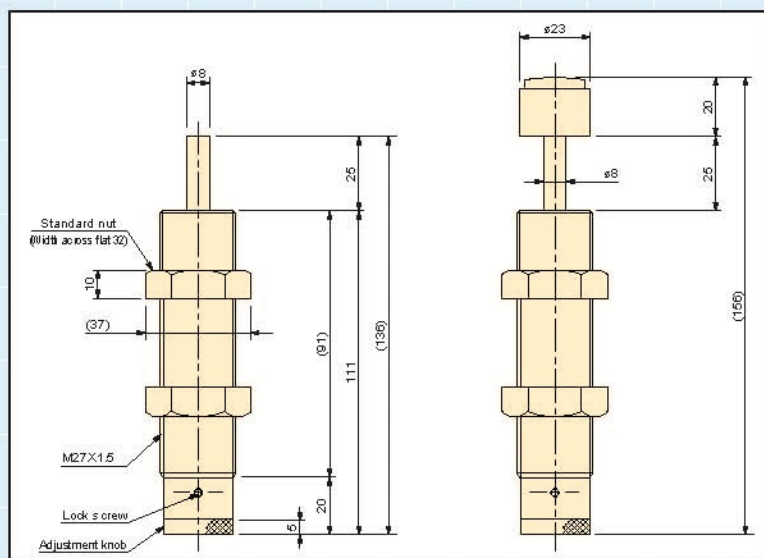
Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-2725FB-S/C	25	79.3 (8.1)	650 (650)	0.3~1	Single-orifice type
FA-2725FD-S/C			300 (300)	0.7~3	Multiple-orifice type
FWM-2725FBD-S/C			450 (450)	0.3~2	Multiple-varying orifice type
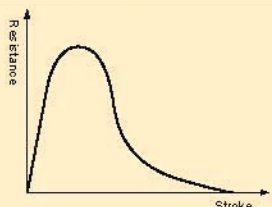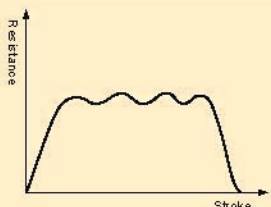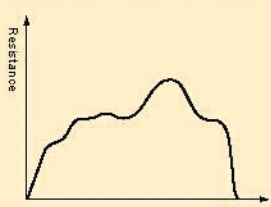
Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	6370 (650)	Operating temperature	°C	−5~70
Max. cycle rate	cycle/min	60	Mass: S type	g	411
Max. absorption energy per minute	J/min (kgf·m/min)	539 (55)	:C type	g	460
Recovering power of the piston rod	N (kgf)	27.3 (2.78) or lower			

Note) M27X3.0 is also available as the main unit's screw pitch specification for the FA-2725 series. Please order using the model number FA-2725F*-S-P3.0 or FA-2725F*-C-P3.0.

<Selection Guideline> The FA-2725 series has the following three patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

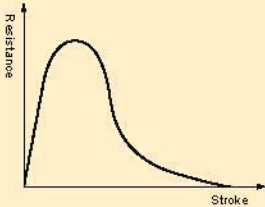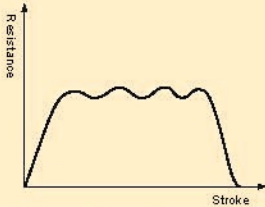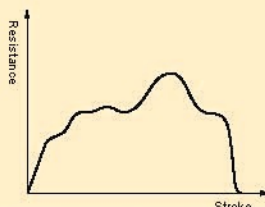| Orifice type	Single-orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-2725FB series	FA-2725FD series	FWM-2725FBD series
Application	For low-speed	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics	Resistance / Stroke	Resistance / Stroke	Resistance / Stroke

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020FB).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

FA-2725FB/FA-2725FD/FWM-2725FBD Series

Soft Silent Safety

RoHS Compliant

(For Low Speed) (For High Speed) (For Medium Speed) Adjustable

## <Optional Parts>

Eccentric angle adaptor OP-010FB

■ Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■ Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■ The main unit can also be used as a stopper.

■ Use it with a capless soft absorber.

■ The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle
(OP-010□B-1)
Guide for eccentric angle
(OP-010□B-2)
M36X1.5
(M36 nut)
ø16
25
10
97
62
15
53.1
Standard nut
(Width across flat 46)
Width across flat 32
188 (Total length)

10° 10°

Mass 587g

Note) Material of cap for eccentric angle: Metal

Stopper nut OP-020FB-□

■ Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020FB-S
(Without cap)

OP-020FB-C
(With cap)

37
35

37
55

M27X1.5

32

Mass 90g

Mass 137g
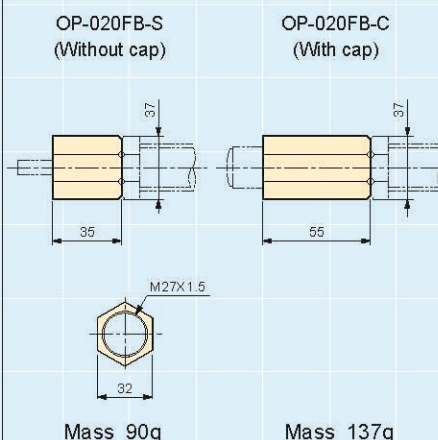
Note) When attaching, make sure that the side without a bearing chamfer is the impact surface. M27 X 3.0 is also available as a screw pitch specification. Model number is either OP-020FB-S or C-P3.0

Liquid-proof cap F□□-2725F□□-C-060

■ Ideal for use in environments where oil splatter poses a problem.

■ Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

■ F□□-2725F□□-C-060
• Model indication A or WM is inserted in □ of F□□.
• Model indication B, D or BD is inserted in □ of F□□.

ø30
50
25
5
156

Mass 112g
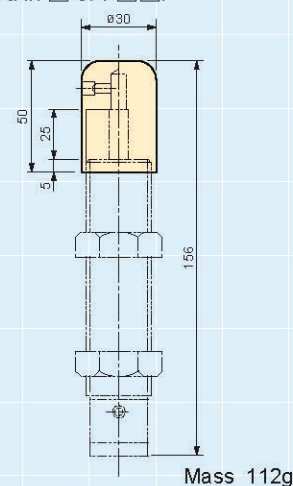
Note) Liquid-proof caps are not sold separately.

Square flange OP-040FB

■ Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M27X1.5
□36
□50
4-ø9

12

Mass 157g

*Standard nuts are sold separately as well.
For FA-2725FB/FA-2725FD/FWM-2725FBD
 : M27 nut
  M27-P3 nut
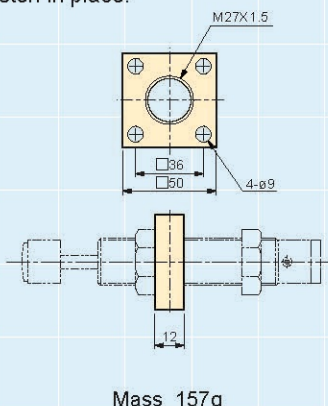
Holder with a switch OP-030FB-□

OP-030FB-1

32
9
21
25
20
ø23

8
21
30
34.6

Mass 68g
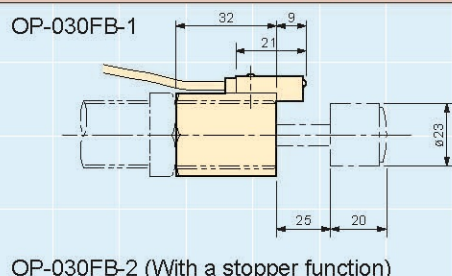
OP-030FB-2 (With a stopper function)
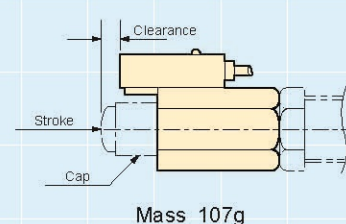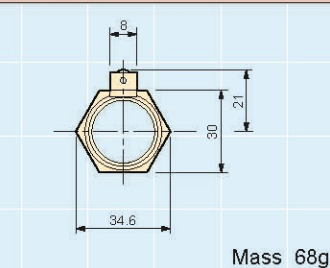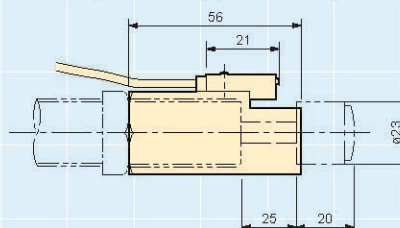
56
21
25
20
ø23

Clearance
Stroke
Cap

Mass 107g

■ When attaching a holder with no stopper function, ensure that there is a gap between the switch and the cap's tip when the piston rod is pressed all the way down to the stroke end. Otherwise, the switch may become damaged by the impact.

■ Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

■ For switch specifications and precautions for use, please refer to page 73. ☞

■ M27 X 3.0 is also available as a screw pitch specification. The model number is either OP-030FB-1 or 2-P3.0

FA-3035TD/FWM-3035TBD Series

Soft Silent Safety

RoHS Compliant

(For High Speed) (For Medium Speed) Adjustable

Standard nut (Width across flat 36)

M30X1.5

Lock screw

Adjustment knob

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-3035TD-S/C	35	196 (20)	700 (700)	0.7~3	Multiple-orifice type
FWM-3035TBD-S/C			1300 (1300)	0.3~2	Multiple-varying orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

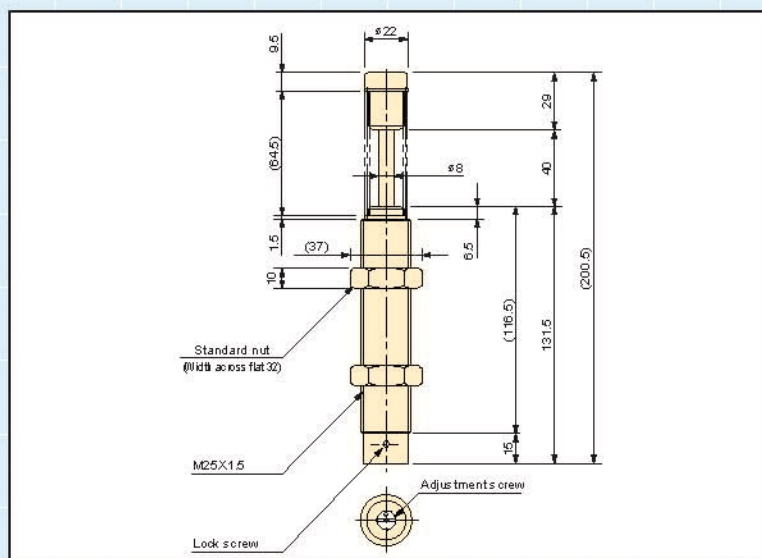|					
Max. drag	N (kgf)	16660 (1700)	Operating temperature	°C	–5~70
Max. cycle rate	cycle/min	30	Mass: S type	g	710
Max. absorption energy per minute	J/min (kgf·m/min)	1176 (120)	:C type	g	760
Recovering power of the piston rod	N (kgf)	44.1 (4.5) or lower			

<Selection Guideline> FA-3035 series has the following two patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-3035TD series	FWM-3035TBD series
Application	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics	Resistance / Stroke	Resistance / Stroke

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020TB).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety
FA-3035TD/FWM-3035TBD Series

RoHS Compliant

(For High Speed) (For Medium Speed) Adjustable

<Optional Parts>

Eccentric angle adaptor OP-010TB

■Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■The main unit can also be used as a stopper.

■Use it with a capless soft absorber.

■The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010□B-1)
Guide for eccentric angle (OP-010□B-2)
M40X1.5 (M40 nut)
ø18
35
10
127
57.7
82
15
Standard nut (Width across flat 50)
Width across flat 36
255 (Total length)

10° 10°

Note) Material of cap for eccentric angle: Metal

Mass 852g

Stopper nut OP-020TB-□

■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020TB-S (Without cap)   OP-020TB-C (With cap)

41.6   41.6

38   58

M30X1.5

36
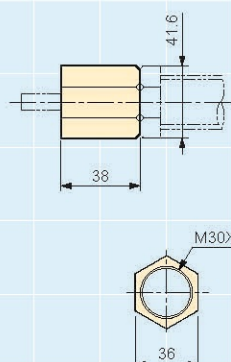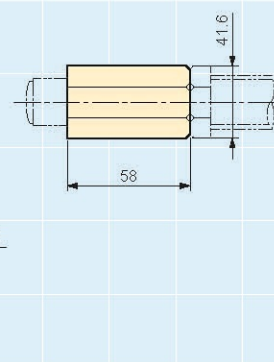
Mass 129g   Mass 197g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Square flange OP-040TB

■Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M30X1.5
□45
□65
4-ø11

14
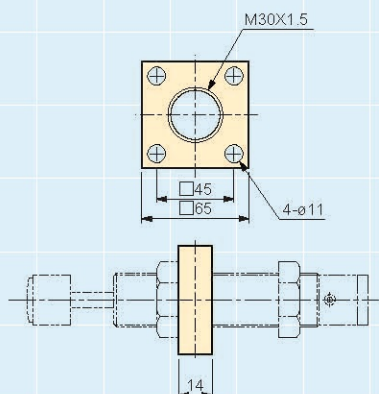
Mass 344g

Liquid-proof cap F□□-3035T□□-C-060

■Ideal for use in environments where oil splatter poses a problem.

■Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.

■F□□-3035T□□-C-060
•Model indication A or WM is inserted in □ of F□□.
•Model indication D or BD is inserted in □ of T□□.

ø38
60
35
5
208
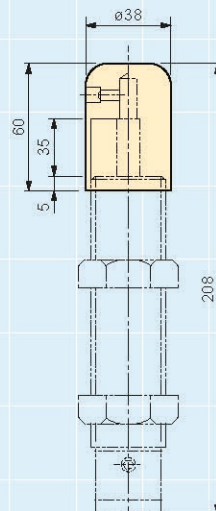
Mass 255g

Note) Liquid-proof caps are not sold separately.

*Standard nuts are sold separately as well.
 For FA-3035TD/FWM-3035TBD: M30 nut
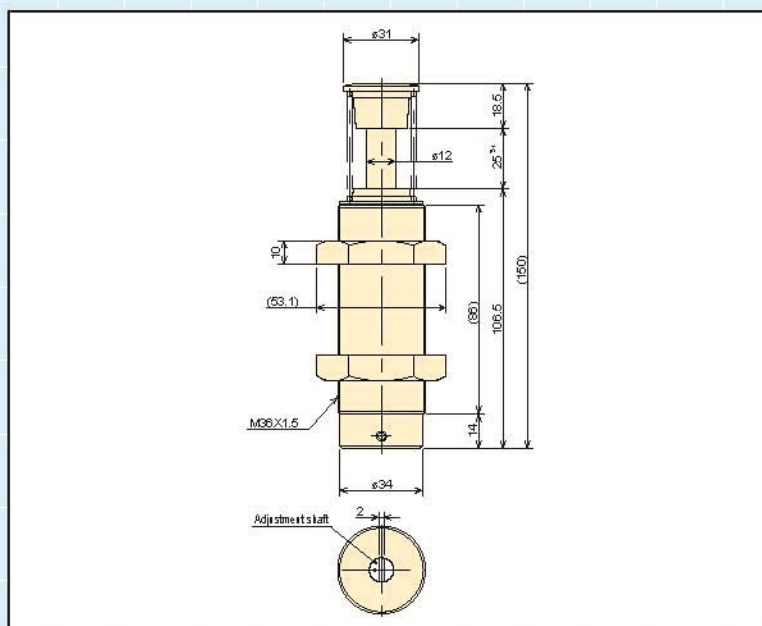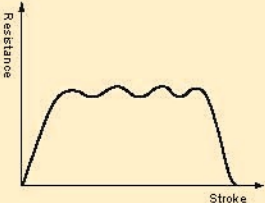
Soft Silent Safety FA-3625A Series

Adjustable Type

RoHS Compliant

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-3625A1-C	25	200 (20.4)	2000	0.3~1	Multiple-orifice type
FA-3625A3-C			700	0.7~3	

<Common Specifications>

Max. drag	N (kgf)	25000 (2550)	Operating temperature	°C	−5~70
Max. cycle rate	cycle/min	30	Mass: C type	g	900
Max. absorption energy per minute	J/min (kgf·m/min)	1500 (153)			
Recovering power of the piston rod	N (kgf)	100 (10.2) or lower			

<Selection Guideline> FA-3625 series has the following two patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Multiple-orifice type	Multiple-orifice type
Model number	FA-3625A1-C	FA-3625A3-C
Application	For low-speed	For high-speed
Absorption characteristics		

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020M36).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety

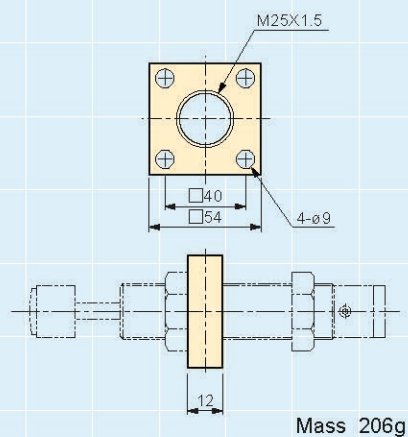# FA-3625A Series

Adjustable Type

RoHS Compliant

<Optional Parts>

Stopper nut OP-020M36	Square flange OP-040UB

■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

■Once the attachment site is determined, use the main unit's nut to securely fasten in place.

OP-020M36

53.1

45

M36X1.5

46

Mass 291g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

M36X1.5

□56
□78

4-ø14

16

Mass 566g

Urethane cap OP-090M36B	

*Standard nuts are sold separately as well.
 For FA-3625A: M36A nut

OP-090M36B

10

ø20
ø34

ø34

23.5

(155)

Dimensions with urethane cap attached

Soft Silent Safety

FA-3650UD/FWM-3650UBD Series

(For High Speed) (For Medium Speed) Adjustable

RoHS Compliant

Standard nut
(Width across flat 46)

M36X1.5

Lock s crew

Adjustment knob

<Specifications>
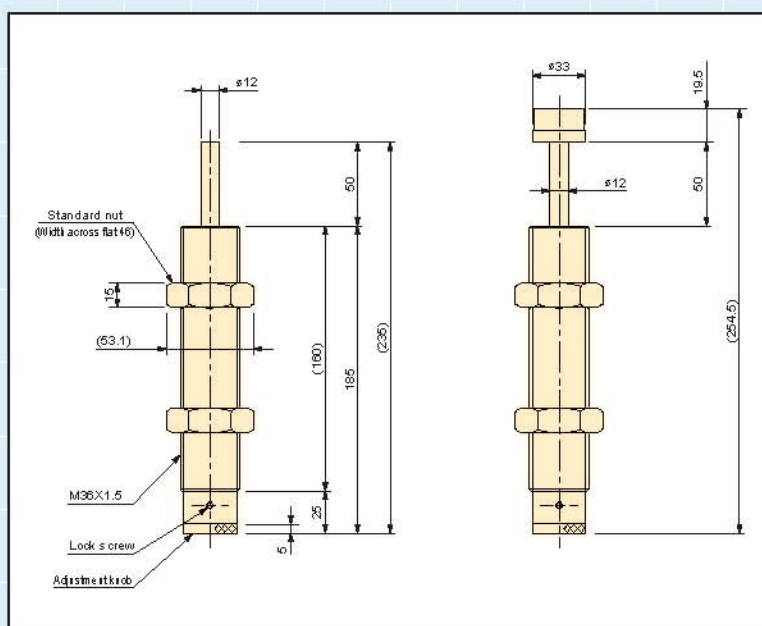
Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-3650UD-S/C	50	392 (40)	1400 (1400)	0.7~3	Multiple-orifice type
FWM-3650UBD-S/C			2700 (2700)	0.3~2	Multiple-varying orifice type

Note) To place an order without a cap, put –S at the end of the model number, and to place an order with a cap, put –C at the end of the model number.

<Common Specifications>

Max. drag	N (kgf)	23520 (2400)	Operating temperature	°C	–5~70
Max. cycle rate	cycle/min	30	Mass: S type	g	1330
Max. absorption energy per minute	J/min (kgf·m/min)	2352 (240)	:C type	g	1410
Recovering power of the piston rod	N (kgf)	68.6 (7.0) or lower			

<Selection Guideline> FA-3650 series has the following two patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-3650UD series	FWM-3650UBD series
Application	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics		

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020UB).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)
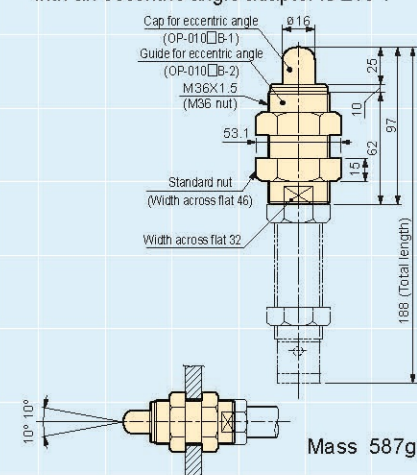
<Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety

FA-3650UD/FWM-3650UBD Series

(For High Speed) (For Medium Speed) Adjustable

RoHS Compliant

<Optional Parts>

Eccentric angle adaptor OP-010UB

■Screw the eccentric angle adaptor into the main unit until the cap for the eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

■Use the eccentric angle adaptor when the eccentric angle is 2.5° or larger.

■The main unit can also be used as a stopper.

■Use it with a capless soft absorber.

■The maximum operating eccentric angle with an eccentric angle adaptor is ±10°.

Cap for eccentric angle (OP-010□B-1)
Guide for eccentric angle (OP-010□B-2)
M45X1.5 (M45 nut)
ø20
50
10
107
167
63.5
15
Standard nut (Width across flat 55)
Width across flat 41
322 (Total length)

10° 10°

Note) Material of cap for eccentric angle: Metal

Mass 1273g

Stopper nut OP-020UB-□

■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020UB-S (Without cap)

OP-020UB-C (With cap)

53.1

53.1

45

65

M36X1.5

46
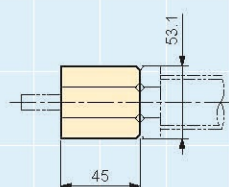
Mass 291g
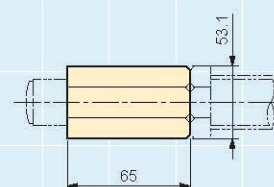
Mass 422g

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

*Standard nuts are sold separately as well. For FA-3650UD/FWM-3650UBD: M36 nut

Square flange OP-040UB

■Once the attachment site is determined, use the main unit's nut to securely fasten in place.

M36X1.5

□56
□78
4-ø14

16

Mass 566g

Soft Silent Safety **FA-4225B/FA-4250B/FA-4275B** Series

Adjustable Type

RoHS Compliant

Adjustment shaft — B — ⌀C — Urethane cap Optional Parts — D — D1 — E — A — A1

*The absorber's main unit does not come with nuts.

<Dimensions>

Model	A	A1	B	C	D	D1	E
FA-4225B3-C	144	162	M42X1.5	12	38	44.5	92
FA-4250B3-C	195	213					118
FA-4275B3-C	246	264					143

*A1 and D1 are dimensions with the optional urethane cap attached.
Urethane cap type: OP-090M42

<Specifications>

Model		FA-4225B3-C	FA-4250B3-C	FA-4275B3-C
Stroke	mm	25	50	75
Max. absorption energy	J(kgf·m)	260 (26.5)	520 (53.1)	780 (79.6)
Max. equivalent mass	kg(kgf)	3,400 (3,400)	6,500 (6,500)	9,700 (9,700)
Range of impact rate	m/s	0.3~3		
Max. drag	N(kgf)	31,590 (3,223)		
Max. cycle rate	cycle/min	20	10	6
Max. absorption energy per minute	J/min	1858	2372	3345
	(kgf·m/min)	(190)	(242)	(341)
Recovering power of the piston rod	N(kgf)	120 (12.2)		
Operating temperature	°C	−5~70		
Mass	g	795	1020	1240

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020M42).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
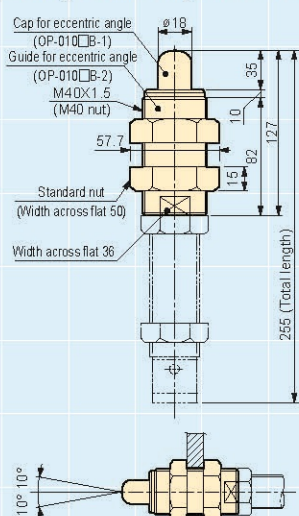* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety FA-4225B/FA-4250B/FA-4275B Series

Adjustable Type

RoHS Compliant

<Optional Parts>

Nut OP-M42

4-ø4.6
4-2.5
ø53
M42X1.5
10

Mass 64g

Square flange OP-040 M42SF

4-ø8.8
M42X1.5
Fixing slit
12
41.4
41.4
57.2
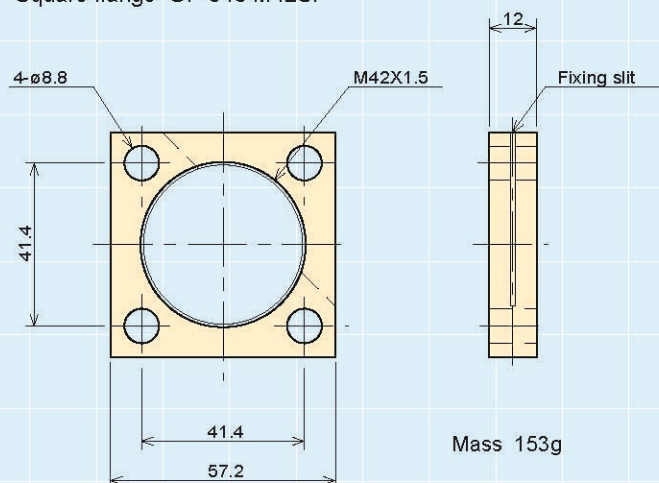
Mass 153g

Stopper nut OP-020 M42

31
2-ø5
M42X1.5
ø49
ø56
32
59
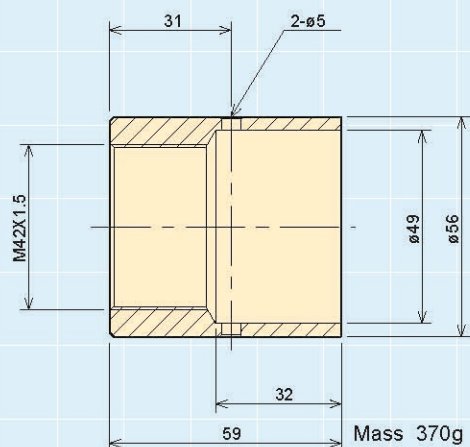
Mass 370g

Rectangle flange OP-040 M42RF

4-ø8.8
M42X1.5
Fixing slit
12
57
41.4
60.5
76
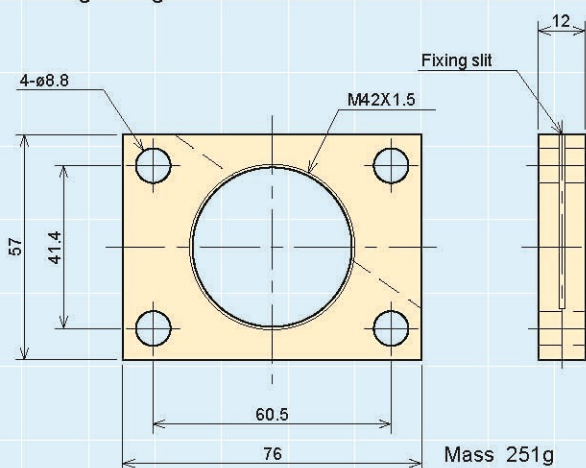
Mass 251g

Urethane cap OP-090 M42A

ø26
ø44.5
24.5
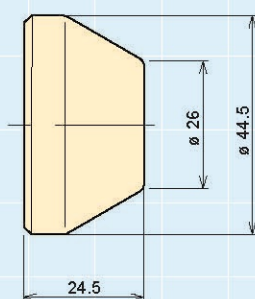
Mass 26g

Side mount OP-M42SM
*Side mount is sold as a set of two.
*Recommended bolt: M8 X 50 hexagon socket head bolt

M42X1.5
ø15
12.5
Fixing slit
15
55
30
38.1
76.2
95
ø9
25

Mass 676g (1 unit)

115
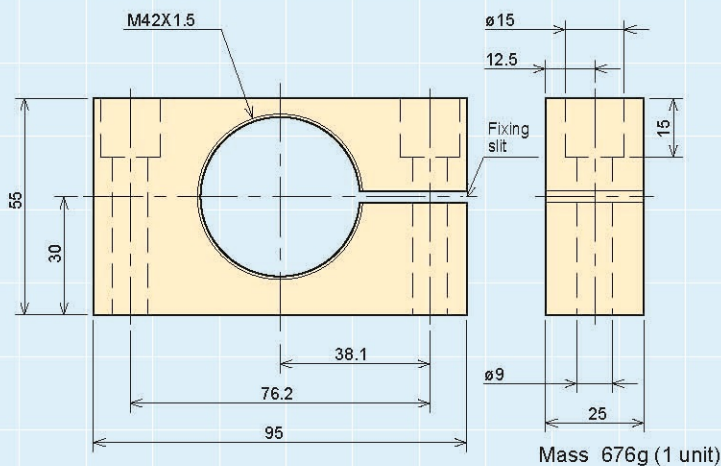
FA-4250YD/FWM-4250YBD Series

Soft Silent Safety

RoHS Compliant

(For High Speed) (For Medium Speed) Adjustable

<Specifications>
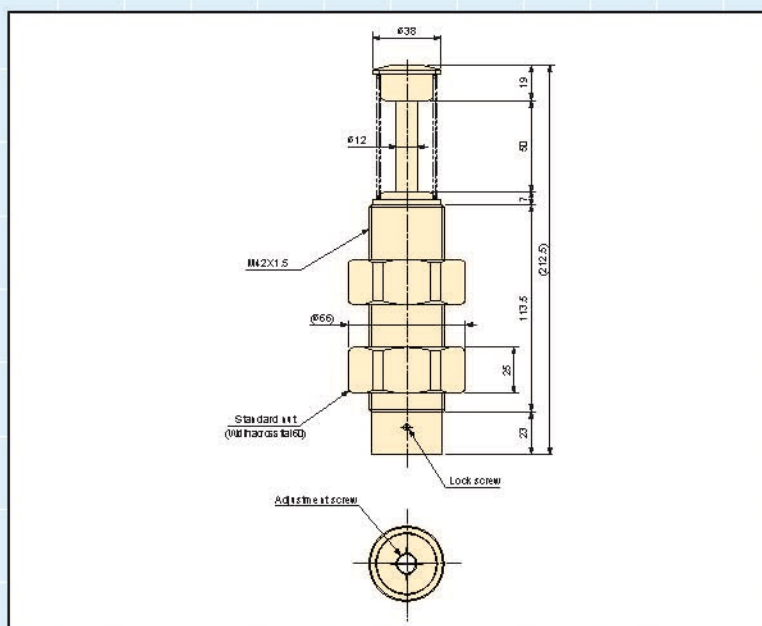
Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-4250YD-C	50	441 (45)	390 (390)	0.7~3	Multiple-orifice type
FWM-4250YBD-C			3500 (3500)	0.3~2	Multiple-varying orifice type

<Common Specifications>

Max. drag	N (kgf)	27030 (2758)	Operating temperature	°C	−5~70
Max. cycle rate	cycle/min	10	Mass: C type	g	1560
Max. absorption energy per minute	J/min (kgf·m/min)	2744 (280)			
Recovering power of the piston rod	N (kgf)	83.3 (8.5) or lower			

<Selection Guideline> FA-4250 series has the following two patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-4250YD series	FWM-4250YBD series
Application	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics		

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

*Standard nuts are sold separately as well.
 For FA-4250YD/FWM-4250YBD: M42 nut

<Adjustment Method>

* To adjust, turn the adjustment knob with a slotted screw driver
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety

FA-4280WD/FWM-4280WBD Series

RoHS Compliant

(For High Speed) (For Medium Speed) Adjustable

ø38

ø12

M42X1.5

Standard nut
(Width across flat 60)

Lock screw

Adjustment knob

<Specifications>

Model	Stroke mm	Max. absorption energy J (kgf·m)	Max. equivalent mass kg (kgf)	Range of impact rate m/s	Orifice type
FA-4280WD-C	80	720 (73.5)	640 (640)	0.7~3	Multiple-orifice type
FWM-4280WBD-C			5500 (5500)	0.3~2	Multiple-varying orifice type

<Common Specifications>

Max. drag	N (kgf)	27030 (2758)	Operating temperature	°C	−5~70
Max. cycle rate	cycle/min	6	Mass: C type	g	2010
Max. absorption energy per minute	J/min (kgf·m/min)	4410 (450)			
Recovering power of the piston rod	N (kgf)	98 (10) or lower			

<Selection Guideline> FA-4280 series has the following two patterns of absorption characteristics depending on the orifice type. Please use the following information as a guideline when making your selection.

Orifice type	Multiple-orifice type	Multiple-varying orifice type
Model number	FA-4280WD series	FWM-4280WBD series
Application	For high-speed	For medium speed, in particular with a pneumatic cylinder
Absorption characteristics		

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

*Standard nuts are sold separately as well.
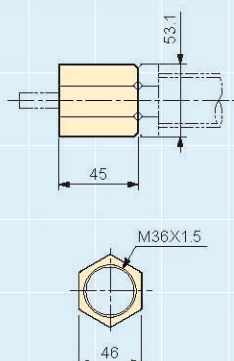For FA-4280WD/FWM-4280WBD: M42 nut

<Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

FA-2016EA/FA-2725FA Series

Multiple-Orifice (2 Openings)   Adjustable

\<Dimensions\>

Model	A	B	C	C1	D	E	F	øG	H	øl	J	øK	L	M
FA-2016EA-S/C	M20X1.5	16	105	122	89	63	10	6	17	18	16	26	10	24
FA-2725FA-S/C	M27X1.5	25	136	156	111	84.5	10	8	20	23	16.5	35	12	32

Note) To place an order without a cap, put –S at the end of the model number; to place an order with a cap, put –C at the end of the model number; and to place an order for a crevice type, put –U at the end of the model number.

\<Specifications\>

Model		FA-2016EA-*	FA-2725FA-*
Stroke	mm	16	25
Max. absorption energy	J (kgf·m)	25.4 (2.6)	79.3 (8.1)
Max. equivalent mass	kg (kgf)	200 (200)	500 (500)
Range of impact rate	m/s	0.15〜3	0.15〜3.0
Max. drag	N (kgf)	9800 (1000)	11760 (1200)
Max. absorption energy per minute	J/min	343	539
	(kgf·m/min)	(35)	(55)
Recovering power of the piston rod	N (kgf)	35.2 (3.59) or lower	44.2 (4.51) or lower
Operating temperature	°C	−5〜70	−5〜70
Mass: S type	g	190	400
: C type	g	260	600

\<Precautions for Use\>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020EB).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

\<Adjustment Method\>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
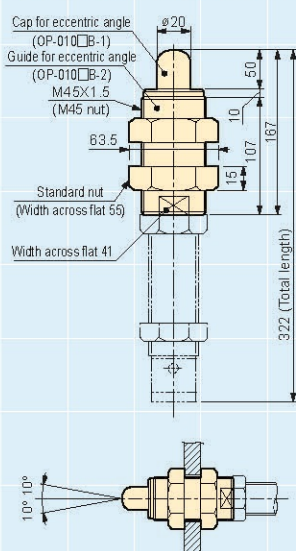* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

Soft Silent Safety

FA-2016EA/FA-2725FA Series

Multiple-Orifice (2 Openings)   Adjustable

\<Optional Parts\>

Stopper nut OP-020EB	Crevice mount

■Adjust so that it stops 1 mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020**-S
(Without cap)

OP-020**-C
(With cap)

Note) When attaching, make sure that the side without the bearing chamfering is the impact surface.

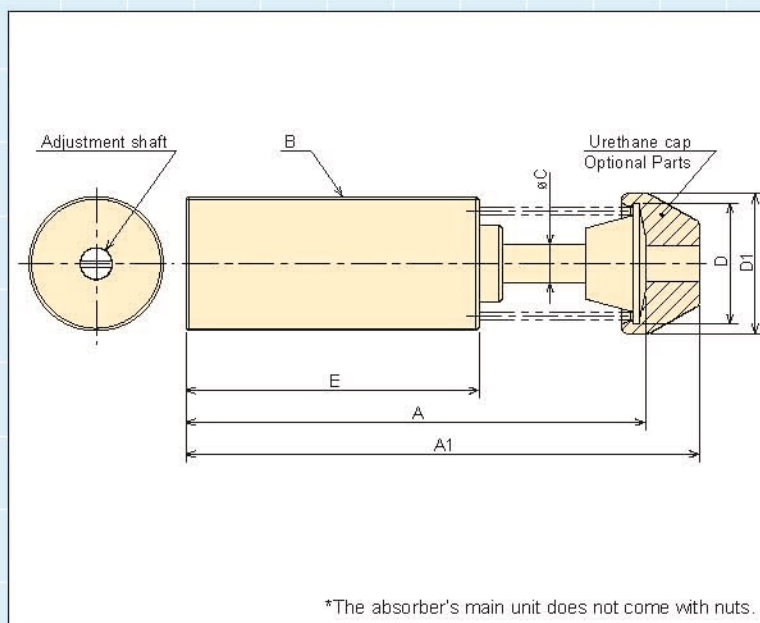| Model	A	B	C	D	E	F		Mass g
OP-020EB-*	30	27.7	47	27.7	24	M20X1.5	S	46
							C	68
OP-020FB-*	35	37	55	37	32	M27X1.5	S	90
							C	137

Square flange OP-040EB, OP-040FB

■Once the attachment site is determined, use the main unit's nut to securely fasten in place.
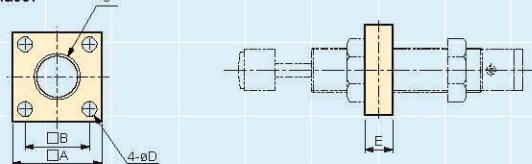
Model	A	B	C	øD	E	Mass g
OP-040EB	40	28	M20X1.5	6.5	12	109
OP-040FB	50	36	M27X1.5	9	12	157
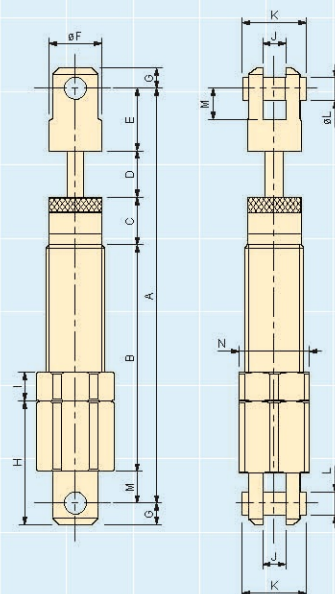
Model	A	B	C	D	E	øF	G
FA-2016EA-U	141.5	88.5	16	16	21	18	7
FA-2725FA-U	180	113.5	16.5	25	25	26	9

Model	H	I	J	K	øL	M	N
FA-2016EA-U	42	10	8	22	8	10.5	24
FA-2725FA-U	47	12	10	32	10	13	32

Holder with a switch OP-030**

OP-030**-1 (Without stopper function)   OP-030**-2 (With stopper function)

Clearance

Stroke

Cap
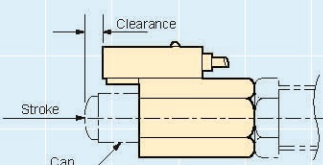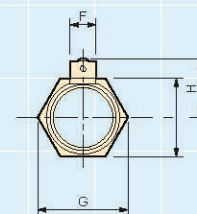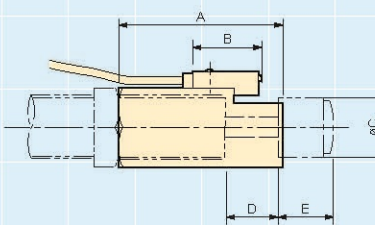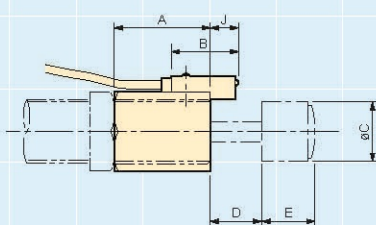
Model	A	B	C	D	E	F	G	H	I	J	Mass g
OP-030EB-1	30	21	18	16	17	8	28	18	24	9	59
OP-030EB-2	50	21	18	16	17	8	28	18	24	—	80
OP-030FB-1	32	21	23	25	20	8	34.6	21	30	9	68
OP-030FB-2	56	21	23	25	20	8	34.6	21	30	—	107

■When attaching a holder with no stopper function, ensure that there is a gap between the switch and the cap's tip when the piston rod is pressed all the way down to the stroke end. Otherwise, the switch may become damaged by the impact.

■Although a holder with a switch can be ordered on its own, we strongly recommend ordering one with the main unit. Please include the main unit's model number when placing an order.

■For switch specifications and precautions in use, please refer to page 73. ☞

*Standard nuts are sold separately as well.
For FA-2016EA: M20EA nut
For FA-2725FA: M27FA nut

119

FA-S Series (Dust Seal Specifications)

Soft Silent Safety

Single Orifice Multiple Orifice   Adjustable

RoHS Compliant

<Structural Diagrams>

Standard product

Dust seal specifications

<Dimensions>
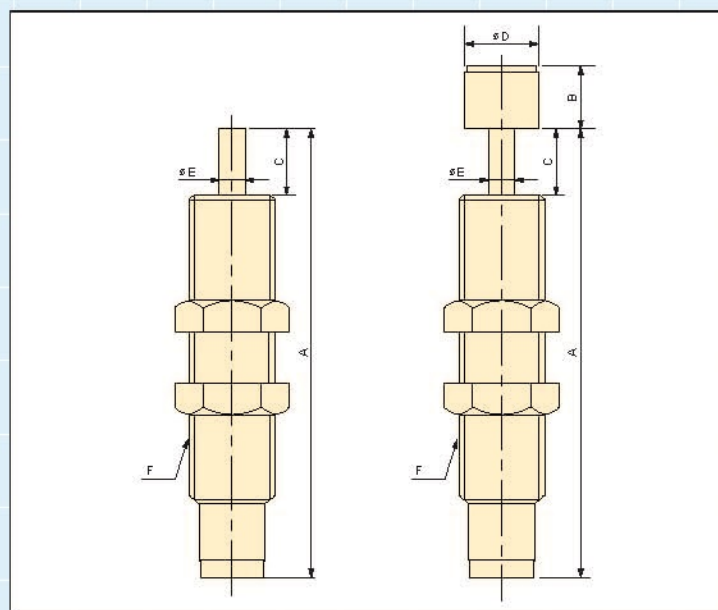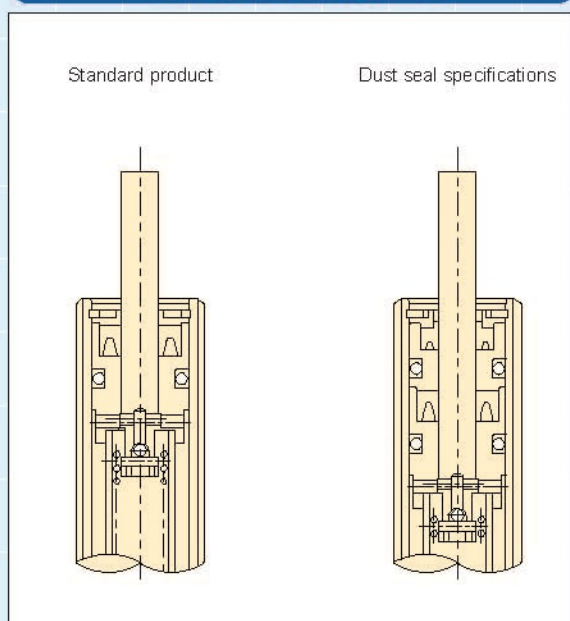
Model	A	B	C	D	E	F
FA-S1210M□-S	76		10		3.5	M12X1
FA-S1210M□-C		8		8		
FA-S1410R□-S	80		10			M14X1.5
FA-S1410R□-C		8		10		
FA-S1612X□-S	102		12		5	M16X1.5
FA-S1612X□-C		15		13.5		
FA-S2016E□-S	120		16		6	M20X1.5
FA-S2016E□-C		17		18		
FA-S2530G□-S	155		30			M25X1.5
FA-S2530G□-C		18		22		
FA-S2540L□-C	171.5	29	40	22.5	8	
FA-S2725F□-S	136		25			M27X1.5
FA-S2725F□-C		20		24		
FA-S3035TD-S	188		35		10	M30X1.5
FA-S3035TD-C		18.5		27		
FA-S3650UD-S	235		50		12	M36X1.5
FA-S3650UD-C		19.5		33		

Note) B or D is inserted in the □.
Insert B for a single-orifice type, and insert D for a multiple-orifice type.

<Precautions for Use>

* Do not use this product in places where it may come in contact with oil as it does not have a liquid-proof structure.

* Although the dimensions are identical to those of the FA series standard products (adjustable), the FA-S2016 series has a longer overall length (dimension A).

Soft Silent Safety

FWM-S Series (Dust Seal Specifications)

RoHS Compliant

Multiple Varying-Orifice   Adjustable

<Structural Diagrams>
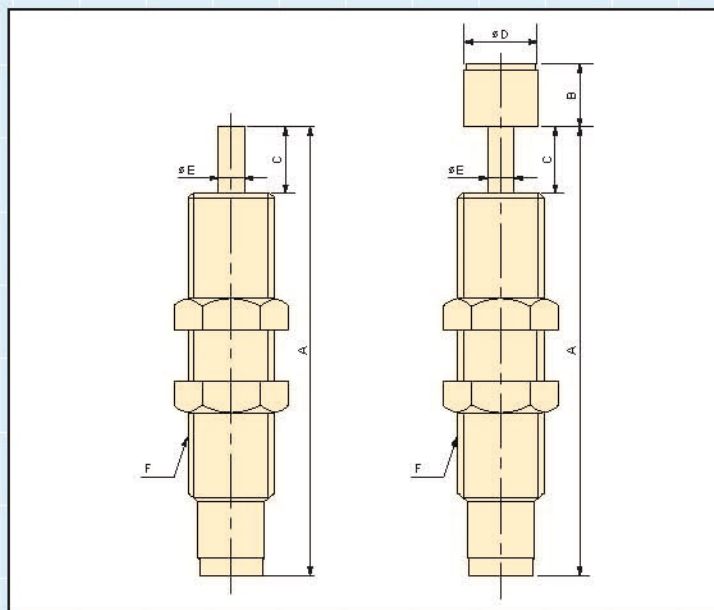
Standard product   Dust seal specifications

<Dimensions>
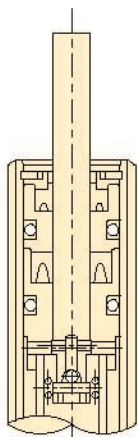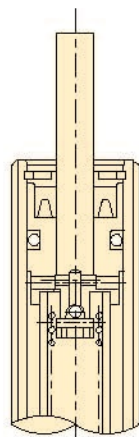
Model	A	B	C	D	E	F
FWM-S1210MBD-S	76		10		3.5	M12X1
FWM-S1210MBD-C		8		8		
FWM-S1410RBD-S	80					M14X1.5
FWM-S1410RBD-C		8		10		
FWM-S1612XBD-S	102		12		5	M16X1.5
FWM-S1612XBD-C		15		13.5		
FWM-S2016EBD-S	120		16		6	M20X1.5
FWM-S2016EBD-C		17		18		
FWM-S2530GBD-S	155		30		8	M25X1.5
FWM-S2530GBD-C		18		22		
FWM-S2540LBD-C	171.5	29	40	22.5		
FWM-S2725FBD-S	136		25			M27X1.5
FWM-S2725FBD-C		20		24		
FWM-S3035TBD-S	188		35		10	M30X1.5
FWM-S3035TBD-C		18.5		27		
FWM-S3650UBD-S	235		50		12	M36X1.5
FWM-S3650UBD-C		19.5		33		

<Precautions for Use>

* Do not use this product in places where it may come in contact with oil as it does not have a liquid-proof structure.

* Although the dimensions are identical to those of the FA series standard products (adjustable), the FWM-S2016 series has a longer overall length (dimension A).

FA-L Series (Anti-Coolant Specifications)

Soft Silent Safety

It is more durable compared to the standard type when used in the presence of volatilized water-insoluble cutting oil (JIS N1-type)

RoHS Compliant

Single Orifice Multiple Orifice   Adjustable

<Structural Diagrams>

Standard product

Anti-coolant specifications

<Dimensions>
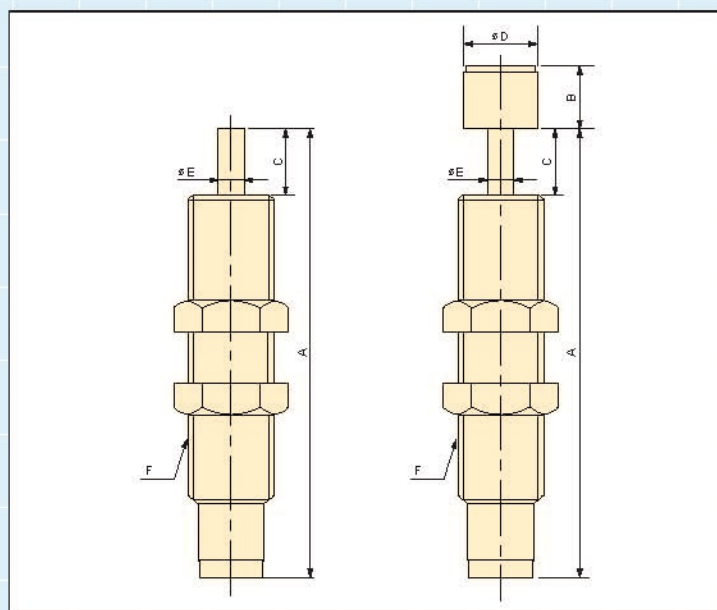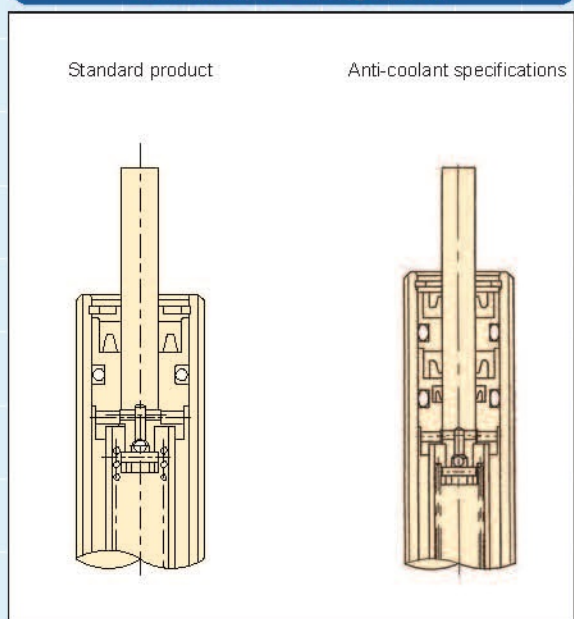
Model	A	B	C	D	E	F
FA-L1008V□-S	73.2		8		2.4	M10X1
FA-L1008V□-C		6.3		6		
FA-L1210M□-S	82.6		10		3.5	M12X1
FA-L1210M□-C		8		8		
FA-L1410R□-S	87					M14X1.5
FA-L1410R□-C		8		10		
FA-L1612X□-S	107.7		12		5	M16X1.5
FA-L1612X□-C		15		13.5		
FA-L2016E□-S	120		16		6	M20X1.5
FA-L2016E□-C		17		18		
FA-L2530G□-S	155		30			M25X1.5
FA-L2530G□-C		18		22	8	
FA-L2725F□-S	142.2		25			M27X1.5
FA-L2725F□-C		20		23		

Note) B or D is inserted in the □.
Insert B for a single-orifice type, and insert D for a multiple-orifice type.

<Precautions for Use>

* This product may not be sufficiently durable depending on the types and amount of liquid used. We strongly recommend you to conduct tests in advance to ensure that the product meets your needs.

* This product has a unique packing structure. Because of this, using this product in places where the piston rod remains dry may cause the inside oil to leak early on in its product life.

![Soft Silent Safety logo]

FWM-L Series (Anti-Coolant Specifications)

It is more durable compared to the standard type when used in the presence of volatilized water-insoluble cutting oil (JIS N1-type)

RoHS Compliant

Multiple Varying-Orifice   Adjustable

\<Structural Diagrams\>
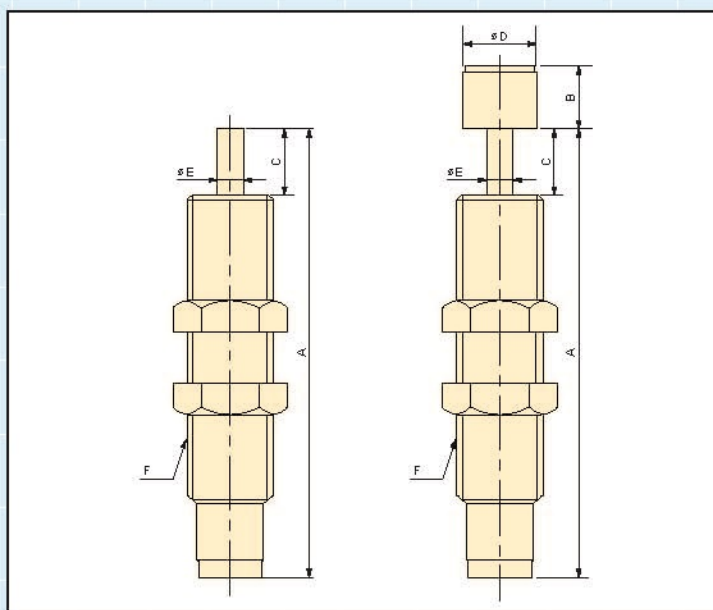
Standard product   Anti-coolant specifications

\<Dimensions\>
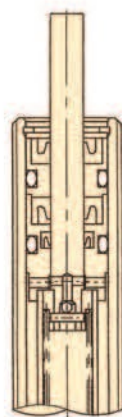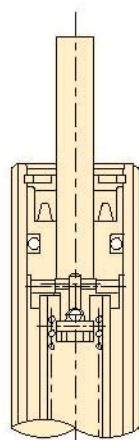
Model	A	B	C	D	E	F
FWM-L1008VBD-S	73.2		8		2.4	M10X1
FWM-L1008VBD-C		6.3		6		
FWM-L1210MBD-S	82.6		10		3.5	M12X1
FWM-L1210MBD-C		8		8		
FWM-L1410RBD-S	87					M14X1.5
FWM-L1410RBD-C		8		10		
FWM-L1612XBD-S	107.7		12		5	M16X1.5
FWM-L1612XBD-C		15		13.5		
FWM-L2016EBD-S	120		16		6	M20X1.5
FWM-L2016EBD-C		17		18		
FWM-L2530GBD-S	155		30		8	M25X1.5
FWM-L2530GBD-C		18		22		
FWM-L2725FBD-S	142.2		25			M27X1.5
FWM-L2725FBD-C		20		23		

\<Precautions for Use\>

* This product may not be sufficiently durable depending on the types and amount of liquid used. We strongly recommend you to conduct tests in advance to ensure that the product meets your needs.

* This product has a unique packing structure. Because of this, using this product in places where the piston rod remains dry may cause the inside oil to leak early on in its product life.

Soft Silent Safety

FK Series Small (M4~M16)

RoHS Compliant

Multiple-Orifice

Fixed

<Characteristics>

■ With a fixed, specially-designed orifice structure, an optimal impact absorption can be achieved, even under variable operating conditions. (FK-0404 and FK-0604 series have a groove-orifice structure.)

■ We have three available types to accommodate various speeds.
For low-speed: L, for medium-speed: M, for high-speed: H

■ Urethane cap specification is also available.

■ 2 or more of this product can be used in parallel.

■ This product can also be custom-designed for optimal impact absorption.

<Specifications>

Model		FK-0404L-☐	FK-0404H-☐	FK-0604L-☐	FK-0604H-☐	FK-1008L-☐	FK-1008M-☐	FK-1008H-☐	FK-1210L-☐	FK-1210M-☐	FK-1210H-☐
Max. absorption energy	J (kgf·m)	0.1 (0.01)	0.3 (0.03)	0.1 (0.01)	0.5 (0.05)	2.94 (0.3)			6.86 (0.7)		
Stroke	mm	4		4		8			10		
Max. equivalent mass	kg (kgf)	1 (1)	3 (3)	1 (1)	3 (3)	20 (20)	6 (6)	2.5 (2.5)	50 (50)	14 (14)	6 (6)
Range of impact rate	m/s	0.3~1		0.3~1		0.3~1	0.3~2	0.3~3	0.3~1	0.3~2	0.3~3
Max. drag	N (kgf)	214 (21.8)		363 (37)		1078 (110)			1960 (200)		
Max. cycle rate	cycle/min	45		45		60			60		
Max. absorption energy per minute	J/min (kgf·m/min)	4.5 (0.46)	13.5 (1.38)	4.5 (0.46)	22.5 (2.29)	58.8 (6.0)			98 (10)		
Recovering power of the piston rod	N (kgf)	2.5 (0.25) or lower		3 (0.3) or lower		4.9 (0.5) or lower			9.8 (1.0) or lower		
Operating temperature	°C	−5~70		−5~70		−5~70			−5~70		
Mass: (S type)	g	2.4		4.1		20			36		
(C type)	g	2.5		4.2		21			37		

Note) Insert S in the ☐ to order without a cap, and insert C in the ☐ to order with a cap (R if ordering urethane cap). Urethane cap specification is not available for FK-0404 and FK0604.

<Specifications>

Model		FK-1412L-☐	FK-1412M-☐	FK-1412H-☐	FK-1417L-☐	FK-1417M-☐	FK-1417H-☐	FK-1612L-☐	FK-1612M-☐	FK-1612H-☐
Max. absorption energy	J (kgf·m)	9.8 (1.0)			14.7 (1.5)			14.7 (1.5)		
Stroke	mm	12			17			12		
Max. equivalent mass	kg (kgf)	75 (75)	20 (20)	8 (8)	110 (110)	30 (30)	13 (13)	110 (110)	30 (30)	13 (13)
Range of impact rate	m/s	0.3~1	0.3~2	0.3~3	0.3~1	0.3~2	0.3~3	0.3~1	0.3~2	0.3~3
Max. drag	N (kgf)	2156 (220)			2646 (270)			2940 (300)		
Max. cycle rate	cycle/min	60			60			60		
Max. absorption energy per minute	J/min (kgf·m/min)	176 (18)			235 (24)			235 (24)		
Recovering power of the piston rod	N (kgf)	8.9 (0.9) or lower			8.9 (0.9) or lower			9.8 (1.0) or lower		
Operating temperature	°C	−5~70			−5~70			−5~70		
Mass: (S type)	g	55			76			76		
(C type)	g	57			77			82		

Note) Insert S in the ☐ to order without a cap, and insert C in the ☐ to order with a cap (R if ordering urethane cap).

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Urethane caps are consumable goods that need to be replaced with new ones if necessary.
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)
* Ensure that an external stopper (OP-020**) is also used. (The FK-0404 and FK-0604 series can be used without a stopper.)

Soft Silent Safety

FK Series Small (M4~M16)

Dimensions

<Dimensions>
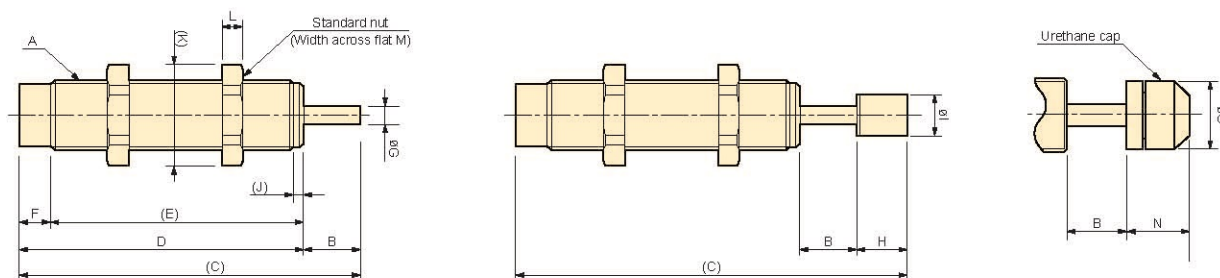
Model	A	B	C	D	E	F	øG	H	øI	J	K	L	M	N	øO
FK-0404□-S	M4X0.5	4	28.6	24.6	20.1	4.5	1.2	—	—	—	8.1	2	7	—	—
FK-0404□-C			32.6					4	3					—	—
FK-0604□-S	M6X0.75	4	29	25	20.5	4.5	1.8	—	—	—	9.2	2	8	—	—
FK-0604□-C			33					4	4.6					—	—
FK-1008□-S	M10X1.0	8	48	40	34.5	5.5	3	—	—	1.5	14.2	3	13	—	—
FK-1008□-C			55					7	6					7.3	8
FK-1210□-S	M12X1.0	10	63	53	47.5	5.5	3.5	—	—	—	16.2	4	14	—	—
FK-1210□-C			71					8	8					8.8	10
FK-1412□-S	M14X1.5	12	70	58	52.5	5.5	3.5	—	—	—	19.6	6	17	—	—
FK-1412□-C			78					8	10					8.8	10
FK-1417□-S	M14X1.5	17	97	80	74.5	5.5	4	—	—	1.5	19.6	6	17	—	—
FK-1417□-C			107					10	10					11	12
FK-1612□-S	M16X1.5	12	75	63	57.5	5.5	5	—	—	—	20	6	19	—	—
FK-1612□-C			90					15	13.5					13.1	14

Note) Urethane cap specification is not available for FK-0404 and FK0604.

<Key to Model Number>

FK - 14 12 M - C

With/Without cap   S: Without cap
                        C: With cap
                        R: With urethane cap

Performance classification   L: For low speed (Impact rate 0.3~1m/s)
                        M: For medium speed (Impact rate 0.3~2m/s)
                        H: For high speed (Impact rate 0.3~3m/s)

Stroke   (indicated in mm)
External screw size   (indicated in mm)
Series name

Soft Silent Safety
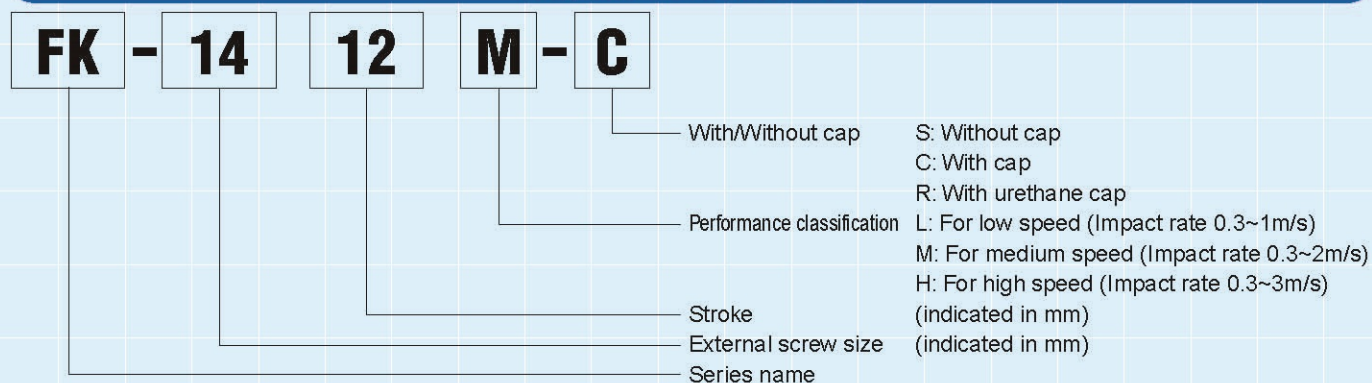
FK Series Medium (M20~M25)

RoHS Compliant

Multiple-Orifice

Fixed

<Characteristics>

■ With a fixed, specially-designed orifice structure, an optimal impact absorption can be achieved, even under variable operating conditions.

■ The main unit can also be used as a stopper. (No external stopper required)

■ We have three available types to accommodate various speeds.
For low-speed: L, for medium-speed: M, for high-speed: H

■ Urethane cap specification is also available.

■ 2 or more of this product can be used in parallel.

■ This product can also be custom-designed for optimal impact absorption.

<Specifications>

Model		FK-2016L-□	FK-2016M-□	FK-2016H-□	FK-2022L-□	FK-2022M-□	FK-2022H-□	FK-2050L-R	FK-2050M-R	FK-2050H-R
Max. absorption energy	J (kgf·m)	29.4 (3.0)			44.1 (4.5)			98 (10)		
Stroke	mm	16			22			50		
Max. equivalent mass	kg (kgf)	230 (230)	60 (60)	25 (25)	73 (73)	30 (30)	15 (15)	30 (30)	15 (15)	8 (8)
Range of impact rate	m/s	0.3~1	0.3~2	0.3~3	0.3~1	0.3~2	0.3~3	0.3~2	0.3~3	0.3~3
Max. drag	N (kgf)	3528 (360)			3920 (400)			4900 (500)		
Max. cycle rate	cycle/min	60			60			30		
Max. absorption energy per minute	J/min (kgf·m/min)	343 (35)			392 (40)			490 (50)		
Recovering power of the piston rod	N (kgf)	18.1 (1.85) or lower			39.2 (4) or lower			39.2 (4) or lower		
Operating temperature	°C	−5~70			−5~70			−5~70		
Mass: (S type)	g	147			163			294		
(C type)	g	168			178					

Note) Insert S in the □ to order without a cap, and insert C in the □ to order with a cap (R if ordering urethane cap).

<Specifications>

Model		FK-2530L-□	FK-2530M-□	FK-2530H-□	FK-2540L-□	FK-2540M-□	FK-2540H-□	FK-2550L-R	FK-2550M-R	FK-2550H-R
Max. absorption energy	J (kgf·m)	88.2 (9.0)			117 (12)			147 (15)		
Stroke	mm	30			40			50		
Max. equivalent mass	kg (kgf)	390 (390)	175 (175)	75 (75)	480 (480)	235 (235)	30 (30)	100 (100)	50 (50)	30 (30)
Range of impact rate	m/s	0.3~1	0.3~2	0.3~3	0.3~1	0.3~2	0.3~3	0.3~1.5	0.3~2	0.3~3
Max. drag	N (kgf)	6370 (650)			6370 (650)			6370 (650)		
Max. cycle rate	cycle/min	60			60			30		
Max. absorption energy per minute	J/min (kgf·m/min)	490 (50)			490 (50)			637 (65)		
Recovering power of the piston rod	N (kgf)	29.4 (3.0) or lower			71.5 (7.3) or lower			39.2 (4) or lower		
Operating temperature	°C	−5~70			−5~70			−5~70		
Mass: (S type)	g	361			437			516		
(C type)	g	391								

Note) Insert S in the □ to order without a cap, and insert C in the □ to order with a cap (R if ordering urethane cap). (-S is not available for FK-2540.)

Note) Urethane cap is the only available specification for FK-2022, 2050, and 2550 with a cap.

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°) Allowable eccentric angle in FK-2050 and 2550: ±1.0°
* Urethane caps are consumable goods that need to be replaced with new ones if necessary.

FK Series Medium (M20~M25)

Soft Silent Safety

Dimensions

<Dimensions>
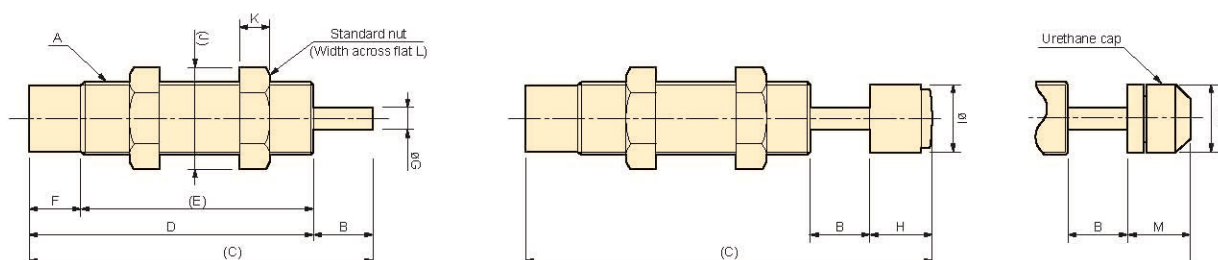
Model	A	B	C	D	E	F	øG	H	øI	J	K	L	M	øN
FK-2016□-S	M20X1.5	16	93	77	63	14	6	—	—	27.7	8	24	—	—
FK-2016□-C	M20X1.5	16	110	77	63	14	6	17	18	27.7	8	24	17	18
FK-2022□-S	M20X1.5	22	112	90	76	14	6	—	—	27.7	8	24	—	—
FK-2022□-R	M20X1.5	22	126.5	90	76	14	6	—	—	27.7	8	24	14.5	18
FK-2050□-R	M20X1.5	50	223.5	156.5	141.5	15	6	—	—	27.7	8	24	17	18
FK-2530□-S	M25X1.5	30	140	110	95	15	8	—	—	37	10	32	—	—
FK-2530□-C	M25X1.5	30	158	110	95	15	8	18	22	37	10	32	18	22
FK-2540□-C	M25X1.5	40	185.5	124.5	109.5	15	8	21	22	37	10	32	26	22
FK-2550□-R	M25X2.0	50	228	160	145	15	8	—	—	37	10	32	18	22

Note) Urethane cap is the only available specification for FK-2022, 2050, and 2550 with a cap.

<Key to Model Number>

FK - 20 16 M - C

- With/Without cap
  - S: Without cap
  - C: With cap
  - R: With urethane cap
- Performance classification
  - L: For low speed (Impact rate 0.3~1m/s)
  - M: For medium speed (Impact rate 0.3~2m/s)
  - H: For high speed (Impact rate 0.3~3m/s)
- Stroke (indicated in mm)
- External screw size (indicated in mm)
- Series name

Soft Silent Safety

FK Series Large (M27~M36)

Multiple-Orifice

Fixed

RoHS Compliant

<Characteristics>

■With a fixed, specially-designed orifice structure, an optimal impact absorption can be achieved, even under variable operating conditions.

■The main unit can also be used as a stopper. (No external stopper required, except for FK-3625A☐)

■We have three available types to accommodate various speeds.

For low-speed: L, for medium-speed: M, for high-speed: H

■Urethane cap specification is also available.

■2 or more of this product can be used in parallel.

■This product can also be custom-designed for optimal impact absorption.

<Specifications>

Model	FK-2725L-☐	FK-2725M-☐	FK-2725H-☐	FK-3035L-☐	FK-3035M-☐	FK-3035H-☐	*FK-3625AL-C	*FK-3625AM-C	*FK-3625AH-C	FK-3650L-☐	FK-3650M-☐	FK-3650H-☐
Max. absorption energy J (kgf·m)	79 (8.1)			196 (20)			150 (15.3)	200 (20.4)		392 (40)		
Stroke mm	25			35			25			50		
Max. equivalent mass kg (kgf)	420 (420)	105 (105)	47 (47)	1560 (1560)	390 (390)	173 (173)	2000	800	150	3137 (3137)	784 (784)	306 (306)
Range of impact rate m/s	0.3~1	0.3~2	0.3~3	0.3~1	0.3~2	0.3~3	0.3~1	0.3~2	0.3~3	0.3~1	0.3~2	0.3~3
Max. cycle rate cycle/min	60			30			30			30		
Max. absorption energy per minute J/min (kgf·m/min)	539 (55)			1176 (120)			1500 (153)			2352 (240)		
Max. drag N (kgf)	6370 (650)			14700 (1500)			25000 (2551)			21110 (2154)		
Recovering power of the piston rod N (kgf)	27.3 (2.78) or lower			47.1 (4.8) or lower			100 (10.2) or lower			68.6 (7.0) or lower		
Operating temperature °C	–5~70			–5~70			–5~70			–5~70		
Mass: (S type) g	341			628			—			1177		
(C type) g	385			681			900			1259		

Note) Insert S in the ☐ to order without a cap, and insert C in the ☐ to order with a cap (R if ordering urethane cap). (-S is not available for FK-3625☐.)
Note) Urethane cap specification is not available for the FK-2725 series.
Note) A urethane cap (OP-090M36B) may be added to FK-3625☐-C.
*FK-3625AL-C, FK-3625AM-C, and FK-3625AH-C will be available soon

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Do not turn the oil inlet screw located at the bottom of the main unit.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.

* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)
* We recommend that you use it with an external stopper (OP-020**).
* Urethane caps are consumable goods that need to be replaced with new ones if necessary.

Soft Silent Safety
FK Series Large (M27~M36)
Dimensions

FK-3625A□

<Dimensions>
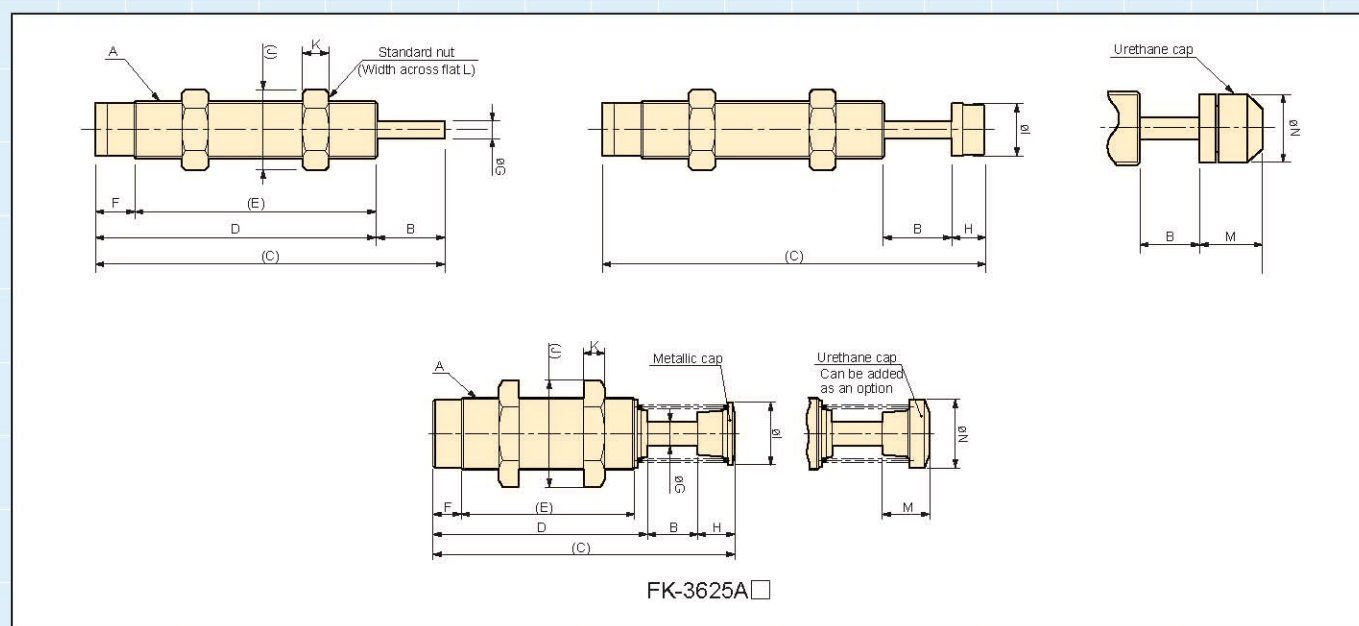
Model	A	B	C	D	E	F	øG	H	øI	J	K	L	M	øN
FK-2725□-S	M27X1.5	25	117.5	92.5	77.5	15	8	—	—	37	10	32	—	—
FK-2725□-C	M27X1.5	25	137.5	92.5	77.5	15	8	20	23	37	10	32	—	—
FK-3035□-S	M30X1.5	35	171.5	136.5	116.5	20	10	—	—	41.6	14	36	—	—
FK-3035□-C	M30X1.5	35	190	136.5	116.5	20	10	18.5	27	41.6	14	36	25	27
FK-3625A□-C	M36X1.5	25	150	106.5	86	14	12	18.5	31	53.1	10	46	23.5	34
FK-3650□-S	M36X1.5	50	218.5	168.5	148.5	20	12	—	—	53.1	15	46	—	—
FK-3650□-C	M36X1.5	50	238	168.5	148.5	20	12	19.5	33	53.1	15	46	24.3	33

<Key to Model Number>

FK - 27 25 M - C

- With/Without cap
  - S: Without cap
  - C: With cap
  - R: With urethane cap
- Performance classification
  - L: For low speed (Impact rate 0.3~1m/s)
  - M: For medium speed (Impact rate 0.3~2m/s)
  - H: For high speed (Impact rate 0.3~3m/s)
  - (indicated in mm)
- Stroke (indicated in mm)
- External screw size
- Series name

Soft Silent Safety **FK** **Series**

RoHS Compliant

Optional Parts

<Optional Parts Compatibility Chart>

Model	Eccentric angle adaptor	Stopper nut		Holder with a switch	Flange	Liquid-proof cap	Urethane cap
		Without cap	With cap				
FK-1008☐-**	OP-010PB	OP-020PB-S	OP-020PB-C	—	OP-040PB	FK-1008☐-C-060	OP-090M10A
FK-1210☐-**	OP-010KB	OP-020KB-S	OP-020KB-C	OP-030KB-2	OP-040KB	FK-1210☐-C-060	OP-090M12A
FK-1412☐-**	OP-010RD	OP-020RB-S	OP-020RB-C	OP-030RB-2	OP-040RB	FK-1412☐-C-060	OP-090M14A
FK-1417☐-**	—	OP-020RB-S	OP-020RB-C	—	OP-040RB	—	OP-090M14B
FK-1612☐-**	OP-010XB	OP-020HB-S	OP-020HB-C	OP-030HB-1,2	OP-040XB	FK-1612☐-C-060	OP-090M16A
FK-2016☐-**	OP-010EB	OP-020EB-S	OP-020EB-C	OP-030EB-1,2	OP-040EB	FK-2016☐-C-060	OP-090M20A
FK-2022☐-**	—	OP-020EB-S	OP-020EB-C	—	OP-040EB	—	OP-090M20A
FK-2050☐-**	—	OP-020EB-S	OP-020EB-C	—	OP-040EB	—	OP-090M20A
FK-2530☐-**	OP-010GB	OP-020GB-S	OP-020GB-C	OP-030GB-1,2	OP-040GB	FK-2530☐-C-060	OP-090M25A
FK-2540☐-**	—	OP-020LB	OP-020LB	—	OP-040GB	—	OP-090M25A
FK-2550☐-**	—	—	––	—	—	—	OP-090M25A
FK-2725☐-**	OP-010FB	OP-020FB-S	OP-020FB-C	OP-030FB-1,2	OP-040FB	FK-2725☐-C-060	—
FK-3035☐-**	OP-010TB	OP-020TB-S	OP-020TB-C	—	OP-040TB	FK-3035☐-C-060	OP-090M30A
FK-3625☐-**	—	—	OP-020M36	—	OP-040UB	—	OP-090M36B
FK-3650☐-**	OP-010UB	OP-020UB-S	OP-020UB-C	—	OP-040UB	—	OP-090M36A

The following five types of optional parts are available for the FK series.

■OP-010☐☐ : Eccentric angle adaptor
■OP-020☐☐-S : Stopper nut (without cap)
　OP-020☐☐-C : Stopper nut (with cap)
■OP-030☐☐-☐ : Holder with a switch
■OP-040☐☐ : Flange
■*FK-☐☐☐☐-C-060 : Liquid-proof cap
■OP-090 : Urethane cap (This is a spare part for the –R type. Please note that it cannot be used on the –S or –C types.)

Urethane caps are consumable goods that need to be replaced with new ones if necessary.
Note) Insert one of the following symbols in ☐☐ according to the external size.

M10····PB　　M25····GB
M12····KB　　M27····FB
M14····RB　　M30····TB
M16····HB　　M36····UB
M20····EB

*Model indication (4 digits and 1 alphabet) is inserted in ☐ of FK-☐☐☐☐-C-060.

*Standard nuts are sold separately as well.

For FK-0404: M04 nut
For FK-0604: M06 nut
For FK-1008: M10 nut
For FK-1210: M12 nut
For FK-1412: M14 nut
For FK-1417: M14 nut
For FK-1612: M16 nut
For FK-2016: M20 nut
For FK-2022: M20 nut
For FK-2050: M20 nut
For FK-2530: M25 nut
For FK-2540: M25 nut
For FK-2550: M25 nut
For FK-2725: M27 nut
For FK-3035: M30 nut
For FK-3625: M36A nut
For FK-3650: M36 nut

Soft Silent Safety

FK Series

Optional Parts

RoHS Compliant

<Stopper nut OP-020>

■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020**-S
(Without cap)
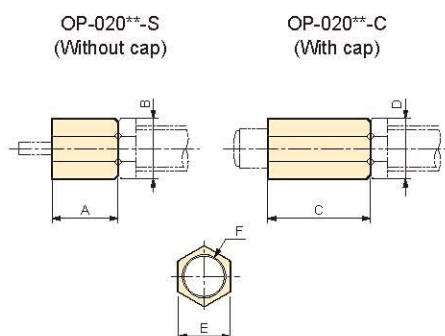
OP-020**-C
(With cap)

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

Model	Standard OP-020□-S		With cap OP-020□-C		Common dimensions		Mass g	
	A	B	C	D	E	F		
OP-020PB-S·C	10	15	16	15	13	M10X1	S	6
							C	9
OP-020KB-S·C	12	16.2	16	16.2	14	M12X1	S	6
							C	8
OP-020RB-S·C	12	19.6	20	19.6	17	M14X1.5	S	10
							C	17
OP-020HB-S·C	15	21.9	30	21.9	19	M16X1.5	S	15
							C	28
OP-020EB-S·C	30	27.7	47	27.7	24	M20X1.5	S	46
							C	68
OP-020GB-S·C	20	37	32	37	32	M25X1.5	S	65
							C	102
OP-020LB	—	—	50	37	32	M25X1.5	153	
OP-020FB-S·C	35	37	55	37	32	M27X1.5	S	90
							C	137
OP-020TB-S·C	38	41.6	58	41.6	36	M30X1.5	S	129
							C	197
OP-020UB-S·C	45	53.1	65	53.1	46	M36X1.5	S	291
							C	422
OP-020M36	—	—	45	53.1	46	M36X1.5	291	

<Eccentric angle adaptor OP-010>

<Dimensions>

Cap for eccentric angle
(OP-010□B-1)
Guide for eccentric angle
(OP-010□B-2)

Standard nut
(Width across flat H)

Width across flat J

K (Total length)

10° 10°

Model	A	B	C	D	E	F	G	H	I	J	K	Mass g
OP-010PB	38	28	2	8	6	8	M16X1.5	19	20	13	65	35
OP-010KB	48	35	3	10	5	10	M18X1.5	21	24.3	14	82	48
OP-010RD	53	38	3	12	7	11	M22X1.5	24	27.7	19	95	84
OP-010XB	60	45	3	12	7	12	M22X1.5	24	27.7	19	102	81
OP-010EB	68	49	3	16	10	14	M27X1.5	32	37	24	129	209
OP-010GB	107.5	67.5	10	30	15	16	M36X1.5	46	53.1	32	197.5	639
OP-010FB	97	62	10	25	15	16	M36X1.5	46	53.1	32	170	587
OP-010TB	127	82	10	35	15	18	M40X1.5	50	57.7	36	239	852
OP-010UB	167	107	10	50	15	20	M45X1.5	55	63.5	41	306	1273

When attaching the eccentric angle adaptor, screw it into the main unit until the cap for eccentric angle and the piston rod form a tight connection. While maintaining this position, fasten the main unit's nut until secured.

* If the eccentric angle adaptor is secured without establishing a tight fit, a sufficient stroke cannot be obtained. Furthermore, if the eccentric angle adaptor is further screwed in, after it has formed a tight connection, and then secured in place, the cap for eccentric angle cannot be pushed all the way to the stroke end.

FK Series

Optional Parts

Soft Silent Safety

<Flange OP-040>

■This is a mounting fixture for soft absorbers.
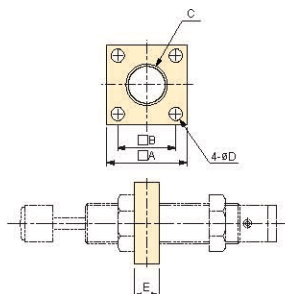
Model	A	B	C	D	E	Mass g
OP-040PB	25	18	M10X1	3.2	4	16
OP-040KB	25	18	M12X1	3.2	4	15
OP-040RB	34	24	M14X1.5	4.5	4	30
OP-040XB	34	24	M16X1.5	4.5	4	29
OP-040EB	40	28	M20X1.5	6.5	12	109
OP-040GB	54	40	M25X1.5	9	12	206
OP-040FB	50	36	M27X1.5	9	12	157
OP-040TB	65	45	M30X1.5	11	14	344
OP-040UB	78	56	M36X1.5	14	16	566

<Liquid-proof cap OP-060>

■Ideal for use in environments where oil splatter poses a problem.

■Ensure that the cap is facing upward. If the cap is facing sideways or downward, it cannot provide an effective means for liquid proofing.
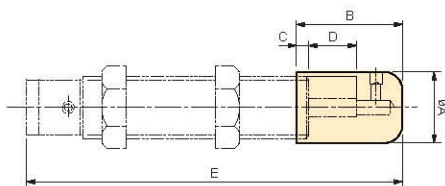
Model	A	B	C	D	E	Mass g
FK-1008□-C-060	13	18	3	8	53	10
FK-1210□-C-060	17	28	9.5	10	72	25
FK-1412□-C-060	19	30	11.5	10	78.5	31
FK-1612□-C-060	21	34	9.5	12	88	46
FK-2016□-C-060	24	35	4	16	109.5	59
FK-2530□-C-060	28	51	6.5	30	154.5	77
FK-2725□-C-060	30	50	5	25	137.5	112
FK-3035□-C-060	38	60	5	35	191.5	255

Note) L, M or H is inserted in the □.

Note) Liquid-proof caps are not sold separately.
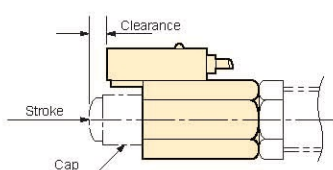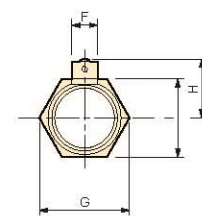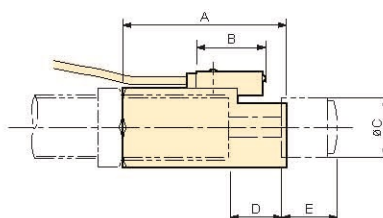
Soft Silent Safety

FK Series

Optional Parts

RoHS Compliant

<Holder with a switch OP-030>

OP-030**-1

OP-030**-2

■When attaching a holder with no stopper function, ensure that there is a gap between the switch and the cap's tip when the piston rod is pressed all the way down to the stroke end. Otherwise, the switch may become damaged by the impact.

■Set the holder's position so that the switch's tip and the edge of the metallic ring on the rod cap are at least 0.5mm apart. Otherwise, it will not work properly.

■For switch specifications and precautions for use, please refer to page 69.

<Dimensions>

Model	A	B	øC	D	E	F	G	H	I	J	Mass g
OP-030KB-2	29	21	8	10	8	8	19.6	13.1	16	—	38
OP-030RB-2	29	21	10	12	8	8	19.6	14.1	17	—	34
OP-030HB-1	25	21	13.5	12	15	8	21.9	15.5	19	9	36
OP-030HB-2	40	21	13.5	12	15	8	21.9	15.5	19	—	46
OP-030EB-1	30	21	18	16	17	8	28	18	24	9	59
OP-030EB-2	50	21	18	16	17	8	28	18	24	—	80
OP-030GB-1	20	21	22	30	18	8	32	20.5	29	9	51
OP-030GB-2	37	21	22	30	18	8	32	20.5	29	—	82
OP-030FB-1	32	21	24	25	20	8	34.6	21	30	9	68
OP-030FB-2	56	21	24	25	20	8	34.6	21	30	—	107

■Cautions for Using the Switch

1) Do not use when it is in a transient state after the power is turned on (approx. 10ms).
2) Keep the cables as short as possible when using in places with a lot of noise. Also, please take all precautions, such as avoiding the parallel wiring of electric lines and power lines, as well as wiring within the same conduit.
3) Ensure that the switch does not come in direct contact with thinner-type chemicals.
4) Because it does not have a short-circuit protection circuit, wiring must be done correctly.

Model GXL-8F specifications Manufactured by SUNX

Item	Summary	Specification
Detection distance	Standard detected object 15X15X1 (Iron)	1.8mm
Power voltage		12~24VDC±10%
Consumption current		15mA or lower
Behaviour form		NO type
Output form		NPN open collector
Output capacity (with 24VDC power voltage)		100mA or lower
Protection feature		Comes with a surge absorption circuit
Residual voltage	At 100mA inflowing current	1V or lower
	At 60mA inflowing current	0.4V or lower
Input/Output circuit diagram		Operation indicator light Red LED (lights up when the output is ON)
Response frequency		500HZ
Ambient operating temperature		0~55°C
Ambient storage temperature		−30~80°C
Ambient operating humidity		45~85%RH
Ambient storage humidity		35~95%RH
Lead wire length		Approximately 1m
M a s s	Including cable	Approximately 11g

133

FL Series (M12~M16)

Soft Silent Safety

RoHS Compliant

Multiple-Orifice

Adjustable

<Characteristics>

■ With an adjustable multiple-orifice structure, an optimal impact absorption can be achieved by making adjustments, even under variable operating conditions.

■ This product is a long-stroke type that is suitable for high-speed (3m/s) collisions.

<Specifications>

Model		FL-1214H-□	FL-1417H-□	FL-1620H-□
Max. absorption energy	J (kgf·m)	5.4 (0.55)	14.7 (1.5)	17.6 (1.8)
Stroke	mm	14	17	20
Max. equivalent mass	kg (kgf)	30 (30)	50 (50)	60 (60)
Range of impact rate	m/s	0.3~3	0.3~3	0.3~3
Max. drag	N (kgf)	1156 (118)	2646 (270)	2646 (270)
Max. cycle rate	cycle/min	60	60	60
Max. absorption energy per minute	J/min	98	176	235
	(kgff·m/min)	(10)	(18)	(24)
Recovering power of the piston rod	N (kgf)	12.7 (1.3) or lower	15.7 (1.6) or lower	19.6 (2.0) or lower
Operating temperature	°C	–5~70	–5~70	–5~70
Mass: (S type)	g	46	80	124
(C type)	g	49	85	136

Note) Insert S in the □ to order without a cap, and insert C in the □ to order with a cap (R if ordering urethane cap).

<Key to Model Number>

FL - 16 20 H - C

With/Without cap — S: Without cap / C: With cap
Performance classification — H: For high speed (Impact rate 0.3~3m/s)
Stroke — (indicated in mm)
External screw size — (indicated in mm)
Series name

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* We recommend that you use it with an external stopper (Stopper nut OP-020**).
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

<Adjustment Method>

* To adjust, turn the adjustment knob located at the bottom of the main unit.
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.
* Once the adjustment is complete, secure with a lock screw using the attached hex wrench.

FL Series

Dimensions, Optional Parts

Soft Silent Safety

<Dimensions>

Model	A	B	C	D	E	F	øG	H	øI	J	K	L	M	N
FL-1214H-S	M12X1.0	14	84	70	59.5	10.5	3.5	–	–	1.5	5	16.2	4	14
FL-1214H-C			92					8	8					
FL-1417H-S	M14X1.5	17	105	88	77.8	10.2	4	–	–	1.5	5	19.6	6	17
FL-1417H-C			115					10	10					
FL-1620H-S	M16X1.5	20	128	108	93.5	14.5	5	–	–	–	4.4	20	6	19
FL-1620H-C			143					15	13.5					

<Optional Parts>

Stopper nut   OP-020-□**
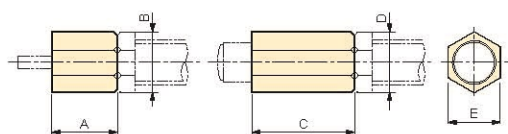
Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

<Dimensions>

Model	Without cap OP-020□□-S		With cap P-020□□-C		E	Applicable model	Mass g	
	A	B	C	D				
OP-020KB-S·C	12	16.2	16	16.2	14	FL-1214H	S	6
							C	8
OP-020RB-S·C	12	19.6	20	19.6	17	FL-1417H	S	10
							C	17
OP-020HB-S·C	15	21.9	30	21.9	19	FL-1620H	S	15
							C	28

Holder with a switch

OP-030HB-1
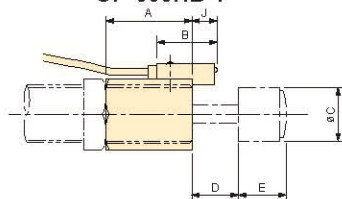
OP-030□□-2
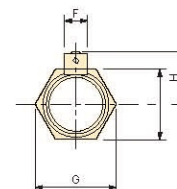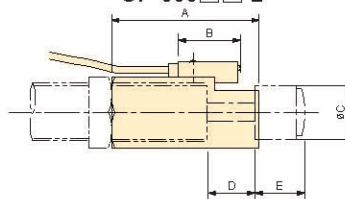
Note) For switch specifications and precautions for use, please refer to page 73. ☞
Note) A holder with a switch cannot be used with the FL-1417 series.

<Dimensions>

Model	A	B	øC	D	E	F	G	H	I	J	Applicable model	Mass g
OP-030KB-2	29	21	8	14	8	8	19.6	13.1	16	–	FL-1214H-C	38
OP-030HB-1	25	21	13.5	20	15	8	21.9	15.5	19	9	FL-1620H-C	36
OP-030HB-2	40	21	13.5	20	15	8	21.9	15.5	19	–	FL-1620H-C	46

*Standard nuts are sold separately as well.
For FL-1214: M12 nut   For FL-1417: M14 nut   For FL-1620: M16 nut

Soft Silent Safety

FW Series (M12~M25)

Double Direction Type Multiple-Orifice Fixed

<Characteristics>

■This product is a double-rod type that can absorb impact from both directions.

■Because of its multiple-orifice structure, a smooth impact absorption is possible.

■Idea for small spaces.

<Specifications>

Model		FW-1212L-C	FW-1616M-□	FW-2025M-□	FW-2530M-□
Max. absorption energy	J (kgf·m)	4.9 (0.5)	13.7 (1.4)	39.2 (4.0)	62.7 (6.4)
Stroke	mm	12	16	25	30
Max. equivalent mass	kg (kgf)	39 (39)	30 (30)	87 (87)	140 (140)
Range of impact rate	m/s	0.3~1	0.3~2	0.3~2	0.3~2
Max. drag	N (kgf)	1078 (110)	2646 (270)	4900 (500)	6370 (650)
Max. cycle rate	cycle/min	60	60	60	60
Max. absorption energy per minute	J/min	41	235	343	490
	(kgff·m/min)	(4.2)	(24)	(35)	(50)
Recovering power of the piston rod	N (kgf)	7.8 (0.8) or lower	17.6 (1.8) or lower	24.5 (2.5) or lower	29.4 (3.0) or lower
Operating temperature	°C	–5~70	–5~70	–5~70	–5~70
Mass: (S type)	g	–	130	234	460
(C type)	g	64	142	271	527

Note) Insert S in the □ to order without a cap, and insert C in the □ to order with a cap (R if ordering urethane cap).

<Key to Model Number>

FW - 12 12 M - C

With/Without cap   S: Without cap
                                     C: With cap

Performance classification   L: For low speed (Impact rate 0.3~1m/s)
                                     M: For medium speed (Impact rate 0.3~2m/s)

Stroke   (indicated in mm)

External screw size   (indicated in mm)

Series name

<Precautions for Use>
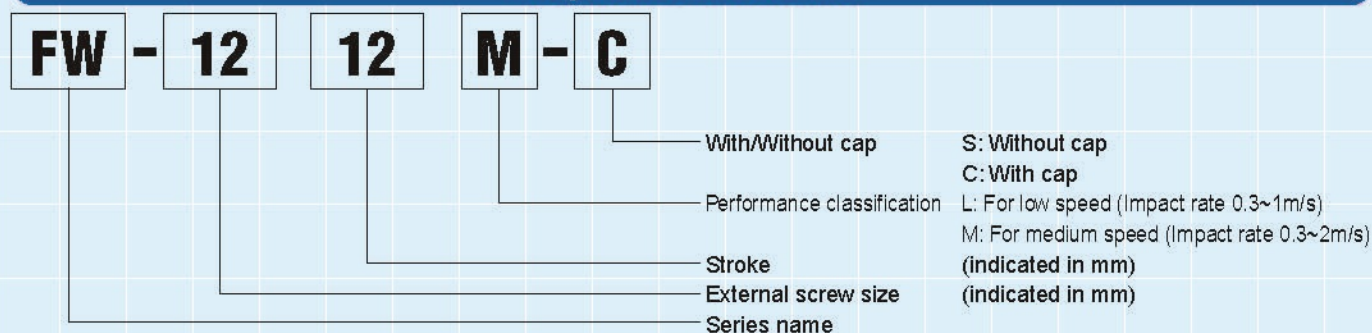
* Do not use this product without carefully reading the attached owner's manual.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* It cannot absorb impact from both directions at the same time.

* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°C)
* Ensure that an external stopper is also used.

Soft Silent Safety

FW Series (M12~M25)

Double Direction Type Multiple-Orifice Fixed

<Dimensions>
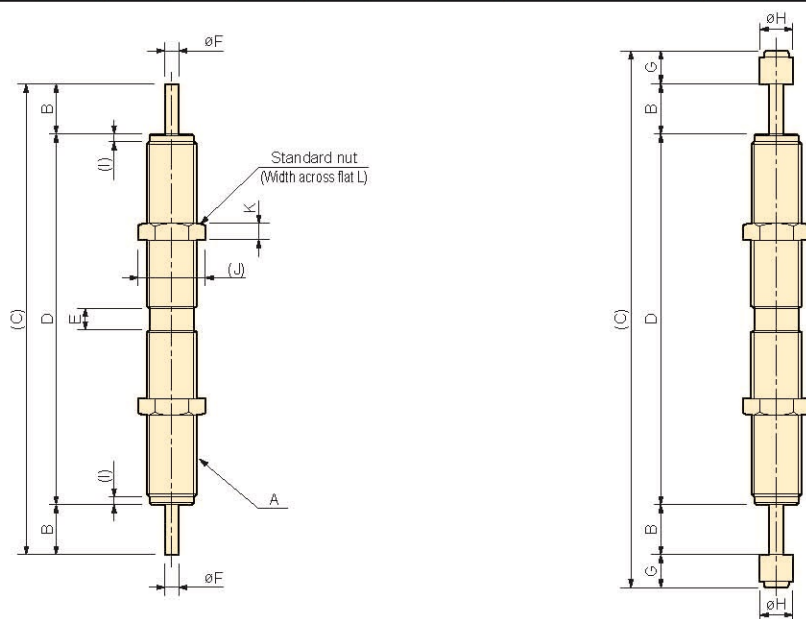
Model	A	B	C	D	E	øF	G	øH	I	J	K	L
FW-1212L-C	M12X1.0	12	130	90	5	3.5	8	8	2	16.2	4	14
FW-1616M-S	M16X1.5	16	134	102	–	5	–	–	6	21.9	6	19
FW-1616M-C			164				15	13.5	6			
FW-2025M-S	M20X1.5	25	170	120	–	6	–	–	6	27.7	8	24
FW-2025M-C			204				17	18	6			
FW-2530M-S	M25X1.5	30	205	145	–	8	–	–	6	37	10	32
FW-2530M-C			241				18	22	6			

<Optional Parts>

Stopper nut   OP-020**-□

■Adjust so that it stops 1mm before the stroke end, and fasten with the main unit's nut until secured.

OP-020**-S (Without cap)   OP-020**-C (With cap)

Note) When attaching, make sure that the side without a bearing chamfer is the impact surface.

*Standard nuts are sold separately as well.
For FW-1212: M12 nut
For FW-1616: M16 nut
For FW-2025: M20 nut
For FW-2530: M25 nut

<Compatible Chart for Applicable Models>
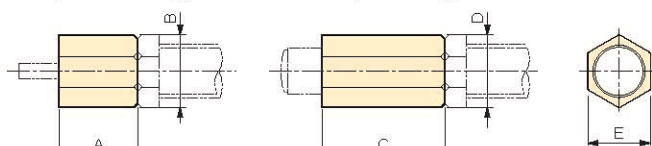
Model	A	B	C	Applicable model	Mass g
OP-020KB-C	16	16.2	14	FW-1212L-C	8
OP-020HB-S	15	21.9	19	FW-1616M-S	15
OP-020HB-C	30	21.9	19	FW-1616M-C	28
OP-020EB-S	30	27.7	24	FW-2025M-S	46
OP-020EB-C	47	27.7	24	FW-2025M-C	68
OP-020GB-S	20	37	32	FW-2530M-S	65
OP-020GB-C	32	37	32	FW-2530M-C	102

Soft Silent Safety

FS Series

RoHS Compliant

Short Stroke Type Single-Orifice Adjustable

Turn the slotted-driver groove to desired position.

Standard nut (Width across flat J)

Lock's crew

Oil inlet (Groove for Phillips screwdriver)
* Do not turn.

<Dimensions>
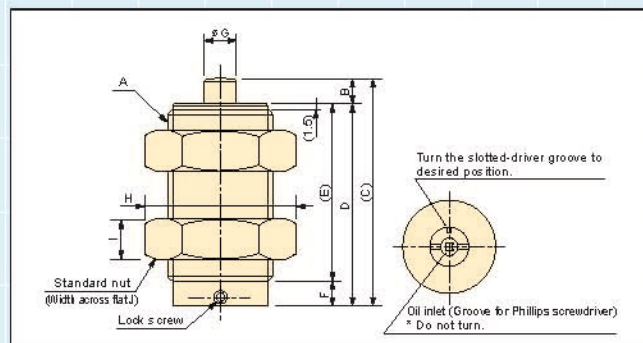
Model	A	B	C	D	E	F	øG	H	I	J
FS-2006L-S	M20X1.5	6	55	49	43	6	6	27.7	8	24
FS-2506L-S	M25X1.5	6	55	49	43	6	8	37	10	32
FS-2706L-S	M27X1.5	6	55	49	43	6	8	37	10	32

<Specifications>

Model		FS-2006L-S	FS-2506L-S	FS-2706L-S
Max. absorption energy	J (kgf·m)	7.8 (0.8)	11.7 (1.2)	15.6 (1.6)
Stroke	mm	6	6	6
Max. equivalent mass	kg (kgf)	60 (60)	90 (90)	120 (120)
Range of impact rate	m/s	0.3~1	0.3~1	0.3~1
Max. drag	N (kgf)	3920 (400)	5880 (600)	7840 (800)
Max. cycle rate	cycle/min	60	60	60
Max. absorption energy per minute	J/min (kgf·m/min)	78 (8.0)	117 (12)	156 (16)
Recovering power of the piston rod	N (kgf)	16.7 (1.7) or lower	19.6 (2.0) or lower	22.6 (2.3) or lower
Operating temperature	°C	–5~70	–5~70	–5~70
Mass	g	114	210	221

<Key to Model Number>

FS - 20 06 L - S

S : Without cap
With/Without cap
Performance classification — L: For low speed (Impact rate 0.3~1m/s)
Stroke — (indicated in mm)
External screw size — (indicated in mm)
Series name

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that an external stopper is also used.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)

*Standard nuts are sold separately as well.
For FS-2006: M20 nut
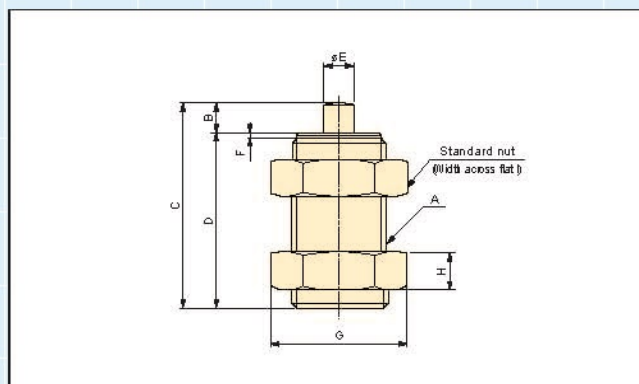For FS-2506: M25 nut
For FS-2706: M27 nut

<Adjustment Method>

* To adjust, turn the adjustment knob with a slotted screw driver
* Because the adjustment can be done in an analog manner, a value between two integers on the indicator can be set.

Soft Silent Safety

FV Series

Short Stroke Type Multiple-Orifice   Adjustable

<Dimensions>

Model	A	B	C	D	øE	F	G	H	I
FV-2008L-S	M20X1.5	8	55	47	6	1.5	27.7	8	24
FV-2508L-S	M25X1.5	8	55	47	8	1.5	37	10	32
FV-2708L-S	M27X1.5	8	55	47	8	1.5	37	10	32

<Specifications>

Model		FV-2008L-S	FV-2508L-S	FV-2708L-S
Max. absorption energy	J (kgf·m)	8.8 (0.9)	13.7 (1.4)	19.6 (2.0)
Stroke	mm	8	8	8
Max. equivalent mass	kg (kgf)	70 (70)	110 (110)	150 (150)
Range of impact rate	m/s	0.3~1	0.3~1	0.3~1
Max. drag	N (kgf)	3430 (350)	5390 (550)	7350 (750)
Max. cycle rate	cycle/min	60	60	60
Max. absorption energy per minute	J/min (kgf·m/min)	88 (9.0)	137 (14)	196 (20)
Recovering power of the piston rod	N (kgf)	14.7 (1.5) or lower	21.6 (2.2) or lower	23.5 (2.4) or lower
Operating temperature	°C	–5~70	–5~70	–5~70
Mass	g	108	199	206.7

<Key to Model Number>

FV - 20 08 L - S

With/Without cap — S: Without cap
Performance classification — L: For low speed (Impact rate 0.3~1m/s)
Stroke — (indicated in mm)
External screw size — (indicated in mm)
Series name

<Precautions for Use>

＊Do not use this product without carefully reading the attached owner's manual.
＊Do not turn the oil inlet screw located at the bottom of the main unit.
＊Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
＊Do not use this product in a vacuum or a location where it may come in contact with oil.

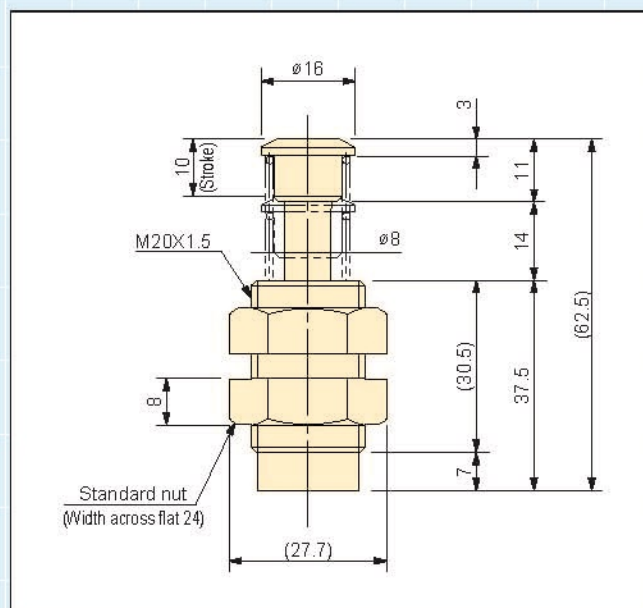＊Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)
＊Ensure that an external stopper is also used.

*Standard nuts are sold separately as well.
 For FV-2008: M20 nut
 For FV-2508: M25 nut
 For FV-2708: M27 nut

Soft Silent Safety

FED-2010M-C

Emergency Absorber Variable-Groove Orifice   Fixed

Standard nut
(Width across flat 24)

<Specifications>

Model	FED-2010M-C
Max. absorption energy J (kgf·m)	19.6 (2.0)
Stroke mm	10
Max. equivalent mass kg (kgf)	30 (30)
Range of impact rate m/s	0.5~2
Max. drag N (kgf)	6860 (700)
Recovering power of the piston rod N (kgf)	41.2 (4.2) or lower
Operating temperature °C	−5~70
Mass g	79

* This product is an affordable compact soft absorber for emergencies.
* Light weight - made of aluminum.
* As an emergency absorber, it will last for approximately 100 uses.

<Key to Model Number>

FED - 20 10 M - C

With/Without cap   C: With cap
Performance classificationa M: For medium speed (Impact rate 0.5~2m/s)
Stroke   (indicated in mm)
External screw size   (indicated in mm)
Series name

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Never apply eccentric load to the piston rod. In particular, when using in a rotating motion, the distance between the rotational centre of the impacted part and the m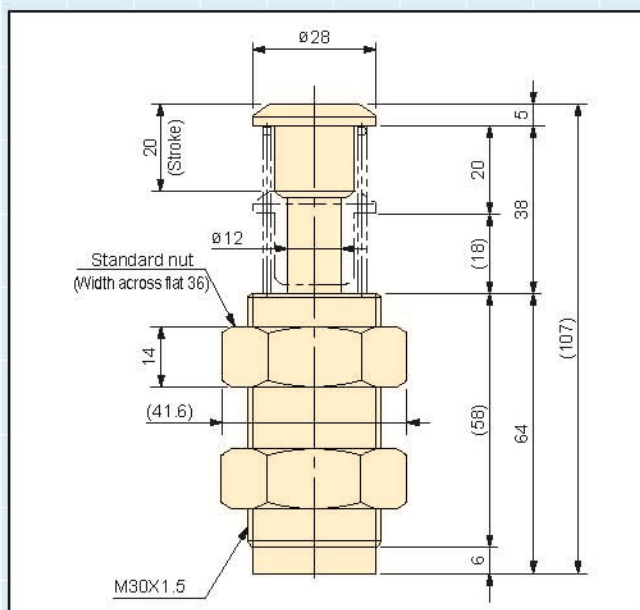ounted soft absorber should be at least 12 times the stroke length. The soft absorber should also be mounted so that it is perpendicular halfway through the stroke.
* Do not over-tighten the standard nut. (Tightening torque: 14.7H·m)
* Do not use this product in a vacuum or a location where it may come in contact with oil.

*Standard nuts are sold separately as well.
 For FED-2010: M20 nut Black

FED-3020M-C

Soft Silent Safety

Emergency Absorber Variable-Groove Orifice   Fixed

ø28
20 (Stroke)
5
20
38
(18)
ø12
Standard nut
(Width across flat 36)
14
(41.6)
(107)
(58)
64
M30X1.5
6

<Specifications>

Model	FED-3020M-C
Max. absorption energy J (kgf·m)	98 (10)
Stroke mm	20
Max. equivalent mass kg (kgf)	140 (140)
Range of impact rate m/s	0.5~2
Max. drag N (kgf)	11760 (1200)
Recovering power of the piston rod N (kgf)	68.6 (7.0) or lower
Operating temperature °C	−5~70
Mass (S type) g	350

* This product is an affordable compact soft absorber for emergencies.
* Light weight - made of aluminum.
* As an emergency absorber, it will last for approximately 100 uses.

<Key to Model Number>

FED - 30 20 M - C

With/Without cap   C: With cap
Performance classificationa M: For medium speed (Impact rate 0.5~2m/s)
Stroke   (indicated in mm)
External screw size   (indicated in mm)
Series name

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Never apply eccentric load to the piston rod. In particular, when using in a rotating motion, the distance between the rotational centre of the impacted part and the mounted soft absorber should be at least 12 times the stroke length. The

soft absorber should also be mounted so that it is perpendicular halfway through the stroke.
* Do not use this product in a vacuum or a location where it may come in contact with oil.
* Do not over-tighten the standard nut. (Tightening torque: 29.4N·m)

*Standard nuts are sold separately as well.
 For FED-3020: M30 nut Black

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Soft Silent Safety

FSB Series (M12, M14, M16)

Multiple-Orifice (M12 is Single-Orifice) Fixed

<Characteristics>

■ High-performance stopper bolt (with an integrated absorber)
■ Designed for easy mounting

<Specifications>

Model		FSB-1205-C	FSB-1407-C	FSB-1609-C
Max. absorption energy	J (kgf·m)	0.68 (0.07)	2.5 (0.25)	6 (0.61)
Stroke	mm	5	7	9
Max. equivalent mass	kg (kgf)	5 (5)	20 (20)	50 (50)
Range of impact rate	m/s	0.3~1.0		
Max. drag	N (kgf)	588 (60)	1078 (110)	1960 (200)
Max. cycle rate	cycle/min	45	60	60
Max. absorption energy per minute	J/min	65	120	200
	(kgf·m/min)	(6.63)	(12.2)	(20.4)
Recovering power of the piston rod	N (kgf)	4.9 or lower (0.5)	4.9 or lower (0.5)	9.8 or lower (1.0)
Operating temperature	°C	−5~70		
Mass	g	40	70	115

Material	Main unit	SUM
	Cap	Polyacetal
Surface treatment	Main unit	Nitriding treatment

<Key to Model Number>

FSB - **16** **09** - **C**

With/Without cap   C : With cap
Stroke   (indicated in mm)
External screw size   (indicated in mm)
Series name

<Precautions for Use>

* Do not use this product without carefully reading the attached owner's manual.
* Ensure that sufficient mounting strength is secured for this product. (As a guideline, it should be 2 to 3 times the maximum drag listed in the catalogue.)
* Do not use this product in a vacuum or a location where it may come in contact with oil.

* Ensure that an eccentric load is not applied to the soft absorber. (Allowable eccentric angle: ±2.5°)
* Do not over-tighten the main unit and nuts. Please use the tightening torque as listed in the owner's manual.
* Due to the structure of this product, using the absorber (piston rod side) in an upright position in a dusty environment causes the dust to collect on the absorber, which may affect the durability.

Soft Silent Safety

FSB Series

Dimensions

<Dimensions>
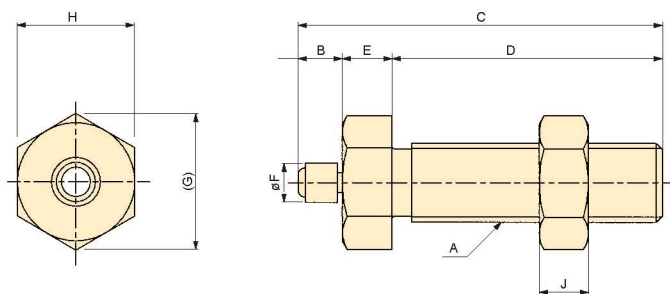
Model	A	B	C	D	E	F	G	H	J
FSB-1205-C	M12X1.75	5	43	30	8	6	21.9	19	7
FSB-1407-C	M14X2	7	56	40	9	6	25.4	22	8
FSB-1609-C	M16X2	9	74	55	10	8	27.7	24	10

* The screw pitch differs from other absorbers.

*Standard nuts are sold separately as well.
 For FSB-1205: FSB-1205 nut
 For FSB-1407: FSB-1407 nut
 For FSB-1609: FSB-1609 nut