

SHOCK ABSORBER Series

Fixed Absorption Capacity Linear Orifice Type

KSHJ Series

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Total of 12 sizes and 66 models from M4 to M27 size.

Offers wide range of speeds, with maximum impact speed of 0.8 m/s to 3 m/s^{Note}.

Note: The maximum impact speed varies by model.
See specification table on p.571.



● With cap



● With stopper nut



● With side mounting bracket



What is the linear orifice type?

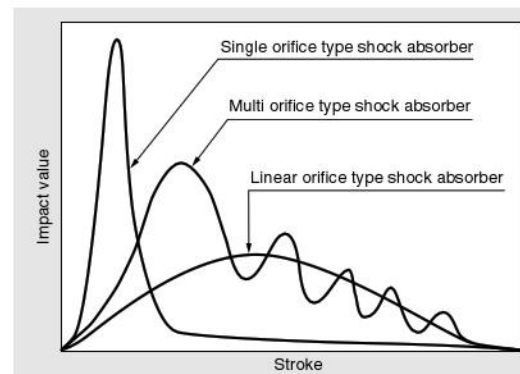
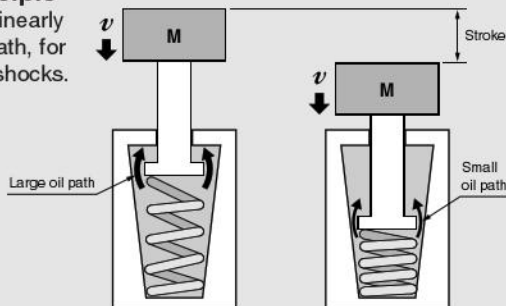
Use of a linear orifice mechanism, in which the orifice changes linearly, ensures smooth shock absorption.

Achieves the performance of shock absorbers with next-size-up stroke lengths, to reduce vibrations on mounting frames and equipment.

Reduces the shock value in impacts, to lower the noise during workpiece impacts.

Operation principle

The piston stroke linearly squeezes the oil path, for soft absorption of shocks.



Fixed Absorption Capacity Linear Orifice Type

KSHA Series

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Total of five sizes, from M6 to M14.
All sizes can be set with heavy load and light load absorption capacities.



● Insert mounting type



● With cap



● With stopper nut



● With flange mounting bracket



● With side mounting bracket



KSHC Series (Clean Room Specification) Class 5 (Equivalent to FED-STD209E Class 100) compatibility

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Total of eight sizes, from M6 to M25.
Uses a special particle pocket structure, to prevent flying dust out.



● With cap



● With stopper nut



Adjustable Absorption Capacity Type

KSHE Series	KSHES Series
<p data-bbox="124 185 877 241"> Multi orifice type Self-compensating type shock absorber. Optimum for high-speed impacts. </p> <div data-bbox="236 300 863 448"> <p data-bbox="148 450 863 477"> Side mounting bracket : -2 Flange mounting bracket : -3 Stopper nut : -S </p> </div> <div data-bbox="236 566 802 952"> <p data-bbox="236 835 384 862">KSHE 10×20C</p> <p data-bbox="520 925 643 952">KSHE12×22</p> </div>	<p data-bbox="959 185 1481 275"> Multi orifice type with sensor switches Can perform position detection simultaneously with completion of shock absorption. </p> <div data-bbox="1034 259 1433 616"> <p data-bbox="1007 645 1201 672">KSHES12×22-H-□□</p> </div> <div data-bbox="1066 600 1433 981"> <p data-bbox="1106 954 1313 981">KSHES12×22-HS-□□</p> </div>
KSH Series	Page 592
<p data-bbox="124 1088 454 1144"> Single orifice type Optimum for low-speed impacts. </p> <div data-bbox="539 1122 1161 1366"> <p data-bbox="552 1339 659 1366">KSH8×10C</p> <p data-bbox="986 1339 1093 1366">KSH12×22</p> </div>	

Safety Precautions (Shock Absorbers)

The following is a safety precaution to Shock Absorbers. For other safety precautions, be sure to read the precautions on p.49.

Danger

- Do not touch or approach too close to the product while it is in operation. Also, do not attempt to mount a shock absorber or adjust operations while devices are operating. Unintended movement of devices could result in personal injury.

Warning

- Never loosen or remove the small screw on the rear end surface of the shock absorber. The oil inside will leak out and damage shock absorber function, which could result in injury.
- For product mounting, always observe the handling instructions and precautions. In addition, when a product has been mounted, before starting operation always check whether mounting nuts have been attached and are secured, etc. Looseness in the mounting nuts could lead to equipment damage, or to accidents.

Caution

- Do not coat the sliding sections with any lubricant whatsoever. Such lubrication could alter or degrade the properties of the product materials, or reduce performance.
- Attempting to use the shock absorber with cap over the specification range could result in damage to the cap or to its flying off and causing personal injury. Moreover, if cracks or fractures appear in the cap, replace it as quickly as possible.

Attention

- When the product's service life is completed or when it is no longer needed, dispose of it as an industrial waste product, in accordance with the Waste Disposal and Public Cleaning Law, or with other local laws and ordinances. Note that because the special oil used in the KSHC series (clean room specification) gives off hydrofluoric acid, a corrosive, toxic substance, when incinerated, disposal should be performed at an incinerator equipped with acid-resisting toxic removal facilities. If large volumes need disposal, consign the operation to a registered waste disposal company.
- The maximum absorption performance in the specifications are values at normal temperatures (20~25°C [68~77°F]). Be aware that performance and characteristics may change depending on the operating temperature.
- The shock absorber's absorption capacity can change depending on the impact speed. Use it within the range shown in the selection graphs (impact mass and impact speed graphs) on p.572, 580, 586 and 593.

Handling Instructions and Precautions



General precautions

If mounting in locations subject to dripping water, dripping oil, etc., or to large amounts of dust, use something to cover and protect the unit. Accumulations of water, oil, or dust can reduce the shock absorber's service life.



Adjustment of shock absorption capacity

● Adjustable absorption capacity type : KSHE and KSH series

1. Align the white mark on the shock absorption adjusting knob to 2 or 3 on the scale.
2. For cases where the stroke end is still undergoing shocks, turn the adjusting knob toward 6 on the scale. In cases where the rod stops before the preset stroke end, or when the shock at time of impact is very large, turn the adjusting knob toward "0" on the scale.
3. When adjustment is complete, always be sure to tighten the lock screw to secure the adjusting knob in place.
4. The KSHE series are designed so that the final orifice hole is closed at the stroke end. Shortening the stroke could lead to an inability to adequately absorb the impact energy. It is recommended that use of the full stroke be made. Moreover, the shock absorber for the KSHE series operate differently when its rod is manually pushed in as opposed to actual operation.

● Fixed absorption capacity type : KSHJ, KSHA, KSHC series

For the fixed absorption capacity type, shock absorption capacity cannot be adjusted. See the Selection Guideline on p.572, 580, 586 to select a model with the optimum shock absorption capacity.



Mounting

1. Mount the shock absorber so that the load contacts at the center of the rod, and it is not subjected to off-centered loads. An off-centered load could result in breakage or defective rod returns. If there is concern that off-centered loads will occur, install a guide, etc.
2. Two or more shock absorbers can be mounted in parallel, to boost absorption capacity. In such an arrangement, however, be careful to ensure that the load is evenly distributed to each shock absorber.
3. The surface in direct contact with the shock absorber rod should have a hardness of HRc40 or more (excluding with cap models).
4. When mounting the shock absorber, do not exceed the maximum tightening torque for the hexagon nut, shown in the table below. Excessive tightening could damage the unit.

Model	Maximum tightening torque
KSHJ4×3(C)-01,-02	0.5 [0.37]
KSHJ6×4(C)-01,-02	0.85 [0.63]
KSHJ8×5(C)-01,-11	2.5 [1.8]
KSHJ8×8(C)-01,-02,-11,-12	2.5 [1.8]
KSHJ10×10(C)-01,-02	6.5 [4.8]
KSHJ10×15(C)-01,-03	6.5 [4.8]
KSHJ12×10(C)-01,-02	6.5 [4.8]
KSHJ14×12(C)-01,-02	12.0 [8.9]
KSHJ16×15(C)-01,-02	20.0 [14.8]
KSHJ18×16(C)-01,-02	25.0 [18.4]
KSHJ20×16(C)-01,-02	30.0 [22.1]
KSHJ22×25(C)-01,-02	35.0 [25.8]
KSHJ25×25(C)-01,-11,-12	42.0 [31.0]
KSHJ27×25(C)-01,-02,-11,-12	42.0 [31.0]

N·m [ft·lbf]

Handling Instructions and Precautions

N·m [ft·lbf]	
Model	Maximum tightening torque
KSHA4×4, CS-KSHC4×4	0.85 [0.63]
KSHA5×5, CS-KSHC5×5	2.5 [1.84]
KSHA6×5	6.5 [4.79]
KSHA6×8, CS-KSHC6×8	
KSHA7×8, CS-KSHC8×8	12.0 [8.85]
KSHA8×10, CS-KSHC9×10	
CS-KSHC11×15C	20.0 [14.8]
CS-KSHC14×16C	30.0 [22.1]
CS-KSHC18×25C	42.0 [31.0]

N·m [ft·lbf]	
Model	Maximum tightening torque
KSHE5×8, KSH5×8	8.0 [5.90]
KSHE6×10, KSH6×10	
KSHE(S)8×15, KSH8×10	15.0 [11.1]
KSHE(S)10×20, KSH10×15	24.0 [17.7]
KSHE(S)12×22, KSH12×22	30.0 [22.1]

●Fixed absorption capacity type

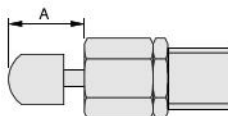
KSHJ, KSHA, KSHC series

1. If using "with cap" or changing the stroke to adjust absorption capacity, use a stopper.
2. If using "with cap", always mount a stopper nut (-S) or an external stopper to ensure that the cap is not subjected to loads at the stroke end. For the stopper nut mounting position, see the dimensions in the table below.

While the shock absorber can be used without a stopper nut (-S) or external stopper, in such an arrangement, the stop position may change due to deformation of the cap after a long period of use.

mm [in.]	
Model	A
KSHJ4×3C-01,-02	3 [0.118]
KSHJ6×4C-01,-02	4 [0.157]
KSHJ8×5C-01,-11	5 [0.197]
KSHJ8×8C-01,-02,-11,-12	8 [0.315]
KSHJ10×10C-01,-02	10 [0.394]
KSHJ10×15C-01,-03	15 [0.591]
KSHJ12×10C-01,-02	10 [0.394]
KSHJ14×12C-01,-02	12 [0.472]
KSHJ16×15C-01,-02	15 [0.591]
KSHJ18×16C-01,-02	16 [0.630]
KSHJ20×16C-01,-02	16 [0.630]
KSHJ22×25C-01,-02	25 [0.984]
KSHJ25×25C-01,-11,-12	25 [0.984]
KSHJ27×25C-01,-02,-11,-12	25 [0.984]

mm [in.]	
Model	A
KSHA4×4C, CS-KSHC4×4C	3.5~3.9 [0.138~0.154]
KSHA5×5C, CS-KSHC5×5C	4.5~4.9 [0.177~0.193]
KSHA6×5C	
KSHA6×8C, CS-KSHC6×8C	7.5~7.9 [0.295~0.311]
KSHA7×8C, CS-KSHC8×8C	
KSHA8×10C, CS-KSHC9×10C	9.5~9.9 [0.374~0.390]
CS-KSHC11×15C	14.5~14.9 [0.571~0.587]
CS-KSHC14×16C	15.5~15.9 [0.610~0.626]
CS-KSHC18×25C	24.5~24.9 [0.965~0.980]



3. For swing impacts, ensure that the angle of eccentricity between the load direction and the center line of the shock absorber is at or below the specification values shown on p.571, p.579 and p.585.
4. Do not loosen or remove the small screw on the rear end of the shock absorber. The oil contained inside could leak out, damaging shock absorber functions.

●Insert mounting : KSHA□×□□-X

1. For the dimensions of the mounting hole for the insert mount, see the insert mounting hole drawings on p.583.
2. When using a panel mounting, use the values in the table below to determine the maximum thickness of the panel.

mm [in.]	
Model	Maximum panel thickness
KSHA6×8□-X	8 [0.315]
KSHA7×8□-X	10 [0.394]

●Adjustable absorption capacity type KSHE and KSH series

1. Do not use the end surface of the shock absorber body in the rod side as a stopper. Always use a stopper nut (Order code: -S) or external stopper.
2. When using the stopper nut, adjust the stopper nut location so that it protrudes 0.5 mm [0.02 in.] from the end surface of the KSHE series shock absorber body, and 0.5 to 1.0 mm [0.02 to 0.04 in.] from the KSH series.
3. When using an external stopper, mount so that impacting objects are stopped 0.5 mm [0.02 in.] in front of the end surface of the KSHE series shock absorber body, and 0.5 to 1.0 mm [0.02 to 0.04 in.] in front of the KSH series.
4. For swing impacts, ensure that the angle of eccentricity between the load direction and the center line of the shock absorber is 3° or less.

KSHES series

1. For holders that can directly stop loads, use a stopper type holder (-HS). If using holders that do not have a stopper function (-H), use an external stopper.
2. Holders and external stoppers should receive all the remaining energy for loads when stopping. Do not let the cap become subjected to loads at the stroke end.

● Calculation

For the calculations, use the speed immediately before striking the absorber. For air cylinders, the speed immediately before striking is larger than the average speed obtained from the "time required for cylinder stroke". In this case, shorter strokes increase the speed, and it reaches 1.2 to 2.0 times higher than the average speed.

Selection procedure of shock absorber

Impact mass m kg
 [Impact weight w' lbf.]
 Impact speed v m/s [ft./sec.]

When additional energy is not applied.

When additional energy from the cylinder, rotary actuator, etc., is applied

Item	Horizontal impact		Horizontal impact		Vertical impact		Swing impact			
	Simple horizontal impact		Cylinder impact	Free fall	Cylinder impact	Arm swing	Turn table			
Impact example										
Impact mass m kg [Impact weight w' lbf.]	m	w'	m	w'	m	w'	m	w'	m	w'
Impact speed v m/s [ft./sec.]	v		v		v		$v=R \cdot \omega$		$v=R \cdot \omega$	
Kinetic energy E_1 J [ft·lbf]	$\frac{m \cdot v^2}{2}$	$\left\{ \frac{w' \cdot v^2}{2 \cdot g} \right\}$	$\frac{m \cdot v^2}{2}$	$\left\{ \frac{w' \cdot v^2}{2 \cdot g} \right\}$	$m \cdot g \cdot h$	$\left\{ w' \cdot h \right\}$	$\frac{m \cdot v^2}{2}$	$\left\{ \frac{w' \cdot v^2}{2 \cdot g} \right\}$	$\frac{I \cdot \omega^2}{2}$	$\left\{ \frac{I' \cdot \omega^2}{2} \right\}$
Thrust, mass, and other additional energy E_2 J [ft·lbf]	—		$F \cdot L$	$\left\{ F' \cdot L \right\}$	$m \cdot g \cdot L$	$\left\{ w' \cdot L \right\}$	$(m \cdot g + F) \cdot L$	$\left\{ (w' + F') \cdot L \right\}$	$\frac{T \cdot L}{R}$	$\left\{ \frac{T' \cdot L}{R} \right\}$
Total energy E J [ft·lbf]	E_1		$E_1 + E_2$		$E_1 + E_2$		$E_1 + E_2$		$E_1 + E_2$	

Shaded areas show calculations using the imperial units.
 [] shows imperial units.

Maximum operating frequency cycle/min
 Operating ambient temperature °C [°F]

Select models where the m, v, E, L , operating frequency and temperature satisfy the specifications.

Remark: The shock absorber's absorption energy will vary depending on speed, temperature, and other conditions. This calculation equation is provided for a general indication only. We recommend selecting from the selection graphs on p.572~573, 580, 586, and 593.

Code explanations	(Unit)
m : Impact mass	kg
w' : Impact weight	[lbf.]
v : Impact speed	m/s [ft./sec.]
E : Total energy	J [ft·lbf]
E_1 : Kinetic energy	J [ft·lbf]
E_2 : Additional energy	J [ft·lbf]
g : Acceleration of gravity	9.8m/s ² [32.2ft./sec. ²]
F : Cylinder thrust	N
$F = \pi / 4 \times D^2 \times P$	
D : Bore size	mm
P : Operating air pressure	MPa
F : Cylinder thrust	N
F' : Cylinder thrust	[lbf.]
$F' = \pi / 4 \times D'^2 \times P'$	
D' : Bore size	[in.]
P' : Operating air pressure	[psi. = lbf./in. ²]
L : Shock absorber stroke	m [ft.]
h : Height of fall	m [ft.]
T : Torque	N·m
T' : Torque	[ft·lbf]
ω : Angular velocity (90° = 1.57rad.)	rad/s
N : Rotating speed $\omega = 2\pi N / 60$	rpm
R : Distance from center of rotation to point of impact	m [ft.]
I : Inertia moment relating to center of gravity	kg·m ²
I' : Inertia moment relating to center of gravity	[ft·lbf·sec ²]

SHOCK ABSORBERS WITH SENSOR SWITCH ADJUSTABLE ABSORPTION CAPACITY TYPE

KSHES Series

Specifications

Item	Model	KSHES8×15	KSHES10×20	KSHES12×22
Maximum absorption	J [ft·lbf]	9.8 [7.23]	14.7 [10.84]	29.4 [21.69]
Absorbing stroke	mm [in.]	14.5 [0.571]	19.5 [0.768]	21.5 [0.846]
Maximum impact speed	m/s [ft./sec.]	1.5 [4.92]		
Maximum operating frequency	cycle/min	60		
Spring return force ^{Note}	N [lbf.]	10.7 [2.41]	14.4 [3.24]	16.3 [3.66]
Angle variation		3° or less		
Operating temperature range	°C [°F]	0~60 [32~140]		

Note: Values when compressed.

Mass

Item	Body Mass	Additional mass							
		Holder		Mounting bracket		Sensor switch			
		-H (Without stopper)	-HS (Stopper type)	-2 (Side mounting)	-3 (Flange mounting)	ZC130□	ZC153□	CS5T□	CS11T□
KSHES 8×15	108 [3.81]	18 [0.63]	44 [1.55]	68 [2.40]	28 [0.99]				
KSHES10×20	153 [5.40]	22 [0.78]	49 [1.73]	110 [3.88]	57 [2.01]	20 ^{Note} [0.71]	20 ^{Note} [0.71]	20 ^{Note} [0.71]	20 ^{Note} [0.71]
KSHES12×22	203 [7.16]	25 [0.88]	57 [2.01]	140 [4.94]	54 [1.90]				

Note: For lead wire length 1000mm [39in.].

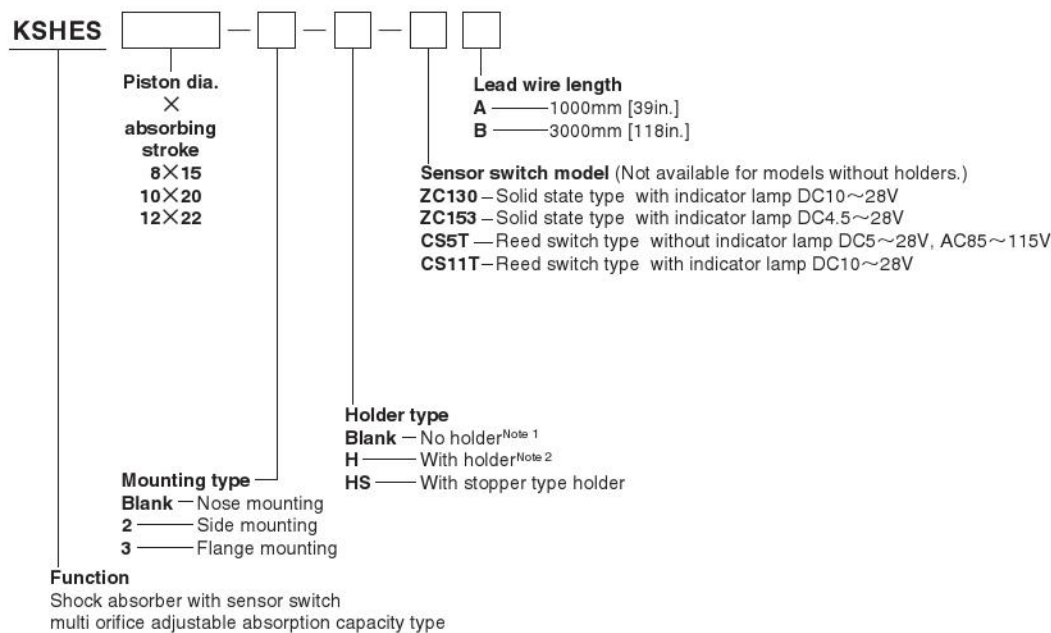
Remarks: 1. Two mounting nuts are supplied with a shock absorber body.

2. One mounting nut is supplied with a holder.

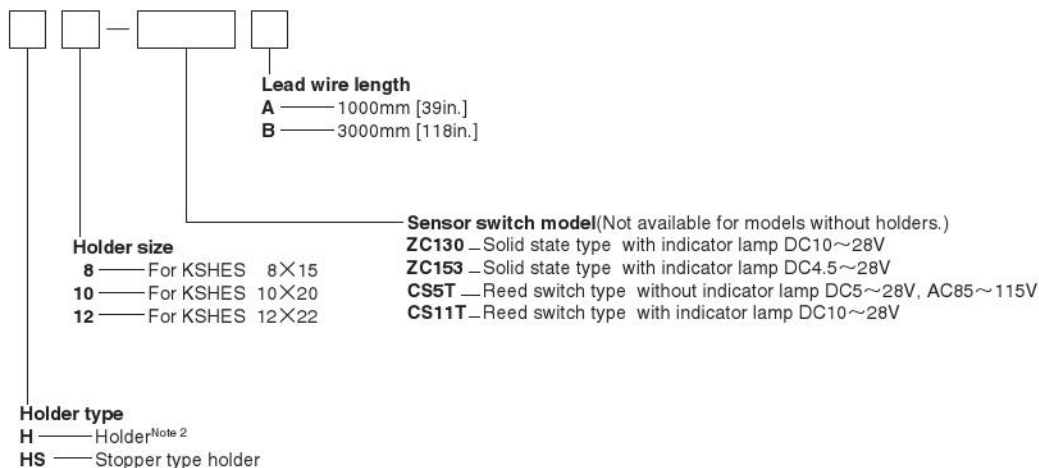
3. Two mounting screws are supplied with a side mounting bracket.

Calculation sample: The mass of KSHES10×20 with a holder (-HS), side mounting bracket (-2), and sensor switch is 153+49+110+20=332 g [11.71 oz.]

Order Codes

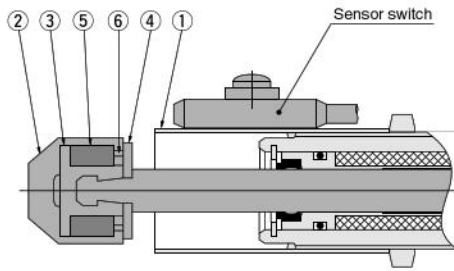


Orders for holders and sensor switches only



Notes: 1. Sensor switch is not included in the models without holders.
2. Cannot be used as a stopper.

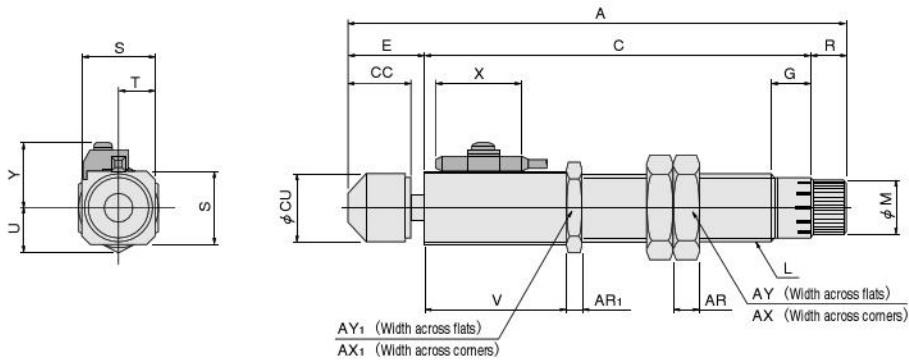
Inner Construction and Major Parts



Major Parts and Materials

No.	Parts	Materials	
①	Holder	-H	Aluminum (black anodized)
		-HS	Stainless steel (no surface treatment)
②	Rubber cap	Urethane rubber	
③	Cap	Polyacetal	
④	Washer	Stainless steel	
⑤	Magnet	Rare earth magnet	
⑥	Magnet support	Polyacetal	

Dimensions (mm)

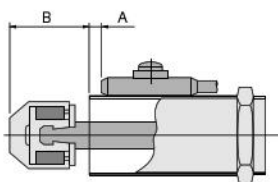


Code	A	C	E	G	L	M	R	S	T	U	V	X				Y	AR	AR ₁	AY	AY ₁	AX	AX ₁	CC	CU
												ZC130□	ZC153□	CS5T□	CS11T□									
KSHES 8×15	117.5	96	14.5	10	M16×1.5	13	7	19	9.5	10	33					17.5	7	4	19	19	21.9	21.9	(15.5)	14
KSHES10×20	130.5	104	19.5	10	M18×1.5	15	7	20	10	10	36	25	25	22	26	18.5	8	6	22	22	25.4	25.4	15.5	16
KSHES12×22	138.5	110	21.5	10	M20×1.5	17	7	22	11	11	37					19.5	10	6	24	24	27.7	27.7	18	18

● For mounting bracket dimensions, see p.594.

Mounting Position for Holders and Sensor Switches

When the sensor switch is mounted in the position in the diagram (the figures in the tables are reference values), the magnet comes to the maximum sensing position of the sensor switch at the end of stroke.



Shock absorber Model	A ^{Note}				B
	Sensor switch model				
	ZC130□	ZC153□	CS5T□	CS11T□	
KSHES 8×15	1.5	1.5	3	1	14.5 ^{+0.3} ₀
KSHES10×20	1.5	1.5	3	1	19.5 ^{+0.3} ₀
KSHES12×22	4.0	4.0	5.5	2	21.5 ^{+0.3} ₀

Note: Mount the sensor switch so that it does not protrude from the holder.

- Cautions:**
- The sensitivity of the sensor switch can vary depending on the environment. If operation appears unstable, relocate the sensor switch to an optimum location, and use a set-screw to secure it in place.
 - Mount so that the sensor switch's order code is displayed on top.

Moving Sensor Switch

- Loosening the sensor switch set-screw allows the sensor switch to be moved along the axis direction of the shock absorber.
- Do not exceed a tightening torque of the set-screw 19.6N·cm [1.73in·lbf].

