

FSA, FSAE

Series

Shock Absorber



FSA, FSAE Series

Shock Absorber

SA Series

SAE Series (Emergency mode)



Select the proper buffer type based on applications

AA Type

- Fixed type
- Single orifice type

Large equivalent loading, suitable for low speed range of 0.3~0.5m/s.

AC Type

- Fixed type
- Multi-orifice type

Small equivalent loading, suitable for medium speed range.

BB Type

- Analog adjusting
- Single orifice type

Large equivalent loading, equipped with adjustable orifice, suitable for low speed range.

CC Type

- Analog fine adjusting
- Multi-orifice type

Small equivalent loading, equipped with adjustable orifice, suitable for high speed range of 0.7~3m/s.

CD Type

- Analog fine adjusting
- Special multi-orifice type

Designed with multi-orifice with performance effect displayed on the first half of the stroke whereas performance effect displayed on the second half is with single-orifice. Mainly designed to be applicable for varied types of changes caused by changing in speed.

Suitable for medium speed range of 0.4~1m/s and has the characteristic of small collision force and great thrust force toward most cylinders.

FSA series

AA Type

- Fixed
- Single orifice type



AC Type

- Fixed
- Multi-orifice type



BB Type

- Analog adjusting
- Single orifice type



CC Type

- Analog fine adjusting
- Multi-orifice type



CD Type

- Analog fine adjusting
- Special multi-orifice type



FSAE series

- Fixed type
- Tapered-shaped, exible orifice



Without rod cap / S



With rod cap / C



Adaptor for slant angle SA-A



Stopper nut

Suitable for without rod cap SAS-N



Suitable for with rod cap SAC-N



- **Fixed type** : Orifice area unadjustable.
- **Analog adjusting type** : Orifice area entirely adjustable.
- **Analog fine adjusting type** : Orifice area partly adjustable.
- **Emergency model** : For emergency purpose only, short life time, high energy absorbing with compact body.

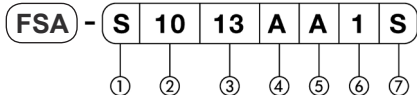
FSA, FSAE Series

Shock Absorber

Representation

• Shock Absorber

Spring return type



① Provision of dust wiper

No mark : No dust wiper

S : With dust wiper

② Outer diameter (mm)

③ Stroke (mm)

④ Adjustment

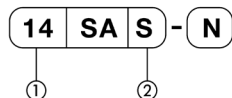
A: Fixed type

B: Analog adjusting type

C: Analog fine adjusting type

• Option

Stopper Nut



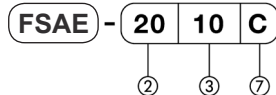
① Outer diameter (mm)

② Provision of rod cap

S: No rod cap

C: With rod cap

Emergency mode



⑤ Absorbing mechanism

A: Single orifice (Piston)

B: Single orifice (Innertube)

C: Multi-orifice

D: Special multi-orifice

⑥ Capacity

1: Standard type

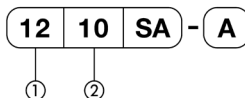
2: Heavy duty type

⑦ Provision of rod cap

S: No rod cap

C: With rod cap

Adaptor for slant angle



① Outer diameter (mm)

② Stroke (mm)

FSA series/AA, AC type

Model No.	Unit	FSA-0805		FSA-1005		FSA-1008		FSA-□1210		FSA-□1412		
		AA1	AA2	AA1	AA2	AA1	AA2	AA1	AA2	AC1	AC2	
Adjustment		Fixed type										
Absorbing stroke	mm	5		5		8		10		12		
Max. energy absorbing capacity	J [kgf·m]	0.392 [0.04]	0.686 [0.07]	0.686 [0.07]	0.98 [0.1]	0.98 [0.1]	1.47 [0.15]	1.96 [0.2]	2.45 [0.25]	3.92 [0.4]	5.88 [0.6]	
Max. equivalent mass	kg	3	5	5	8	7	10	15	30	15	20	
Max. impact velocity	m/s	1		1		1		1		1.5		
Max. heat dissipation capacity per minute	J/min [kgf·m/min]	17.64 [1.8]	23.22 [2.37]	41.16 [4.2]		58.8 [6]		98 [10]		176.4 [18]		
Max. operating cycles	cycle/min	45		60		60		60		60		
Ambient temperature range		°C -10~70										
Spring returning force	Set state	N[kgf]	1.96[0.2]		3.13[0.32]		3.13[0.32]		4.9[0.5]		3.52[0.36]	
	Compressed state	N[kgf]	3.04[0.31]		5.88[0.6]		5.88[0.6]		9.8[1.0]		8.23[0.84]	
Mounting structure strength		N[kgf]	980[100]		1470[150]		1470[150]		2940[300]		3626[370]	
Mass		g	10		10		13		23		50	
Dust wiper	Provided		○		○		○		○		○	
	Not provided		—		—		—		○		○	
Rod cap	Provided		○		○		○		○		○	
	Not provided		○		○		○		○		○	
Option	Stopper nut		08SAS-N		10SAS-N		12SAS-N		14SAS-N			
			08SAC-N		10SAC-N		12SAC-N		14SAC-N			
	Adaptor for slant angle		0805SA-A		1005SA-A		1008SA-A		1210SA-A		1412SA-A	

FSA series/BB type

Model No.	Unit	FSA-1008	FSA-□1210	FSA-□1412	FSA-□1612	FSA-□2016	FSA-□2530	FSA-□2540	FSA-□2725	
		BB1	BB1	BB1	BB1	BB1	BB1	BB1	BB1	
Adjustment		Analog fine adjusting type								
Absorbing stroke	mm	8	10	10	12	16	30	40	25	
Max. energy absorbing capacity	J [kgf·m]	1.47 [0.15]	2.94 [0.3]	3.92 [0.4]	9.8 [1.0]	29.4 [3.0]	49 [5.0]	63.7 [6.5]	79.4 [8.1]	
Max. equivalent mass	kg	10	30	30	50	300	400	500	650	
Max. impact velocity	m/s	1	1.5	1.5	1	1	1	1	1	
Max. heat dissipation capacity per minute	J/min [kgf·m/min]	58.8 [6]	98 [10]	176 [18]	235.2 [24]	343 [35]	490 [50]	637 [65]	539 [55]	
Max. operating cycles	cycle/min	60	60	60	60	60	60	60	60	
Ambient temperature range		°C -10~70								
Spring returning force	Set state	N[kgf]	2.94[0.3]	4.9[0.5]	4.51[0.46]	5.39[0.55]	11.95[1.22]	16.56[1.69]	23.81[2.43]	16.17[1.65]
	Compressed state	N[kgf]	5.88[0.6]	9.8[1.0]	9.8[1.0]	14.7[1.5]	18.03[1.84]	33.12[3.38]	71.44[7.29]	27.24[2.78]
Mounting structure strength		N[kgf]	1274[130]	2940[300]	3626[370]	5292[370]	9800[1000]	9800[1000]	9800[1000]	13720[1400]
Mass		g	22.5	40	58	97	156	335	393	357
Dust wiper	Provided		○	○	○	○	○	○	○	
	Not provided		—	○	○	○	○	○	○	
Rod cap	Provided		○	○	○	○	○	○	—	
	Not provided		○	○	○	○	○	○	○	
Option	Stopper nut		10SAS-N	12SAS-N	14SAS-N	16SAS-N	20SAS-N	25SAS-N	—	27SAS-N
			10SAC-N	12SAC-N	14SAC-N	16SAC-N	20SAC-N	25SAC-N	25SAC-N4	27SAC-N
	Adaptor for slant angle		1008SA-A	1210SA-A	1410SA-A	1612SA-A	2016SA-A	2530SA-A	—	2725SA-N

FSA series/CC type

Model No.		Unit	FSA-1008 CC1	FSA-□1210 CC1	FSA-□1410 CC1	FSA-□1612 CC1	FSA-□2016 CC1	FSA-□2530 CC1
Adjustment			Analog fine adjusting type					
Absorbing stroke	mm		8	10	10	12	16	30
Max. energy absorbing capacity	J [kgf·m]		1.76 [0.18]	4.9 [0.5]	5.88 [0.6]	9.8 [1.0]	29.4 [3.0]	49 [5.0]
Max. equivalent mass	kg		2.5	4	4.5	10	120	150
Max. impact velocity	m/s		3	3	3	3	3	3
Max. heat dissipation capacity per minute	J/min [kgf·m/min]		58.8 [6]	98 [10]	147 [15]	235 [24]	343 [35]	490 [50]
Max. operating cycles	cycle/min		60	60	60	60	60	60
Ambient temperature range		°C	-10~70					
Spring returning force	Set state	N[kgf]	2.94[0.3]	4.9[0.5]	4.51[0.46]	5.39[0.55]	11.95[1.22]	16.56[1.69]
	Compressed state	N[kgf]	5.88[0.6]	9.8[1]	9.8[1]	14.7[1.5]	18.03[1.84]	33.12[3.38]
Mounting structure strength		N[kgf]	1274[130]	2940[300]	3626[370]	5292[540]	9800[1000]	9800[1000]
Mass		g	22.5	40	58	97	156	335
Dust wiper	Provided		○	○	○	○	○	○
	Not provided		—	○	○	○	○	○
Rod cap	Provided		○	○	○	○	○	○
	Not provided		○	○	○	○	○	○
Option	Stopper nut		10SAS-N	12SAS-N	14SAS-N	16SAS-N	20SAS-N	25SAS-N
			10SAC-N	12SAC-N	14SAC-N	16SAC-N	20SAC-N	25SAC-N
	Adaptor for slant angle		1008SA-A	1210SA-A	1410SA-A	1612SA-A	2016SA-A	2530SA-A

Model No.		Unit	FSA-□2540 CC1	FSA-□2725 CC1	FSA-3035 CC1	FSA-3650 CC1	FSA-4250 CC1	FSA-4280 CC1
Adjustment			Analog fine adjusting type					
Absorbing stroke	mm		40	25	35	50	50	80
Max. energy absorbing capacity	J [kgf·m]		63.7 [6.5]	79.4 [8.1]	196 [20]	392 [40]	441 [45]	720 [73.5]
Max. equivalent mass	kg		200	300	700	1400	390	640
Max. impact velocity	m/s		3	3	3	3	3	3
Max. heat dissipation capacity per minute	J/min [kgf·m/min]		637 [65]	539 [55]	1176 [120]	2352 [240]	2744 [280]	4410 [450]
Max. operating cycles	cycle/min		60	60	30	30	10	6
Ambient temperature range		°C	-10~70					
Spring returning force	Set state	N[kgf]	23.81[2.43]	16.17[1.65]	19.6[2.0]	22.54[2.3]	24.5[2.5]	24.5[2.5]
	Compressed state	N[kgf]	71.44[7.29]	27.24[2.78]	44.1[4.5]	68.6[7.0]	83.3[8.5]	98[10]
Mounting structure strength		N[kgf]	9800[1000]	13720[1400]	33320[3400]	47040[4800]	54057[5516]	54057[5516]
Mass		g	393	357	640	1120	1300	1750
Dust wiper	Provided		○	○	○	○	○	○
	Not provided		○	○	—	—	—	—
Rod cap	Provided		—	○	○	○	—	—
	Not provided		○	○	○	○	○	○
Option	Stopper nut		—	27SAS-N	30SAS-N	36SAS-N	—	—
			25SAC-N4	27SAC-N	30SAC-N	36SAC-N	—	—
	Adaptor for slant angle		—	2725SA-A	3035SA-A	3650SA-A	—	—

SA, SAE Series

FSA series/CD type

Model No.		Unit	FSA-1008 CD1	FSA-□1210 CD1	FSA-□1410 CD1	FSA-□1612 CD1	FSA-□2016 CD1	FSA-□2525 CD1
Adjustment			Analog fine adjusting type					
Absorbing stroke	mm		8	10	10	12	16	25
Max. energy absorbing capacity	J [kgf·m]		15 [1.5]	15 [1.5]	5.88 [0.6]	20 [2.0]	29.4 [3.0]	85 [8.5]
Max. equivalent mass	kg		10	30	35	50	200	400
Max. impact velocity	m/s		3	3	3	3	3	3
Max. heat dissipation capacity per minute	J/min [kgf·m/min]		58.8 [6]	98 [10]	147 [15]	235.5 [24]	343 [35]	470 [47]
Max. operating cycles	cycle/min		60	60	60	60	60	60
Ambient temperature range		°C	-10~80					
Spring returning force	Set state	N[kgf]	2.94[0.3]	4.9[0.5]	4.51[0.46]	5.39[0.55]	11.95[1.22]	15.95[1.59]
	Compressed state	N[kgf]	5.88[0.6]	9.8[1.0]	9.8[1.0]	14.7[1.5]	18.03[1.84]	30.26[3.03]
Mounting structure strength		N[kgf]	1274[130]	2940[300]	3626[370]	5292[540]	9800[1000]	9800[1000]
Mass		g	22.5	40	58	97	156	320
Dust wiper	Provided		○	○	○	○	○	○
	Not provided		—	○	○	○	○	○
Rod cap	Provided		○	○	○	○	○	○
	Not provided		○	○	○	○	○	○
Option	Stopper nut		10SAS-N	12SAS-N	14SAS-N	16SAS-N	20SAS-N	25SAS-N
			10SAC-N	12SAC-N	14SAC-N	16SAC-N	20SAC-N	25SAC-N
	Adaptor for slant angle		1008SA-A	1210SA-A	1410SA-A	1612SA-A	2016SA-A	2525SA-A

Model No.		Unit	FSA-□2530 CD1	FSA-□2540 CD1	FSA-□2725 CD1	FSA-3035 CD1	FSA-3325 CD1	FSA-3350 CD1
Adjustment			Analog fine adjusting type					
Absorbing stroke	mm		30	40	25	35	25	50
Max. energy absorbing capacity	J [kgf·m]		95 [9.5]	100 [10.0]	120 [12.0]	196 [20]	250 [25]	300 [30]
Max. equivalent mass	kg		480	700	1000	1300	1700	2100
Max. impact velocity	m/s		3	3	3	3	3	3
Max. heat dissipation capacity per minute	J/min [kgf·m/min]		490 [50]	637 [65]	539 [55]	1176 [120]	1470 [150]	1764 [180]
Max. operating cycles	cycle/min		60	60	60	30	30	30
Ambient temperature range		°C	-10~80					
Spring returning force	Set state	N[kgf]	16.56[1.69]	23.81[2.43]	16.17[1.65]	19.6[2.0]	18.5[1.9]	21.4[2.2]
	Compressed state	N[kgf]	33.12[3.38]	71.44[7.29]	27.24[2.78]	44.1[4.5]	40.2[4.1]	52.3[5.3]
Mounting structure strength		N[kgf]	9800[1000]	9800[1000]	13720[1400]	33320[3400]	40180[4100]	40180[4100]
Mass		g	335	393	357	640	650	750
Dust wiper	Provided		○	○	○	○	○	○
	Not provided		○	○	○	—	—	—
Rod cap	Provided		○	○	○	○	○	○
	Not provided		○	○	○	○	○	○
Option	Stopper nut		25SAS-N	—	27SAS-N	30SAS-N	33SAS-N	33SAS-N
			25SAC-N	25SAC-N4	27SAC-N	30SAC-N	33SAC-N	33SAC-N
	Adaptor for slant angle		2530SA-A	—	2725SA-A	3035SA-A	3325SA-A	3350SA-A

SA, SAE Series

FSA series/CD type

Model No.		Unit	FSA-3625 CD1	FSA-3650 CD1	FSA-4225 CD1	FSA-4250 CD1	FSA-4280 CD1
Adjustment			Analog fine adjusting type				
Absorbing stroke		mm	25	50	25	50	80
Max. energy absorbing capacity		J [kgf·m]	342 [35]	392 [40]	420 [42]	441 [45]	720 [72.0]
Max. equivalent mass		kg	2400	2700	3000	3500	5500
Max. impact velocity		m/s	3	3	3	3	3
Max. heat dissipation capacity per minute		J/min [kgf·m/min]	2058 [210]	2352 [240]	2548 [260]	2744 [280]	4410 [450]
Max. operating cycles		cycle/min	30	30	30	30	10
Ambient temperature range		°C	-10~80				
Spring returning force	Set state	N[kgf]	21.9[2.2]	22.54[2.3]	23.2[2.4]	24.5[2.5]	24.5[2.5]
	Compressed state	N[kgf]	61.4[6.2]	68.6[7.0]	75.6[7.6]	83.3[8.5]	98[10]
Mounting structure strength		N[kgf]	47040[4800]	47040[4800]	54057[5516]	54057[5516]	54057[5516]
Mass		g	800	1120	1150	1300	1750
Dust wiper	Provided		○	○	○	○	○
	Not provided		—	—	—	—	—
Rod cap	Provided		○	○	○	○	○
	Not provided		○	○	○	○	○
Option	Stopper nut		36SAS-N	36SAS-N	—	—	—
			36SAC-N	36SAC-N	—	—	—
	Adaptor for slant angle		3625SA-A	3650SA-A	—	—	—

FSAE series

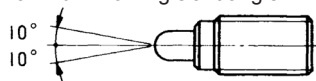
Model No.		Unit	FSAE-2010	FSAE-3020
Adjustment			fixed type	
Absorbing stroke		mm	10	20
Max. energy absorbing capacity		J [kgf·m]	19.6 [2.0]	98 [1.0]
Max. equivalent mass		kg	30	140
Max. impact velocity		m/s	2	2
Ambient temperature range		°C	-10~70	
Spring returning force	Set state	N[kgf]	11.76[1.2]	29.4[3]
	Compressed state	N[kgf]	41.16[4.2]	68.6[7]
Mounting structure strength		N[kgf]	13720[1400]	23520[2400]
Mass		g	55	250
Dust wiper	Provided		—	—
	Not provided		○	○

1. Use minimum-energy absorbing capacity at about 1/5 of maximum energy absorbing capacity.
2. Maximum heat dissipation capacity per minute is a value applicable where ambient temperature is 20±10°C.
3. Mounting structure strength means the one for mounting racks for shock absorber.
4. Mass means net value without cap.

Adaptor for slant angle

This adaptor can be set easily by screwing to a shock absorber. When load is applied to the shock absorber at an angle of more than 2.5°.

Maximum working slant angle +10°.

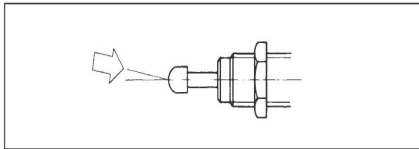


HANDLING PRECAUTIONS

When adopting shock absorber, please read the following precautions carefully before use.

Installation

- Shut off all the electricity supplies to avoid electricity shock before installation.
- Turn off air supply source and reduce pressure before installation.
- After installation the shock absorber, make sure the loading force is applied onto the central point of the axis. If the deflection angle tilts more than 2.5°, U-packing will have faster wear out, or axis may be bending causing oil leakage and compromising buffer effect, etc. In case of deflection angle, please use adaptor for slant angle to solve the situation.



- Torque recommended for fastening hexagon nut for installation. (Excess torque will damage the shock absorber)

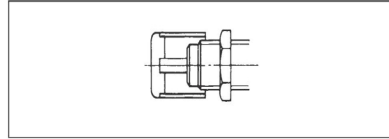
(N·m[kgf·cm])

Thread	Torque	Thread	Torque
M8	4[40]	M25	50[500]
M10, M12	8[80]	M27	60[600]
M14	10[100]	M30	80[800]
M16	15[150]	M36	100[1000]
M18, M20	30[300]	M40, M45	120[1200]
M22	40[400]		

- Avoid using shock absorber as stopping device because the collision force may exceeds specifications for the product which may reduce its usage life. Nut for stopping purpose are available for purchase and can be use at 1~2mm before the stroke end.

Environment

- Avoid operating at an dusty environment, otherwise, U-packing will be damage and its efficacy will be compromised. An added-on dust cover is recommended.

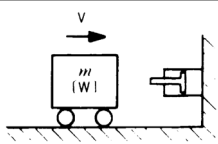
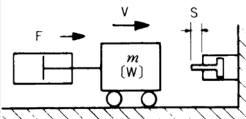
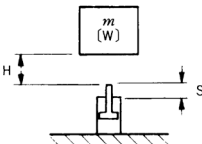
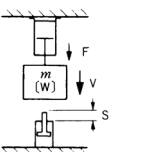
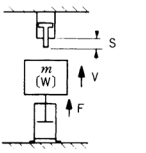
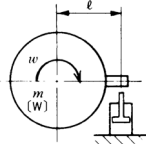


- Avoid operating at an environment with water, oil, or other type of liquids; otherwise liquids may infiltrate the shock absorber from the U-packing causing damage and compromising efficacy. An added-on protective cap is recommended.
- Please use shock absorber within operating temperature range to prolong its usage time. In addition, operating temperature for solenoid with air resetting type should not exceed 5~50°C.
- Please avoid operating in vacuum environment; otherwise oil leakage may occur.

Operation and Adjustment

- Please protect the piston rod with care to avoid debris and scratches; otherwise, U-packing may be damaged and oil leakage may occur.
- When using an adjustable shock absorber at uncertain setting, it is recommended to preset the position at medium or low. In order to avoid shock absorber clashes and damages and personnel injuries, make adjustment and testing in accordance with the actual situation to analyse collision force.
- When stopping devices is in place, an axis will be stopped 1~1.5mm before stroke end.
- Air pressure supplied for the air resetting shock absorber should be maintained within 0.3~0.7MPa (3.1~7.1kgf/cm²).
- Please supply with clean, compressed air to avoid oil leakage caused by debris and dust scratching the packing and axis.

Energy absorption formula

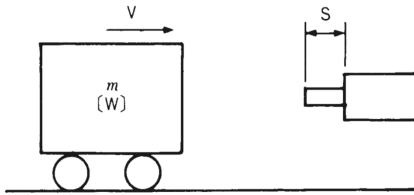
Applications		Formula	
		Absorbing energy	Equivalent load
Simple Standard horizontal collision		$E = \frac{m \cdot V^2}{2}$ $\left[E = \frac{W \cdot V^2}{2g} \right]$ $= 0.051 W \cdot V^2$	$We = m$ $[We = W]$
Cylinder thrust collision		$E = \frac{m \cdot V^2}{2} + F \cdot S$ $\left[E = \frac{W \cdot V^2}{2g} + F \cdot S \right]$	$We = \frac{E}{0.5V^2}$ $\left[We = \frac{E}{0.051V^2} \right]$
Free fall collision		$E = m \cdot g(H+S)$ $[E = W(H+S)]$	$We = \frac{E}{0.5V^2}$ $(V = \sqrt{2g \cdot H})$ $\left[We = \frac{E}{0.051V^2} \right]$
Cylinder facing down		$E = \frac{m \cdot V^2}{2} + (F+m \cdot g)S$ $\left[E = \frac{W \cdot V^2}{2g} + (F+W)S \right]$	$We = \frac{E}{0.5V^2}$ $\left[We = \frac{E}{0.051V^2} \right]$
Cylinder facing up		$E = \frac{m \cdot V^2}{2} + (F-m \cdot g)S$ $\left[E = \frac{W \cdot V^2}{2g} + (F-W)S \right]$	$We = \frac{E}{0.5V^2}$ $\left[We = \frac{E}{0.051V^2} \right]$
Rotating body		$E = \frac{I \cdot w^2}{2}$ $\left[E = \frac{I \cdot w^2}{2} \right]$ $\left(w = \frac{2 \pi \cdot n}{60} \right)$	$We = \frac{E}{0.5V^2}$ $(V = I \cdot w)$ $\left[We = \frac{E}{0.051V^2} \right]$

E : Energy absorption	[kgf · m]	w : Angular velocity	rad/s
m : Mass	kg	H : Height of fall	m
W : Weight	[kgf]	l : Radius	m
We : Equivalent mass	kg [kgf]	n : Numbers of rotation	rev./min
g : Gravitational acceleration	9.8m/s ² [G]	I : Moment of inertia	N · m ² (kgf · m · s ²)
v : Collision velocity	m/s	Rotating body : $I = m \cdot \frac{d^2}{8}$	
S : Shock absorbing stroke	m	$\left[I = \frac{W}{g} \cdot \frac{d^2}{8} \right]$	
F : Thrust	N [kgf]		

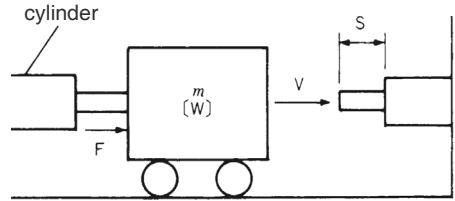
Selection guide

When selecting a hydraulic shock absorber, please considering the following examples. Total energy for each stroke is noted as “E”, equivalent load as “We”, collision velocity “V”, and energy absorption per minute. If you have any questions, please consult FONTAL.

• Horizontal collision without thrust



• Horizontal collision with cylinder thrust



Basic formula

Item	SI Unit	Conventional Unit
① Collision energy $E_1 =$	$0.5 \cdot m \cdot V^2$ (J)	$0.051 \cdot W \cdot V^2$ (kgf·m)
② Additional energy $E_2 =$	0	0
③ Total energy $E =$	$E_1 + E_2 = E_1$ (J)	$E_1 + E_2 = E_1$ (kgf·m)
④ Equivalent mass (load) $We =$	$\frac{E}{0.5 \cdot V^2} = m$ (kg)	$\frac{E}{0.051 \cdot V^2}$ (kgf)
⑤ Total collision energy per minute $ET =$	$E \cdot n$ (J/min)	$E \cdot n$ (kgf·m/min)

Basic formula

Item	SI Unit	Conventional Unit
① Energy before collision $E_1 =$	$0.5 \cdot m \cdot V^2$ (J)	$0.051 \cdot W \cdot V^2$ (kgf·m)
② Additional energy $E_2 =$	$F \cdot S$ (J)	$F \cdot S$ (kgf·m)
③ Total energy $E =$	$E_1 + E_2$ (J)	$E_1 + E_2$ (kgf·m)
④ Equivalent mass (load) $We =$	$\frac{E}{0.5 \cdot V^2}$ (kg)	$\frac{E}{0.051 \cdot V^2}$ (kgf)
⑤ Total collision energy per minute $ET =$	$E \cdot n$ (J/min)	$E \cdot n$ (kgf·m/min)

Calculation sample

$m = 10\text{kg}$ [$W = 10\text{kgf}$] $V = 0.6\text{m/s}$ $n = 30\text{cycle/min}$
 $S = 12 \times 10^{-3}\text{m}$

Item	SI Unit	Conventional Unit
① $E_1 =$	$0.5 \times 10 \times 0.6^2 = 1.8$ (J)	$0.051 \times 10 \times 0.6^2 = 0.1836$ (kgf·m)
② $E_2 =$	0	0
③ $E =$	1.8 (J)	0.1836 (kgf·m)
④ $E =$	10 (kg)	10 (kgf)
⑤ $ET =$	$1.8 \times 30 = 54$ (J/min)	$0.1836 \times 30 = 5.508$ (kgf·m/min)

Model selected : FSA-1210AA1、FSA-1210BB1

Calculation sample

$m = 30\text{kg}$ [$W = 30\text{kgf}$] $V = 0.6\text{m/s}$ $F = 617.4\text{N}$ [63kgf]
 $n = 20\text{cycle/min}$ $S = 16 \times 10^{-3}\text{m}$

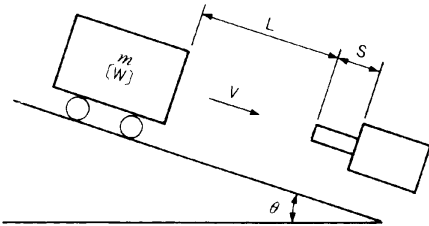
Item	SI Unit	Conventional Unit
① $E_1 =$	$0.5 \times 30 \times 0.6^2 = 5.4$ (J)	$0.051 \times 30 \times 0.6^2 = 0.5508$ (kgf·m)
② $E_2 =$	$617.4 \times 16 \times 10^{-3} = 9.8784$ (J)	$63 \times 16 \times 10^{-3} = 1.008$ (kgf·m)
③ $E =$	$5.4 + 9.8784 = 15.2784$ (J)	$0.5508 + 1.008 = 1.5588$ (kgf·m)
④ $We =$	$\frac{15.2784}{0.5 \times 0.6^2} = 85$ (kg)	$\frac{1.5588}{0.051 \times 0.6^2} = 85$ (kgf)
⑤ $ET =$	$15.2784 \times 20 = 305.568$ (J/min)	$1.5588 \times 20 = 31.176$ (kgf·m/min)

Model selected : FSA-2016BB1、FSA-2016CC1

Condition

m : Mass of colliding objects	kg	θ : Angle of inclination	degree
W : Load of colliding objects	[kgf]	d : Diameter	m
V : Collision velocity	m/s	w : Rotational angular speed	rad/s
F : Thrust	N[kgf]	R : Mounting distance	m
n : Operation frequency	cycle/min	g : Gravitational acceleration	9.8m/s ² [G]
S : Stroke	m	I : Moment of inertia	N·m ² [kgf·m·s ²]
L : Height of falling	m		

• When cuboid has small descending friction and collision



Basic formula

Item	SI Unit	Conventional Unit
① Potential energy of mass for the collision objects E ₁ =	m·g·L·sinθ (J)	W·L·sinθ (kgf·m)
② Additional energy E ₂ =	m·g·S·sinθ (J)	W·S·sinθ (kgf·m)
③ Total energy E=	E ₁ +E ₂ (J)	E ₁ +E ₂ (kgf·m)
④ Collision velocity V=	$\sqrt{2 \cdot g \cdot L \cdot \sin\theta}$ (m/s)	$\sqrt{2 \cdot g \cdot L \cdot \sin\theta}$ (m/s)
⑤ Equivalent mass (load) We=	$\frac{E}{0.5 \cdot V^2}$ (kg)	$\frac{E}{0.051 \cdot V^2}$ (kgf)
⑥ Total collision energy per minute Et=	E·n (J/min)	E·n (kgf·m/min)

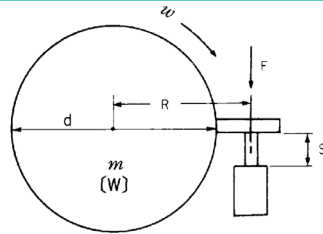
Calculation sample

m=60kg [W=60kgf] L=1m $\theta=2^\circ$
 n=10 cycle/min S=16X10⁻³m

Item	SI Unit	Conventional Unit
① E ₁ =	60×9.8×1×sin2° = 20.52 (J)	60×1×sin2° = 2.094 (kgf·m)
② E ₂ =	60×9.8×16×10 ⁻³ ×sin2° = 0.328 (J)	60×16×10 ⁻³ ×sin2° = 0.034 (kgf·m)
③ E =	20.52+0.328 = 20.848 (J)	2.094+0.034 = 2.128 (kgf·m)
④ V =	$\sqrt{2 \times 9.8 \times 1 \times \sin^2 2^\circ}$ = 0.827 (m/s)	$\sqrt{2 \times 9.8 \times 1 \times \sin^2 2^\circ}$ = 0.827 (m/s)
⑤ We =	$\frac{20.848}{0.5 \times 0.827^2} = 61$ (kg)	$\frac{2.128}{0.051 \times 0.827^2} = 61$ (kgf)
⑥ Et =	20.848×10 = 208.48 (J/min)	2.128×10 = 21.28 (kgf·m/min)

Model selected : FSA-2016BB1、FSA-2016CC1

• Horizontal rotating collision(disc)



Basic formula

Item	SI Unit	Conventional Unit
① Velocity before collision V=	R·w (m/s)	R·w (m/s)
② Kinetic energy of w E ₁ =	$\frac{1}{2} \cdot I \cdot w^2$ = $\frac{1}{2} \cdot m \cdot \frac{d^2}{8} \cdot w^2$ (J)	$\frac{1}{2} \cdot I \cdot w^2$ = $\frac{1}{2} \cdot \frac{W}{g} \cdot \frac{d^2}{8} \cdot w^2$ (kgf·m)
③ Additional energy E ₂ =	F·S (J)	F·S (kgf·m)
④ Total energy E=	E ₁ +E ₂ (J)	E ₁ +E ₂ (kgf·m)
⑤ Equivalent mass (load) We=	$\frac{E}{0.5 \cdot V^2}$ (kg)	$\frac{E}{0.051 \cdot V^2}$ (kgf)
⑥ Total collision energy per minute Et=	E·n (J/min)	E·n (kgf·m/min)

Calculation sample

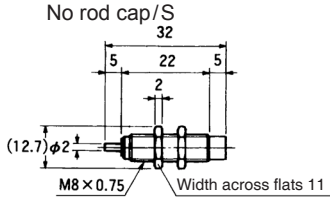
m=1kg [W=1kgf] d=2m F=78.4N [F=8kgf]
 w=0.6 rad/s R=1.25 n=20 cycle/min S=16X10⁻³m

Item	SI Unit	Conventional Unit
① V =	1.25×0.6= 0.75 (m/s)	1.25×0.6= 0.75 (m/s)
② E ₁ =	$\frac{1}{2} \times 1 \times \frac{2^2}{8} \times 0.6^2$ = 0.09 (J)	$\frac{1}{2} \times \frac{1}{9.8} \times \frac{2^2}{8} \times 0.6^2$ = 0.009 (kgf·m)
③ E ₂ =	78.4×12×10 ⁻³ = 0.94 (J)	8×12×10 ⁻³ = 0.096 (kgf·m)
④ E =	0.09+0.94=1.03 (J)	0.009+0.096 = 0.105 (kgf·m)
⑤ We =	$\frac{1.03}{0.5 \times 0.75^2} = 3.7$ (kg)	$\frac{0.105}{0.051 \times 0.75^2} = 3.7$ (kgf)
⑥ Et =	1.03×20= 20.6 (J/min)	0.105×20 = 2.1 (kgf·m/min)

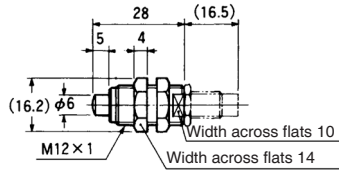
Model selected : FSA-1210AA1、FSA-1210BB1

FSA-0805AA

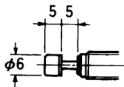
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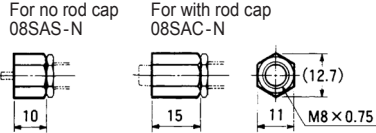
Adaptor for slant angle/0805SA-A



With rod cap/C

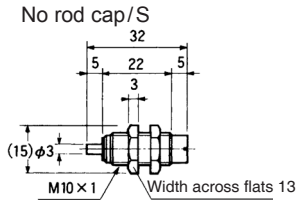


Stopper nut

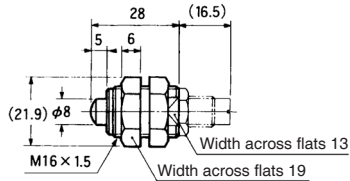


FSA-1005AA

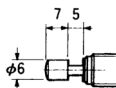
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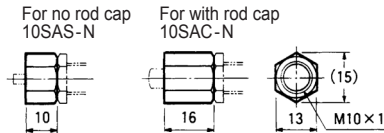
Adaptor for slant angle/1005SA-A



With rod cap/C

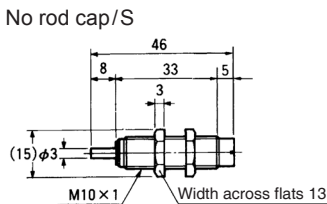


Stopper nut

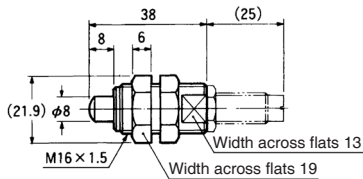


FSA-1008AA

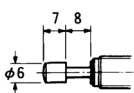
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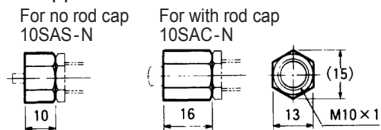
Adaptor for slant angle/1008SA-A



With rod cap/C



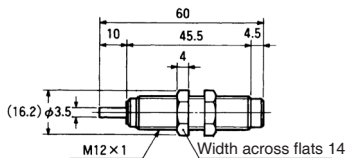
Stopper nut



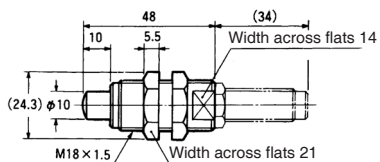
FSA-1210AA

(Unit : mm)

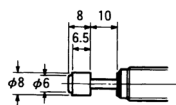
No rod cap/S



Adaptor for slant angle/1210SA-A



With rod cap/C

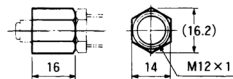


Stopper nut

For no rod cap
12SAS-N



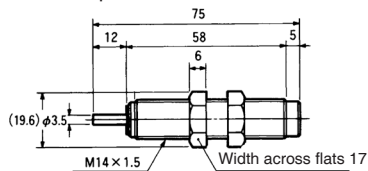
For with rod cap
12SAC-N



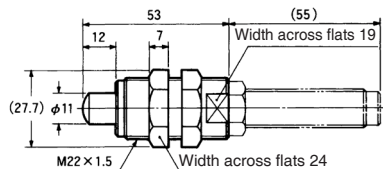
FSA-1412AC

(Unit : mm)

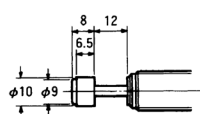
No rod cap/S



Adaptor for slant angle/1412SA-A

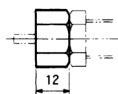


With rod cap/C

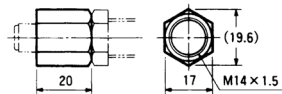


Stopper nut

For no rod cap
14SAS-N



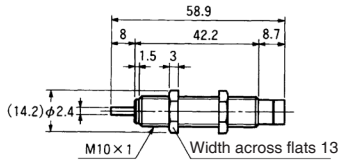
For with rod cap
14SAC-N



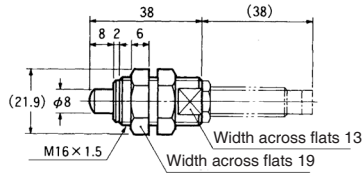
FSA-1008BB, FSA-1008CC, FSA-1008CD

(Unit : mm)

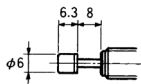
No rod cap/S



Adaptor for slant angle/1008SA-A



With rod cap/C

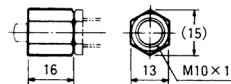


Stopper nut

For no rod cap
10SAS-N



For with rod cap
10SAC-N

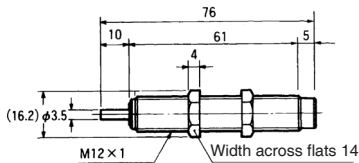


SA, SAE Series

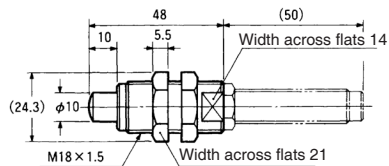
FSA-1210BB, FSA-1210CC, FSA-1210CD

(Unit : mm)

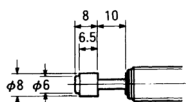
No rod cap/S



Adaptor for slant angle/1210SA-A



With rod cap/C

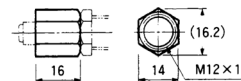


Stopper nut

For no rod cap
12SAS-N



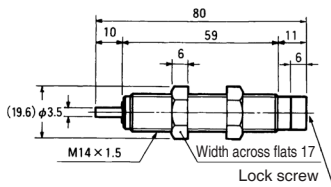
For with rod cap
12SAC-N



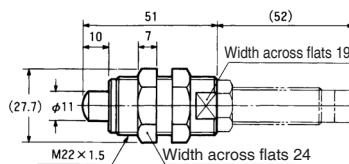
FSA-1410BB, FSA-1410CC, FSA-1410CD

(Unit : mm)

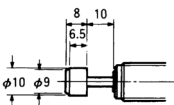
No rod cap/S



Adaptor for slant angle/1410SA-A

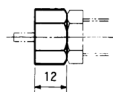


With rod cap/C

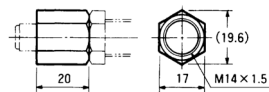


Stopper nut

For no rod cap 14SAS-N



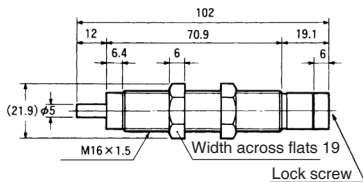
For with rod cap 14SAC-N



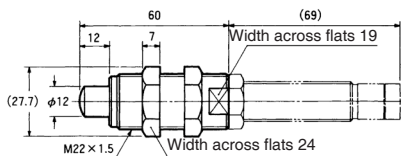
FSA-1612BB, FSA-1612CD

(Unit : mm)

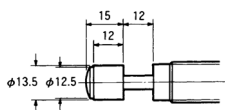
No rod cap/S



Adaptor for slant angle/1612SA-A

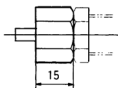


With rod cap/C

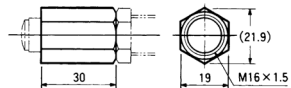


Stopper nut

For no rod cap 16SAS-N



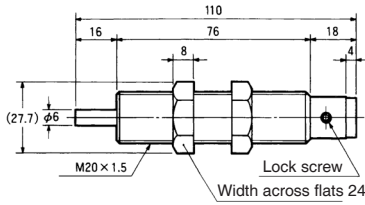
For with rod cap 16SAC-N



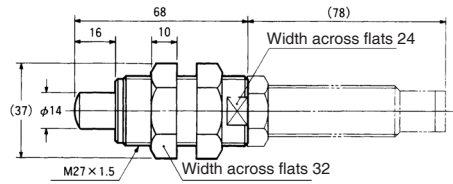
FSA-2016BB, SA-2016CC, SA-2016CD

(Unit : mm)

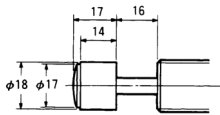
No rod cap/S



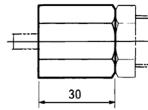
Adaptor for slant angle/2016SA-A



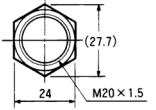
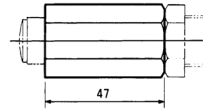
With rod cap/C



Stopper nut
For no rod cap
20SAS-N

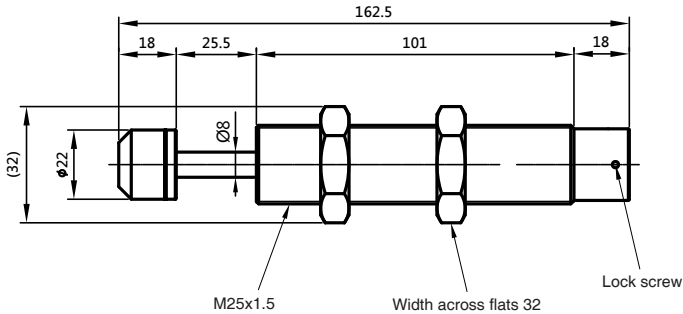


For with rod cap
20SAC-N



FSA-2525CD

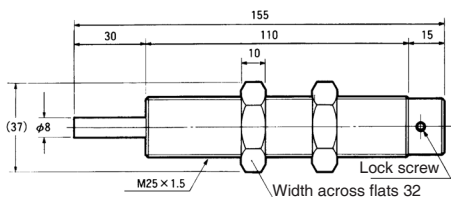
(Unit : mm)



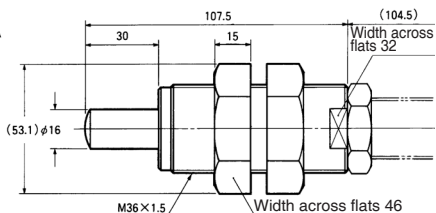
FSA-2530BB, FSA-2530CC, FSA-2530CD

(Unit : mm)

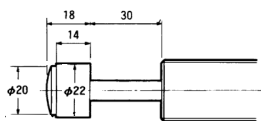
No rod cap/S



Adaptor for slant angle/2530SA-A



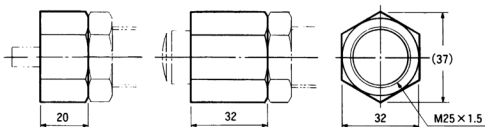
With rod cap/C



Stopper nut

For no rod cap
25SAS-N

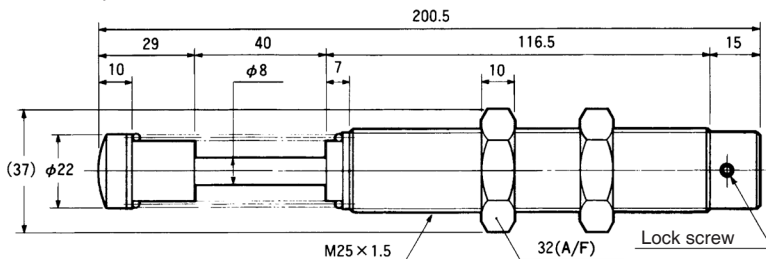
For with rod cap
25SAC-N



FSA-2540BB, FSA-2540CC, FSA-2540CD

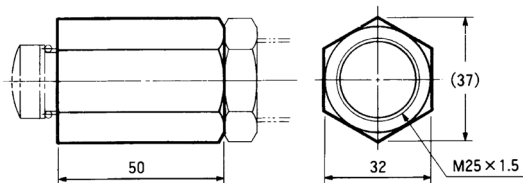
(Unit : mm)

No rod cap/C



Stopper nut

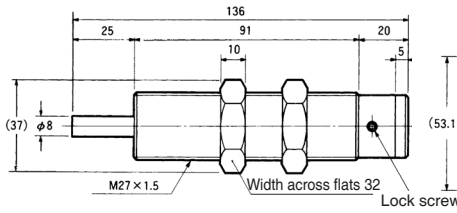
For no rod cap/25SAC-N4



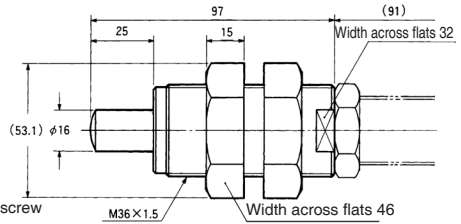
FSA-2725BB, FSA-2725CC, FSA-2725CD

(Unit : mm)

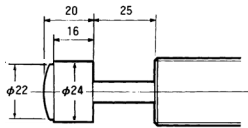
No rod cap/S



Adaptor for slant angle/2725SA-A

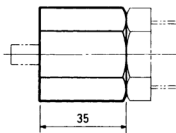


With rod cap/C

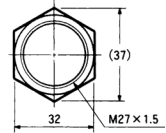
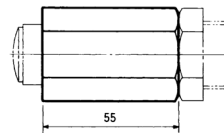


Stopper nut

For no rod cap
27SAS-N



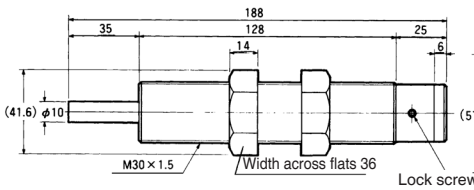
For with rod cap
27SAC-N



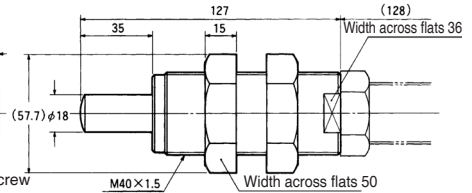
FSA-3035CC, FSA-3035CD

(Unit : mm)

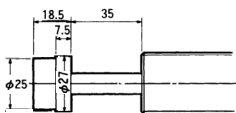
No rod cap/S



Adaptor for slant angle/3035SA-A



With rod cap/C

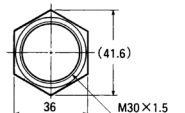
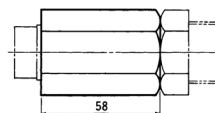


Stopper nut

For no rod cap
30SAS-N



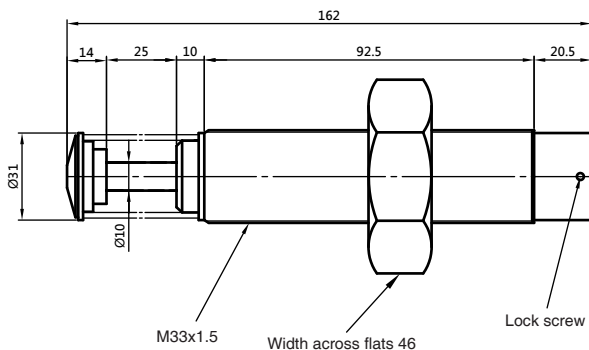
For with rod cap
30SAC-N



FSA - 3325CD

(Unit : mm)

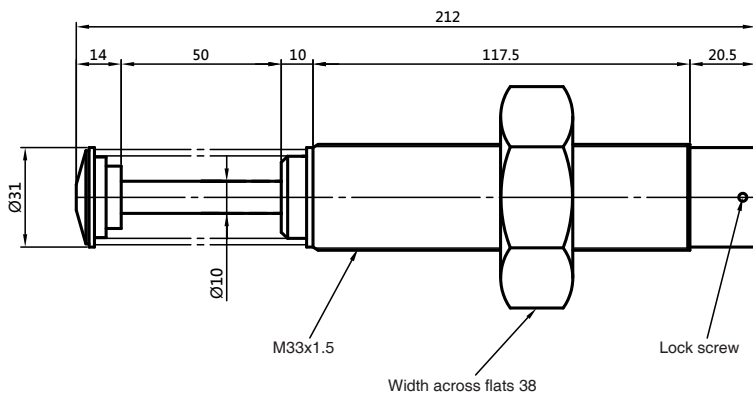
With rod cap/C



FSA - 3350CD

(Unit : mm)

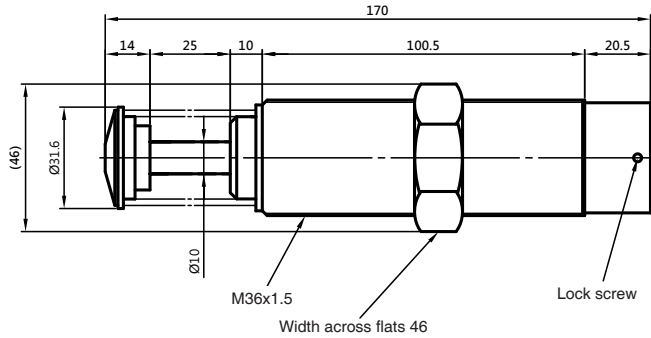
With rod cap/C



FSA - 3625CD

(Unit : mm)

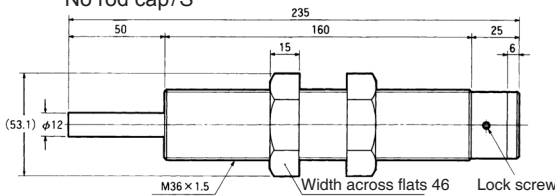
With rod cap/C



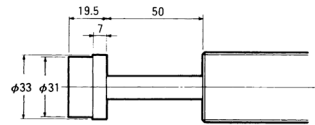
FSA - 3650CC

(Unit : mm)

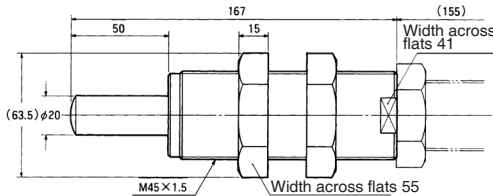
No rod cap/S



With rod cap/C

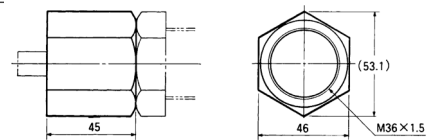


Adaptor for slant angle/3650SA-A

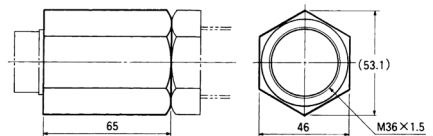


Stopper nut

For no rod cap
36SAS-N

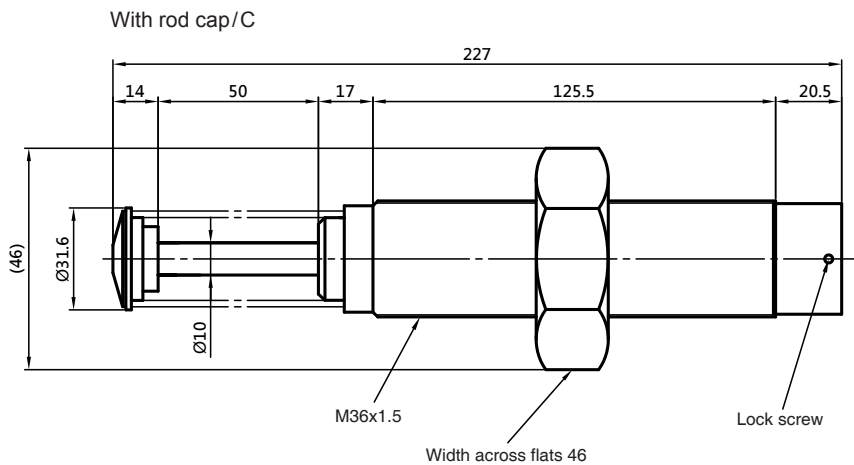


For with rod cap
36SAC-N



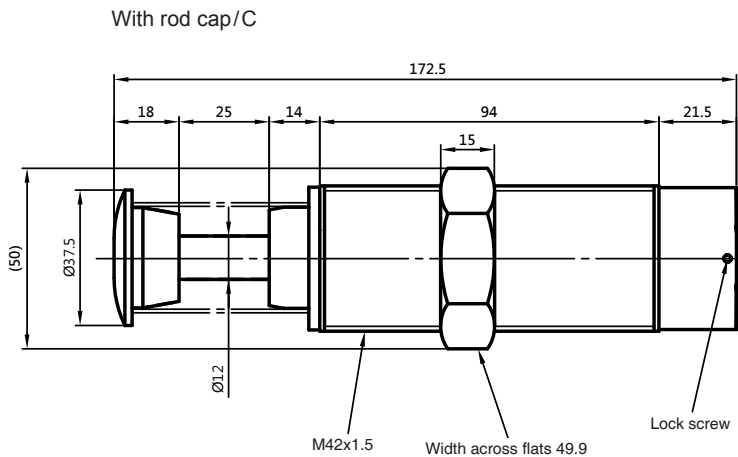
FSA-3650CD

(Unit : mm)



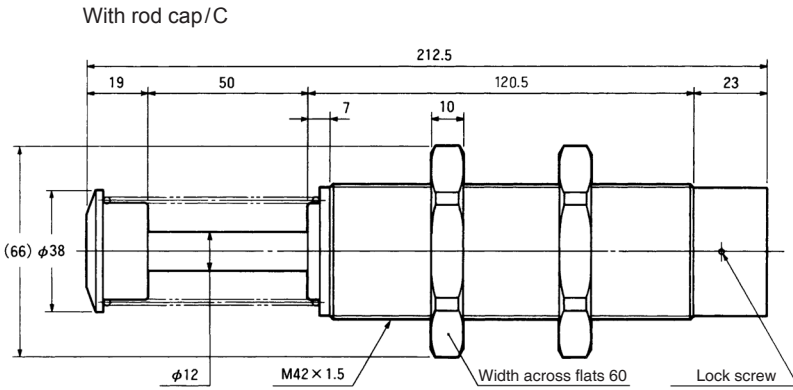
FSA-4225CD

(Unit : mm)



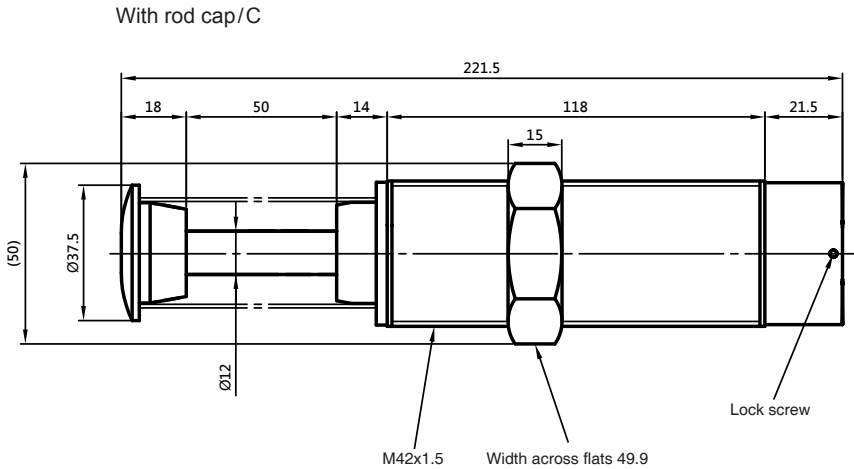
FSA-4250CC

(Unit : mm)



FSA-4250CD

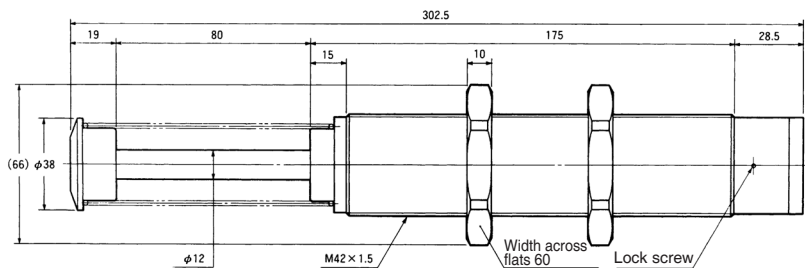
(Unit : mm)



FSA-4280CC, FSA-4280CD

(Unit : mm)

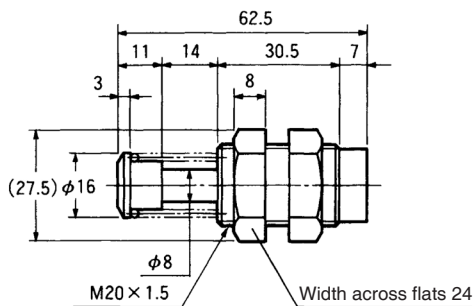
With rod cap/C



FSAE-2010

(Unit : mm)

With rod cap/C



FSAE-3020

(Unit : mm)

With rod cap/C

