

Shock Absorbers - Oil Type

Overview

Shock Absorbers - Oil Type

For this system, oil is mainly utilized. Compared with other cushioning materials (rubber, spring, air etc.), they are compact and capable of repeatedly absorbing large impact energy softly without rebound. Internal structure and basic principle of oil type shock absorbers are shown as follows.

When an object collides with a piston rod, the oil in the pressure chamber is compressed by a piston.

The clearance between inner tube and piston is so small that compressed oil is forced out of the orifices. At this point, the impact energy is converted into heat energy by dynamic resistance.

The piston rod sinks into the shock absorber body so that the oil equal in volume to the piston moves into the accumulator.

This mechanism provides an ideal shock absorbing action.

Various absorption characteristics can be obtained depending on the number and size of orifices. (Refer to classification according to absorption characteristics structures on P372.)

Please note that when the wrong collision speed is selected, some abnormal reaction may occur during collision or the impact energy may not be absorbed in an ideal manner.

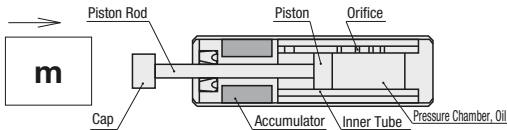
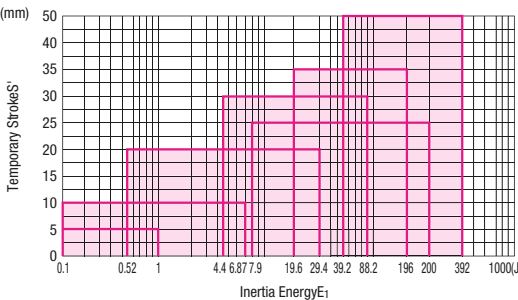


Fig. 1 Calculate the temporary stroke S' with the Inertial Energy E₁. (Adjustable / Fixed Force Type)



Procedure of Selection

① Calculation of Inertial Energy (E₁)

According to examples of calculation for selection, calculate inertial energy based on collision mass (m), collision velocity (V), moment of inertia (I) and collision angular velocity (ω).

② Temporary Decision of Absorber Stroke

Obtain the temporary stroke (S') based on Fig. 1.

③ Calculation of Additional Energy (E₂)

Confirm whether there is propulsion (F) or not and calculate the additional energy according to examples of calculation for selection.

④ Calculation of Total Energy

Calculate the total energy from the sum of inertial energy (E₁) and additional energy (E₂).

⑤ Check Equiv. Mass

According to examples of calculation for selection, calculate the equivalent mass and confirm whether it is less than the max. equivalent mass in the catalog (me').

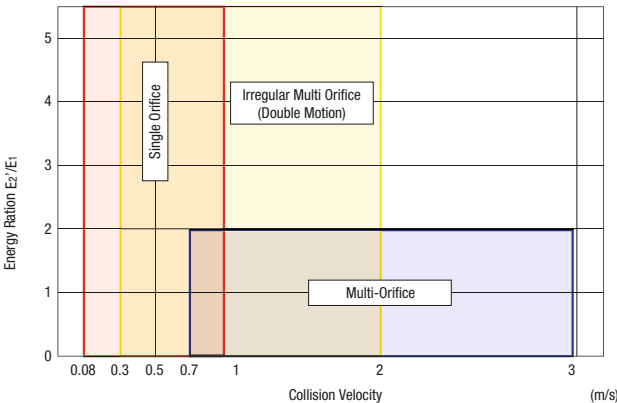
⑥ Select Absorption Characteristics Structures from Energy Ratio.

Select an orifice type from Fig. 2 temporarily.

⑦ Check Max. Absorbed Energy per Minute

Calculate the energy corresponding to one minute (E_T) from the operating cycle (time/min) and total energy, and confirm whether or not the value is within the operating range.

Fig. 2 Select the orifice type from energy ratio (additional energy E₂' / inertial energy E₁)



❗ For Single, Irregular Multi, Multi Orifice Types, these are the values of Adjustable / Fixed Types.

* If both Single Orifice and Multi-Orifice are applicable, select irregular Multi-Orifice.

* If both Irregular Multi-Orifice and Multi-Orifice are applicable, select Multi-Orifice.

* For Speed S Type, the collision velocity is 0.08 ~ 0.5m/s.

Examples of Calculation for Selection	Ex.) Pure Inertial Collision (Horizontal Collision without Thrust Force)	Ex.) Horizontal Collision with Air Cylinder Thrust Force	Ex.) Soft Stop in the Cylinder Falling
Example and Collision Conditions	 <Collision Conditions> m=25kg V=0.6m/s F=0N N=30 times/min	 Air Cylinder I.D. 040 Operating Pressure 0.5MPa <Collision Conditions> m=30kg V=0.6m/s N=20 times/min	 Air Cylinder I.D. 025 Operating Pressure 0.5MPa <Collision Conditions> m=15kg V=0.2m/s N=10 times/min
Collision Velocity V[m/s]	V=0.6m/s	V=0.6m/s	V=0.2m/s * Collision velocity V is actual measurements or 1.5 ~ 2 times the average speed.
Inertial Energy E₁ [J]	$E_1 = \frac{mV^2}{2} = \frac{25 \times 0.6^2}{2} = 4.5J$	$E_1 = \frac{mV^2}{2} = \frac{30 \times 0.6^2}{2} = 5.4J$	$E_1 = \frac{mV^2}{2} = \frac{15 \times 0.2^2}{2} = 0.3J$
Temporary Stroke S'[mm]	From Fig. 1, S'=20mm (Select Adjustable Type)	From Fig. 1, S'=15mm (Select Adjustable Type)	From Fig. 1, S'=10mm (Select Adjustable Type)
Additional Energy E₂' [J]	E ₂ '=0J	Thrust of the cylinder is F=628.4N E ₂ '=FxS'=628.4x0.015=9.4J	Thrust of the cylinder is F=245.4N E ₂ '=(F+mg)xS'=(245.4+15x9.8)x0.01=3.92J
Total Energy E'[J]	E'=E ₁ +E ₂ '=4.5+0=4.5J	E'=E ₁ +E ₂ '=5.4+9.4=14.8J	E'=E ₁ +E ₂ '=0.3+3.92=4.22J
Equiv. Mass me' [kg]	$me' = \frac{2xE'}{V^2} = \frac{2 \times 4.5}{0.6^2} = 25kg$	$me' = \frac{2xE'}{V^2} = \frac{2 \times 14.8}{0.6^2} = 82.2kg$	$me' = \frac{2xE'}{V^2} = \frac{2 \times 4.22}{0.2^2} = 211kg$
Temporary Selection	Select Adjustable Type Select L from the collision velocity. Select MAC1612 from E' and me'. (Stroke S=12mm)	Select Adjustable Type Select medium speed M from the collision velocity. Select MAC2016M from E' and me'. (Stroke S=16mm)	Select Adjustable Type Select ultra low speed S from Fig. 2. Select MAC1612S from E' and me'. (Stroke S=12mm)
Recalculation	E ₂ =0J E=E ₁ +E ₂ =4.5J me= $\frac{2xE}{V^2} = 25kg$	E ₂ =FxS=10.1J E=E ₁ +E ₂ =15.5J me= $\frac{2xE}{V^2} = 86.1kg$	E ₂ =(F+mg)xS=4.71J E=E ₁ +E ₂ =0.3+4.71=5.01J me= $\frac{2xE}{V^2} = 250kg$
Energy per Minute E_T	E _T =ExN=4.5x30=135J/min	E _T =ExN=15.5x20=310J/min	E _T =ExN=5.01x10=50.1J/min
Confirmation	E, me, N and E _T are OK. Select MAC1612L	E, me, N and E _T are OK. Select MAC2016M	E, me, N and E _T are OK. Select MAC1612S

* For horizontal collision without thrust force, select the Orifice Type only by collision velocity.

	Ex.) Horizontal Collision with Belt Conveyor Thrust Force	Ex.) Collision with Synchronous Motor Driven Load	Ex.) Horizontal Rotary Collision with Torque
Example and Collision Conditions	 Dynamic Friction Coefficient μ=0.4 <Collision Conditions> m=5kg V=0.5m/s N=20 times/min	 Motor Output P=20W, Number of Poles M=36 Power Supply Frequency f=50Hz, Deceleration Ratio K=20 <Collision Conditions> m=1kg R=0.4m r=0.3m θ=20° N=10 times/min I=4.3 3mF=0.12kg·m² ω=5.8rad/s F=59.3N	 <Collision Conditions> I=125.5kg·m² ω=1.8rad/s R=1.25m N=6 times/min T=68.6N·m
Collision Velocity V[m/s]	V=0.5m/s	V=Rω=0.4x5.6=2.24m/s	V=Rω=1.25x1.8=2.25m/s
Inertial Energy E₁ [J]	$E_1 = \frac{mV^2}{2} = \frac{5 \times 0.5^2}{2} = 0.625J$	$E_1 = \frac{I\omega^2}{2} = \frac{0.12 \times 5.6^2}{2} = 1.88J$	$E_1 = \frac{I\omega^2}{2} = \frac{125.5 \times 1.8^2}{2} = 203.31J$
Temporary Stroke S'[mm]	From Fig. 1, S'=5mm (Select Fixed Force Type)	From Fig. 1, S'=10mm (Select Adjustable Type)	From Fig. 1, S'=50mm (Select Adjustable Type)
Additional Energy E₂' [J]	F=μmg=0.4x5x9.8=19.6N E ₂ '=F·S'=19.6x0.005=0.098J E'=E ₁ +E ₂ '=0.625+0.098=0.723J	E ₂ '=(F+mg)xS'=(59.3+1x9.8)x0.01=0.69J E'=E ₁ +E ₂ '=1.88+0.69=2.57J	E ₂ '= $\frac{T}{R} \cdot S' = \frac{68.6}{1.25} \times 0.05 = 2.74J$ E'=E ₁ +E ₂ '=203.31+2.74=206.05J
Equiv. Mass me' [kg]	$me' = \frac{2xE'}{V^2} = \frac{2 \times 0.723}{0.5^2} = 5.8kg$	$me' = \frac{2xE'}{V^2} = \frac{2 \times 2.57}{2.24^2} = 1.0kg$	$me' = \frac{2xE'}{V^2} = \frac{2 \times 206.05}{2.25^2} = 81.4kg$
Temporary Selection	Select Fixed Force Type Select Single Orifice from V Select MAK1005B from E' and me'. (Stroke S=5mm)	Select Adjustable Type Select Multi-Orifice from Fig. 2. Select MAC1210H from E' and me'. (Stroke S=10mm)	Select Adjustable Type Select Speed H Type from Fig. 2. Select MAC3650H from E' and me'. (Stroke S=50mm)
Recalculation	E ₂ =E ₂ '=0.098J E=E ₁ +E ₂ =0.723J me= $\frac{2xE}{V^2} = 5.8kg$	E ₂ =0.69J E=E ₁ +E ₂ =2.57J me=1.0kg	E ₂ = $\frac{T}{R} \cdot S = 2.74J$ E=E ₁ +E ₂ =206.05J me= $\frac{2xE}{V^2} = 81.4kg$
Energy per Minute E_T	E _T =ExN=0.723x20=14.46J/min	E _T =ExN=2.57x10=25.7J/min	E _T =ExN=206.05x6=1236.3J/min
Confirmation	E, me, N and E _T are OK. Select MAK1005B	E, me, N and E _T are OK. Select MAC1210H	E, me, N and E _T are OK. Select MAC3650H

Shock Absorbers (P373~378) Classification according to absorption characteristics structures

Structure	Adjustable *	Fixed Force Type
Single Orifice	S Type A Type B Type L Type	 Single orifice structure has the same resistance properties as forms of a dashed pot structure with a space between the piston and cylinder tube, a single tube structure with an orifice in the piston, and a double tube single orifice structure. Ex. Description of a Single Tube Structure A piston with a single orifice slides into an oil-filled cylinder tube. Because the orifice area is constant over the entire stroke, as the shock absorption characteristics shown in the right graph, the resistance is the largest immediately after a collision but gradually reduces speed as the stroke continues.
Irregular Multi Orifice	Medium Speed M Type	 In this double-tube structure, the piston slides in the inner tube. This inner tube has several orifices along the direction of strokes, and not only constant energy but energy depending on various purposes can be absorbed. It is designed to absorb kinetic energy during the first half of stroke and control speed during the second half. Therefore, it is well suited to absorb energy against air cylinder thrust.
Multi Orifice	High Speed H Type	 In this double-tube structure, the piston slides in the inner tube. This inner tube has several orifices along the direction of strokes. Because the orifice area becomes small gradually as the stroke speed slows down, drag remains largely constant, though the drag fluctuates like a ripple.

❗ * Adjustable Type No.0806M is single orifice structure and No.3625L Type is multi-orifice structure.

Shock Absorbers

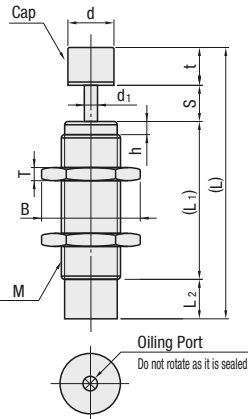
Fixed Force Type

Similar Products Comparison Point | RoHS Compliant Replacement Interval (cycle): 1,000,000 cycles



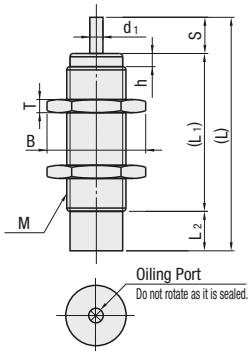
RoHS

MAKC
(Cap)



Oiling Port
Do not rotate as it is sealed.

MAKS
(No Cap)



Oiling Port
Do not rotate as it is sealed.

For parallel use of more than 2 pieces, be sure to use the same type and install them to receive the shock equally.

Operating Ambient Temperature: -5 ~ 70°C

Fully threaded if there is no h dimensions in the specification table.

Replace after 1,000,000 cycles.

No.	M Material (Main Body)	S Surface Treatment
0404	EN 1.4305 Equiv.	-
0604	EN CW614N Equiv.	-
0805	EN CW614N Equiv.	-
1005	Free Cutting Steel	Electroless Nickel Plating
1008	Free Cutting Steel	Electroless Nickel Plating
1210	Free Cutting Steel	Electroless Nickel Plating
1412	Free Cutting Steel	Electroless Nickel Plating
1612	Free Cutting Steel	Electroless Nickel Plating
2016	Free Cutting Steel	Electroless Nickel Plating
2022	Free Cutting Steel	Electroless Nickel Plating
2530	EN 1.0038 Equiv.	-
2725	EN 1.0038 Equiv.	-
3035	EN 1.0038 Equiv.	-
Cap	Polycetal Only 2022 is urethane rubber.	-

Part Number			Thread	Stroke	Max. Absorbed Energy (E)		Max. Equiv. Mass (me)	Piston Rod Return Force (N)	Max. Drag Value (N)	(L)	(L1)	L2	d	d1	t	B (Wrench Flats)	T	h	MAKC		MAKS	
Type	No.	Velocity	Dia. M	S	per Impact (J)	per Minute (J)	(kg)												Unit Price	Volume Discount Rate	Unit Price	Volume Discount Rate
																			1 ~ 4 pcs	5 ~ 30 pcs	1 ~ 4 pcs	5 ~ 20 pcs
MAKC (Cap)	0404	A	M4 x 0.5	4	0.1	4.5	1	2.5 or Less	214	32.6 (28.6)	20.1		3	1.2		8.1 (7)	2					
		B			0.3	13.5	3															
	0604	A	M6 x 0.75	4	0.1	4.5	1	3 or Less	363	33 (29)	20.5	4.5	4.6	1.8	4	9.2 (8)	2	0.5				
		B			0.3	13.5	2															
	0805	A	M8 x 0.75	5	0.39	17.6	3	4.9 or Less	490	37 (32)	22		2	5	12.7 (11)	2						
		B			0.68	22.5	5		588	39 (32)												
	1005	A	M10 x 1.0	8	0.98	41.1	8	5.88 or Less	735	53 (46)	33	6	3	7	14.2 (13)	3	1.5					
		B					7			55 (48)	34.5	5.5										
	1008	A	M10 x 1.0	8	1.47	58.8	20	4.9 or Less	1078	55 (48)												
		B					6															
	1210	A	M12 x 1.0	10	1.96	98	15		1470	68 (60)	45	5				16.2 (14)	4	1.5				
		B					30	9.8 or Less		71 (63)	47.5		3.5	8								
MAKS (No Cap)	1412	L	M14 x 1.5	12	9.8	176	75	8.9 or Less	2156	78 (70)	52.5	5.5	10			19.6 (17)	6					
		H					8															
	1612	L	M16 x 1.5	12	14.7	235	110	9.8 or Less	2940	90 (75)	57.5		13.5	5	15	20 (19)	6					
		H					30															
	2016	L	M20 x 1.5	16	29.4	343	230	18.1 or Less	3528	110 (93)	63				17	27.7 (24)	8	-				
		H					60															
	2022	L	M20 x 1.5	22	44.1	392	73	39.2 or Less	3920	126.5 (112)	76		14	18	6	14.5	8					
		H					15															
	2530	L	M25 x 1.5	30	88.2	490	390	29.4 or Less	6370	158 (140)	95		22		18	37 (32)	10					
		H					175															
	2725	L	M27 x 1.5	25	79	539	420	27.3 or Less	6370	137.5 (117.5)	77.5		15	8								
		H					75															
3035	M	L	M30 x 1.5	35	196	1176	1560	47.1 or Less	14700	190 (171.5)	116.5	20	27	10	18.5	41.6 (36)	14					
		H					390															

L dimension values in () are for MAK5. kgf·m=Jx0.101972 kgf=Nx0.101972

Collision Velocity Type	Collision Velocity Range	Max. Operating Cycle
A	0.3~1m/s	60cycle/min *
B		
L	0.3~2m/s	
Medium Speed M	0.3~2m/s	
High Speed H	0.3~3m/s	

* No.0404, 0604 and 0805 are 45cycle/min; No.3035 is 30cycle/min.

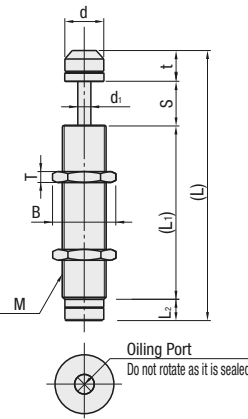
Shock Absorbers

Fixed Force Type

Similar Products Comparison Point | Not RoHS Compliant Replacement Interval (cycle): 700,000 cycles

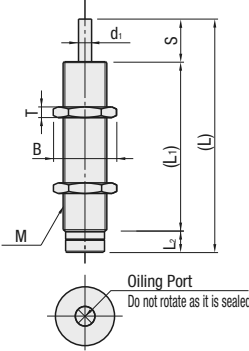


C-MAKC
(Cap)



Oiling Port
Do not rotate as it is sealed.

C-MAKS
(No Cap)



Oiling Port
Do not rotate as it is sealed.

Operating Ambient Temperature: -5 ~ 70°C

In No. 0806, 1005 and 1008, base surface is of minus slot-type.

Keep the distance between location point of the shock absorber and the Fulcrum more than 6 times of stroke of absorber to ensure that shock absorber does not put stress on the side, in case of rotational load. Also, absorbed energy is maximum when the load on the side surface is at 5° angle with the centerline of the shock absorber.

M Material		S Surface Treatment
Main Body	Cap	
EN 1.0034 Equiv.	Polyurethane	Black Oxide

Part Number			Thread	Stroke	Max. Absorbed Energy (E)		Max. Equiv. Mass (me)	(L)	(L1)	L2	d	d1	t	B (Wrench Flats)	T	C-MAKC		C-MAKS	
Type	No.	Velocity	Dia. M	S	per Impact (J)	per Minute (J)	(kg)									Unit Price	Volume Discount Rate	Unit Price	Volume Discount Rate
																1 ~ 4 pcs	5 ~ 30	1 ~ 4 pcs	5 ~ 30
C-MAKC (Cap)	0806	L	M8 x 1.0	6	0.6	36.3	1.8	50 (44)	33	5	6.6	2.8	6	11	3				
		M					0.6												
	1005	L	M10 x 1.0	5	1.2	48	0.15	38.5 (32.5)	21.5	6	8.6	2.8	6	12.7	3				
		M					2.8												
	1008	L	M10 x 1.0	8	2.4	48	1.2	57 (51)	38	5	8.6	3	6	12.7	3				
		M					0.4												
	1210	L	M12 x 1.0	10	3	42.9	7.2	69.4 (60.2)	45.5	5.7	9.5	3	9.2	14	4				
		M					2.4												
	1412	L	M14 x 1.5	12	9	161.6	1.2	100 (88)	67	9	11.8	4	12	19	6				
		M					30												
	2020	L	M20 x 1.5	20	24	280	18	145.8 (130)	101	9	18	6	15.8	26	8				
		M					6												

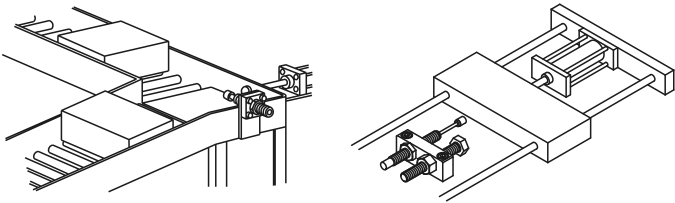
L dimension values in () are for C-MAKS.

Collision Velocity Type	Max. Collision Velocity	Operating Ambient Temperature	Replacement Interval
Low Speed L	~0.8m/s	-5~70°C	700,000 cycles
Medium Speed M	~1.5m/s		
High Speed H	~3m/s		

In No.0806, maximum collision velocity for L type is 0.5m/s, for M type it is 1.0m/s, and for H type it is 2.0m/s.

In No.2020, maximum collision velocity for L type is 1.0m/s, and for M type it is 2.0m/s.

Example



Shock Absorbers

Economy

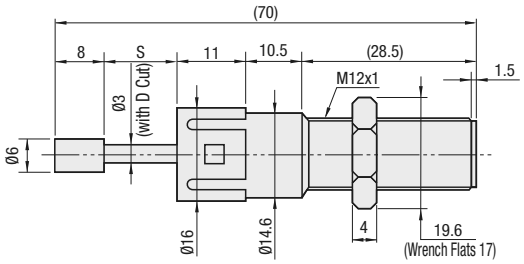
Shock Absorbers

Adjustable



RoHS

EMACN



Operating Temp. Range : -10 ~ 50°C
Durability : 500,000 times
Collision Velocity Range : No.1212A, B, C : 0.3~1.0 m/s
No.1212D : 0.1~0.7 m/s
No.1212E : 0.1~0.5 m/s
Max. Tightening Torque: 1.5N·m
(When shouldering to Ø14.6, tighten up at 1.0N/m.)

Parts	Material	Surface Treatment
Main Body	PPS	-
Cap	POM	-
Piston Rod	EN CW614N Equiv.	Electroless Nickel Plating

Accessory: Nut <Opposite Angle 19.6, Opposite Side 17>

Part Number		Cap Color	Thread Dia. M	Stroke S	Max. Absorbed Energy (E')		Max. Equiv. Mass (me') (kg)	Piston Rod Return Force (N)	Max. Drag Value (N)	Unit Price	Volume Discount Rate
Type	No.				per Impact (J)	per Minute (J)				1 ~ 4 pc(s).	5 ~ 10 pcs.
EMACN	1212A	White	M12x1	12	0.29	14.7	1.5	2.45	245		
	1212B	Black			0.49		3.0				
	1212C	Yellow			1.0	5.0	5.0		294		
	1212D	Green					7.5				
	1212E	Red					10.0				



Ordering Example

Part Number

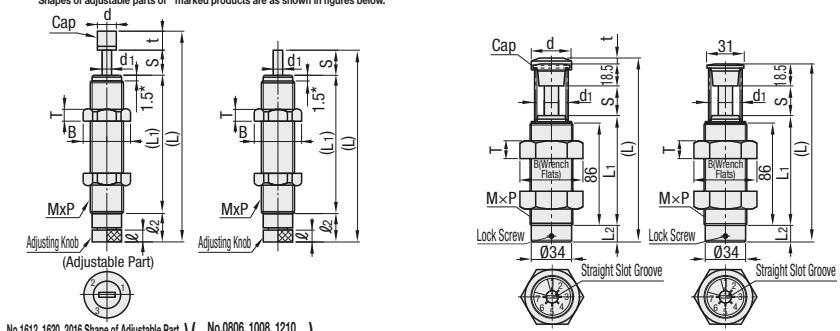
EMACN1212A



RoHS

MAC (Cap)
(No.0806*, 1008*, 1210*, 1214, 1410, 1417, 1612*, 1620*, 2016*, 2530*, 2725*, 3035*, 3650*)
Shapes of adjustable parts of * marked products are as shown in figures below.

MAS (No Cap)
(No.3625)



Operating Temp. Range : -10 ~ 50°C
Durability : 500,000 times
Collision Velocity Range : No.1212A, B, C : 0.3~1.0 m/s
No.1212D : 0.1~0.7 m/s
No.1212E : 0.1~0.5 m/s
Max. Tightening Torque: 1.5N·m
(When shouldering to Ø14.6, tighten up at 1.0N/m.)

No.	Material (Main Body)	Surface Treatment
0806	EN 1.4305 Equiv.	-
1008, 1210, 1214, 1410, 1417, 1612, 1620, 3625	Free Cutting Steel	Electroless Nickel Plating
2016, 2530, 2725, 3035, 3650	EN 1.0038 Equiv.	-
Cap	Polycetal 3035, 3625 and 3650 is urethane rubber.	-

Accessory: Nut <Opposite Angle 19.6, Opposite Side 17>

Part Number		Thread Dia. MxP	Stroke S	Max. Absorbed Energy (E') per Impact (J)	Max. Absorbed Energy (E') per Minute (J)	Max. Equiv. Mass (me') (kg)	Piston Rod Return Force (N)	Max. Drag Value (N)	(L)	(L1)	L2	ℓ	d	d1	t	B (Wrench Flats)	T	MAC Unit Price 1 ~ 4 pc(s).	MAC Volume Discount Rate 5 pcs.	MAS Unit Price 1 ~ 4 pc(s).	MAS Volume Discount Rate 5 pcs.
MAC (Cap)	0806	M8 x 0.75	6	1.4	36.7	15	9 or Less	670	58 (53)	41	6	3	6	2.5	5	12.7 (11)	2				
	1008	M10 x 1.0	8	1.02	90	10	5.88 or Less	637	65.2 (58.9)	42.2	8.7	3.5	6	2.4	6.3	14.2 (13)	3				
	1210	M12 x 1.0	10	2.94	100	30	9.8 or Less	1470	84 (76)	61	5	-	8			16.2 (14)	4				
	1214	M12 x 1.0	14	5.4	98	4	12.7 or Less	1156	92 (84)	59.5	10.5	5		3.5	8						
	1410	M14 x 1.5	10	3.62	120	30	9.8 or Less	1813	88 (80)	59	11	6	10			19.6 (17)	6				
	1417	M14 x 1.5	17	5.88	147	4.5	15.7 or Less	2646	115 (105)	77.8	10.2	5		4	10						
	1612	M16 x 1.5	12	6.3	270	50	14.7 or Less	2646	117 (102)	75.5		4.5	13.5	5	15	20 (19)	6				
	1620	M16 x 1.5	20	9.8	235	10	19.6 or Less		143 (128)	93.5											
	2016	M20 x 1.5	16	20	343	600	18.1 or Less	3528	127 (110)	76	18	4	18	6	17	27.7 (24)	8				
	2530	M25 x 1.5	30	29.4	490	300	33.2 or Less	3920	173 (155)	110	15	-	22		18						
	2725	M27 x 1.5	25	32	539	1500	27.3 or Less	6370	156 (136)	91	20		23		20	37 (32)	10				
	3035	M30 x 1.5	35	100	1176	2000	44.1 or Less	16660	206.5 (188)	128	25		27	10	18.5	41.6 (36)	14				
	3625	M36 x 1.5	25	125	1500	3500	100 or Less	25000	155 (150)	92.5	14	-	34	12	5	53.1 (46)	10				
	3650	M36 x 1.5	50	200	2352	700	68.6 or Less	23520	254.5 (235)	160	25	5	33	12	19.5		15				
				235		6700															
				392		1400															

* L Dimension values in () are for MAS.

kgf·m=Jx0.101972 kgf=Nx0.101972

Collision Velocity Type	Collision Velocity Range	Max. Operating Cycle
Ultra Low Speed S	0.08~0.5m/s	60cycle/min*
Low Speed L	0.3 ~1 m/s	
Medium Speed M	0.3 ~2 m/s	
High Speed H	0.7 ~3 m/s	



Ordering Example

Part Number

MAC1008H

* No.0806 is 45cycle/min; No.3035, 3625 and 3650 are 30cycle/min.

Eccentric Angle Adapters / Stopper Nuts for Shock Absorbers

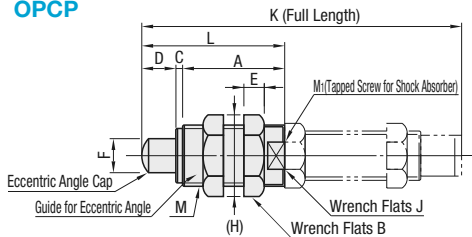
For Adjustable/Fixed Types

■ Eccentric Angle Adapters



RoHS

OPCP



Use an Eccentric Angle Adapter with the same number as the Shock Absorber.

No.	Material		Surface Treatment
	Main Body	Cap	
0805, 1005, 1008 1210, 1410, 1612	Free Cutting Steel	Polyacetal	Electroless Nickel Plating
2016, 2530 2725, 3035, 3650	Free Cutting Steel	EN 1.7242 Equiv.	Electroless Nickel Plating

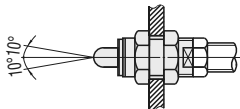
Part Number Type	No.	M1	L	A	C	D	E	F	M	Reference (H)	B	J	Reference K		Unit Price 1 ~ 4 pc(s).	Volume Discount Rate 5 pcs.
													MAS	MAKS		
OPCP	0805	M8x0.75	28	21	2	5	4	6	M12x1.0	16.2	14	10	66.5	44.5		
	1005	M10x1.0	38	28		8	6	8	M16x1.5	20.0	19	13	-	65		
	1008	M12x1.0	48	35		10	5	10	M18x1.5	24.3	21	14	97.8	82		
	1410	M14x1.5	51	38		10	7	11	M22x1.5	27.7	24	19	103	-		
	1612	M16x1.5	60	45	3	12	7	12	M22x1.5	27.7	24	19	129	102		
	2016	M20x1.5	68	49		16	10	14	M27x1.5	37	32	24	146	129		
	2530	M25x1.5	107.5	67.5		30			M36x1.5	53.1	46	32	212	198		
	2725	M27x1.5	97	62		25	15		M36x1.5	53.1	46	32	188	170		
	3035	M30x1.5	127	82		35		18	M40x1.5	57.7	50	36	255	239		
	3650	M36x1.5	167	107		50		20	M45x1.5	63.5	55	41	322	-		

■ How to Use

Note the following points when using the Eccentric Angle Adapter (for Adjustable/Fixed Types).

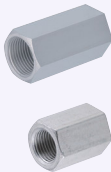
- It cannot be used for Cap Type Shock Absorbers (MAC, MAKC). Please use it for No Cap Types (MAS, MAKs).
- When installing an eccentric angle adapter on a shock absorber, screw the shock absorber to the eccentric angle adapter cap and tighten it with standard nut for shock absorbers.

Usable Max. Eccentric Angle	±10°
Replacement Interval (cycle)	1,000,000



■ Stopper Nuts for Shock Absorbers

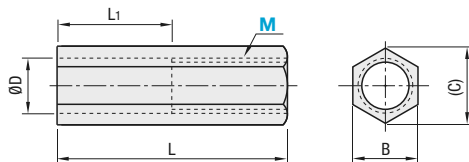
Stopper Nuts



RoHS

STNC (for Cap Type) STNS (for No Cap Type)

STNC and STNS for M36 are same products.



M	Material	Surface Treatment	Hardness
06~14 16~30 36	EN 1.1191 Equiv.	Electroless Nickel Plating Trivalent Chrome (Chromate)	- 40~47HRC -

Part Number Type	M	L		D	L1		(C)	B	M	STNC		STNS	
		STNC	STNS		STNC	STNS				Unit Price 1 ~ 4 pc(s).	Volume Discount Rate 5 pcs.	Unit Price 1 ~ 4 pc(s).	Volume Discount Rate 5 pcs.
STNC (Cap)	06	10	6	6	5	-	9.2	8	M6x0.75				
	08	15		8	6	-	12.7	11	M8x0.75				
	10	16	10	10	5	-	15	13	M10x1.0				
	12	16		12	3	-	16.2	14	M12x1.0				
	14	20	12	14	4	-	19.6	17	M14x1.5				
	16	30	15	16	11	2	21.9	19	M16x1.5				
	20	47	30	20	23	6	27.7	24	M20x1.5				
	25	32	20	25	6	-		37	M25x1.5				
	27	55	35	27	23	6			M27x1.5				
	30	58	38	30	7	7	41.6	36	M30x1.5				
STNS (No Cap)	36	45	45	38	18	18	53.1	46	M36x1.5				

■ How to Use

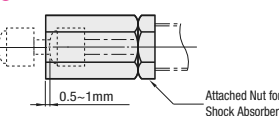
Note the following points when using Stopper Nuts (for Adjustable/Fixed Types).

•How to Attach Stopper Nuts

- For No Cap Type, put the stopper nut out forward 0.1mm ~ 1mm from the shock absorber body (cylinder) to the direction of the piston rod.
- For Cap Type, put the stopper nut out forward the cap length 0.5mm ~ 1mm from the shock absorber body (cylinder) to the direction of the piston rod.

- After installing the stopper nuts, tighten it with a Standard Nut for Shock Absorbers.

STNC and STNS is not available for EMACN.



Ordering Example

Part Number

OPCP1008
STNC12

Shock Absorbers

Compact Adjustable/Fixed Type

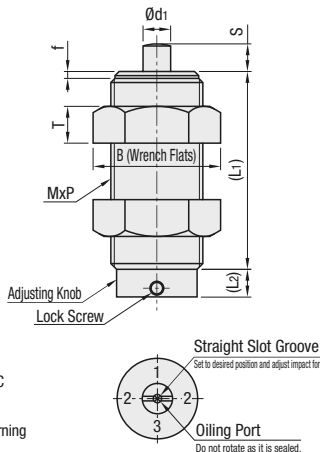
■ Features: More compact than conventional absorbers. Fits in limited spaces.

■ Compact Adjustable



RoHS

MAMS



- Operating Ambient Temperature: -5 ~ 70°C
- Collision Velocity Range: 0.3 ~ 1m/s
- Max. Operating Cycle: 60cycle/min
- Impact force can be easily adjusted by turning Straight Slot Groove.

Material: Free Cutting Steel

Surface Treatment: Electroless Nickel Plating

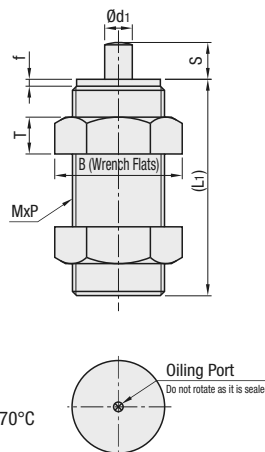
Part Number Type	No.	Thread Dia. MxP	Stroke S	Max. Absorbed Energy (E)		Max. Equiv. Mass (me)(kg)	Piston Rod Return Force (N)	Max. Drag Value (N)	(L1)	(L2)	d1	f	B (Wrench Flats)	T	Unit Price 1 ~ 4 pc(s).	Volume Discount Rate 5 ~ 10 pcs.
				per Impact (J)	per Minute (J)											
MAMS	1406	M14x1.5	6	3.5	100	80	15	2,000	41	8	4	2	19.6(17) 20(19)	6		
	1606	M16x1.5		4.8	130	120	20	2,700								
	2006	M20x1.5		7.8	200	60	16.7	3,920								
	2506	M25x1.5		11.7	300	90	19.6	5,880	43	6	8	1.5	37(32)	10		
	2706	M27x1.5		15.6	350	120	22.6	7,840								

■ Compact Fixed Type



RoHS

MAMKS



- Operating Ambient Temperature: -5 ~ 70°C
- Collision Velocity Range: 0.3 ~ 1m/s
- Max. Operating Cycle: 60cycle/min

Material: Free Cutting Steel

Surface Treatment: Electroless Nickel Plating

Part Number Type	No.	Thread Dia. MxP	Stroke S	Max. Absorbed Energy (E)		Max. Equiv. Mass (me)(kg)	Piston Rod Return Force (N)	Max. Drag Value (N)	(L1)	d1	f	B (Wrench Flats)	T	Unit Price 1 ~ 4 pc(s).	Volume Discount Rate 5 ~ 10 pcs.
				per Impact (J)	per Minute (J)										
MAMKS	1406	M14x1.5	6	4.5	100	80	15	2,000	40	4	2	19.6(17) 20(19)	6		
	1606	M16x1.5		5.5	130	120	20	2,700							
	2008	M20x1.5		8.8	200	70	14.7	3,430							
	2508	M25x1.5	8	13.7	300	110	21.6	5,390	47	8	1.5	37(32)	10		
	2708	M27x1.5		19.6	350	150	23.5	7,350							



Ordering Example

Part Number

MAMS2006
MAMKS2508

Shock Absorbers

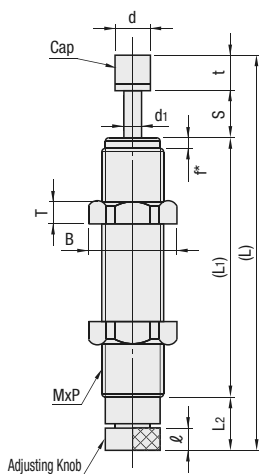
Water & Coolant Resistant Type

Shock Absorbers Water & Coolant Resistant Type

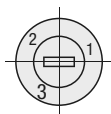


RoHS

MACC (Cap)

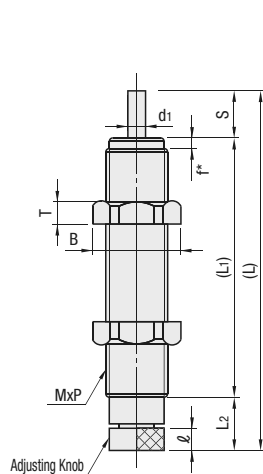


(Adjustable Part)

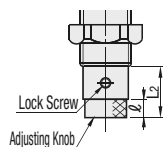


- ⚠ F is the dimension of thread dia. M14 or smaller. M16 or larger is threaded to the tip.
- ⚠ Avoid parallel use of Adjustable Type as synchronization of shock absorption characteristics is difficult.
- ⚠ Impact force can be easily adjusted by turning the adjusting knob on the bottom.
- ⚠ Operating Ambient Temperature: -5 ~ 70°C

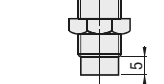
MACS (No Cap)



(No.1612, 2016 Shape of Adjustable Part)



(No.0806, 1008, 1210 Shape of Adjustable Part)



No.	Material (Main Body)	Surface Treatment
0806	EN 1.4305 Equiv.	-
1008, 1210, 1410, 1612	Free Cutting Steel	Electroless Nickel Plating
2016	EN 1.0038 Equiv.	-
Cap	Polycetal	-

Part Number			Thread Dia. MxP	Stroke S	Max. Absorbed Energy (E)		Max. Equiv. Mass (me)(kg)	Piston Rod Return Force (N)	Max. Drag Value (N)	(L)	(L1)	L2	ℓ	d	d1	t	f	B (Wrench Flats)	T	MACC		MACS	
					per Impact (J)	per Minute (J)														Unit Price	Volume Discount Rate	Unit Price	Volume Discount Rate
Type	No.	Velocity																		1 - 4 pcs	5 - 10 pcs	1 - 4 pcs	5 - 10 pcs
MACC (Cap)	0806	M	M8 x 0.75	6	1.4	36.7	15	9 or Less	670	64 (59)	47	6	3	6	2.5	5	2.3	12.7 (11)	2				
	1008	L	M10 x 1.0	8	1.47	58.8	10	9 or Less	637	79.5 (73.2)	56.7	8.5	3.5	6	2.4	6.3	1.6	14.2 (13)	3				
		H			1.76		2.5																
	1210	L	M12 x 1.0	10	2.94	98	30	13 or Less	1470	90.6 (82.6)	67.6	5	-	8	3.5	8	1.5	16.2 (14)	4				
		M			4.9		4																
	1410	L	M14 x 1.5	10	3.92	147	30	14 or Less	1813	108.2 (98.2)	77.8	10.4	5	10	4	10	1.7	19.6 (17)	6				
M		5.88			35 4.5																		
1612	L	M16 x 1.5	12	9.8	235	50	20 or Less	2646	122.7 (107.7)	81.2	14.5	4.5	13.5	5	15	-	20 (19)	6					
	M					10																	
2016	L	M20 x 1.5	16	29.4	343	300	33 or Less	3528	137 (120)	86	18	4	18	6	17	-	27.7 (24)	8					
	M					200																	
	H					120																	

⚠ L Dimension values in () are for MACS Type.

kgf · m=Jx0.101972 kgf=Nx0.101972

Collision Velocity Type	Collision Velocity Range	Max. Operating Cycle
Low Speed L	0.3~1m/s	60cycle/min*
Medium Speed M	0.3~2m/s	
High Speed H	0.7~3m/s	

* For No.0806, max. operating cycle should be 45cycle/min.



Ordering Example

Part Number
MACC1008H

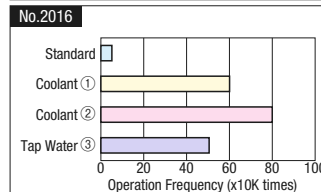
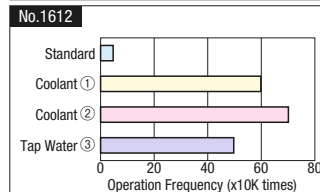
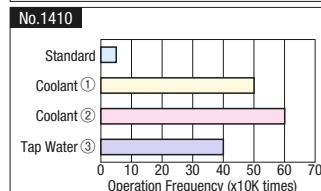
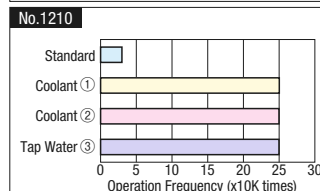
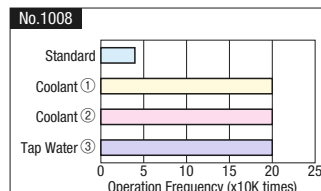
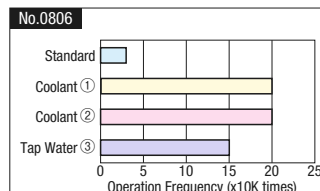
Features of Water & Coolant Resistant Type

- Having a structure of protection seals for fluid intrusions makes usable in wet conditions, suitable for machine tools and related applications.
- Replacement is possible with Standard Type since mounting O.D. screw size is the same.
- Suitable for water-soluble cutting oil A1 [JIS K2241-2000], but also available for water-insoluble cutting oil or under wet conditions. (In case of using water instead of water-soluble cutting oil, the durability may be inferior.)

Durability Test Data (Ref.)

Test Condition

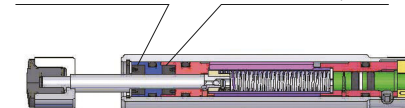
- Coolant①: JIS A1 Emulsion Water-Soluble Cutting Oil (Yushiro Chemical Industry Co., Ltd. Yushiroken FGE330 Dilution 20 times)
- Coolant②: JIS N1 Water-Insoluble Cutting Oil (Yushiro Chemical Industry Co., Ltd. Yushiro Oil CG8)
- ③: Tap Water
- Load: Ø40 Air Cylinder (Cylinder Propulsion only)
- Collision Cycle: 30/min. • Dripping: 4cc/min.



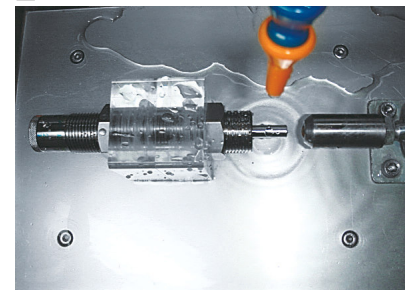
- Durability results may vary depending on each test condition. Testing fluid or volume may affect the results. Prior tests are recommended to obtain appropriate results.
- When used in environments where the piston rods are kept from fluid contacts, the internal oil may be lost by premature leakage.

Inner Structure

Protection Seals for Fluid Intrusions Protection Seals for Internal Operation Oil Loss

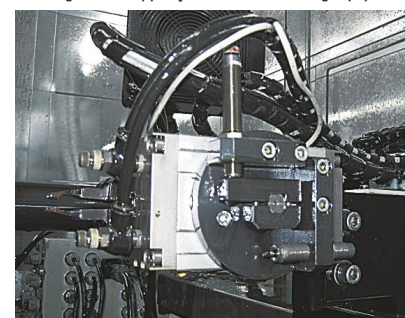


Test Scene



App. Example

Rotating Table Stopper [Dedicated Machining Equipment]



Gas Springs

Overview

Gas Springs

• High pressure gas (Nitrogen gas: non-combustible) is sealed in a cylinder, and the gas reaction force is used as spring. Because this small gas spring receive small spring constant from large initial load in spite of its size, it can be used for wide range of applications including machines, furniture, cars, office automation equipments, etc.

Features

- In spite of its size and weight, large spring (reaction) force can be obtained.
- Spring (reaction) force is almost constant throughout its stroke.
- Can be designed as required for wide applications.

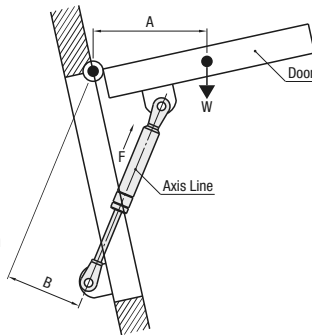
About Initial Selection

1. Calculate the necessary reaction force (F) through the following formula, then find out possible model types.

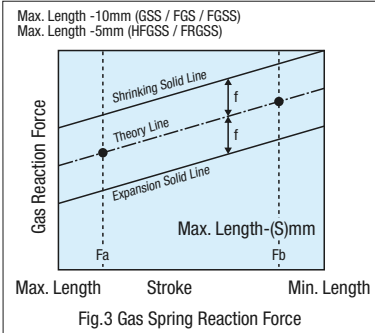
$$F = \frac{W \times A}{B}$$

F : Necessary Reaction Force (at Max. Length)
W : Weight of Doors, etc.
A : Horizontal Distance between Fulcrum (Door Hinge, etc.) and the Center of Gravity
B : Vertical Distance between Fulcrum (Door Hinge, etc.) and the Axis of Gas Spring

2. Select Fx1.1 or more for the gas spring reaction force. Gas reaction forces may vary within about $\pm 10\%$.
3. If required reaction force (Fx1.1) is larger than the reaction force at the max. length of gas spring -() mm, use 2 or more springs.
4. Reaction forces are designed at 20°C. Reaction forces increase or decrease as the temperature changes.



Gas reaction force at the max. length -10 (5) mm and the max. length -(s) mm are listed in this catalog. Gas reaction force generally changes proportionately. If the gas reaction force on a certain stroke is required, connect the 2 points with a straight line as shown in Fig. 3 and read the value on the stroke to conjecture.



f= Internal Sliding Resistance (Theoretical Value x0.1)

About Final Selection

- Load may vary depending on door angles or gas spring mounting positions. Calculate the reaction force moment based on the subject design drawing.

Precautions for Use (for FGS, GSS, FGSS, HFGSS and FRGSS)

- Pay attention to temperature of gas springs during use. Do not store for prolonged duration. It will cause premature seal deterioration and reaction force decline. (Product Temperature Range: GSS, FGSS: -20°C ~ 60°C / HFGSS: -20°C ~ 80°C / FRGSS: -30°C ~ 80°C Some products have different temperature range. Confirm on each product page.)
- Gas reaction forces are slightly different among individual products and may change depending on the temperature.
- Reaction force may decrease depending on the operating condition and times of use. Please replace it when it cannot reach the necessary reaction force.
- Do not store or use in the environments where the rod may rust, or in chemical atmosphere. Furthermore, do not paint the gas spring.
- Do not damage the cylinders and rods. If rods are wrapped with tape or plastic strings, adhesives or fibers remained on the surface will come inside, resulting in gas/oil leakage. Be sure to see if there is no rust, scratches, adhesives and foreign objects on the rod before use.
- Do not apply forces like bending load and torsion. Receiving load only with gas springs results in unbalanced load, which causes early deterioration and gas/oil leakage. For rotating motion, be sure to secure smooth sliding on the hinge. For linear motion, install a guide, etc. to prevent unbalanced load.
- Do not extend gas springs beyond its max. length. Even in the max. stroke (during compression), it must remain about 10mm away from the stroke end. Do not extend and compress at high speeds (with 1m/s or more).
- Use FGS and GSS with the cylinder side up and the rod side down, so that internal oil protects the rubber seal. For FGS, GSS and FRGSS, do not tilt more than 60 degrees. When it is necessary to temporarily store, do not tilt more than 60 degrees.
- Although there is no restriction in the use angle for the FGSS and HFGSS, rod downward is recommended.

Features of Mounting Orientation Free Gas Springs (FGSS)

Mounting Orientation Free Gas Springs

1. Nitrogen gas (non-combustible) is sealed in the gas chamber C with a free moving piston intervening, and gas reaction force is used as a spring.
2. Gas chamber C has a constant reaction force in extending direction since it pressurizes oil chamber AB. Therefore the size of reaction force depends on the inner pressure of gas chamber C.
3. When rod moves from the predetermined position, oil in chamber AB moves through orifice hole of the piston.
4. The rod volume change in the cylinder is adjusted by the change of gas chamber C.

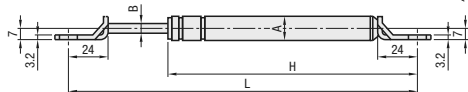
Gas Springs

Mounting Orientation Free Type

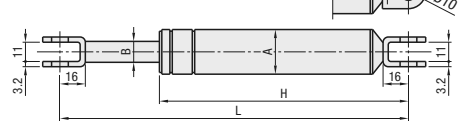


FGSS

No.15050A~No.22300B



No.27150A~No.27300B



Operating Temperature : -20 ~ 60°C
Material : EN 1.0034 Equiv. (Carbon Steel Hollows for Machine Structural Use)
Rod : EN 1.1149 Equiv. (Nitrogen Gas (N₂))
Surface Treatment : Baked Paint (Black Matt)
Rod : Hard Chrome Plating

Part Number		Max. Length Lmax	Min. Length Lmin	Stroke	Gas Reaction Force (20°C)				(S)	A	B	H	Applicable Mounting Bracket	Weight (g)	Unit Price	Volume Discount Rate	
					Lmax. -10mm Stroke		Lmax. -(S)mm Stroke								1 ~ 9 pc(s).	10~14	15~20
Type	No.				N	kgf	N	kgf									
FGSS	15050A	246	196	50	49	5	69	7	40	15	7	164	GSBR8A-S GSBR8B-S GSBR8C-S GSBR8D-S (P384)	125			
	15050K				70	7.1	90	9.1									
	15050B				98	10	127	13									
	15080A	49	5	69	7	70	218	150									
	15080B	98	10	127	13												
	15090A	49	5	69	7				80		238	155					
	15090B	98	10	127	13												
	15100A	49	5	69	7	90	254	170									
	15100B	98	10	127	13												
	18100A	196	20	255	26				18		8	253		210			
	18100B	294	30	382	39												
	18150A	196	20	265	27												
	18150B	294	30	392	40	140	343	280									
	22050A	196	20	265	27												
	22050B	294	30	402	41				40	163	215						
	22050C	392	40	529	54												
	22050D	490	50	655	66	70	217	270									
	22080A	196	20	274	28												
	22080B	294	30	412	42												
	22080C	392	40	539	55	80	237	280									
	22080D	490	50	675	68												
	22090A	196	20	265	27				90	253	305						
	22090B	294	30	402	41												
	22090C	392	40	529	54												
	22090D	490	50	659	67	110	287	320									
	22100A	196	20	274	28												
	22100B	294	30	412	42				120	307	330						
	22100C	392	40	549	56												
	22120A	196	20	274	28	140	343	400									
	22120B	294	30	402	41												
	22120C	392	40	539	55				170	397	420						
	22120D	490	50	672	68												
	22130A	196	20	274	28	190	433	480									
	22130B	294	30	402	41												
	22130C	392	40	539	55				240	467	540						
	22150A	196	20	274	28												
	22150B	294	30	402	41	290	517	600									
	22150C	392	40	539	55												
	22180A	196	20	274	28				27.4	12.5	351	GSBR8F-S (P384)		610			
	22180B	294	30	402	41	441	475	760									
22180C	392	40	539	55													
22200A	196	20	265	27	190				240	290	900						
22200B	294	30	402	41													
22200C	392	40	529	54		240	475	900									
22250A	196	20	304	31													
22250B	294	30	451	46	290				525	1000							
22250C	392	40	598	61													
22300A	196	20	323	33													
22300B	294	30	490	50	140	351	610	GSBR8F-S (P384)	760								
27150A	490	50	657	67						190	240	290	900				
27150B	588	60	784	80													
27150C	686	70	921	94	240	475	900										
27200A	490	50	657	67													
27200B	588	60	784	80				290	525	1000							
27200C	686	70	921	94													
27250A	490	50	725	74													
27250B	588	60	872	89	240	475	900	GSBR8F-S (P384)	760								
27250C	686	70	1019	104													
27300A	490	50	774	79						290	525	1000					
27300B	588	60	931	95													

For Mounting Brackets, see P.384, 385.



Ordering Example
Part Number
FGSS15050A

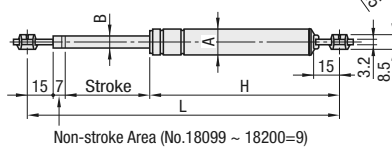
Gas Springs

Mounting Orientation Limited Type

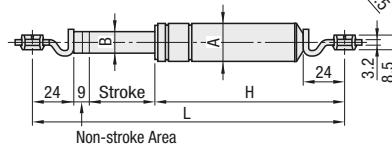


FGS

No.15049~No.18200



No.22250~No.22360



M Material

Cylinder: EN 1.0034 Equiv.
(Carbon Steel Hollows for Machine Structural Use)
Rod : EN 1.1149 Equiv.

Bushing: Polyacetal Resin (White)
Gas : Nitrogen Gas (N₂)

S Surface Treatment

Cylinder: Baked Paint (Black Matt)
Rod: Hard Chrome Plating

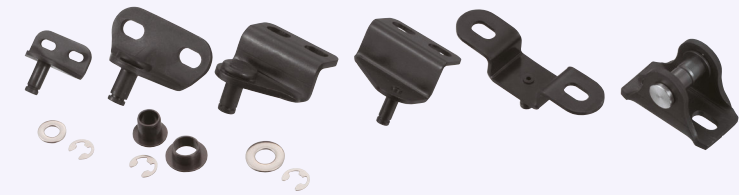
Operating Temperature: -20 ~ 60°C
For No.15049, operating temperature should be 0 ~ 60°C.

RoHS

Part Number			Max. Length	Min. Length	Stroke	Gas Reaction Force (20°C)				O.D.	Rod Dia.	H	Applicable Mounting Bracket	Weight (g)	Unit Price				
Type	No.	Reaction Force (Fa)				Lmax -10mm Stroke		Lmax - (S) in the Stroke								(S)			
						Fa	Fb												
			Lmax	Lmin	max	N	kgf	N	kgf		A	B							
FGS	15049 - 030	181	132	49	30	3.0	40	4.1	39	15	7	110	GSBR6A GSBR6B GSBR6C GSBR6D (P.384)	83					
	15049 - 055				55	6.0	71	7.2											
	15049 - 070				70	7.1	89	9.0											
	15049 - 085				85	9.0	109	11.1											
	15049 - 150	150	15.0	191	19.5														
	15069 - 050	221	152	69	50	5.0	67	6.8	59					18	8	130	96		
	15069 - 080				80	8.0	107	10.9											
	15069 - 100				100	10.2	132	13.4											
	15069 - 120				120	12.0	158	16.1											
	15089 - 070	261	172	89	70	7.0	94	9.6	79			18				8	150	109	
	15089 - 085				85	8.7	115	11.7											
	15089 - 100				100	10.0	135	13.8											
	15089 - 150				150	15.0	202	20.6											
	15089 - 200	281	182	99	200	20.0	268	27.3	89					18	8		160	116	
	15099 - 075				75	8.0	101	10.3											
	15099 - 120				120	12.0	162	16.5											
	15099 - 200				200	20.0	270	27.6											
	18099 - 300	281	184	97	300	30.5	392	39.9	110	18	8	221				183			
	18099 - 400				400	40.7	522	53.2											
	18120 - 100				100	10.0	123	13.0											
	18120 - 200				200	20.0	245	25.0											
	18120 - 300	365	245	120	300	31.0	367	37.0	140			18		8	246	205			
	18120 - 400				400	41.0	489	50.0											
	18150 - 100				100	10.0	126	12.9											
	18150 - 150				150	15.0	188	19.2											
	18150 - 200	420	270	150	200	20.0	251	25.6	190	22	12.5				301	248			
	18150 - 250				250	26.0	313	31.9											
	18200 - 100				100	10.0	127	13.0											
	18200 - 150				150	15.0	190	19.4											
	18200 - 200	525	325	200	200	20.0	253	25.8	240			22		12.5	352	409			
	18200 - 300				300	31.0	379	38.7											
	22250 - 100				100	10.0	129	13.2											
	22250 - 150				150	15.2	193	19.6											
	22250 - 200	635	385	250	200	20.0	257	26.2	260	22	12.5				367	531			
	22250 - 300				300	31.0	384	39.2											
	22250 - 400				400	41.0	511	52.1											
	22270 - 345				345	35.0	528	53.9											
	22270 - 500	670	400	270	500	51.0	763	77.9	280			10		377	556				
	22270 - 700				700	71.0	1065	108.7											
	22290 - 745				745	76.0	1160	118.4											
	22290 - 845				845	86.0	1314	134.1											
	22300 - 200	740	440	300	200	20.0	257	26.2	350	10	407			469					
	22300 - 250				250	26.0	321	32.8											
	22300 - 300				300	31.0	385	39.3											
	22360 - 215				215	22.0	284	29.0											
	22360 - 345	833	473	360	345	35.0	456	46.5											

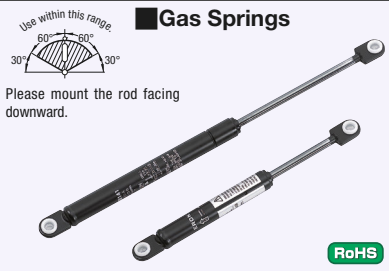
Ordering Example
Part Number: FGS15049
Reaction Force: 150

Mounting Brackets for Gas Springs



Gas Springs/Mounting Brackets for Gas Springs

Mounting Orientation Limited Type



Operating Temperature: -20 ~ 60°C

Gas Springs

Part Number		Max. Length (Lmax)	Min. Length (Lmin)	Stroke	Gas Reaction Force (20°C)		A	B	C	D	G	H	Applicable Mounting Bracket	Weight (g)	Unit Price					
Type	No.				Max. Length-10mm (kgf)	Max. Length-5mm (kgf)														
GSS	15050A	181.0	131.0	50.0	2.8	3.3	15	6	15	6.5	R8	111	GSSB6A	75						
	15050B				8.7	10.4														
	15050C				15.0	17.8														
	15070A	221.0	151.0	70.0	8.3	10.4								90						
	15070B				12.1	12.6														
	15090A				7.0	9.1														
	15090B	261.0	171.0	90.0	8.1	10.5								108						
	15090C				9.0	11.7														
	15090D				15.0	19.5														
	15100A	281.0	181.0	100.0	7.8	10.5								120						
	15100B				20.0	26.2														
	18090A				26.8	36.0								170						
	18100A	281.0	181.0	100.0	33.0	43.6														
	22235A	580.0	344.5	235.5	13.2	19.9								GSSB8A	370					
	22080A	279.0	199.0	80.0	20.0	25.0									178					
	22096A	306.0	210.0	96.0	40.0	51.6									195					
	22142A	472.0	330.0	142.0	28.5	37.8									300					
	22147A	412.0	265.0	147.0	15.0	19.7									265					
	22235B	580.0	344.5	235.5	25.3	31.9									370					
	22356A	833.0	476.5	356.5	22.0	29.4									8.5		R10	452		530
	22356B				35.2	46.9														470
	22243A				20.0	30.7														500
	22243B	627.0	384.0	243.0	44.2	67.0								GSSB8D				470		
	22270A	670.0	400.0	270.0	35.0	49.6														
	22270B				51.7	75.1														
	22300A				76.0	118.3														
	22300B	700.0	400.0	300.0	86.2	134.6								GSSB8E				525		

Mounting Brackets for Gas Springs (Washer 1 pc. and Retaining Ring 1 pc. included)

GSSB6A Material: EN 1.4016 Equiv. (hot coiled) Bracket: EN 1.1181 Equiv. (hot coiled) Pin: EN 1.0320 Equiv. (hot coiled) Washers: EN 1.0320 Equiv. (hot coiled) Retaining Ring: EN 1.1525 Equiv. (hot coiled) Surface Treatment: Trivalent Chromate Plating Part Number: GSSB 6A, Mass (g): 20, Unit Price: [blank]	GSSB8A Material: EN 1.0320 Equiv. (hot coiled) Bracket: EN 1.0320 Equiv. (hot coiled) Pin: EN 1.0320 Equiv. (hot coiled) Washers: EN 1.0320 Equiv. (hot coiled) Retaining Ring: EN 1.1525 Equiv. (hot coiled) Surface Treatment: Trivalent Chromate Plating Part Number: GSSB 8A, Mass (g): 60, Unit Price: [blank]	GSSB8B Material: EN 1.0320 Equiv. (hot coiled) Bracket: EN 1.0320 Equiv. (hot coiled) Pin: EN 1.0320 Equiv. (hot coiled) Washers: EN 1.0320 Equiv. (hot coiled) Retaining Ring: EN 1.1525 Equiv. (hot coiled) Surface Treatment: Trivalent Chromate Plating Part Number: GSSB 8B, Mass (g): 60, Unit Price: [blank]
GSSB8C Material: EN 1.0320 Equiv. (hot coiled) Bracket: EN 1.0320 Equiv. (hot coiled) Pin: EN 1.0320 Equiv. (hot coiled) Washers: EN 1.0320 Equiv. (hot coiled) Retaining Ring: EN 1.1525 Equiv. (hot coiled) Surface Treatment: Trivalent Chromate Plating Part Number: GSSB 8C, Mass (g): 60, Unit Price: [blank]	GSSB8D Material: EN 1.0320 Equiv. (hot coiled) Bracket: EN 1.0320 Equiv. (hot coiled) Pin: EN 1.0320 Equiv. (hot coiled) Washers: EN 1.0320 Equiv. (hot coiled) Retaining Ring: EN 1.1525 Equiv. (hot coiled) Surface Treatment: Trivalent Chromate Plating Part Number: GSSB 8D, Mass (g): 60, Unit Price: [blank]	GSSB8E Material: EN 1.0320 Equiv. (hot coiled) Bracket: EN 1.0320 Equiv. (hot coiled) Pin: EN 1.0320 Equiv. (hot coiled) Washers: EN 1.0320 Equiv. (hot coiled) Retaining Ring: EN 1.1525 Equiv. (hot coiled) Surface Treatment: Trivalent Chromate Plating Part Number: GSSB 8E, Mass (g): 60, Unit Price: [blank]

Ordering Example: Part Number GSS15050B

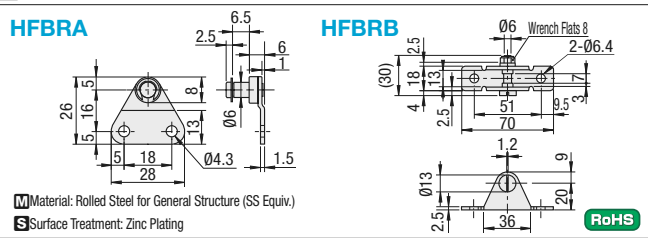
Gas Springs/Stainless Steel Gas Springs

Gas Reaction Force Configurable Type



Part Number	Type	Tip Shape	Stroke	Gas Reaction Force (20°C) N Max. Length-5mm	Lmax	Gas Reaction Force Change Rate Min. Length-5mm	Weight (g)	Unit Price		
								Tip Shape A	Tip Shape B	Tip Shape C
HFGSS	A	6	40	N	106	126%	49			
			50				55			
			60				61			
			80				73			
			100				84			
			120				96			
	B	16	40	20~400	266	128%	113			
			50							
			60							
			80							
			100							
			120							

Brackets for HFGSS



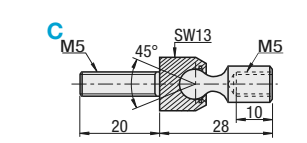
Part Number	Mass (g)	Unit Price
HFBRA	10	
HFBRB	55	



Part Number	Type	Tip Shape	Stroke	Gas Reaction Force (20°C) N Max. Length-5mm	Lmax	M	A	B	Weight (g)	Unit Price	
										Tip Shape A	Tip Shape B
FRGSS	A	60	100	10.2kgf	171	104.5	18	8	140		
			125	12.8kgf							
			150	15.3kgf							
			200	20.4kgf							
			300	30.6kgf							
			400	40.8kgf							
	B	80	100	10.2kgf	211	126.5	18	8	190		
			125	12.8kgf							
			150	15.3kgf							
			200	20.4kgf							
			300	30.6kgf							
			400	40.8kgf							

Material: Alloy Tool Steel (JIS-SKS (TS for cold work))
Rod: Carbon Steel Tube for Pressure Service (JIS-STPG) (DIN Standards: S37-2)
Main Body: Rolled Steel for General Structure (SS Equiv.)
Clevis: Nitrogen Gas
Gas: Nitrogen Gas
Tip: Rolled Steel for General Structure (SS Equiv.)

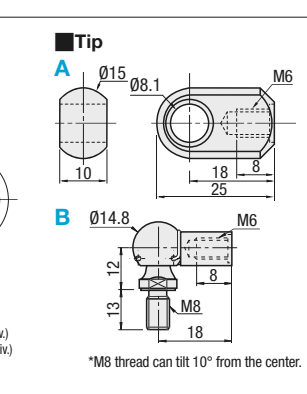
Surface Treatment: Rod: Ceramic Coating, Main Body: Black Paint, Clevis: Zinc Galvanizing, Tip: Zinc Galvanizing



Part Number	Type	Tip Shape	Stroke	Unit Price
HFGSS	A	60	N	N300

Ordering Example: Part Number HFGSS - A 60 - N300

Part Number	Mass (g)	Unit Price
HFBRA	10	
HFBRB	55	



* Example of Gas Reaction Calculation

Specified Gas Reaction Force Max. Length-5mm (Lmax-5)	Min. Length +5mm (Lmax-Stroke+5)
100N	134N

Gas reaction force change rate is 34% regardless of its stroke.
Kgf (Load) = Nx0.101972

Ordering Example: Part Number FRGSS - A 60 - 100