

SUSPENSION UNITS

Torsional torque	0 N · m to 2160 N · m
Torsional angle	0° to 30° (60°)
Operating temperature	-40°C to 80°C
No hazardous substances are used, in accordance with the RoHS Directive	

Multi-functional and Multi-purpose Suspension Units



A total of six types of suspension units with different shell and core shapes, materials, and mounting methods are available. The multi-purpose machine elements can be used freely in a wide range of applications, including industrial machines, conveying and transportation equipment, and playground and amusement equipment.

* Depending on your location and such, we may not be able to sell you our products. Please contact us for details.

Suspension Tensioner with Spring, Damper, and Bearing Functions

Spring Function

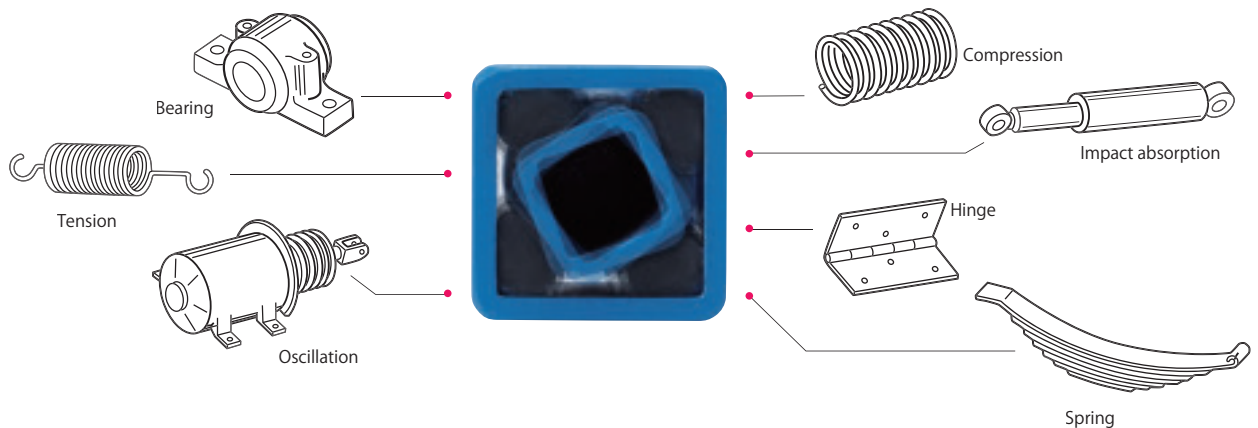
A torsional angle of up to $\pm 30^\circ$ can be tolerated. The spring characteristic is nonlinear and the torsional stiffness increases as the load increases. Furthermore, the torque characteristic is determined by the length of the ROSTA. Loads in all directions, specifically the tension, compression, and shearing loads can be supported.

Damper Function

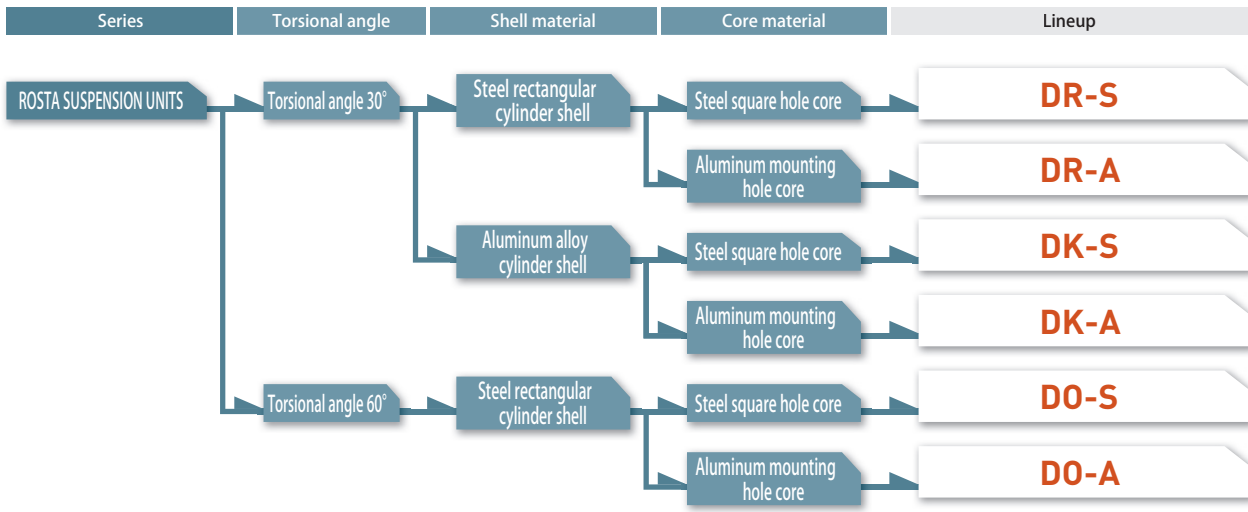
The internal friction of a press-fitted cylindrical rubber is more than 1,000 times that of metallic materials (e.g. spring steel). Therefore, it is possible to stop vibrations caused by impacts or a decrease in amplitude resulting from resonance at an early stage. The unit can be used in a shock absorber, for vibration isolation, and anti-vibration support.

Bearing Function

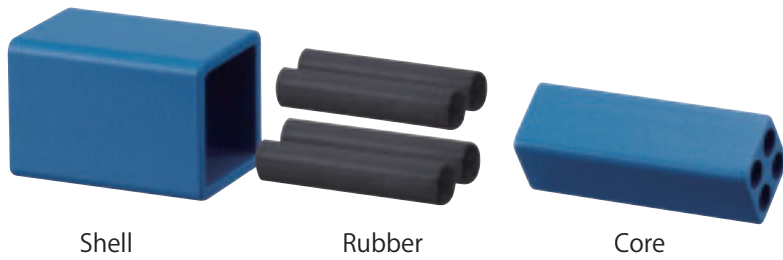
A high frequency oscillating movement can be transmitted while absorbing vibrations. When normal bearings are used, the transmission of oscillating movement is poorer and the durability decreases if the amount of lubricating oil supply is insufficient. The bearing function of the ROSTA can be used maintenance-free as substitute for the ball bearings and needle bearings.



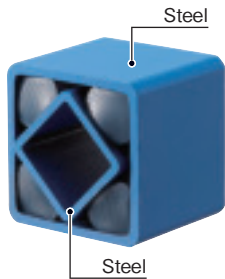
Available Models



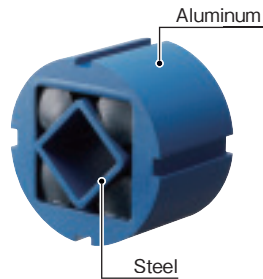
Structure and Materials



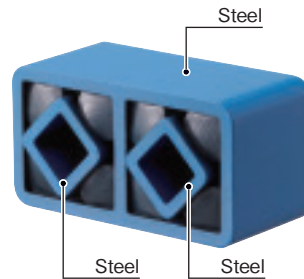
DR-S



DK-S



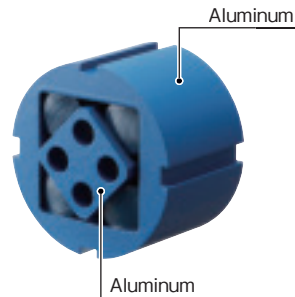
DO-S



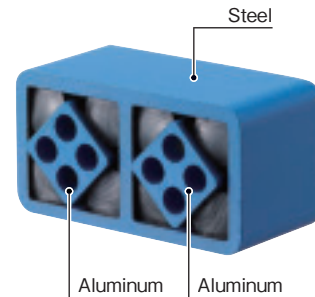
DR-A



DK-A



DO-A



MODELS

DR

DK

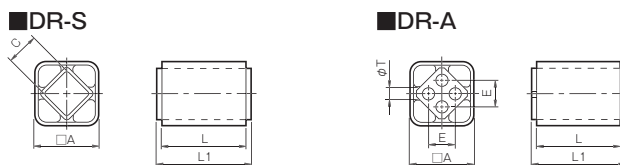
DO

DR Models

Specifications

Size	Torque at torsional angle [N-m]						Mass [kg]
	5°	10°	15°	20°	25°	30°	
11 × 20	0.3	0.8	1.3	2.0	2.9	4.0	0.04
11 × 30	0.4	1.2	2.0	3.1	4.3	6.0	0.05
11 × 50	0.7	2.0	3.4	5.1	7.2	10.0	0.08
15 × 25	0.7	1.6	2.6	4.0	5.7	8.2	0.07
15 × 40	1.1	2.5	4.2	6.4	9.2	13.2	0.12
15 × 60	1.6	3.8	6.3	9.6	13.8	19.8	0.18
18 × 30	1.9	4.5	7.5	11.0	15.0	20.6	0.12
18 × 50	3.2	7.5	12.5	18.3	25.0	34.4	0.20
18 × 80	5.1	12.0	20.0	29.3	40.0	55.0	0.32
27 × 40	4.7	10.7	17.5	26.9	39.5	57.0	0.26
27 × 60	7.0	16.0	26.3	40.3	59.3	85.5	0.39
27 × 100	11.7	26.7	43.8	67.2	98.8	142.5	0.65
38 × 60	13.0	30.4	50.6	78.0	113.0	162.0	0.67
38 × 80	17.3	40.5	67.5	104.0	151.0	216.0	0.90
38 × 120	26.0	60.8	101.2	156.0	226.0	324.0	1.32
45 × 80-N	27.6	62.4	104.0	160.0	222.0	320.0	1.42
45 × 100-N	34.5	78.0	130.0	200.0	278.0	400.0	1.76
45 × 150-N	51.8	117.0	195.0	300.0	420.0	600.0	2.62
50 × 120-N	51.0	133.0	250.0	395.0	570.0	780.0	2.37
50 × 200-N	102.0	260.0	475.0	745.0	1070.0	1450.0	3.91
50 × 300-N	150.0	385.0	700.0	1100.0	1590.0	2160.0	5.80

Dimensions



Unit [mm]

Size		A	C	E	L	L1	T ^{+0.5} ₀
DR-S	DR-A						
11 × 20	—				20	25	
11 × 30	—	20	8 ^{+0.25} ₀	—	30	35	—
11 × 50	—				50	55	
15 × 25	15 × 25				25	30	
15 × 40	15 × 40	27	11 ^{+0.25} ₀	10	40	45	5
15 × 60	15 × 60				60	65	
18 × 30	18 × 30				30	35	
18 × 50	18 × 50	32	12 ^{+0.25} ₀	12	50	55	6
18 × 80	18 × 80				80	85	
27 × 40	27 × 40				40	45	
27 × 60	27 × 60	45	22 ^{+0.25} ₀	20	60	65	8
27 × 100	27 × 100				100	105	
38 × 60	38 × 60				60	70	
38 × 80	38 × 80	60	30 ^{+0.25} ₀	25	80	90	10
38 × 120	38 × 120				120	130	
45 × 80-N	45 × 80-N				80	90	
45 × 100-N	45 × 100-N	75	35 ^{+0.4} ₀	35	100	110	12
45 × 150-N	45 × 150-N				150	160	
50 × 120-N	50 × 120-N				120	130	
50 × 200-N	50 × 200-N	80	40 ^{+0.4} ₀	40	200	210	M12 × 40
50 × 300-N	50 × 300-N				300	310	

* The BR model is applicable as the mounting clamp. (Refer to the options on P569)

How to Place an Order

DR - S - 11 × 20
 Type (Core material)
 S: Steel A: Aluminum alloy

* Depending on your location and such, we may not be able to sell you our products. Please contact us for details.

DK Models

COUPLINGS

ETP BUSHINGS

ELECTROMAGNETIC
CLUTCHES & BRAKES

SPEED CHANGERS
& REDUCERS

INVERTERS

LINEAR SHAFT DRIVES

TORQUE LIMITERS

ROSTA

SERIES

SUSPENSION UNITS

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MOUNTINGS

OSCILLATING
MOUNTINGS

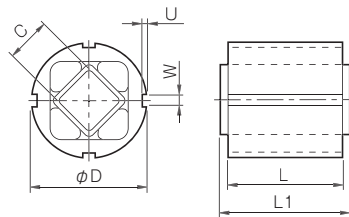
Specifications

Size	Torque at torsional angle [N·m]						Mass [kg]
	5°	10°	15°	20°	25°	30°	
11 × 20	0.3	0.8	1.3	2.0	2.9	4.0	0.03
11 × 30	0.4	1.2	2.0	3.1	4.3	6.0	0.05
11 × 50	0.7	2.0	3.4	5.1	7.2	10.0	0.07
15 × 25	0.7	1.6	2.6	4.0	5.7	8.2	0.06
15 × 40	1.1	2.5	4.2	6.4	9.2	13.2	0.10
15 × 60	1.6	3.8	6.3	9.6	13.8	19.8	0.14
18 × 30	1.9	4.5	7.5	11.0	15.0	20.6	0.13
18 × 50	3.2	7.5	12.5	18.3	25.0	34.4	0.20
18 × 80	5.1	12.0	20.0	29.3	40.0	55.0	0.33
27 × 40	4.7	10.7	17.5	26.9	39.5	57.0	0.27
27 × 60	7.0	16.0	26.3	40.3	59.3	85.5	0.40
27 × 100	11.7	26.7	43.8	67.2	98.8	142.5	0.66
38 × 60	13.0	30.4	50.6	78.0	113.0	162.0	0.72
38 × 80	17.3	40.5	67.5	104.0	151.0	216.0	0.94
38 × 120	26.0	60.8	101.2	156.0	226.0	324.0	1.37
45 × 80	27.6	62.4	104.0	160.0	222.0	320.0	1.35
45 × 100	34.5	78.0	130.0	200.0	278.0	400.0	1.65
45 × 150	51.8	117.0	195.0	300.0	420.0	600.0	2.44

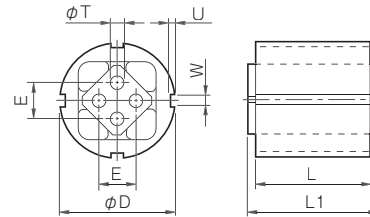
* The sizes 45 × 80, 45 × 100, and 45 × 150 are made to order.

Dimensions

DK-S



DK-A



Unit [mm]

Size		C	D	E	L	L1	T ^{+0.5}	U	W
DK-S	DK-A								
11 × 20	—	—	—	—	20	25	—	—	—
11 × 30	—	8 ^{+0.25} ₀	28 ^{+0.5} _{+0.1}	—	30	35	—	2.5	4
11 × 50	—	—	—	—	50	55	—	—	—
15 × 25	15 × 25	—	—	—	25	30	—	—	—
15 × 40	15 × 40	11 ^{+0.25} ₀	36 ^{+0.5} _{+0.1}	10	40	45	5	2.5	5
15 × 60	15 × 60				60	65			
18 × 30	18 × 30				30	35			
18 × 50	18 × 50	12 ^{+0.25} ₀	45 ^{+0.6} _{+0.1}	12	50	55	6	2.5	5
18 × 80	18 × 80				80	85			
27 × 40	27 × 40	22 ^{+0.25} ₀	62 ^{+0.7} _{+0.1}	20	40	45	8	3	6
27 × 60	27 × 60				60	65			
27 × 100	27 × 100				100	105			
38 × 60	38 × 60	30 ^{+0.25} ₀	80 ^{+0.8} _{+0.1}	25	60	70	10	3.5	7
38 × 80	38 × 80				80	90			
38 × 120	38 × 120				120	130			
45 × 80	45 × 80	35 ^{+0.25} ₀	95 ^{+1.0} _{+0.1}	35	80	90	12	4	8
45 × 100	45 × 100				100	110			
45 × 150	45 × 150				150	160			

* The BK model is applicable as the mounting clamp. (Refer to the options on P569)

MODELS

DR

DK

DO

How to Place an Order

DK - S - 11 × 20
 Type (Core material)
 S: Steel A: Aluminum alloy

* Depending on your location and such, we may not be able to sell our products. Please contact us for details.

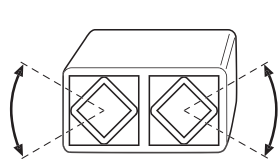
DO Models

Made to order

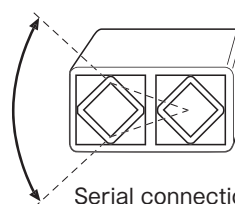
Specifications

Size	Torque at torsional angle [N-m]						Mass [kg]
	5° [10°]	10° [20°]	15° [30°]	20° [40°]	25° [50°]	30° [60°]	
15 × 25	0.7	1.6	2.6	4.0	5.7	8.2	0.07
15 × 40	1.1	2.5	4.2	6.4	9.2	13.2	0.10
15 × 60	1.6	3.8	6.3	9.6	13.8	19.8	0.15
18 × 30	1.9	4.5	7.5	11.0	15.0	20.6	0.12
18 × 50	3.2	7.5	12.5	18.3	25.0	34.4	0.20
18 × 80	5.1	12.0	20.0	29.3	40.0	55.0	0.30
27 × 40	4.7	10.7	17.5	26.9	39.5	57.0	0.32
27 × 60	7.0	16.0	26.3	40.3	59.3	85.5	0.47
27 × 100	11.7	26.7	43.8	67.2	98.8	142.5	0.78
38 × 60	13.0	30.4	50.6	78.0	113.0	162.0	0.87
38 × 80	17.3	40.5	67.5	104.0	151.0	216.0	1.15
38 × 120	26.0	60.8	101.2	156.0	226.0	324.0	1.68

* The angles in parentheses are the values when the DO model is used in serial connection.



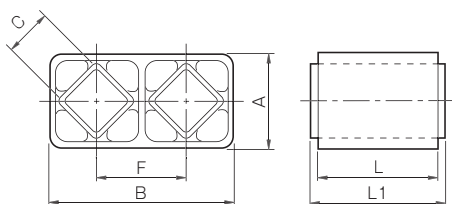
Parallel connection



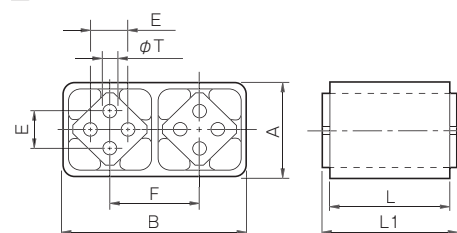
Serial connection

Dimensions

DO-S



DO-A



Unit [mm]

Size		A	B	C	E	F	L	L1	T ^{+0.5}
DO-S	DO-A								
15 × 25	15 × 25						25	30	
15 × 40	15 × 40	28	53.5	11 ^{+0.25} ₀	10	25.5	40	45	5
15 × 60	15 × 60						60	65	
18 × 30	18 × 30						30	35	
18 × 50	18 × 50	34	65	12 ^{+0.25} ₀	12	31	50	55	6
18 × 80	18 × 80						80	85	
27 × 40	27 × 40						40	45	
27 × 60	27 × 60	47	91	22 ^{+0.25} ₀	20	44	60	65	8
27 × 100	27 × 100						100	105	
38 × 60	38 × 60	63	123	30 ^{+0.25} ₀	25	60	60	70	10
38 × 80	38 × 80						80	90	
38 × 120	38 × 120						120	130	

* For large dimensions other than the above, please contact Miki Pulley.

How to Place an Order

DO - S - 15 × 25

— Size

Type (Core material)
S: Steel A: Aluminum alloy

* Depending on your location and such, we may not be able to sell you our products. Please contact us for details.

Optional Clamps and Brackets

COUPLINGS

ETP BUSHINGS

ELECTROMAGNETIC CLUTCHES & BRAKES

SPEED CHANGERS & REDUCERS

INVERTERS

LINEAR SHAFT DRIVES

TORQUE LIMITERS

ROSTA

SERIES

SUSPENSION UNITS

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ANTI-VIBRATION MOUNTINGS

OSCILLATING MOUNTINGS

MODELS

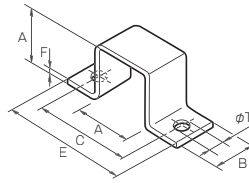
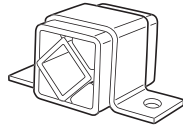
DR

DK

DO

Clamp BR Models

Bracket for DR

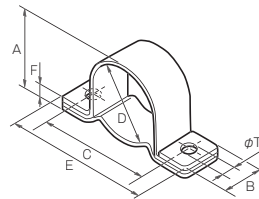
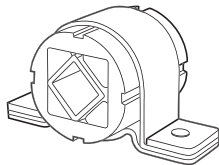


Unit [mm]

Model	Applied unit	A	B	C	E	F	T	Mass [kg]
BR-11	DR-□-11	20	20	37	50	2	6	0.03
BR-15	DR-□-15	27	25	50	65	2	7	0.04
BR-18	DR-□-18	32	30	60	80	2.5	9	0.08
BR-27	DR-□-27	45	35	80	105	3	11	0.15
BR-38	DR-□-38	60	40	100	125	4	13	0.27
BR-45-N	DR-□-45(-N)	75	45	120	150	5	13	0.48
BR-50-N	DR-□-50(-N)	80	50	135	175	6	18	0.71

Clamp BK Models

Bracket for DK

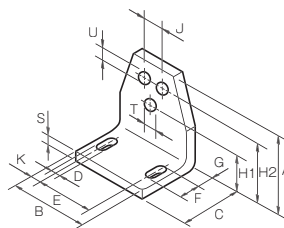
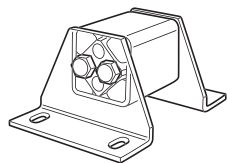


Unit [mm]

Model	Applied unit	A	B	C	D	E	F	T	Mass [kg]
BK-11	DK-□-11	31	20	45	28	60	6	6.5	0.04
BK-15	DK-□-15	40	25	55	36	75	7	6.5	0.09
BK-18	DK-□-18	49	30	68	45	90	8	8.5	0.14
BK-27	DK-□-27	67	35	92	62	125	10	10.5	0.29
BK-38	DK-□-38	86	40	115	80	150	11	12.5	0.45
BK-45	DK-□-45	103	45	130	95	165	14	12.5	0.74

Bracket WS/WD Models

Bracket for DR, DK, and DO-A



Unit [mm]

Model	Applied unit	A	B	C	D	E	F	G	H1	H2	J	K	S	T	U	Mass [kg]
WS-11/ WD-15	DR,DK,DO-A-15	46	45	30	7	30	13	11.5	27	35	10	7.5	4	6.5	5.5	0.08
WS-15/ WD-18	DR,DK,DO-A-18	58	55	32	7	40	13	13.5	34	44	12	7.5	5	8.5	6.5	0.15
WS-18/ WD-27	DR,DK,DO-A-27	74	70	38	9.5	50	15.5	16.5	43	55	20	10	6	10.5	8.5	0.28
WS-27/ WD-38	DR,DK,DO-A-38	98	90	52	11.5	65	21.5	21	57	75	25	12.5	8	12.5	10.5	0.70
WS-38/ WD-45	DR,DK,DO-A-45	116	110	55	14	80	24	21	66	85	35	15	8	16.5	12.5	0.90
WS-45/ WD-50	DR,DK,DO-A-50	140	140	66	18	100	30	26	80	110	40	20	10	20.5	12.5	1.80

DR/DK/DO Models

Items Checked for Design Purposes

I Selection

The following shows the conditions necessary for selection.

Required load : F [N]
 Arm length : L [m]

Obtain the required torque (T) from the required load (F) and arm length (L).

$$T = F \times L \quad [\text{N}\cdot\text{m}]$$

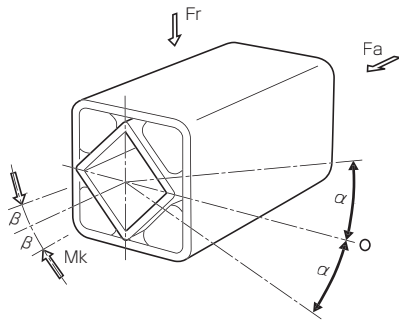
Refer to the relation between the torsional angle and torque of the suspension unit (refer to the specifications table of each model) and select the model whose torsional torque at the set angle of 10 to 20° matches the required torque.

T ≤ torque at a torsional angle of 10 to 20° of ROSTA

The set angle of the mounted ROSTA is 10 to 20°. If necessary, check that the load and moment in each direction are within the allowable load range of the relevant sizes shown on P571.

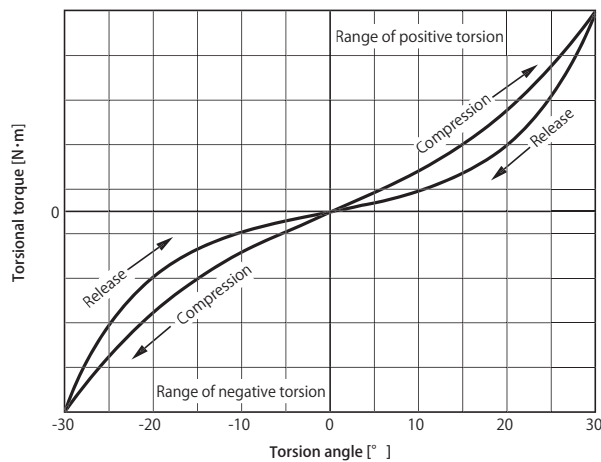
I Motion

The ROSTA rubber suspension is basically designed to be able to be used as a torsion spring. The spring characteristic is nonlinear. Consider the loads in the radial and axial directions, and bending moment. (Refer to the allowable load in each direction on P571.)



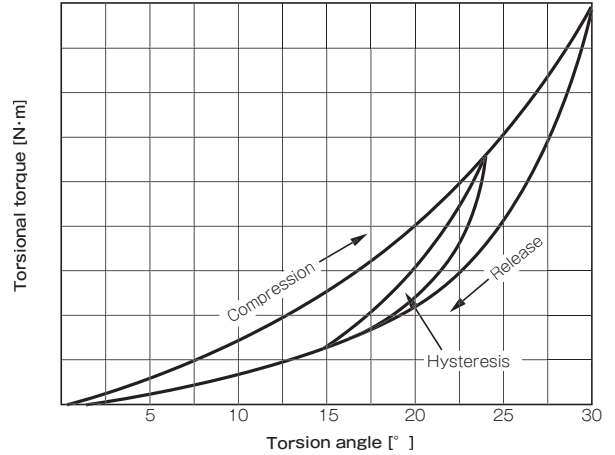
I Spring Characteristic

ROSTA with a unique structure has the nonlinear spring characteristic that the load increases nonlinearly as positive and negative torsion is applied.



I Damping Characteristic

The area surrounded by the torsional angle and torque curves after compression and release shows the lost energy. This area is the lost part of the vibration energy, which is called damping. The damping varies depending on the temperature, amplitude, and load. The damping of the rubber is normally 15% to 20%.



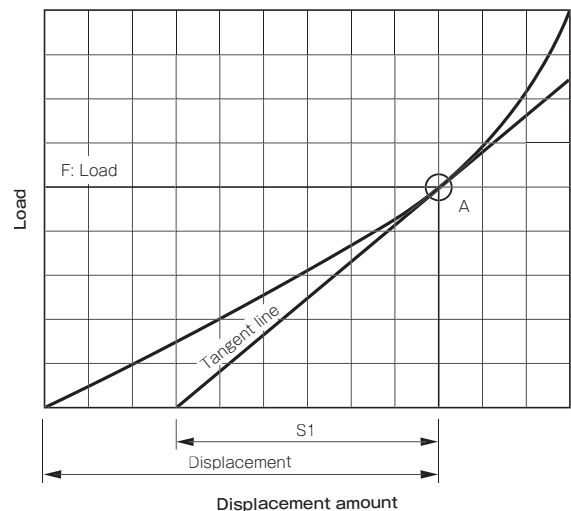
I Natural Frequency (for Up-and-down Motion)

The natural frequency can easily be obtained from the following figure. The natural frequency (ne) can be obtained by obtaining the static deflection of the horizontal axis ($S1$) from the tangent at the point (A) with a load (F) of the mounted ROSTA.

$$ne = \frac{949}{\sqrt{S1}} \text{ min}^{-1}$$

Example: $S1 = 50 \text{ mm}$

$$ne = \frac{949}{\sqrt{50}} = 134 \text{ min}^{-1}$$

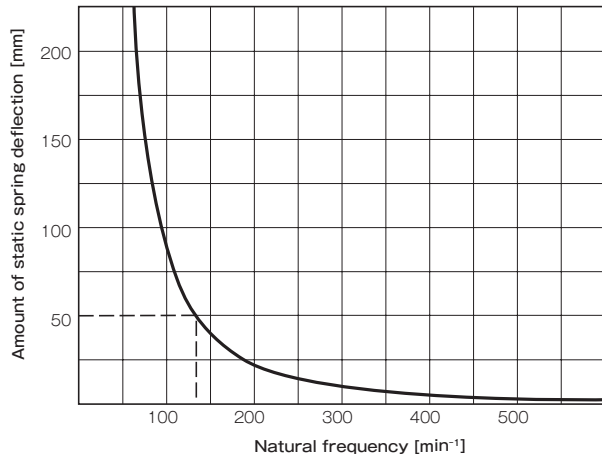


Relation between Natural Frequency and Deflection (for Up-and-down Motion)

Only the natural frequency of the up-and-down motion can easily be obtained from the static spring deflection under the mass of the machine.

This relation is shown in the figure below. For example, the natural frequency is 134 min^{-1} if the spring displacement is 50 mm.

- Spring deflection** **1 mm** \cong **960 min^{-1}**
- 10 mm** \cong **300 min^{-1}**
- 50 mm** \cong **134 min^{-1}**
- 100 mm** \cong **96 min^{-1}**

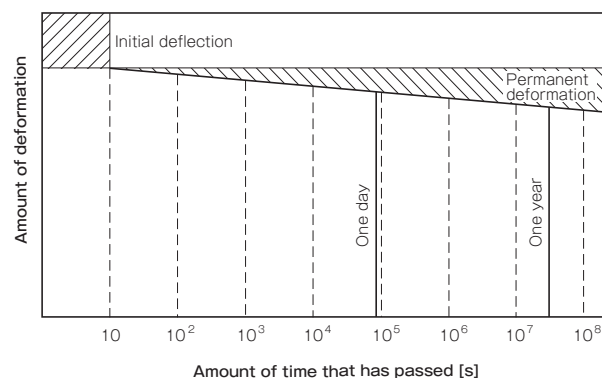


Permanent Deformation (Strain)

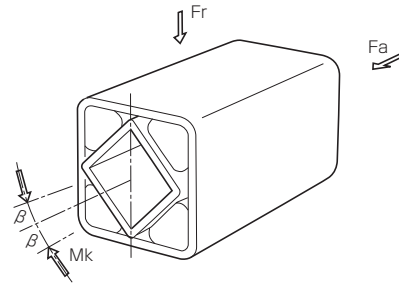
Rubber materials deform permanently over time when a load is always applied.

As shown in the figure below, the permanent deformation of rubber materials is generally expressed using the normal scale on the vertical axis for the deformation and the logarithmic scale on the horizontal axis for the time. The figure shows that the rubber deforms to some degree initially and thereafter the change is smaller.

For ROSTA, the deformation is 3 to 5° as torsional angle.

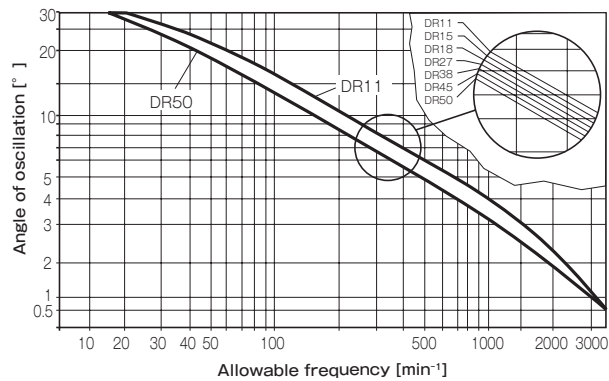


Allowable Load in Each Direction



Size	Radial direction Fr		Axial direction Fa		Bending moment Mk [β = 1°] [N·m]
	Displacement [mm]	Load [N]	Displacement [mm]	Load [N]	
11 × 20	0.25	200	0.25	60	0.4
	30	340	0.25	80	1.1
	50	600	0.25	150	5.6
15 × 25	0.25	200	0.25	70	0.6
	40	300	0.25	100	2.0
	60	500	0.25	160	5.5
18 × 30	0.25	400	0.25	80	1.6
	50	700	0.25	160	7.0
	80	1000	0.25	300	28.0
27 × 40	0.5	800	0.5	200	3.8
	60	1300	0.5	300	11.5
	100	2400	0.5	600	48.0
38 × 60	0.5	1500	0.5	300	11.4
	80	2000	0.5	500	24.7
	120	3000	0.5	600	76.0
45 × 80	0.5	1900	0.5	560	28.0
	100	3000	0.5	700	54.0
	150	4800	0.5	1000	140.0
50 × 120	0.5	2800	0.5	800	80.0
	200	6300	0.5	1100	250.0
	300	8600	0.5	2200	1200.0

Allowable Frequency



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LINEAR SHAFT DRIVES

TORQUE LIMITERS

ROSTA

SERIES

SUSPENSION UNITS

TENSIONERS

ANTI-VIBRATION MOUNTINGS

OSCILLATING MOUNTINGS

MODELS

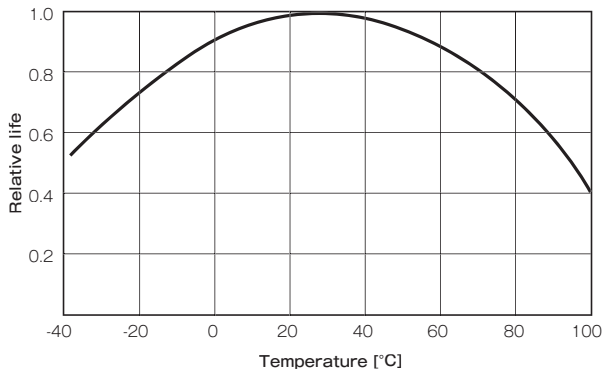
DR	
DK	
DO	

DR/DK/DO Models

Items Checked for Design Purposes

Relation Between Rubber Life and Ambient Temperature

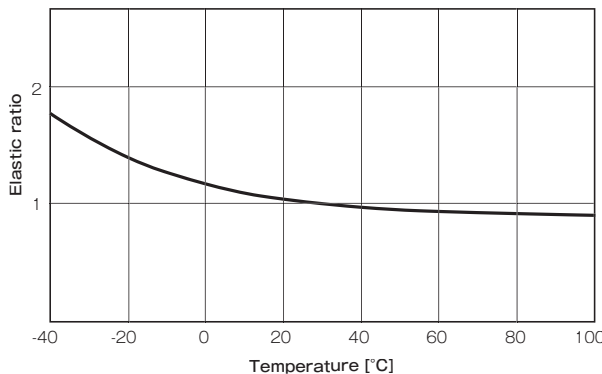
The rubber life varies depending on the ambient temperature. The following figure shows the estimated life at each ambient temperature using 20 to 30°C as the reference.



Relation Between Rubber Elastic Modulus and Ambient Temperature

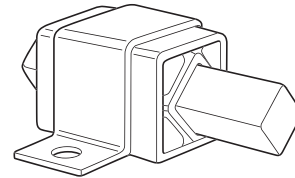
The rubber elastic modulus (spring characteristic) varies depending on the ambient temperature.

The following figure shows the elastic ratio (spring characteristic change ratio) at each ambient temperature using 25°C as the reference.



Precautions for Mounting and Handling

- If a lever arm is to be inserted into the core of the DR-S, DK-S, and DO-S suspension units, make sure the length of the lever arm is more than three times the dimension C in the dimensional drawing of each model. For size 18 or less, the lever or similar can be mounted directly using a penetrating bolt. (Fixed by friction)



If a square bar is used for the core, the square bar shall be provided with a chamfer of C1 or more.

- The core of the DR-A, DK-A, and DO-A suspension units is provided with four holes. If a lever arm or similar is to be mounted to the core, pass the bolt through two diagonal holes to fix it. Furthermore, the holes can be tapped to mount the lever arm. In this case, the effective screw length l shall be $1.5 \times M$ (nominal screw diameter) or more.
- Load applied to the suspension unit from each direction shall be within the range shown on P571.
- When the lever arm is to be mounted to the suspension unit, make sure its load is applied to the suspension unit.
- The allowable torsional angle is up to $\pm 30^\circ$, but select a model with torsional angle of about $\pm 20^\circ$.
- The rubber spring characteristic is $\pm 20\%$.

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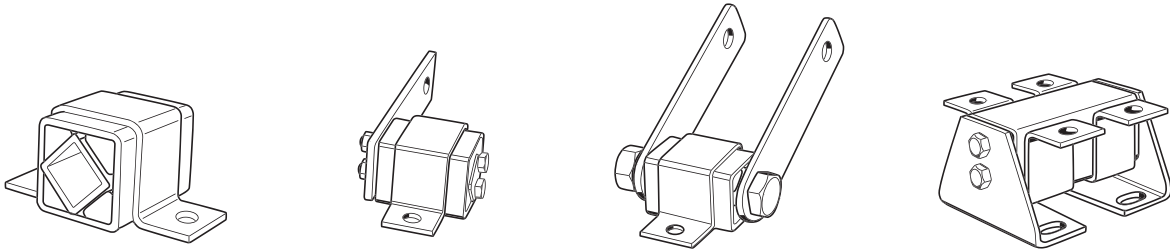
OSCILLATING
MOUNTINGS

MODELS

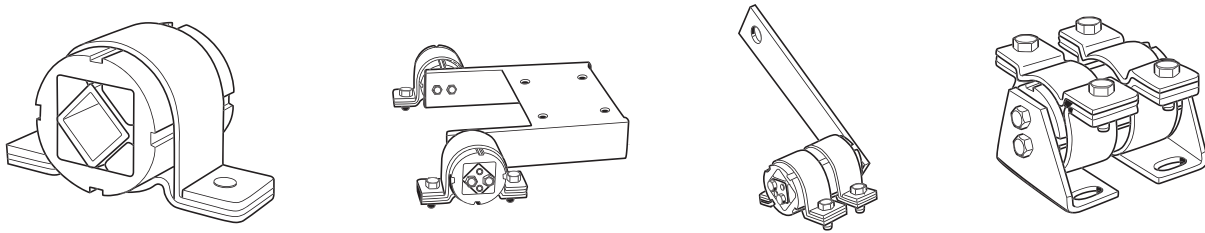
DR	
DK	
DO	

Mounting Examples

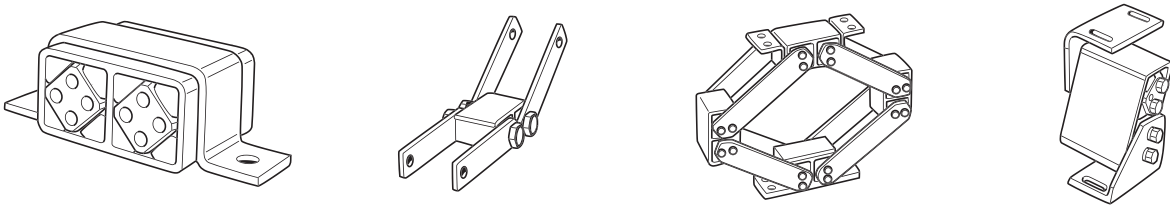
DR-A, DR-S



DK-A, DK-S



DO-A, DO-S



DR-A, DR-S

