



Seismic devices

# mageba seismic protection devices – for reliable preservation of structures



Highway A3, Mels, Switzerland

## RESTON® PSD Preloaded Spring Damper

dissipating, resisting, recentering



mageba



# Characteristics & Dimensions

## Principle

mageba RESTON®PSD preloaded spring dampers are designed to perform the following functions:

- For general loads due to traffic, creep, shrinkage and thermal variations, the RESTON®PSD devices act as fixed points of the structure and do not allow any movements.
- In a seismic event, the RESTON®PSD devices allow the structure to move. The units dissipate seismic energy and control displacements simultaneously.
- After a seismic event, the RESTON®PSD devices automatically re-center themselves back to their initial position.

The proper definition of the preloaded value  $F_0$  is very important, as the units will prevent any displacement before reaching this threshold. It has to be further taken into account that  $F_0$  varies in relation to the temperature.

## Properties

RESTON®PSD preloaded spring dampers can dissipate over 30 % of the introduced energy due to a dynamic event.

This allows the structures to be protected at a lower cost as compared to conventional strengthening methods.

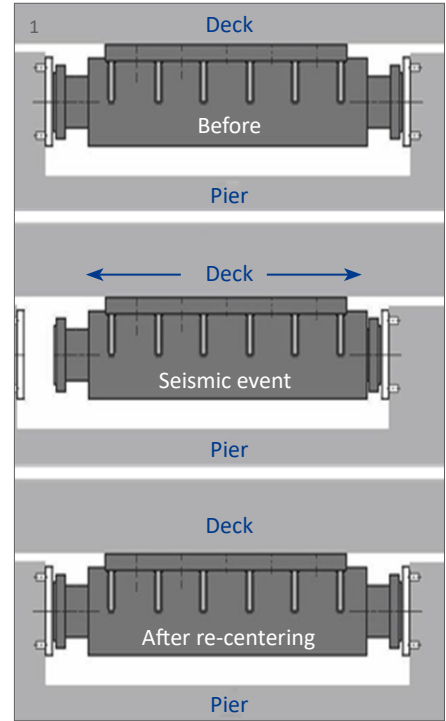
The re-centering capability is given by the internal compression. The return force has to be defined in advance and is an important design parameter of the device. In any case, return force and friction force must be higher than the friction force of the structure's sliding bearing, which ensures its return to initial position.

These devices can be produced in the following options:

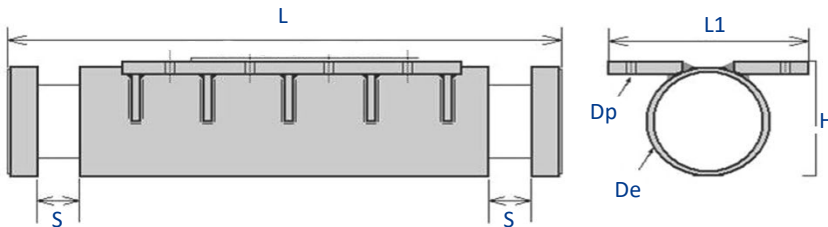
- compression in one direction
- compression in two directions
- traction only
- traction and compression

## Main Dimensions

The table below summarizes the main dimensions of the standard units. Values for other sets of input parameters can be provided upon request.



1 Working principle of RESTON®PSD compression in two directions



Unit	F		L		De		Dp		L1		H		S		F <sub>0</sub>		K	
	(kN)	(kips)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(kN)	(kips)	(MN/m)	(kips/ft)
PSD 300/100-25	300	67.4	426	16.8	120	4.7	18	0.7	190	7.5	125	4.9	25	1.0	100	22.5	4.4	0.30
PSD 300/100-50	300	67.4	573	22.6	120	4.7	18	0.7	190	7.5	125	4.9	50	2.0	100	22.5	2.2	0.15
PSD 580/210-40	580	130.4	640	25.2	150	5.9	22	0.9	230	9.1	155	6.1	40	1.6	210	47.2	4.5	0.31
PSD 580/210-80	580	130.4	927	36.5	150	5.9	22	0.9	230	9.1	155	6.1	80	3.1	210	47.2	2.3	0.16
PSD 1200/390-40	1,200	269.8	795	31.3	185	7.3	30	1.2	350	13.8	190	7.5	40	1.6	390	87.7	9.4	0.64
PSD 1200/390-80	1,200	269.8	1,120	44.1	185	7.3	30	1.2	350	13.8	190	7.5	80	3.1	390	87.7	4.7	0.32
PSD 1650/580-45	1,650	370.9	930	36.6	230	9.1	33	1.3	430	16.9	235	9.3	45	1.8	580	130.4	13	0.89
PSD 1650/580-90	1,650	370.9	1,335	52.6	230	9.1	33	1.3	430	16.9	235	9.3	90	3.5	580	130.4	6.5	0.45
PSD 2300/850-90	2,300	517.1	1,660	65.4	265	10.4	36	1.4	486	19.1	270	10.6	90	3.5	850	191.1	7.2	0.49
PSD 3500/1550-50	3,500	786.8	2,702	106.4	521	20.5	40	1.6	800	31.5	530	20.9	50	2.0	1,550	348.5	25	1.71

(Dimensions for differing input parameters can be provided upon request)



# Properties & Benefits

## Mode of Operation

The behavior of RESTON®PSD preloaded spring dampers is governed by the following constitutive law:

$$F = F_0 + K \times x + C \times v^\alpha$$

Where:

*F*: Maximum force [kN]

*F*<sub>0</sub>: Preloaded force [kN]

*K*: Stiffness [kN/m]

*x*: Stroke [m]

*C*: Damping constant [kN/(m/s)<sup>α</sup>]

*v*: Velocity [m/s]

*α*: Damping exponent [-]

## Materials

The following materials are used by mageba for the production of RESTON®PSD devices:

- Main outer steel parts such as cylinder tubes, cylinder pipes, etc. conforming to ASTM A709 Grade 36 and 50
- Piston rods are machined from type 17-4 PH stainless steel billet, through hardened, hand polished to a mirror-like 2 micro-inch surface finish
- Operating fluid is manufactured per U.S. Federal standards, environmentally safe, and cosmetically inert

## Viscous Fluid

The viscous fluid used by mageba for seismic devices is protected against aging by special additives, while the fluid itself protects the device from inner corrosion. In the case of temperature variations, viscosity remains nearly constant. This characteristic causes the mechanical system to be thermally compensated.

## Sealing

The sealing is the most critical element of the hydraulic system and requires highest quality standards. Consequently, mageba employs a high grade sealing that demonstrates a quasi-zero natural wear and an absolute physical chemic compatibility with the adopted viscous fluid.

## Corrosion Protection

mageba proposes corrosion protection systems based on hot dip galvanizing ASTM A-123 / AASTHO M111, or any applicable

painting systems approved by the responsible Department of Transportation (D.O.T.). Corrosion protection systems according to other standards can be provided upon request.

## Temperature Resistance

Typically, mageba seismic devices are designed for an operating temperature range of 14 °F to 122 °F (-10 °C to +50 °C). Upon request, devices with even greater resistance with a design temperature range of -31 °F to +176 °F (-35 °C to +80 °C) can be manufactured.

For short periods of time, all devices can withstand temperatures above 392 °F (200 °C), arising from energy dissipation during a seismic event.

It has to be further considered that the preloaded force *F*<sub>0</sub> varies with the temperature.

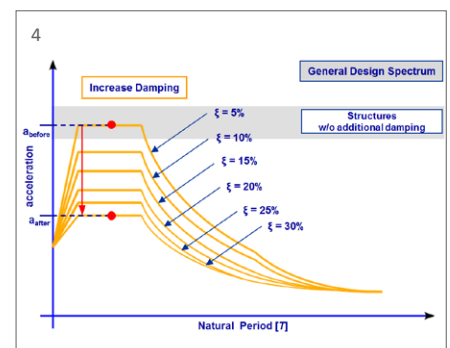
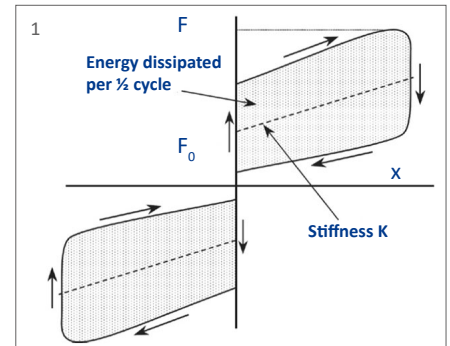
## Service Life Time

The high quality of materials and components used for manufacturing the seismic devices ensures a service life of 50 years without requiring extensive maintenance. mageba recommends visual inspection of the devices during regular inspection of the main structure.

## Benefits

- Significant increase in the safety of the structure and its users
- Longer lifespan of the devices due to finest quality standards for all components
- Devices tailored to the needs of the client
- Applicable for new structures as well as for retrofitting of existing ones
- Recentering of the structure after the event of an exceptional load (earthquake)

- 1 Force-displacement diagram, traction and compression
- 2 Sealing system
- 3 Manufacturing of RESTON®PSD device
- 4 Reduction of acceleration by additional damping





## Seismic devices

# Quality & Support

### Quality

For five decades, mageba products have proven their worth in thousands of structures under the most demanding conditions. In addition to the product properties, the extensive experience of mageba's well-qualified manufacturing and installation staff also contributes to the high quality and durability of the products.

mageba has a process-orientated quality system. In addition, its quality is regularly inspected by independent testing institutes. mageba factories are AISC certified for Major Bridges (CPT, STD, SPE) and also maintain AWS certifications for D1.1 and D1.5.

### Testing

If required by the client, full-scale factory production control testing can be carried out. mageba performs the tests in-house as well as with independent 3<sup>rd</sup> party test institutes. Commonly performed tests are based on AASHTO Specifications or European Standard EN 15129:2009. Upon request, customized testing based on other codes can also be performed.

### Installation

mageba offers supervision of installation for its products all over the world. The supervision is highly recommended to ensure proper installation of the devices and to provide the benefit of the full mageba guarantee.

Careful handling of the devices is essential during transportation and installation to avoid damages.

### Inspection and Maintenance

Thanks to the use of high quality components, the application of advanced design methods and a systematic internal quality assurance system, mageba seismic protection devices can be regarded as maintenance free.

Nevertheless, mageba recommends an inspection to be carried out every 5 years to verify the internal pressure of the units.

Upon delivery of the units, mageba submits an installation as well as an inspection and maintenance manual, allowing a regular and appropriate inspection to be carried out by the operation and maintenance staff.

### Customer Support

Our product specialists will be pleased to advise you in selection of the optimal solution for your project, and to provide you with a quotation.

On our website [mageba-group.com](http://mageba-group.com) you can find further product information.

### Reference Projects for mageba Seismic Devices



Awaza Bridge (TM)



Flendruz (CH)



Langenargen (DE)



Ramstore Bridge (KZ)



Agin Bridge (TR)



Vasco da Gama Bridge (PT)

### mageba Seismic Devices



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RESTON®PSD



RESTON®PENDULUM



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