



Seismic devices

Infrastructure | Buildings | Industrial structures

# 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-centre 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.

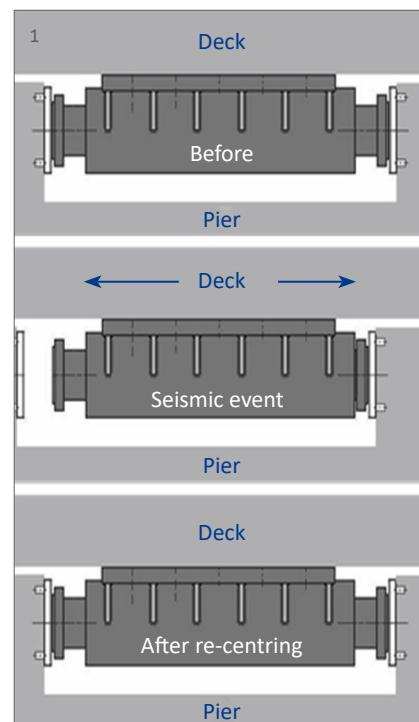
The re-centring capability is given by the internal compression. The return force has to be defined in advance and is an important design parameter of the device. In any case, return force and friction force must be higher than the friction force of the structure's sliding bearing, which ensures its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

These devices can be produced in the following options:

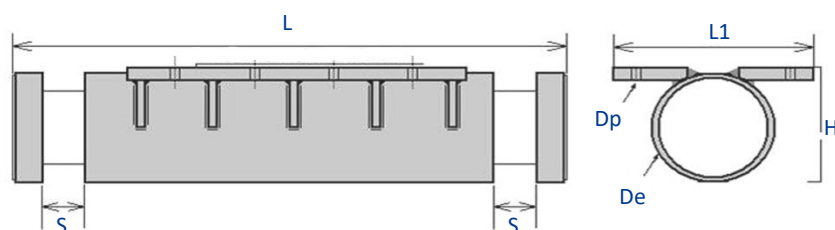
- compression in one direction
- compression in two directions
- traction only
- traction and compression

## 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.



Working principle of RESTON®PSD compression in two directions



Unit	F (kN)	L (mm)	De (mm)	Dp (mm)	L1 (mm)	H (mm)	S (mm)	$F_0$ (kN)	K (MN/m)
PSD 300/100-25	300	426	120	18	190	125	25	100	4.4
PSD 300/100-50	300	573	120	18	190	125	50	100	2.2
PSD 580/210-40	580	640	150	22	230	155	40	210	4.5
PSD 580/210-80	580	927	150	22	230	155	80	210	2.3
PSD 1200/390-40	1'200	795	185	30	350	190	40	390	9.4
PSD 1200/390-80	1'200	1'120	185	30	350	190	80	390	4.7
PSD 1650/580-45	1'650	930	230	33	430	235	45	580	13
PSD 1650/580-90	1'650	1'335	230	33	430	235	90	580	6.5
PSD 2300/850-90	2'300	1'660	265	36	486	270	90	850	7.2
PSD 3500/1550-50	3'500	2'702	521	40	800	530	50	1'550	25

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



# Properties & benefits

## Mode of operation

The behaviour 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]

$F_0$ : Preloaded force [kN]

$K$ : Stiffness [kN/m]

$x$ : Stroke [m]

$C$ : Damping constant [kN/(m/s) $^\alpha$ ]

$v$ : Velocity [m/s]

$\alpha$ : 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. of S355 steel according to EN 10025 or equivalent
- Piston rods of 42CrMo4 steel according to EN 10083 or equivalent
- Hydraulic valves of cast steel according to EN 10025 or equivalent

Higher steel grades can be processed if required by the project specifications or local codes.

## 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 chemical compatibility with the adopted viscous fluid.

## Corrosion protection

mageba proposes standard corrosion protection systems according to EN ISO 12944, with corrosivity category depending on location, environmental conditions and the required degree of protection.

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  $-10^\circ\text{C}$  to  $+50^\circ\text{C}$ . Upon request, devices with even greater resistance with a design temperature range of  $-35^\circ\text{C}$  to  $+80^\circ\text{C}$  can be manufactured.

For short periods of time, all devices can withstand temperatures above  $200^\circ\text{C}$ , arising from energy dissipation during a seismic event.

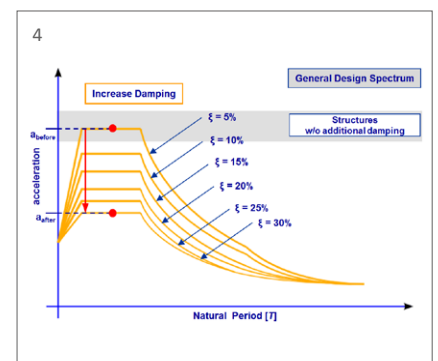
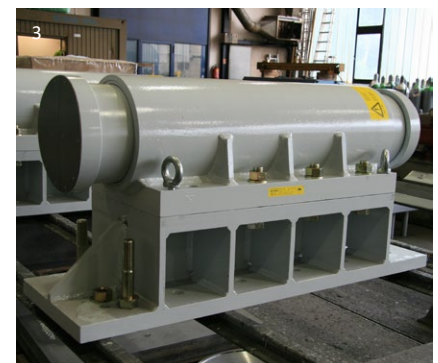
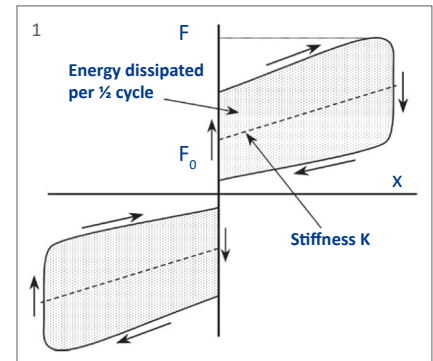
It has to be further considered that the preloaded force  $F_0$  varies with the temperature.

## 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 that is certified in accordance with ISO 9001:2008. mageba's factories are certified for welding in accordance with ISO 3834-2, and according to the current steel construction standard EN 1090.

### 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 European Standard EN 15129:2009 or AASHTO "Guide Specifications for Seismic Isolation Design". 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, including reference lists and tender documentation.

### Reference projects for mageba seismic protection devices



Awaza Bridge (TM)



Flendruz (CH)



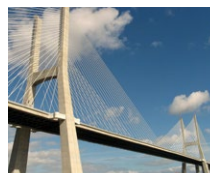
Langenargen (DE)



Ramstore Bridge (KZ)



Agin Bridge (TR)



Vasco da Gama Bridge (PT)

### mageba seismic protection devices



RESTON®SA & STU



RESTON®PSD



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