



Seismic devices

Infrastructure | Buildings | Industrial structures

# mageba seismic protection devices – for reliable preservation of structures



Hospital Leoben, Austria

## RESTON® SA Shock Absorber

durable, safe, reliable



mageba



# Characteristics & Dimensions

## Principle

mageba RESTON®SA shock absorbers are velocity dependent devices, consisting primarily of a piston, a piston rod and a cylinder pipe. They allow free movements of a structure during service conditions, but provide displacement control and dissipate energy during sudden movements caused by events such as earthquakes, exceptional traffic or high wind forces.

The resistance force depends on the flow of a viscous fluid that passes from one chamber of the cylinder pipe into the other. The fluid is squeezed through small holes in the piston whose size determine the damping characteristics of the shock absorber.

## Properties

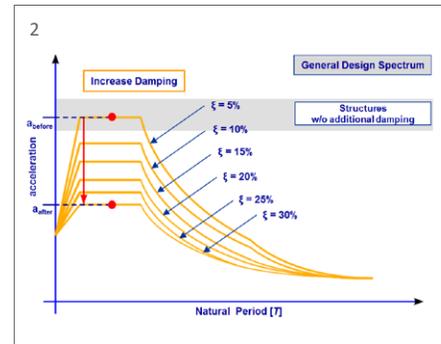
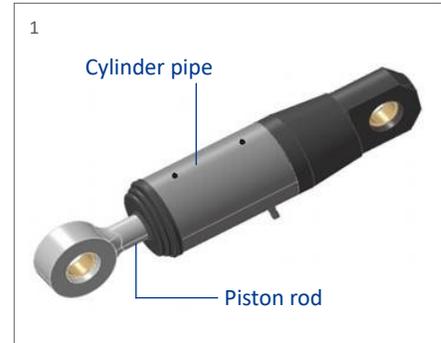
RESTON®SA shock absorbers dissipate energy from sudden, exceptional loading, and thus reduce the impact on the structure.

This allows the design of the structure to be optimized, avoiding conventional strengthening which might be rarely or never needed during the lifetime of the structure. RESTON®SA shock absorbers can provide over 30% of additional damping, significantly reducing design loads acting on the adjacent structural members.

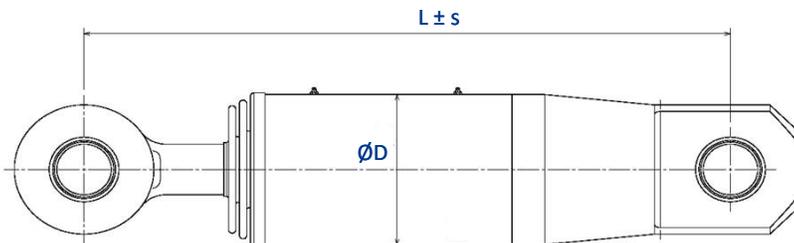
The devices are ideally combined with seismic isolators such as mageba LASTO®LRB lead rubber bearings, LASTO®HDRB high damping rubber bearings or RESTON®PENDULUM isolators to further reduce forces and control the movements of the structure.

## Main Dimensions

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



1 RESTON®SA shock absorber  
2 Reduction of acceleration by additional damping



Type	Axial Force		Maximum displacements [+/- inch (mm)]													
			+/- 2" (50 mm)		+/- 4" (100 mm)		+/- 6" (150 mm)		+/- 8" (200 mm)		+/- 10" (250 mm)		+/- 12" (300 mm)		+/- 16" (400 mm)	
	kN	kips	D [in]	L [in]	D [in]	L [in]	D [in]	L [in]	D [in]	L [in]	D [in]	L [in]	D [in]	L [in]	D [in]	L [in]
SA 50	50	11.2	4.3	28.3	4.3	40.2	4.3	52.0	4.3	63.8	4.3	75.6	4.3	87.4	4.3	111.0
SA 100	100	22.5	4.7	29.5	4.7	41.3	4.7	53.1	4.7	65.0	4.7	76.8	4.7	88.6	4.7	112.2
SA 200	200	45.0	7.1	30.7	7.1	42.5	7.1	54.3	7.1	66.1	7.1	78.0	7.1	89.8	7.1	113.4
SA 500	500	112.4	7.7	32.3	7.7	44.1	7.7	55.9	7.7	67.7	7.7	79.5	7.7	91.3	7.7	115.0
SA 750	750	168.6	8.5	32.9	8.5	44.7	8.5	56.5	8.5	68.3	8.5	80.1	8.5	91.9	8.5	115.6
SA 1000	1,000	224.8	9.3	33.7	9.3	45.5	9.3	57.3	9.3	69.1	9.3	80.9	9.3	92.7	9.3	116.3
SA 1250	1,250	281.0	11.0	36.2	11.0	48.0	11.0	59.8	11.0	71.7	11.0	83.5	11.0	95.3	11.0	118.9
SA 1500	1,500	337.2	11.6	39.0	11.6	50.8	11.6	62.6	11.6	74.4	11.6	86.2	11.6	98.0	11.6	121.7
SA 1750	1,750	393.4	12.8	41.1	12.8	53.0	12.8	64.8	12.8	76.6	12.8	88.4	12.8	100.2	12.8	123.8
SA 2000	2,000	449.6	14.4	46.9	14.4	58.7	14.4	70.5	14.4	82.3	14.4	94.1	14.4	105.9	14.4	129.5
SA 2500	2,500	562.0	15.9	50.0	15.9	61.8	15.9	73.6	15.9	85.4	15.9	97.2	15.9	109.1	15.9	132.7
SA 3000	3,000	674.4	17.9	54.5	17.9	66.3	17.9	78.1	17.9	90.0	17.9	101.8	17.9	113.6	17.9	137.2
SA 4000	4,000	899.2	19.9	59.3	19.9	71.1	19.9	82.9	19.9	94.7	19.9	106.5	19.9	118.3	19.9	141.9

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



# Properties & Benefits

## Mode of Operation

The behavior of RESTON®SA shock absorbers is governed by the following constitutive law:

$$F = C \times v^\alpha$$

Where:

*F*: Maximum force [kN]

*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®SA 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 these devices is protected against aging by special additives. The fluid itself protects the device from inner corrosion. In the case of temperature variations, viscosity remains nearly constant. This characteristic helps the mechanical system to be thermally compensated.

## 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 retrofitting of existing ones

## Sealing

The sealing represents 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 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.

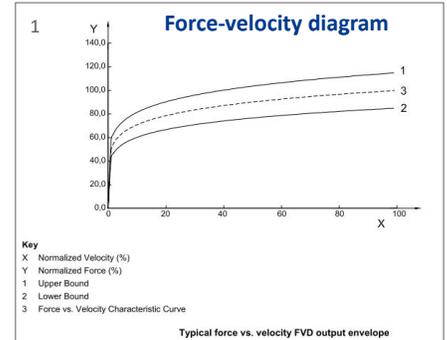
## Temperature Resistance

Typically, mageba seismic protection 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 are able to withstand temperatures above 392°F (200 °C) which can arise due to energy dissipation during a seismic event.

## Service Life Time

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



- 1 Force-velocity diagram
- 2 Sealing system
- 3 RESTON®SA shock absorber ready for installation
- 4 Vasco da Gama Bridge, Portugal – equipped with RESTON®SA shock absorbers since 1998



## 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 manual as well as an inspection and maintenance manual, allowing the appropriate regular inspections to be carried out by the operation and maintenance staff.

### Customer Support

Our product specialists will be pleased to advise you in the 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



RESTON®SA & STU



RESTON®PSD



RESTON®PENDULUM



LASTO®LRB & HDRB

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