mageba seismic protection devices – for reliable preservation of structures

RESTON® STU Shock Transmission Unit
prevention, protection, control
Seismic devices

Characteristics & Dimensions

Principle
mageba RESTON®STU shock transmission units consist of a piston, a piston rod and a cylinder pipe. They are temporary (dynamic) connecting devices allowing free movements during service conditions while locking up during a shock loading from an earthquake or due to traffic/train braking. In such cases, they transmit the forces to the connected elements.

Shock transmission units — also known as lock-up devices — work on the principle that the rapid passage of a viscous fluid through a narrow gap, orifice or port generates high resistance, while slow passage at low velocity generates only minor resistance. Consequently, RESTON®STU devices lock-up during a quick motion, while delivering a very small reaction force caused by friction during slow displacements such as from thermal expansion or contraction.

Properties
RESTON®STU shock transmission units do not dissipate energy and consequently there is no reduction of the load impacts. However, by locking up in certain extraordinary events, the RESTON®STU devices temporarily change the static system of a structure, e.g. from simply supported to continuously supported elements.

The main purpose is to control the load distribution and to share the forces with several structural elements. In addition, RESTON®STU devices avoid large movements of the structural elements such as bridge decks in case of sudden load impacts. RESTON®STU devices are frequently applied in combination with seismic isolators such as mageba LASTO®LRB lead rubber bearings, LASTO®HDRB high damping rubber bearings or RESTON®PENDULUM isolators in order to control the forces and to minimize the movements of structures.

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.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Axial Force</th>
<th>Length L</th>
<th>Diameter D</th>
<th>Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RM (kN)</td>
<td>RM (kips)</td>
<td>(mm)</td>
<td>(inch)</td>
</tr>
<tr>
<td>STU 100 - 100</td>
<td>100</td>
<td>22.5</td>
<td>490</td>
<td>19.3</td>
</tr>
<tr>
<td>STU 150 - 100</td>
<td>150</td>
<td>33.7</td>
<td>620</td>
<td>24.4</td>
</tr>
<tr>
<td>STU 300 – 100</td>
<td>300</td>
<td>67.4</td>
<td>720</td>
<td>28.3</td>
</tr>
<tr>
<td>STU 500 - 100</td>
<td>500</td>
<td>112.4</td>
<td>800</td>
<td>31.5</td>
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<tr>
<td>STU 750 – 100</td>
<td>750</td>
<td>168.6</td>
<td>860</td>
<td>33.9</td>
</tr>
<tr>
<td>STU 1000 – 100</td>
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<td>224.8</td>
<td>930</td>
<td>36.6</td>
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<tr>
<td>STU 1250 – 100</td>
<td>1,250</td>
<td>281.0</td>
<td>1,000</td>
<td>39.4</td>
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<tr>
<td>STU 1500 – 100</td>
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<td>337.2</td>
<td>1,050</td>
<td>41.3</td>
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<tr>
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<td>449.6</td>
<td>1,150</td>
<td>45.3</td>
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<tr>
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<td>562.0</td>
<td>1,250</td>
<td>49.2</td>
</tr>
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<td>674.4</td>
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<td>53.1</td>
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<td>786.8</td>
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<td>59.1</td>
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<tr>
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<td>2,200</td>
<td>86.6</td>
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<tr>
<td>STU 5000 – 100</td>
<td>5,000</td>
<td>1,124.0</td>
<td>2,500</td>
<td>98.4</td>
</tr>
</tbody>
</table>

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

Mode of Operation
The behavior of RESTON®STU shock transmission units is completely different for the following two operational situations:

- At low velocities, free movement with no load transmission
- At high velocity, the full axial design force is transmitted while any movement is locked and restrained

Materials
The following materials are used by mageba for the production of RESTON®STU 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. 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.

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 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.

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 of 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
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 3rd party test institutes. Commonly performed tests are based on AAHSTO 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 the selection of the optimal solution for your project, and to provide you with a quotation.
On our website, mageba-group.com, you can find further product information, including reference lists and tender documentation.

Reference Projects for mageba Seismic Devices

Awaza Bridge (TM) Flendruz (CH) Langenargen (DE) Ramstore Bridge (KZ) Agin Bridge (TR) Vasco da Gama Bridge (PT)