

# Technical Specification for mageba

## Preloaded Spring Dampers

### PART 1 – GENERAL

#### 1.1 SECTION INCLUDES

Fabrication and installation of Preloaded Spring Dampers (PSD's). The PSD includes the complete assembly inserted between sliding plates. The preloaded spring damper unit, working in compression, is inserted between the plates and is connected to the structure in accordance with the Contract Documents

#### 1.2 REFERENCES

- A. Standards: Conform to the applicable provisions of the current editions of the following standards, except as indicated otherwise on the drawings or the specifications:
- A1. EN 25125 - EN ISO 4017- 4014 and 27311- Standard Specification for Structural Bolts, Steel, Heat Treated,
  - A2. EN 10083-1/02-97 – EN 1035-1 or EN 10297-1 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel,
  - A3. ISO 9001:2000 - Quality Management Systems – Requirements. International Organization for Standardization, 2000.

#### 1.3 SUBMITTALS

- A. Refer to appropriate section of contractor's tender documentation for submittal procedures.
- B. Shop Drawings: Shop Drawings shall include, but shall not be limited to, installation drawings, setting diagrams, bolting templates. Submit Shop Drawings for:
- B1. Each PSD type, indicating dimensions, weights, and component material types. Submit prior to manufacture of item, allowing adequate time for review and approval.
  - B2. All steel mounting and connecting hardware which is integral with the PSD.

- C. Certifications: Submit the following documents, written and signed by an independent testing agency.
- C1. Certification that all testing equipment has been checked for accuracy by appropriate standards for the purpose of this specification.
  - C2. Certified mill test reports for all steel to be used.

#### 1.4 QUALITY ASSURANCE

- A. Approved supplier: PSD Preloaded Spring Damper units shall be supplied by the following pre-approved vendor:
- Mageba SA, Solistrasse 68, 8180 Bulach, Switzerland  
Tel. +41-44-872 40 50 - Fax +41-44-872 40 59  
[www.mageba.ch](http://www.mageba.ch) - [mageba@mageba.ch](mailto:mageba@mageba.ch)
- B. Product Quality Control: To ensure effective control over product quality, the PSD manufacturer shall establish and maintain a manufacturing/processing control system including written process specifications and procedures to ensure that manufacturing, processing, inspection and testing are accomplished in accordance with the following:
- B1. Control of Quality ISO 9001 version 2000: A valid certificate should be necessary.
  - B2. Calibration System Requirements: All devices used to measure shall be calibrated in compliance with ISO standard.

#### 1.5 DELIVERY STORAGE AND HANDLING

- A. Deliver PSD's to the job-site in protective packaging for freight and handling purposes. Store PSD's in a clean place. Protect from dirt, fumes, construction debris and physical damage. Handle PSD's and components carefully to prevent damage, breaking, denting or scoring.

#### 1.6 WARRANTIES AND GUARANTEES

- A. General: The PSD Manufacturer shall provide a written warranty in accordance with the following:
- A1. Warrant the design, workmanship and materials of the preloaded spring damper units within the 'Operating Conditions' specified in Section 3.3 for a period of ten (10) years from the date of first delivery.
  - A2. All repairs and/or replacements of any defective preloaded spring damper

unit's or parts thereof within the warranty period shall be at the PSD Manufacturer's expense.

- A3. Obligation under the warranty may be terminated under the following conditions:
- A3.1 Preloaded Spring Damper is exposed to fire.
  - A3.2 Incorrect installation or improper storage prior to the installation
  - A3.3 Attempt to repair the unit

## **PART 2 - PRODUCTS**

### 2.1 PRODUCT LIFE AND MAINTAINABILITY

- A. Preloaded Spring Damper: The preloaded spring damper units shall be intended to be maintenance-free and to perform within the specified 'Operating Tolerances' for a life of 10 years, within the 'Operating Conditions' given in this specification. Maintenance free shall mean that no refilling of viscous medium or replacement of any other parts shall be required.
- B. Installation: The PSD's shall be designed and constructed such that installation, removal and replacement, if necessary, shall be a simple process not requiring any special tools or methods.

### 2.2 PSD MATERIALS AND FABRICATION

- A. General: All components of the PSD's including the unit shall comply with the requirements of this section.
- A1. All materials and processes used shall be identified in the PSD Manufacturer's drawings by complete specifications and by known standards. Certified material test reports may be required for all structural materials.
  - A2. Unless suitably protected against electrolytic corrosion, dissimilar materials shall not be used in contact with each other. Dissimilar metal joints shall not be permitted without a not-metallic separator or gasket of at least .15mm thickness. The use of aluminium, aluminium alloys, magnesium, magnesium alloys, beryllium and beryllium alloys is prohibited.
  - A3. All packings, seals, wipers or gaskets shall be manufactured with materials consistent with the terms of the design life of the PSD.

## 2.3 PSD COMPONENTS

A. Preloaded spring damper unit components: All components of the preloaded spring damper units shall comply with the requirements of this section

A1. Pressure Vessels: The pressure vessel components of the preloaded spring damper shall not include externally supported heads or end caps. Welded construction or castings of any type are not permitted for pressure vessel construction.

A2. Castings: All castings shall be prohibited for pressure vessel parts or any other parts subjected to tensile or bending stresses, except for parts such as covers, handles, etc. whose failure would not affect the structural integrity or performance characteristics of the unit.

A3. Piston Rods: Base metal shall be wrought or forged steel only and shall be either chrome plated or tenifer or stainless steel. The piston rod shall be designed for life and wear durability of the bearing and sealing surface.

A4. Viscous Medium: The preloaded spring damper unit shall use the following viscous media: approved non-toxic, non-flammable material. The working range of the viscous medium shall be between -30°C to +80°C. Any material used in the preloaded spring damper unit shall be both chemically inert, non-corrosive, non-toxic and non-flammable. Petrochemical materials shall not be used.

A5. Seals: The preloaded spring damper unit seals shall perform over a range of temperatures from -30°C to +80°C. Under the Operating Conditions specified herein, the preloaded spring damper unit seals shall not leak externally.

A6. Reservoirs and Plumbing: External reservoirs, external plumbing are not permitted.

B. PSD Exterior Finish and Corrosion Protection: All components of the PSD, shall comply with the requirements of this section.

Corrosion protection according to DIN EN ISO 12944, C4ANV695, expected durability L (long). Target of surface roughness: Rz min 60µm, or alternatively Elcometer-roughness 2. Applied layers: Sand blasting Sa 2 ½, Zinc dust 2K-EP-primer 2-pack 50µm, MIO EP 2-pack 2x70µm, MIO-PUR, 2-pack 40µm. Total target thickness 230µm, Quality level 100% parts conform.

## **PART 3 - PSD DESIGN AND PERFORMANCE REQUIREMENTS**

### 3.1 GENERAL

- A. Theoretical output relationship: The PSD shall produce blocking force called preload value within the specified Output Tolerances, in both directions of travel, according to the following Theoretical Output Relationship:

$$F = F_0 + K \cdot X + C \cdot V^{\square}$$

Where:

K = stiffness of the spring (kN/meter)

F = resulting force from the PSD (kN)

F<sub>0</sub> = preload force (kN)

X = PSD displacement (meter)

C = coefficient (kN / (m/sec)<sup>a</sup>)

V = velocity (meter/sec)

□ = velocity exponent

- B. PSD Design Parameters:

The range of permissible values for preload force stroke and maximum reaction will be defined by the designer

- C. Output Tolerances:

Force Output: The shock transmission unit force output shall not be less than +/- 15 % of the value indicated by the Theoretical Output Relationship in Section 3.1A in either direction of travel.

- D. Articulation: The sliding end attachments of the PSD shall require articulation of +/- 2°.

### 3.2 DESIGN LOADS AND FACTORS OF SAFETY

- A. DESIGN LIMIT STATES

A1. Yield Limit State: All components of the PSD unit shall be proportioned such that all component stresses are at or below the yield stress under application:

A1.1 Application of 1.3 times the design force, under any of the Operating Conditions specified in Section 3.3.

A2. Ultimate Limit State: All components of the PSD unit shall be proportioned such that all component stresses are at or below the ultimate stress under application:

A2.1 Application of 1.5 times the design force, under any of the Operating Conditions specified in Section 3.3.

### 3.3 OPERATING CONDITIONS.

A. The unit shall be capable of producing force according to the Theoretical Output Relationship when operating at the temperatures, installed duration, train braking duty cycles, total seal travel and other environmental conditions specified herein, without degradation of performance, within the output tolerances

A1. Total seal travel: A minimum of 3 000 mm of seal travel per year resulting from all other types of non-seismic input.

A2. Ambient operating temperature: Maximum and minimum ambient air temperatures will be defined by the engineer.

A3. Atmospheric pressure: The unit shall operate at close to sea level pressure (760 ±50mm mercury).

A4. Humidity: Relative humidity up to 100 percent, including condensation due to temperature change.

A5. Other atmospheric elements: Any of the probable combinations of the following atmospheric elements: rain, snow, sleet, hail, ice, fog, smoke, wind, ozone, sunshine, sand and dust, and salt atmosphere.

### 3.4 SAFETY

The design of the unit shall be such that all possible sources of danger to personnel or equipment during assembly, disassembly, testing, operation and maintenance are minimized. Where required, precautionary measures shall be prominently and clearly indicated on the equipment.

### 3.5 SERIAL NUMBER ASSIGNMENT

Unique serial numbers shall be assigned to all units. The individual number shall be assigned according to the manufacturer's standard practice unless otherwise specified in the purchase order or contract.

## **PART 4 - TESTING**

### **4.1 TESTING OF PRELODED SPRING DAMPING UNITS**

- A. Quality Control Testing: The Quality Control Testing phase is a program of quality control testing implemented during the manufacture of the production preloaded spring damper units for this project. This testing shall be proposed by the PSD manufacturer. This testing is described in Section 4.2.
- B. Test Acceptance Criteria: For all testing, all of the following criteria shall be met by each tested preloaded spring damper unit.
  - B1. No evidence of external leakage before, during or after the testing program.
  - B2. No evidence of binding, yielding or permanent deformation in any part of the preloaded spring damper unit.
  - B3. No evidence of degradation of the seals in the preloaded spring damper unit.

### **4.2 TESTING PROGRAM**

- A. QUALITY CONTROL TESTING: Production preloaded spring damper units shall be tested in accordance with this section:
  - A1. 20% of the preloaded spring damper will be tested under a press at a certain velocity in order to show the stiffness of the spring function.