SPEKTRAL
SEISMIC SOLUTIONS

Seismic restraint

SEISMOLINK™

Technical Datasheet v1.03



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SEISMIC SOLUTIONS

1. PRODUCT DESCRIPTION

The seismic restraint SEISMOLINK™ represents an innovative solution for retrofitting of vulnerable precast industrial and commercial buildings. Its main function is the protection of non-structural elements (e.g. claddings) during an earthquake. The restraint was designed to be activated upon failure of the existing connections between the structure and non-structural element, thus preventing the non-structural element from collapsing. The device guarantees additional protection that can effectively prevent human casualties, equipment damage, damage to stored products, or other direct and indirect losses

The SEISMOLINK™ consists of a synthetic fibre rope and special anchoring elements that enable quick and simple installation. The high strength-to-weight ratio, moderate stiffness and improved damping characteristics compared to traditional steel wire ropes make SEISMOLINK™ a unique solution, unparalleled for resisting impact loads.

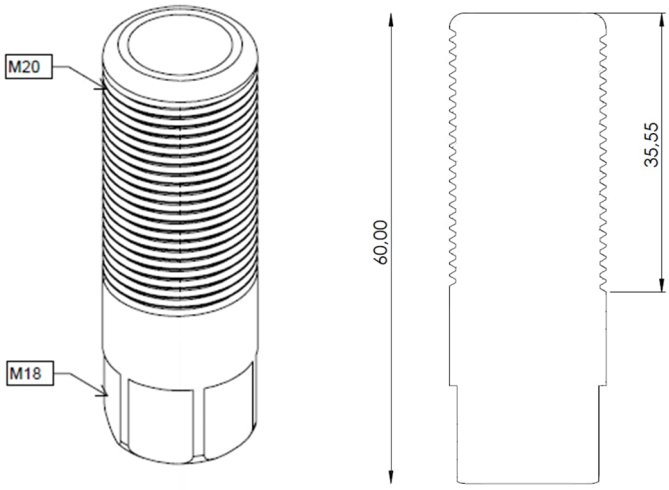


2. DIMENSIONS & APPLICATION

SEISMOLINK™ is a tension component currently available in three variants - R6, R8 and R10, which differ in breaking strength and size. The basic length of restraint is 0,5 m; however, the length is variable and can be adjusted according to the customer's needs. In these cases, the length of the synthetic fibre rope is modified, whereas the diameter of the rope and the type of anchoring elements (sockets) are standardized. The anchoring elements are available in stainless or galvanized steel, according to the customer's needs and requirements.

Socket Type R6

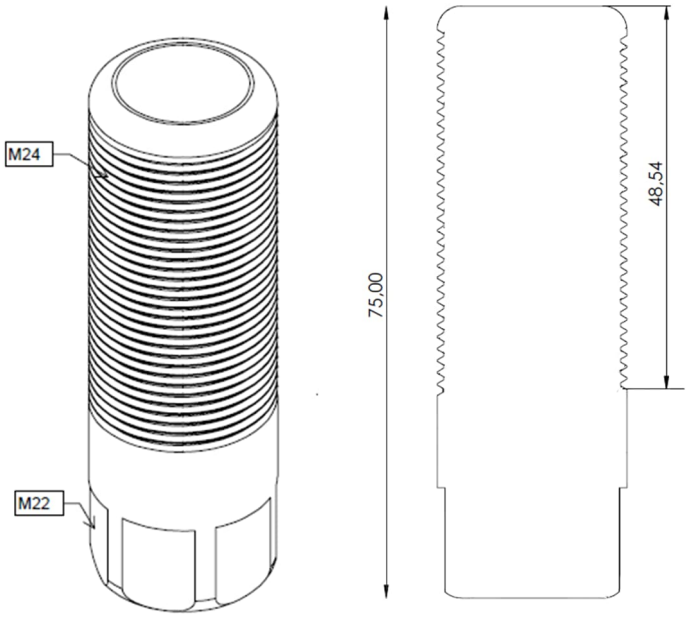




Dimensions in [mm].

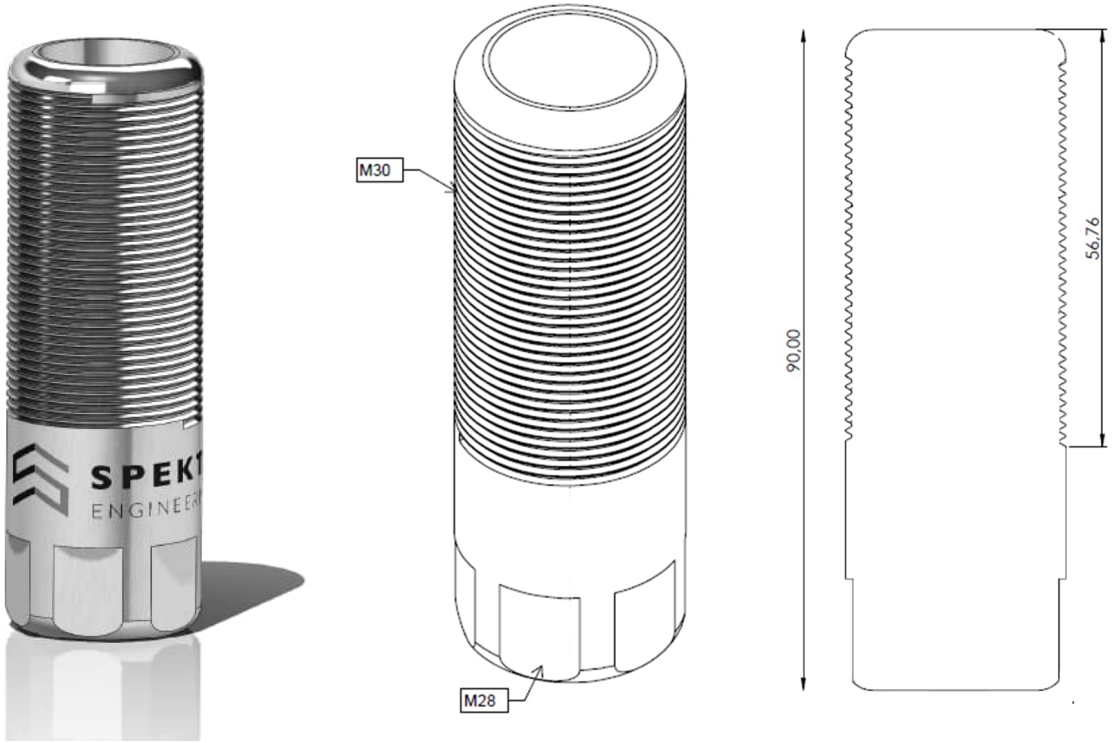
Socket Type R8





Dimensions in [mm].

Socket Type R10



Dimensions in [mm].

3. MECHANICAL PROPERTIES

The restraint can be used indoors or outdoors since it is corrosion-resistant. The characteristic strength at failure, mean strength at failure and stiffness are presented in the table below.

Type	Characteristic strength $R_{t,k}$ [kN]	Mean strength $R_{t,m}$ [kN]	Stiffness[1] $k_{t,k}$ [kN/m]
R6	19.9	26.0	1496
R8	40.5	47.5	2264
R10	69.7	79.3	2985

[1] Stiffness was evaluated for a total length of L_{tot} = 0.5 m. In other cases, the stiffness of the restraint can be determined as $k_{t,k}^* = k_{t,k} \times (L_{tot} / 0.5 \text{ m})$ where L_{tot} is in [m].

The design resistance of a single device should be determined as:

$R_{t,d} = R_{t,k} / \gamma_R$

where $R_{t,k}$ is the characteristic breaking strength, and γ_R is the material safety factor which should be equal to 1.5. The value of material safety factor is determined considering the analogy to provisions in *EN 1993-1-11: 2006: Design of structures with tension components*.

The seismic demand on the restraint should be determined according to the provisions for non-structural elements of *EN 1998-1: 2005 "Design of structures for earthquake resistance —Part 1: General rules, seismic actions and rules for buildings"*. It is recommended that the design of SEISMOLINK™ is based on unreduced seismic forces, i.e. the seismic forces assessed using a behaviour factor equal to q = 1.0.

The mathematical model for the determination of the design forces must adequately describe the interaction of the protected non-structural element with the primary structural system. It should adequately consider all phenomena of the dynamic behaviour of the system non-structural element - primary structural system.

NOTE: It is recommended that the design forces are determined by performing nonlinear dynamic analyzes with ground motion records selected based on the appropriate target acceleration spectrum.

4. PRODUCT USE

The SEISMOLINK™ connects to other elements by means of threaded anchoring elements.

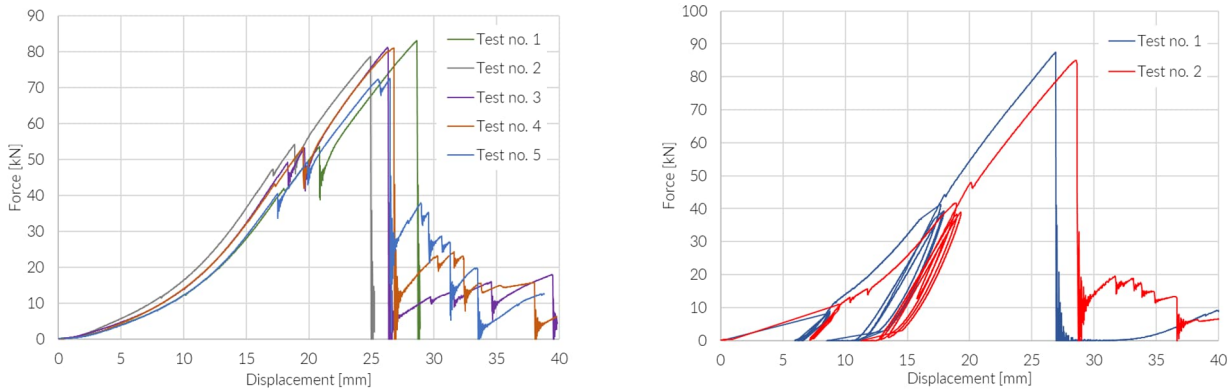
The product does not require special maintenance. The allowable temperature range for storage, transport and usage is between -30°C to 45°C.

During installation or use, contact between synthetic rope and sharp objects or edges must be avoided.

In case of a fire in the building where the restraint is installed, it is required to replace the restraint regardless of the condition of the product.

5. LABORATORY TESTING

The mechanical properties of the SEISMOLINK^{TM} device were assessed by experiments performed at the laboratory of the Faculty of civil and geodetic engineering, University of Ljubljana, and the Slovenian National Building and Civil Engineering Institute. Several monotonic and cyclic tensile tests were performed to evaluate the breaking strength, stretch at failure, stiffness and cyclic degradation.



Force-displacement relationship obtained during monotonic and cyclic tests of SEISMOLINK type R10