SLOVENSKI STANDARD
SIST EN 15129:2018

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Naprave za zagotavljanje potresne varnosti konstrukcij

Anti-seismic devices

Erdbebenvorrichtungen

Dispositifs anti-sismiques

Ta slovenski standard je istoveten z: EN 15129:2018

ICS:

91.120.25	Zaščita pred potresi in vibracijami	Seismic and vibration protection

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English Version

Anti-seismic devices

Dispositifs anti-sismiques

Erdbebenvorrichtungen

This European Standard was approved by CEN on 8 February 2018.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 15129:2018) has been prepared by Technical Committee CEN/TC 340 "Anti-seismic devices", the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2018, and conflicting national standards shall be withdrawn at the latest by November 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15129:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Regulation 305/2011.

For relationship with EU Regulation 305/2011, see informative Annex ZA, which is an integral part of this document.

The main changes with respect to the previous edition are listed below:

— editorial revision;

— new subclause 10.1 AVCP;

— new Annex ZA.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document covers the design of devices that are provided in structures, with the aim of modifying their response to the seismic action. It specifies functional requirements and general design rules of the devices for the seismic and non-seismic design situations, material characteristics, manufacturing and testing requirements, as well as assessment and verification of constancy of performance, installation and maintenance requirements. This document covers the types of devices and combinations thereof as defined in 3.4.

NOTE Additional information concerning the scope of this document is given in Annex A.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1090-2, *Execution of steel structures and aluminium structures — Part 2: Technical requirements for steel structures*

EN 1337 (all parts), *Structural bearings*

EN 1337-1:2000, *Structural bearings — Part 1: General design rules*

EN 1337-2:2004, *Structural bearings — Part 2: Sliding elements*

EN 1337-3:2005, *Structural bearings — Part 3: Elastomeric bearings*

EN 1337-7:2004, *Structural bearings — Part 7: Spherical and cylindrical PTFE bearings*

EN 1337-10:2003, *Structural Bearings — Part 10: Inspection and maintenance*

EN 1990:2002, *Eurocode — Basis of structural design*

EN 1991-1-5, *Eurocode 1: Actions on structures — Part 1-5: General actions — Thermal actions*

EN 1998 (all parts), *Eurocode 8: Design of structures for earthquake resistance*

EN 1998-1:2004, *Eurocode 8: Design of structures for earthquake resistance — Part 1: General rules, seismic actions and rules for buildings*

EN 1998-2:2005, *Eurocode 8 — Design of structures for earthquake resistance — Part 2: Bridges*

EN 10025 (all parts), *Hot rolled products of structural steels*

EN 10083 (all parts), *Steels for quenching and tempering*

EN 10088 (all parts), *Stainless steels*

EN 10088-2:2014, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

EN 10204, *Metallic products — Types of inspection documents*

EN 10210 (all parts), *Hot finished structural hollow sections of non-alloy and fine grain steels*

EN 10297 (all parts), *Seamless circular steel tubes for mechanical and general engineering purposes — Technical delivery conditions*

EN ISO 898 (all parts), *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread (ISO 898 series)*

EN ISO 4287, *Geometrical product specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters (ISO 4287)*

EN ISO 4526, *Metallic coatings — Electroplated coatings of nickel for engineering purposes (ISO 4526)*

EN ISO 4527, *Metallic coatings — Autocatalytic (electroless) nickel-phosphorus alloy coatings — Specification and test methods (ISO 4527)*

EN ISO 6158, *Metallic and other inorganic coatings — Electrodeposited coatings of chromium for engineering purposes (ISO 6158)*

EN ISO 6507-2, *Metallic materials — Vickers hardness test — Part 2: Verification and calibration of testing machines (ISO 6507-2)*

EN ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system (ISO 7500-1)*

ISO 34 (all parts), *Rubber, vulcanized or thermoplastic — Determination of tear strength*

ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 815 (all parts), *Rubber, vulcanized or thermoplastic — Determination of compression set*

ISO 1083, *Spheroidal graphite cast irons — Classification*

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 4664 (all parts), *Rubber, vulcanized or thermoplastic — Determination of dynamic properties*

ISO 14737, *Carbon and low alloy cast steels for general applications*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

NOTE In this European Standard, compressive forces, stresses and strains are positive.

3.1.1
activation velocity
velocity at which a Temporary Connection Device (TCD) or a Shock Transmission Unit (STU) reacts with its design force

3.1.2
connection to the structure
mechanical component or system of mechanical components to fix the device interface to the structure or to the foundation

Note 1 to entry: The mechanical components should be able to transfer the forces developed in the device and to avoid any relative movement.

Note 2 to entry: Example of mechanical components:

— Anchor bolts and/or pins to fix the base plate of an isolator to the concrete foundation or to the concrete or steel elements of the structure.

— Anchor bolts to fix the clevis plate of the hinge of a hydraulic device to the concrete foundation or to the concrete or steel elements of the structure.

3.1.3
core element
component of a Linear Device (LD) or of a Non Linear Device (NLD) on which the mechanism characterizing the device's behaviour is based

Note 1 to entry: Core elements of a LD or of a NLD are the device's components that provide it with the flexibility and, eventually, with the energy dissipation and/or re-centring capacity or any other mechanical characteristic compatible with the requirements of a LD or of a NLD. Examples of core elements are steel plates or bars, shape memory alloy wires or bars, rubber elements.

3.1.4
design displacement
d_{bd}
<of a device> total displacement (due to both translation and rotation about the vertical axis of the isolation system) that a device will undergo when the structural system is subjected to the design seismic action alone

3.1.5
design displacement
d_{cd}
horizontal displacement of an isolation system in a principal direction at the effective stiffness centre, occurring under the design seismic action alone

3.1.6
maximum displacement
d_{Ed}
for an anti-seismic device in a bridge d_{Ed} equals d_{max}, the maximum total horizontal displacement of a device in a principal direction at the location of the device including all actions effects and the application of the reliability factor to d_{bd}

Note 1 to entry: For devices in other structures d_{Ed} equals γ_x d_{bd}, the design displacement increased by the reliability factor.

3.1.7
design force
V_{bd}
<of a device> force (or moment) corresponding to d_{bd}

3.1.8
device
element which contributes to modify the seismic response of a structure by isolating it, by dissipating energy or by creating permanent or temporary restraints via rigid connections

Note 1 to entry: The devices considered are described in the various clauses of this European Standard.

3.1.9
ductility demand
<of a device> displacement ductility demand referred to the theoretical bilinear cycle, and is evaluated as d_{bd}/d_1

Note 1 to entry: See 3.1.4 and 3.1.42.

Note 2 to entry: The ductility demand is a useful parameter to evaluate the plastic demand of an EDD based on material hysteresis (see 3.1.17).

3.1.10
effective damping ratio
$\xi_{eff,b}$
<of a device> value of the effective viscous damping, corresponding to the energy dissipated by the device during cyclic response at the total design displacement:

$$\xi_{eff,b} = H(d_{bd}) / (2\pi\, V_{bd}\, d_{bd}) \qquad (1)$$

where

$H(d_{bd})$ is the energy dissipated by a device during the 3rd load cycle at design displacement d_{bd}

Note 1 to entry: $\xi_{eff,b}$ is introduced for a simple characterization of the behaviour of any device. It cannot be used in the analytical calculations of the response of the structural system, unless they can be carried out by linear analysis and all the devices have the same damping and stiffness in the given direction. Where different devices are used, reference is made to the overall effective damping of the isolation system.

3.1.11
effective period
T_{eff}
<seismic isolation> period of a single degree of freedom system moving in the direction considered, having the mass of the superstructure and the stiffness equal to the effective stiffness of the isolation system

3.1.12
effective radius
R_{eff}
radius of simple pendulum with same natural frequency as the curved surface slider under consideration

3.1.13
effective stiffness
$K_{eff,b}$
ratio between the value of the total horizontal force transferred through the device and the component of the total design displacement of a device in a principal direction in the same direction, divided by the absolute value of the total design displacement (secant stiffness)

$$K_{eff,b} = V_{bd} / d_{bd} \quad (2)$$

Note 1 to entry: $K_{eff,b}$ is introduced for a simple characterization of the behaviour of a device. It cannot be used in the analytical calculations of the response of the structural system, unless they can be carried out by linear analysis and all the devices have the same damping and stiffness in the given direction. Where different devices are used, reference is made to the overall effective stiffness of the isolation system.

3.1.14
effective stiffness
K_{eff}
sum of the effective stiffness of the devices located at the isolation interface of an isolation system in a principal direction

3.1.15
effective stiffness centre
stiffness centre of an isolation system, accounting for the effective stiffness of the devices

3.1.16
energy dissipation capacity
ability of a device to dissipate energy during the load-displacement cycles

3.1.17
energy dissipating device
EDD
device which has a large energy dissipation capacity, i.e. which dissipates a large amount of the energy

Note 1 to entry: After unloading it normally shows a large residual displacement. A device is classified as EDD if the effective damping ratio ξ is greater than 15 %.

3.1.18
essential characteristic
characteristic of the construction product which relates to the basic requirements for construction works

3.1.19
Factory Production Control
FPC
documented, permanent and internal control of production in a manufacturing plant, in accordance with the relevant harmonized technical specifications

3.1.20
first branch stiffness
$\boldsymbol{K_1}$
initial stiffness of a NLD defined as the secant stiffness between the points corresponding to the forces 0,1 V_{bd} and 0,2 V_{bd}:

$$K_1 = (0{,}2\ V_{bd} - 0{,}1\ V_{bd}) / [d(0{,}2\ V_{bd}) - d(0{,}1\ V_{bd})] \tag{3}$$

where

$d(0{,}2\ V_{bd})$ is the displacement corresponding to 0,2 V_{bd};

$d(0{,}1\ V_{bd})$ is the displacement corresponding to 0,1 V_{bd}.

Note 1 to entry: K_1 is referred to as initial or elastic stiffness when dealing with softening devices.

3.1.21
Fluid Viscous Damper
FVD
anti-seismic device whose output is an axial force that depends on the imposed velocity only; its principle of functioning consisting of exploiting the reaction force of a viscous fluid forced to flow through an orifice and/or valve system

3.1.22
Fluid Spring Damper
FSD
anti-seismic device whose output is an axial force that depends on both imposed velocity and displacement; its principle of functioning consisting of exploiting the reaction force of a viscous fluid forced to flow through an orifice and/or valve system and at the same time is subjected to progressive compression

3.3.23
Fuse Restraint
FR
device that, below a certain pre-established force threshold (break-away force), prevents any relative movement between connected parts, whilst it permits movement after the aforesaid threshold has been exceeded