SLOVENSKI STANDARD
oSIST prEN 1337-3:2018

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Konstrukcijska ležišča - 3. del: Elastomerna ležišča

Structural bearings - Part 3: Elastomeric bearings

Lager im Bauwesen - Teil 3: Elastomerlager

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Structural bearings - Part 3: Elastomeric bearings

Lager im Bauwesen - Teil 3: Elastomerlager

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 167.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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European foreword

This document (prEN 1337-3:2018) has been prepared by Technical Committee CEN/TC 167 “Structural bearings”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1337-3:2005.

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.

prEN 1337, *Structural bearings*, consists of the following 8 Parts:

— *Part 1: General;*

— *Part 2: Sliding elements;*

— *Part 3: Elastomeric bearings;*

— *Part 4: Roller bearings;*

— *Part 5: Pot bearings;*

— *Part 6: Rocker bearings;*

— *Part 7: Spherical and cylindrical PTFE bearings;*

— *Part 8: Guide bearings and Restraint bearings.*

The major technical changes are listed below**:**

— Complete technical and editorial revision of the whole document; it is not possible to list all implemented changes to this edition of EN 1337-3.

1 Scope

This document specifies rules for the design, testing and manufacture of laminated elastomeric bearings, elastomeric plain pad bearings, elastomeric strip bearings and sliding elastomeric bearings.

It is applicable to laminated and plain pad bearings:

— of rectangular and circular shape in plan with a rectangular cross-section, with dimensions in plan up to 1 200 mm,

— subjected to temperatures between −25 °C and +50 °C or between −40 °C and +50 °C,

— subjected to temperatures below −25 °C due to climate changes,

— subjected to temperatures up to 70 °C for repeated periods of less than 8 h.

This document will be used in conjunction with prEN 1337-1:2018 and other relevant parts of the EN 1337 series.

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.

prEN 1337-1:2018, *Structural bearings — Part 1: General*

prEN 1337-2:2018, *Structural bearings — Part 2: Sliding elements*

EN 1990:2002[1], *Eurocode — Basis of structural design*

EN 1993-2:2006, *Eurocode 3 — Design of steel structures — Part 2: Steel Bridges*

EN 1993 (all parts), *Eurocode 3: Design of steel structures*

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

EN 10029, *Hot-rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*

EN 10088 (all parts), *Stainless steels*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN ISO 7500-1:2015, *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 7500-1:2015)*

ISO 34-1:2010, *Rubber, vulcanized or thermoplastic — Determination of tear strength — Part 1: Trouser, angle and crescent test pieces*

ISO 37:2011, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

[1] This reference is currently impacted by EN 1990:2002/A1:2005 and EN 1990:2002/A1:2005/AC:2010.

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 815-1:2008, *Rubber, vulcanized or thermoplastic — Determination of compression set — Part 1: At ambient or elevated temperatures*

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

ISO 1827:2011, *Rubber, vulcanized or thermoplastic — Determination of shear modulus and adhesion to rigid plates — Quadruple-shear methods*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 1337-1:2018 and the following 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

3.1.1
batch
individual mix or blend of mixes of elastomer, if used for bearing production or a number of identical components produced at the same machine setting

3.1.2
elastomer
macromolecular material, which returns to approximately its initial dimensions and shape after substantial deformation by a weak stress and release of stress

3.1.3
elastomeric bearing
bearing comprising a element of vulcanised elastomer that may be reinforced with one or more steel plates

3.1.4
laminated bearing
elastomeric bearing reinforced internally with one or more steel plates, chemically bonded during vulcanisation

3.1.5
plain pad bearing
elastomeric bearing consisting of a solid element of vulcanized elastomer without internal cavities

3.1.6
sliding elastomeric bearing
laminated bearing which incorporates a sliding element

3.1.7
sliding plate
component which bears on and is immediately adjacent to the top sliding surface of a bearing

Note 1 to entry: It can be:

a) a single piece of austenitic steel,

b) a thin plate of austenitic steel fixed to a mild steel backing plate,

c) a thin plate of austenitic steel bonded to an elastomeric interlayer which is vulcanised to a mild steel backing plate.

3.1.8
strip bearing
plain pad bearing acting as a linear support covered by the specifications given for plain pad bearings

3.1.9
sliding surface
external layer vulcanised onto an elastomeric bearing, in contact with the sliding plate which allows relative translational displacement

3.1.10
effective area
plan area of the elastomer in common with the steel plate, including the area of any manufacturing holes (which are later effectively plugged)

3.1.11
reduced area
common area of the effective area at the top reinforcing plate projected on the effective area of the bottom reinforcing plate

3.2 Symbols

For the purposes of this document, the following symbols and abbreviations apply.

3.2.1 Latin upper case letters:

A	Overall plan area of elastomeric bearing	mm^2
A_{eff}	Effective plan area of laminated bearing (area of the steel reinforcing plates excluding the area of any holes if these are not later effectively plugged)	mm^2
$A_{eff;red}$	Reduced effective plan area of elastomeric bearing	mm^2
C	Compressive stiffness of a bearing	MPa
E	Modulus of elasticity	MPa
E_b	Bulk modulus	MPa
E_{cs}	Secant compression modulus	MPa

E_d	Internal design load effects arising from actions and imposed deformations	MPa
F	Force	MPa
F_{xy}	Internal Force, generated by shear deformation	MPa
$V_{x;d}$, $V_{y;d}$	Horizontal design forces	N
$V_{xy;d}$	Resultant horizontal design force obtained by vectorial addition of forces in x and y direction	N
$N_{z;d}$	Vertical design force	MPa
G_{nom}	Nominal value of conventional shear modulus of elastomeric bearing	MPa
G_{dyn}	Conventional shear modulus of elastomeric bearing under dynamic actions	MPa
G_{el}	Shear modulus of elastomer	MPa
G_d	Design shear modulus of elastomer or shear modulus of elastomer for design purposes	MPa
G_{exp}	Conventional shear modulus of elastomeric bearing determined by testing	MPa
M_f	Moment caused by the friction force in the cylindrical or spherical bearing used for the restoring moment test	Nmm
$M_{rt;exp}$	Experimental value of restoring moment	Nmm
$M_{rt;d}$	Design value of restoring moment	Nmm
R_d	Design value of resistance	
$R_{t,exp}$	Experimental minimum tear resistance	N/mm
S	Shape factor	–
$V_{xy;Sd}$	Resultant of the forces reacting to translational movements in x and y direction	N
T	Temperature	°C

3.2.2 Latin lower case letters:

a	Minor dimension of rectangular bearing	mm
a_{eff}	Effective width of laminated bearing (width of the steel reinforcing plates)	mm
a_1	Effective length of lever arm in restoring moment test	mm
b	Major dimension of rectangular bearing	mm
b_{eff}	Effective length of laminated bearing (length of the steel reinforcing plates)	mm
c	Compression stiffness	N/m
d	diameter of circular bearing	mm
d_{eff}	Effective diameter of circular laminated bearing	mm
e	Eccentricity of vertical force	mm

f_u	Tensile strength	N/mm^2
f_y	Yield stress	N/mm^2
$h_{m0;tot;netto}$	Average total initial thickness of bearing ignoring top and bottom covers	mm
$h_{m0;tot}$	Mean total initial thickness of bearing	mm
$h_{m0;tot;eff}$	Sum of the elastomer layer nominal thicknesses participating in the shear deformation, including the top and bottom layers in the unloaded condition	mm
$h_{nom;tot}$	Nominal total thickness of bearing	mm
$h_{nom;tot;el}$	Total nominal thickness of elastomer in a bearing	mm
k_{dyn}	Factor for dynamic behaviour of elastomer	–
k_f	Friction factor	–
$k_{N;t}$	Factor for induced tensile stresses in reinforcing plate	–
k_M	Moment factor	–
k_{cor}	Stress correction factor for the steel reinforcing plates	–
k_{rot}	Rotation factor	–
k_G	Correction factor related to the shear modulus	–
k_{Si}	Shape factor for the internal layer	–
$k_{M;rt}$	Factor for restoring moment	–
k_{temp}	Factor for temperature effects on elastomer	–
u_{st}	Force free perimeter of the steel reinforcing plates including that of any holes if these are not later effectively plugged.	mm
n	Number of elastomer layers	–
t_{el}	Thickness of plain pad bearing	mm
$t_{el;eff}$	Effective thickness of elastomer in compression	mm
$t_{el;i}$	Thickness of an individual elastomer layer in a laminated bearing	mm
t_{PTFE}	Thickness of PTFE sheet	mm
t_s	Thickness of steel reinforcing plate	mm
$t_{s;o}$	Thickness of outer steel reinforcing plate	mm
w_{tot}	Total vertical deflection	mm
u_a	Horizontal relative displacement in direction of dimension a	mm
u_b	Horizontal relative displacement in direction of dimension b	mm
u_z	Vertical movement	mm
w	Deflection in vertical direction	mm

w_i	Vertical deflection of individual elastomer layer	mm
u_{ab}	Resultant horizontal relative design displacement obtained by vectorial addition of u_a and u_b	mm

3.2.3 Greek letters:

α	Angular rotation of a bearing	rad
α_a	Angular rotation about an axis parallel to side "*a*" of a rectangular bearing	rad
α_b	Angular rotation about an axis parallel to side "*b*" of a rectangular bearing	rad
α_d	Angular rotation about the diameter d of a circular bearing	rad
γ_m	Partial factor for the resistance of the material	–
$\varepsilon_{\alpha;d}$	Design strain in elastomer slab due to angular rotation	–
$\varepsilon_{c;d}$	Design strain in elastomer slab due to compressive loads	–
$\varepsilon_{a;d;\varepsilon b;d}$	Design shear strain in elastomer slab due to translational movements in direction of the a respectively b dimension	–
ε_u	Elongation at break	–
ε_q	Shear strain of the bearing	–
ε_z	Compressive strain of a bearing	–
μ_{el}	Friction coefficient for elastomer	–
σ_c	Compressive stress for concrete	N/mm^2
$\sigma_{c;m}$	Average of the compressive stress for concrete	N/mm^2
σ_s	Tensile and compressive stress for steel	N/mm^2
τ	Shear stress	N/mm^2

3.2.4 Subscripts:

a	in direction of side with dimension a, in the vertical plane through side a	–
b	in direction of side with dimension b, in the vertical plane through side b	–
c	concrete; compression	–
d	Design	–
dyn	Dynamic	–
exp	Experimental	
min	Minimum	
max	Maximum	
tot	Total	–
u	At Ultimate Limit State	–
x, y, z	In direction of x-, y-, z-axis	–

3.2.5 Abbreviations:

CR	Polychloroprene rubber
NR	Natural rubber
pphm	Parts per hundred million by volume
PTFE	Polytetrafluoroethylene
SLS	Serviceability Limit State
ULS	Ultimate Limit State

4 Types of elastomeric bearings

4.1 General

Elastomeric bearings shall be designed and manufactured to transmit and resist the specified forces (Load bearing capacity) and to accommodate translational movements in any direction (horizontal distortion capability) and rotational movements about any axis (Rotation capacity) by elastic deformation. They can be combined with complementary bearing devices to extend their field of use, e.g. sliding or restraining elements.

Features of types A to E (see 4.2) can be combined.

The horizontal distortion capability is expressed as shear strain limit, see 6.3.5.1 and 6.4.6.1.

Although elastomeric bearings are designed to accommodate shear movements, they shall not be used to provide resistance to a permanently applied external shear force.

NOTE Although elastomer is a nonlinear viscoelastic material, for some design rules a simplified but conservative linear approach for the modelling of the bearing behaviour is used.

4.2 Laminated bearings

4.2.1 General

Usually bearings are rectangular or circular in plan.

The nominal thickness of the internal elastomeric layers shall be at least 5 mm and a maximum of 25 mm. All internal layers shall have the same nominal thickness. The nominal edge cover thickness shall be 5 mm. The top and bottom cover thickness shall be at least 2,5 mm.

For laminated bearings it is permissible to reduce the loaded area, without changing the plan dimensions, by including holes of uniform section in the loaded area.