

Nederlandse norm

# NEN-ISO 22762-3

(en)

Seismische beschermingsisolatoren van  
elastomeer - Deel 3: Toepassingen voor gebouwen  
- Specificaties (ISO 22762-3:2018, IDT)

Elastomeric seismic-protection isolators - Part 3:  
Applications for buildings - Specifications (ISO  
22762-3:2018, IDT)

Vervangt NEN-ISO 22762-3:2010

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- ISO 22762-3:2018, IDT

Normcommissie 342045 'Rubber'



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**Elastomeric seismic-protection  
isolators —**

**Part 3:  
Applications for buildings —  
Specifications**

*Appareils d'appuis structuraux en élastomère pour protection  
sismique —*

*Partie 3: Applications pour bâtiments — Spécifications*



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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations/governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

This third edition cancels and replaces the second edition (ISO 22762-3:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

- the definitions of some symbols in [Clause 4](#) have been changed;
- a column stipulating the minimum number of test pieces has been added to [Table 4](#);
- a new subclause [\(6.9\)](#) has been added.

A list of all parts in the ISO 22762 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

ISO 22762 series includes two parts related to specifications for isolators, i.e. ISO 22762-2 for bridges and ISO 22762-3 for buildings. This is because the isolator requirements for bridges and buildings are quite different, although the basic concept of the two products is similar. Therefore, ISO 22762-2 and the relevant clauses in ISO 22762-1 are used when ISO 22762 (all parts) is applied to the design of bridge isolators whereas ISO 22762-3 and the relevant clauses of ISO 22762-1 are used when it is applied to building isolators.

The main differences to be noted between isolators for bridges and isolators for buildings are the following.

- a) Isolators for bridges are mainly rectangular in shape and those for buildings are circular in shape.
- b) Isolators for bridges are designed to be used for both rotation and horizontal displacement, while isolators for buildings are designed for horizontal displacement only.
- c) Isolators for bridges are designed to perform on a daily basis to accommodate length changes of bridges caused by temperature changes as well as during earthquakes, while isolators for buildings are designed to perform only during earthquakes.
- d) Isolators for bridges are designed to withstand dynamic loads caused by vehicles on a daily basis as well as earthquakes, while isolators for buildings are mainly designed to withstand dynamic loads caused by earthquakes only.

For structures other than buildings and bridges (e.g. tanks), the structural engineer uses either ISO 22762-2 or ISO 22762-3, depending on the requirements of the structure.



# Elastomeric seismic-protection isolators —

## Part 3: Applications for buildings — Specifications

### 1 Scope

This document specifies minimum requirements and test methods for elastomeric seismic isolators used for buildings and the rubber material used in the manufacture of such isolators.

It is applicable to elastomeric seismic isolators used to provide buildings with protection from earthquake damage. The isolators covered consist of alternate elastomeric layers and reinforcing steel plates. They are placed between a superstructure and its substructure to provide both flexibility for decoupling structural systems from ground motion, and damping capability to reduce displacement at the isolation interface and the transmission of energy from the ground into the structure at the isolation frequency.

### 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.

ISO 630 (all parts), *Structural steels*

ISO 22762-1:2018, *Elastomeric seismic-protection isolators — Part 1: Test methods*

### 3 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:

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

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

#### 3.1

##### breaking

rupture of *elastomeric isolator* (3.8) due to compression- (or tension-) shear loading

#### 3.2

##### buckling

state when *elastomeric isolators* (3.8) lose their stability under compression-shear loading

#### 3.3

##### compressive properties of elastomeric isolator

$K_v$

compressive stiffness for all types of rubber bearings

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## 3.4

**cover rubber**

rubber wrapped around the outside of inner rubber and reinforcing steel plates before or after curing of elastomeric isolators for the purposes of protecting the inner rubber from deterioration due to oxygen, ozone and other natural elements and protecting the reinforcing plates from corrosion

## 3.5

**design compressive stress**

long-term compressive force on the *elastomeric isolator* (3.8) imposed by the structure

## 3.6

**effective loaded area**

area sustaining vertical load in *elastomeric isolator* (3.8), which corresponds to the area of reinforcing steel plates

## 3.7

**effective width**

<rectangular elastomeric isolator> the smaller of the two side lengths of inner rubber to which direction shear displacement is not restricted

## 3.8

**elastomeric isolator**

rubber bearing, for seismic isolation of buildings, bridges and other structures, which consists of multi-layered vulcanized rubber sheets and reinforcing steel plates

EXAMPLE High-damping rubber bearings, linear natural rubber bearings and lead rubber bearings.

## 3.9

**first shape factor**

ratio of effectively loaded area to free deformation area of one inner rubber layer between steel plates

## 3.10

**high-damping rubber bearing****HDR**

elastomeric isolator with relatively high damping properties obtained by special compounding of the rubber and the use of additives

## 3.11

**inner rubber**

rubber between multi-layered steel plates inside an elastomeric isolator *elastomeric isolator* (3.8)

## 3.12

**lead rubber bearing****LRB**

*elastomeric isolator* (3.8) whose *inner rubber* (3.11) with a lead plug or lead plugs press fitted into a hole or holes of the isolator body to achieve damping properties

## 3.13

**linear natural rubber bearing****LNR**

*elastomeric isolator* (3.8) with linear shear force-deflection characteristics and relatively low damping properties, fabricated using natural rubber

Note 1 to entry: Any bearing with relatively low damping can be treated as an LNR bearing for the purposes of isolator testing.

## 3.14

**maximum compressive stress**

peak stress acting briefly on *elastomeric isolators* (3.8) in compressive direction during an earthquake

**3.15****nominal compressive stress**

long-term stress acting on *elastomeric isolators* (3.8) in compressive direction as recommended by the manufacturer for the isolator, including the safety margin

**3.16****roll-out**

instability of an isolator with either dowelled or recessed connection under shear displacement

**3.17****routine test**

test for quality control of the production isolators during and after manufacturing

**3.18****second shape factor**

<circular elastomeric isolator> ratio of the diameter of the *inner rubber* (3.11) to the total thickness of the inner rubber

**3.19****second shape factor**

<rectangular or square elastomeric isolator> ratio of the effective width of the *inner rubber* (3.11) to the total thickness of the inner rubber

**3.20****shear properties of elastomeric isolators**

comprehensive term that covers characteristics determined from isolator tests:

- shear stiffness,  $K_h$ , for LNR;
- shear stiffness,  $K_h$ , and equivalent damping ratio,  $h_{eq}$ , for HDR and LRB;
- post-yield stiffness,  $K_p$ , and characteristic strength,  $Q_d$ , for LRB

**3.21****standard value**

value of isolator property defined by manufacturer based on the results of type test

**3.22****structural engineer**

engineer who is in charge of designing the structure for base-isolated bridges or buildings and is responsible for specifying the requirements for *elastomeric isolators* (3.8)

**3.23****type test**

test for verification either of material properties and isolator performances during development of the product or that project design parameters are achieved

**3.24****ultimate properties**

properties at either buckling, breaking, or roll-out of an isolator under compression-shear loading

**3.25****ultimate property diagram****UPD**

diagram giving the interaction curve of compressive stress and buckling strain or breaking strain of an elastomeric isolator

**4 Symbols**

For the purposes of this document, the symbols given in [Table 1](#) apply.

Table 1 — Symbols and descriptions

| Symbol           | Description   |
|------------------|---|
| $A$              | effective plan area; plan area of elastomeric isolator, excluding cover rubber portion  |
| $A_b$            | effective area of bolt  |
| $A_e$            | overlap area between the top and bottom elastomer area of isolator  |
| $A_{free}$       | load-free area of isolator  |
| $A_{load}$       | loaded area of isolator   |
| $A_p$            | area of the lead plug for a lead rubber bearing   |
| $a$              | side length of square elastomeric isolator, excluding cover rubber thickness, or length in longitudinal direction of rectangular isolator, excluding cover rubber thickness |
| $a_e$            | length of the shorter side of the rectangular isolator, including cover rubber thickness  |
| $a'$             | length in longitudinal direction of the rectangular isolator, including cover rubber thickness  |
| $B$              | effective width for bending of flange   |
| $b$              | length in transverse direction of the rectangular isolator, excluding cover rubber thickness  |
| $b'$             | length in transverse direction of the rectangular isolator, including cover rubber thickness  |
| $c$              | distance from centre of bolt hole to effective flange section   |
| $D'$             | outer diameter of circular isolator, including cover rubber   |
| $D_f$            | diameter of flange  |
| $d_i$            | inner diameter of reinforcing steel plate   |
| $d_k$            | diameter of bolt hole   |
| $d_0$            | outer diameter of reinforcing steel plate   |
| $E_{ap}$         | apparent Young's modulus of bonded rubber layer   |
| $E_c$            | apparent Young's modulus corrected, if necessary, by allowing for compressibility   |
| $E_c^s$          | apparent Young's modulus corrected for bulk compressibility depending on its shape factor ( $S_1$ )   |
| $E_\infty$       | bulk modulus of rubber  |
| $E_0$            | Young's modulus of rubber   |
| $F_u$            | tensile force on isolator by uplift   |
| $G$              | shear modulus   |
| $G_{eq}(\gamma)$ | equivalent linear shear modulus at shear strain   |
| $H$              | height of elastomeric isolator, including mounting flange   |
| $H_n$            | height of elastomeric isolator, excluding mounting flange   |
| $h_{eq}$         | equivalent damping ratio  |
| $h_{eq}(\gamma)$ | equivalent damping ratio as a function of shear strain  |
| $K_d$            | post-yield stiffness (tangential stiffness after yielding of lead plug) of lead rubber bearing  |
| $K_h$            | shear stiffness   |
| $K_i$            | initial shear stiffness   |
| $K_p$            | shear stiffness of lead plug inserted in lead rubber bearing  |
| $K_r$            | shear stiffness of lead rubber bearing before inserting lead plug   |
| $K_t$            | tangential shear stiffness  |
| $K_v$            | compressive stiffness   |
| $L_f$            | length of one side of a rectangular flange  |
| $M$              | resistance to rotation  |
| $M_f$            | moment acting on bolt   |
| $M_r$            | moment acting on isolator   |
| $n$              | number of rubber layers   |
| $n_b$            | number of fixing bolts  |

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