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**Elastomeric seismic-protection  
isolators —**

**Part 4:  
Guidance on the application of  
ISO 22762-3**

**iTeh STANDARD PREVIEW**  
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*Appareils d'appuis structuraux en élastomère pour protection  
sismique —  
Partie 4: Lignes directrices pour l'application de l'ISO 22762-3*

ISO/TS 22762-4:2014

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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

ISO 22762 consists of the following parts, under the general title *Elastomeric seismic-protection isolators*:

- *Part 1: Test methods*
- *Part 2: Applications for bridges — Specifications*
- *Part 3: Applications for buildings — Specifications*
- *Part 4: Guidance on the application of ISO 22762-3 [Technical Specification]*

# Elastomeric seismic-protection isolators —

## Part 4:

## Guidance on the application of ISO 22762-3

### 1 Scope

This Technical Specification provides guidance on the use of ISO 22762-3:2010. It includes example design calculations and provides data on the characteristics obtained from all types of elastomeric isolators.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 22762-1:2010, *Elastomeric seismic-protection isolators — Part 1: Test methods*

ISO 22762-3:2010, *Elastomeric seismic-protection isolators — Part 3: Applications for buildings — Specifications*

### 3 Terms and definitions

[ISO/TS 22762-4:2014](https://standards.iteh.ai/catalog/standards/sist/31333269-bf24-4e70-866f-6541e3082014/iso-ts-22762-4-2014)

<https://standards.iteh.ai/catalog/standards/sist/31333269-bf24-4e70-866f-6541e3082014/iso-ts-22762-4-2014>

For the purposes of this document, the terms and definitions given in ISO 22762-3:2010 apply.

### 4 Guidance on the use of Clause 4 of ISO 22762-3

No guidance is given.

### 5 Guidance on the use of Clause 5 of ISO 22762-3

No guidance is given.

### 6 Guidance on the use of Clause 6 of ISO 22762-3

#### 6.1 General

Guidance is given for 6.2, 6.4, and 6.5.

#### 6.2 Type tests and routine tests

An example of the scaled test pieces (scales A and B) for the type testing of the specific isolator size is given as follows.

Dimensions and properties of target isolator (isolator-X) are shown in [Table 1](#).

**Table 1 — Dimensions and properties of isolator-X**

Outer diameter, $d_o$ (mm)	1 000
Inner diameter, $d_i$ (mm)	25
Thickness of one rubber layer, $t_r$ (mm)	6,7
Thickness of reinforcing steel plate, $t_s$ (mm)	4,4
Number of rubber layer, $n$	30
First shape factor, $S_1$	36,4
Second shape factor, $S_2$	5,0
Shear stiffness, $K_h$ (N/mm $\times 10^3$ )	2,44
Equivalent damping ratio, $h_{eq}$	0,225
Compressive stiffness, $K_v$ (N/mm $\times 10^3$ )	5 450

In this case, requirement for scales A and B test piece are shown in Table 4 of ISO 22762-3:2010.

An example of dimensions and properties of scales A and B is shown in Table 2.

**Table 2 — Examples of Scales A and B for Isolator-X**

Characteristics	Scale A	Scale B
Scale	0,25	0,6
Outer diameter, $d_o$ (mm)	250	600
Inner diameter, $d_i$ (mm)	0 (6,3)	15
Thickness of one rubber layer, $t_r$ (mm)	1,7	4,0
Thickness of reinforcing steel plate, $t_s$ (mm)	1,2	2,2
Number of rubber layer, $n$	30	30
First shape factor, $S_1$	36,4	36,4
Second shape factor, $S_2$	5,0	5,0
Shear stiffness, $K_h$ (N/mm $\times 10^3$ )	0,61	1,46
Equivalent damping ratio, $h_{eq}$	0,225	0,225
Compressive stiffness, $K_v$ (N/mm $\times 10^3$ )	1 360	3 270

For any dimension, variation of  $\pm 5$  % from exact scale-downed dimensions can be allowed.

The scaling of reinforcing plate for scale A can be adjusted if the effect on characteristics of isolator is not significant. In the case of scale A in Table 2, the thickness of the plate is computed as 1,1 mm and 1,2 mm is adopted for the test piece.

Number of the test pieces required is not specified in the text. The recommended number of the test pieces is shown in Table 3 when each test piece is tested individually. In the case that double-shear testing arrangement is used for determining the shear properties, it is recommended that two tests are performed and the number of test pieces doubled.

**Table 3 — Recommended number of test pieces for each test item**

Properties		Number of test pieces
Compressive properties		2
Shear properties		2
Dependency of shear properties	Shear strain dep.	2
	Compressive stress dep.	2
	Others	1
Dependency of compressive properties		1
Ultimate properties		1
Durability		1

In the case shown in Table 4, the available previous test results can be used for substitution of the test required for the newly designed isolator.

**Table 4 — An example of available previous type test results: Comparison of characteristics between newly designed and previously tested isolator**

Characteristics	Previously tested isolator	Newly designed isolator (-)	Newly designed isolator (+)	Remarks
Outer diameter, $d_o$ (mm)	1 100	1 000	1 200	within $\pm 10$ %
Inner diameter, $d_i$ (mm)	25	25	27	within $\pm 10$ %
Thickness of one rubber layer, $t_r$ (mm)	7,0	6,7	7,5	within $\pm 10$ %
Thickness of reinforcing plate, $t_s$ (mm)	4,4	4,4	4,8	within $\pm 10$ %
Number of rubber layer, $n$	30	30	30	same
First shape factor, $S_1$	38,4	36,4	42,0	within $\pm 10$ %
Second shape factor, $S_2$	5,2	5,0	5,3	within $\pm 10$ %
Maximum comp. stress for test, $\sigma_{\max}$ (MPa)	30	25	30	Previous test more severe condition
Minimum comp. stress for test, $\sigma_{\min}$ (MPa)	-0,5	5,0	0,5	Previous test more severe condition
Maximum shear strain for test, $\gamma_{\max}$	3,5	3,0	3,2	Previous test more severe condition

### 6.3 Functional requirements

No guidance is given.

### 6.4 Design compressive force and design shear displacement

Design compressive force refers to the force under non-seismic conditions.

Any specification or guidance is not given regarding nominal stress,  $\sigma_{\text{nom}}$ . Recommended process to specify  $\sigma_{\text{nom}}$  is given as follows:

- $\sigma_{\text{nom}}$  is determined in the range less than 30 % of critical stress,  $\sigma_{\text{cr}}$ . Maximum  $\sigma_{\text{nom}}$  is less than or equal to 15 MPa.
- Adequacy of  $\sigma_{\text{nom}}$  is verified so that compressive stress dependency (change of shear property under 0,5  $\sigma_{\text{nom}}$  and 2,0  $\sigma_{\text{nom}}$ ) is acceptable. Maximum  $\sigma_{\text{nom}}$  is less than or equal to 15 MPa.

## 6.5 Performance requirements

Examples of tests for each requirement are introduced.

### 6.5.1 General

No guidance is given.

### 6.5.2 Compressive properties

Example for 6.5.2 of ISO 22762-3 on compressive properties is given.

#### 6.5.2.1 In case of HDR

##### a) Test piece and test conditions

Test piece is shown in [Table 5](#).

**Table 5 — Test isolators (scaled isolator)**

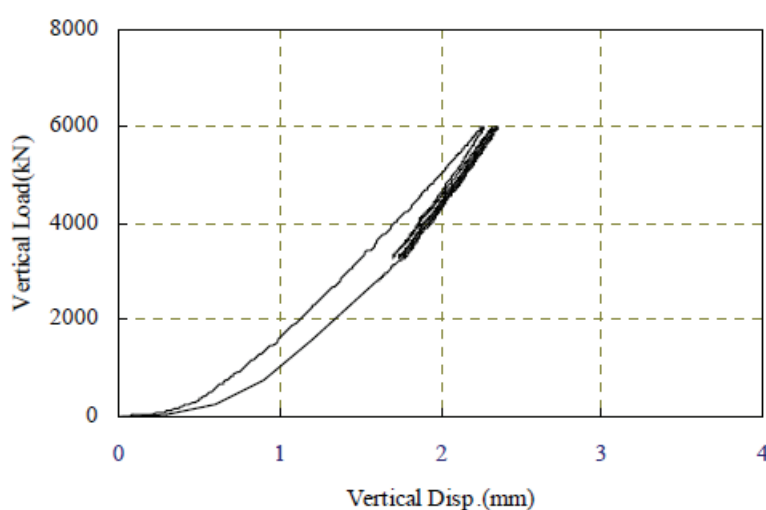
Type	Outer diameter (mm)	Inner diameter (mm)	First shape factor	Second shape factor	Compressive stress (N/mm <sup>2</sup> )	Number of test isolator
HDR	700	15	36,4	5,0	12,0	1

Test conditions are given below:

- compressive stress amplitude: 12 MPa  $\pm$  30 %;
- number of cycles: 3 cycles;
- compressive stiffness,  $K_v$ , is computed from 3rd cycle.

##### b) Test result

The result for one type of HDR is plotted in [Figure 1](#) and [Table 6](#).



**Figure 1 — Compressive property test of HDR**

**Table 6 — Test results**

Characteristics	Test result
Compressive stiffness, $K_v$	4 592,0 kN/mm

### 6.5.3 Shear properties

Example for 6.2.2 of ISO 22762-3 on shear properties is given.

#### 6.5.3.1 In case of HDR

a) Test piece and test conditions

Test piece is shown in [Table 7](#).

**Table 7 — Test isolators (scaled isolator)**

Type	Outer diameter (mm)	Inner diameter (mm)	First shape factor	Second shape factor	Compressive stress (N/mm <sup>2</sup> )	Number of test isolator
HDR	700	15	36,4	5,0	12,0	1

Test conditions are given below:

- compressive stress: 12 MPa;
- shear strain amplitude:  $\pm 100\%$  (141 mm);
- number of cycles: 3 cycles;
- shear stiffness,  $K_h$ , and damping ratio,  $h_{eq}$ , are computed from 3rd cycle.

b) Test results

The result for one type of HDR is shown in [Figure 2](#) and [Table 8](#).

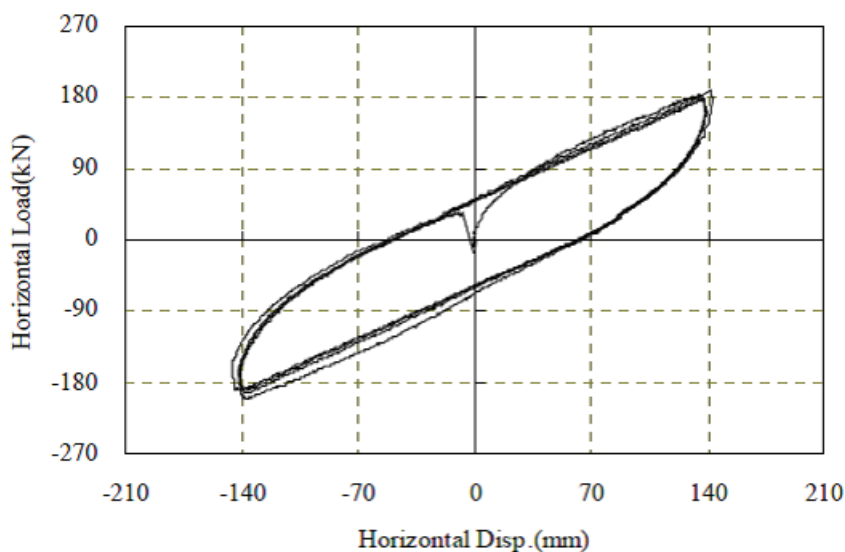
**Figure 2 — Shear property test of HDR**

Table 8 — Test piece

Characteristics	Test result
Shear stiffness, $K_h$	4 592,0 kN/mm
Equivalent damping ration, $h_{eq}$	0,21

#### 6.5.4 Tensile properties

Example for 6.5.4 of ISO 22762-3 on shear properties is given.

##### 6.5.4.1 In case of LNR

###### a) Test piece and test conditions

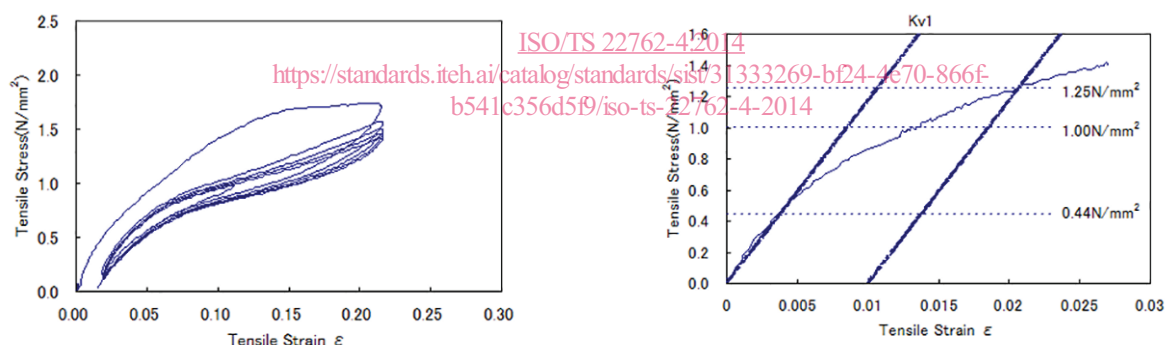
Test pieces are shown in Table 9.

Table 9 — Test piece

Type	Outer diameter (mm)	$S_1$	$S_2$
LNR	500	32,0	5,1
	800	31,7	5,1

###### b) Test results

Test results are shown in Figures 3 a) and b) and Table 10.



a) relationship of tensile stress and tensile strain of LNR under shear-strain offset of 100%

b) measurement of tensile yield stress

Figure 3 — Tensile performance at  $\gamma = 100 \%$ 

Table 10 — Test results

Outer diameter (mm)	Tensile yield stress under shear strain of 100% (MPa)
500	1,25
800	1,19

##### 6.5.4.2 In case of HDR

###### a) Test piece and test conditions

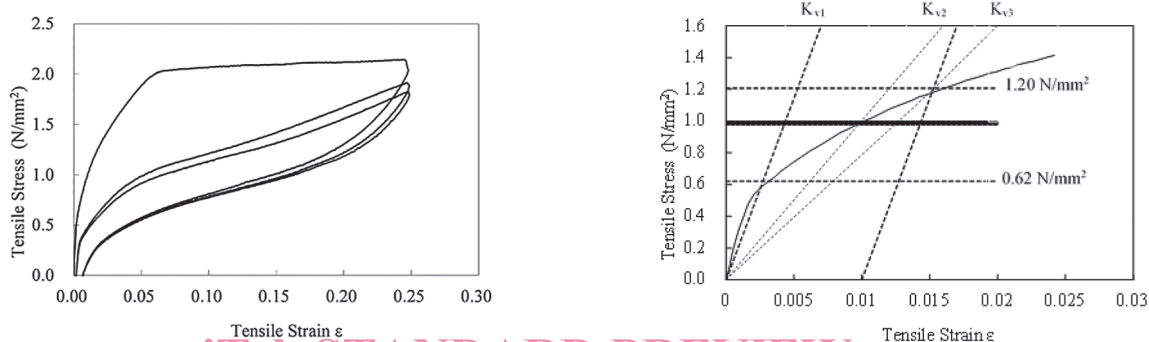
Test pieces are shown in [Table 11](#).

**Table 11 — Test piece**

Type	Outer diameter (mm)	$S_1$	$S_2$
HDR	800	36,1	4,0
	600	36,6	3,0

b) Test results

Test results are shown in [Figures 4 a\) and b\)](#) and [Table 12](#).



a) relationship of tensile stress and tensile strain of HDR under shear-strain offset of 100%      b) measurement of tensile yield stress

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**Figure 4 — Tensile performance at  $\gamma = 100\%$**

**Table 12 — Test results**

Outer diameter (mm)	Tensile yield stress under shear strain of 100% (MPa)
800	1,2
600	1,4

## 6.5.5 Dependencies of shear properties

### 6.5.5.1 Shear strain dependency

Example for 6.5.5.1 of ISO 22762-3 on shear strain dependency is given.

#### 6.5.5.1.1 In case of HDR

##### a) Test piece and test conditions

###### 1) Scaled model

Test pieces of scaled model are shown in [Table 13](#).

**Table 13 — Test isolators (scaled model)**

Type	Outer dia. (mm)	First shape factor	Second shape factor	Compressive stress (N/mm <sup>2</sup> )	Number of isolators tested
HDR	225	35,2	3,3	9,3	1
	225	35,2	5,0	15,0	2
	225	35,2	8,3	15,0	1

Test conditions are given below:

- test vibration frequency: 0,33 Hz, sinusoidal wave;
- shear strain amplitude:  $\gamma = \pm 10 \%$ ,  $\pm 20 \%$ ,  $\pm 50 \%$ ,  $\pm 100 \%$ ,  $\pm 150 \%$ ,  $\pm 200 \%$ , and  $\pm 270 \%$ ;
- loading cycles: 3 cycles, respectively;
- reference cycle: 3rd cycle;
- test results were corrected to the corresponding value of the property at 20 °C by the specified method in ISO 22762-3, 6.5.3.3.3.

## 2) Full scale isolators

Test pieces of full scale isolators are shown in [Table 14](#).

**Table 14 — Test isolators (full scale)**  
(standards.iteh.ai)

Type	Outer dia. (mm)	First shape factor	Second shape factor	Compressive stress (N/mm <sup>2</sup> )	Number of isolators tested
HDR	600	36,6	3,0	6,6	1
	800	36,1	4,0	12,1	1
	1 000	36,4	5,0	15,0	1
	1 200	35,8	6,0	15,0	1
	1 600	36,5	6,4	15,0	1

Test conditions are given below and in [Table 15](#).

- test wave: triangular wave;
- shear strain amplitude:  $\gamma = \pm 50 \%$ ,  $\pm 100 \%$ , and  $\pm 200 \%$ ;
- loading cycles: 3 cycles, respectively;
- reference cycle: 3rd cycle;
- test results were corrected to their counterpart with 0,33 Hz by the specified method in ISO 22762-3, 6.5.5.3;
- test results were corrected to the corresponding value of the property at 20 °C by the specified method in ISO 22762-3, 6.5.5.5.