

Elastomeric seismic-protection isolators —

Part 3: Applications for buildings — Specifications

ICS 83.140.99; 91.120.25

National foreword

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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



Reference number
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Documents

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 22762-3 was prepared by Technical Committee 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*

Introduction

This International Standard contains two parts related to specifications for isolators — one for bridges and the other for buildings — since the requirements for isolators for bridges and for buildings are quite different, although the basic concept of the two products is similar. Therefore, when this International Standard is applied to the design of bridge isolators, Part 2 and the relevant clauses in Part 1 are used and, when it is applied to building isolators, Part 3 and the relevant clauses in Part 1 are used.

The main differences to be noted between isolators for bridges and isolators for buildings are as below:

- a) Isolators for bridges are mainly rectangular in shape and those for buildings 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 that are neither buildings nor bridges (e.g. tanks), the structural engineer may use either Part 2 or Part 3 of this International Standard, depending on the requirements of the structure.

Elastomeric seismic-protection isolators —

Part 3: Applications for buildings — Specifications

1 Scope

ISO 22762 applies to elastomeric seismic isolators used to provide buildings or bridges with protection from earthquake damage. The isolators covered consist of alternate elastomer 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.

This part of ISO 22762 specifies the requirements for elastomeric seismic isolators used for buildings and the requirements for the rubber material used in the manufacture of such isolators. The specification covers requirements, design rules, manufacturing tolerances, marking and labelling and test methods for elastomeric isolators.

Some items of classification and some requirements need to be confirmed before production and these should be reviewed using the list given in Annex B.

2 Normative references

The following referenced documents are indispensable for the application 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, *Structural steels — Plates, wide flats, bars, sections and profiles*

ISO 1052, *Steels for general engineering purposes*

ISO 1629, *Rubber and latices — Nomenclature*

ISO 3302-1, *Rubber — Tolerances for products — Part 1: Dimensional tolerances*

ISO 22762-1:2005, *Elastomeric seismic-protection isolators — Part 1: Test methods*

3 Terms and definitions

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

- 3.1
breaking**
rupture of elastomeric isolator due to compression (or tension)-shear loading
- 3.2
buckling**
state when elastomeric isolators lose their stability under compressive-shear loading
- 3.3
compressive properties of elastomeric isolator**
compressive stiffness (K_v) for all types of rubber bearings
- 3.4
compressive-shear testing machine**
machine used to test elastomeric isolators, which has the capability of shear loading under constant compressive load
- 3.5
cover rubber**
rubber wrapped around the outside of inner rubber and reinforcing steel plates before or after curing of elastomeric isolators for the purpose of protecting the inner rubber from deterioration due to oxygen, ultraviolet rays and other natural elements and protecting the reinforcing plates from corrosion
- 3.6
design compressive stress**
long-term compressive force on the elastomeric isolator imposed by the structure
- 3.7
effective loaded area**
area sustaining vertical load in elastomeric isolators, which corresponds to the area of reinforcing steel plates
- 3.8
effective width**
(rectangular elastomeric isolator) the smaller of the two side lengths of inner rubber to which direction shear displacement is not restricted
- 3.9
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
- NOTE Types of such isolators include high-damping rubber bearings, linear natural rubber bearings and lead rubber bearings.
- 3.10
first shape factor**
ratio of effectively loaded area to free deformation area of one inner rubber layer between steel plates
- 3.11
high-damping rubber bearing
HDR**
elastomeric isolator with relatively high-damping properties obtained by special compounding of the rubber and the use of additives

3.12**inner rubber**

rubber between multi-layered steel plates inside an elastomeric isolator

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

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

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

elastomeric isolator with linear shear force-deflection characteristics and relatively low-damping properties and fabricated using natural rubber

NOTE Any bearing with relatively low damping may be treated as an LNR bearing for the purposes of isolator testing.

3.15**maximum compressive stress**

maximum compressive stress acting briefly on elastomeric isolators during an earthquake

3.16**nominal compressive stress**

long-term compressive stress recommended by the manufacturer for the isolator, including the safety margin

3.17**roll-out**

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

3.18**routine test**

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

3.19**second shape factor**

⟨circular elastomeric isolator⟩ ratio of the diameter of the inner rubber to the total thickness of the inner rubber

⟨rectangular or square elastomeric isolator⟩ ratio of the effective width of the inner rubber to the total thickness of the inner rubber

3.20**shear properties of elastomeric isolators**

a 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_d) and characteristic strength (Q_d) for LRB.

3.21**structural engineer**

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

3.22

type test

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

3.23

ultimate properties

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

3.24

ultimate property diagram

UPD

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

4 Symbols and abbreviated terms

For the purposes of all three parts of ISO 22762, the symbols given in Table 1 apply.

Table 1 — Symbols and definitions

Symbol	Definition
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 sheared under non-seismic displacement
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_o	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 the shape factor (S_1)
E_∞	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 γ
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 square 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
P	compressive force
P_0	design compressive force
P_{max}	maximum design compressive force

$P_{\min}$	minimum design compressive force
P_{Tb}	tensile force at break of isolator
P_{Ty}	tensile force at yield of isolator
Q	shear force
Q_b	shear force at break
Q_{buk}	shear force at buckling
Q_d	characteristic strength
S_1	first shape factor
S_2	second shape factor
T	temperature
T_r	total rubber thickness, given by $T_r = n \times t_r$
t_r	thickness of one rubber layer
t_{r1}, t_{r2}	thickness of rubber layer laminated on each side of plate
t_s	thickness of one reinforcing steel plate
t_o	thickness of outside cover rubber
$U(\gamma)$	function giving ratio of characteristic strength to maximum shear force of a loop
V	uplift force
v	loading velocity
W_d	energy dissipated per cycle
X	shear displacement
X_0	design shear displacement
X_b	shear displacement at break
X_{buk}	shear displacement at buckling
X_s	shear displacement due to quasi-static shear movement
$X_{\max}$	maximum design shear displacement
X_d	shear displacement due to dynamic shear movement
Y	compressive displacement
Z	section modulus of flange
α	coefficient of linear thermal expansion
γ	shear strain

γ_0	design shear strain
γ_a	upper limit of the total of design strains on elastomeric isolators
γ_b	shear strain at break
γ_c	local shear strain due to compressive force
γ_d	shear strain due to dynamic shear movement
$\gamma_{\max}$	maximum shear strain during earthquake
γ_r	local shear strain due to rotation
γ_s	shear strain due to quasi-static shear movement
γ_u	ultimate shear strain
δ_H	horizontal offset of isolator
δ_V	difference in isolator height measured between two points at opposite extremes of the isolator
ε	compressive strain of isolator
ε_{cr}	creep strain
ε_T	tensile strain of isolator
ε_{Tb}	tensile strain at break of isolator
ε_{Ty}	tensile strain at yield of isolator
ζ	ratio of total rubber height to total height of rubber and steel layers
θ	rotation angle of isolator about the diameter of a circular bearing or about an axis through a rectangular bearing
θ_a	rotation angle of isolator in the longitudinal direction (a)
θ_b	rotation angle of isolator in the transverse direction (b)
λ	correction factor for calculation of stress in reinforcing steel plates
η	correction factor for calculation of critical stress
κ	correction factor for apparent Young's modulus according to hardness
$\Sigma\gamma$	total local shear strain
ρ_R	safety factor for roll-out
ρ_T	safety factor for tensile force
σ	compressive stress in isolator
σ_0	design compressive stress
σ_B	tensile stress in bolt

σ_b	bending stress in flange
σ_{bf}	allowable bending stress in steel
σ_{cr}	critical stress in isolator
σ_f	allowable tensile stress in steel
σ_{max}	maximum design compressive stress
σ_{min}	minimum design compressive stress
σ_{nom}	for building: nominal long term compressive stress recommended by manufacturer
σ_s	tensile stress in reinforcing steel plate
σ_{sa}	allowable tensile stress in steel plate
σ_{sy}	yield stress of steel for flanges and reinforcing steel plates
σ_{su}	tensile strength of steel for flanges and reinforcing steel plates
σ_t	tensile stress
σ_{te}	allowable tensile stress in isolator
σ_{yi}	yield stress in steel plate
τ_B	shear stress in bolt
τ_f	allowable shear stress in steel
ϕ	factor for computation of buckling stability
ψ	factor for computation of buckling check
ξ	factor for computation of critical stress

5 Classification

5.1 General

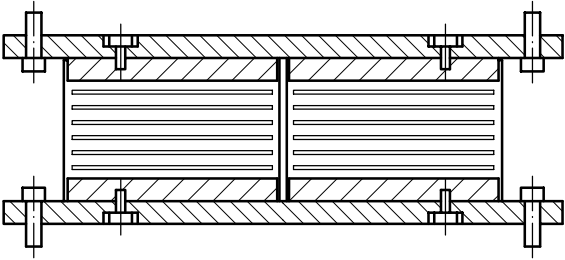
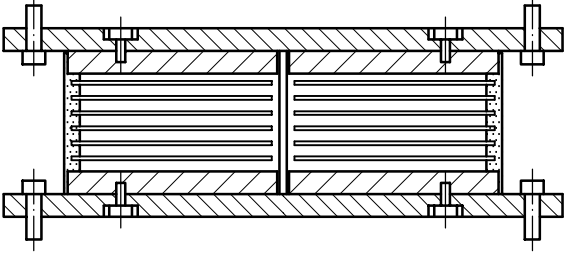
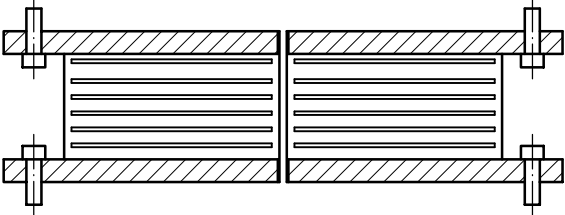
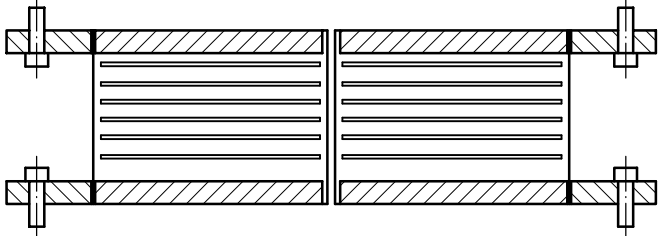
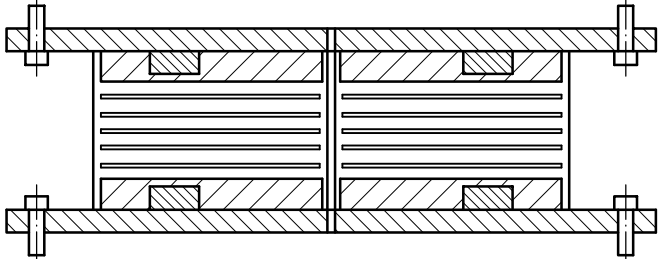
Elastomeric isolators are classified by construction, their ultimate properties, and tolerances on their performance.

5.2 Classification by construction

Elastomeric isolators are classified by construction as shown in Table 2.

Other methods not listed in Table 2 may be used to fix flanges to the laminated rubber if the resulting construction has adequate strength to resist the shear forces and bending moments due to shear deflection. Furthermore, such constructions shall be capable of resisting tension if the elastomeric isolator is designed for uplift.

Table 2 — Classification by construction

Type I	Mounting flanges are bolted to connecting flanges, which are bonded to the laminated rubber. Cover rubber is added before curing of isolator.	
	Mounting flanges are bolted to connecting flanges, which are bonded to the laminated rubber. Cover rubber is added after curing of isolator.	
Type II	Mounting flanges are directly bonded to the laminated rubber.	
Type III	Isolators without mounting flanges, connected to base by either recess rings or dowell pins.	 Recess connection
		 Dowell connection

5.3 Classification by ultimate properties

Elastomeric isolators may be classified by their ultimate properties as shown in Table 3. The ultimate properties are defined as the compressive stress and the shear strain when the isolator reaches the ultimate state. The ultimate state of the isolator is defined as buckling, breaking or roll-out (see Annex C).

Table 3 — Classification by ultimate properties

Ultimate shear strain	$\gamma_u \geq 350 \%$	$300 \% \leq \gamma_u < 350 \%$	$250 \% \leq \gamma_u < 300 \%$	$200 \% \leq \gamma_u < 250 \%$	$150 \% \leq \gamma_u < 200 \%$	$150 \% > \gamma_u$
Class	A	B	C	D	E	F

Isolators are designated using the ultimate shear strain γ_u at a nominal compressive stress σ_{nom} and at a compressive stress of $2 \times \sigma_{nom}$, where σ_{nom} is taken as the long-term stress and $2 \times \sigma_{nom}$ as the maximum short-term compressive stress during an earthquake. A recommended value of σ_{nom} is given by the manufacturer.

The shear strain in the ultimate state may be determined, at each of these two compressive stresses, by the methods specified in Annex C and Annex H.

The way in which the designation code of an isolator is derived is illustrated by the following example:

At $\sigma_{nom} = 8 \text{ N/mm}^2$, $\gamma_u = 320 \%$. The isolator is therefore class B under these conditions.

At $2 \times \sigma_{nom} = 16 \text{ N/mm}^2$, $\gamma_u = 240 \%$. The isolator is therefore class D under these conditions.

The designation code is therefore:

N8B-M16D (the stress value is always rounded to the nearest whole number)

where N denotes nominal and M maximum.

NOTE In the selection of isolators for a particular project, the ultimate properties under both maximum compressive stress and minimum compressive stress need to be considered. The classification in Table 3 provides a guide for bolted isolators in situations where the minimum stress is not tensile.

5.4 Classification by tolerance on shear properties

Elastomeric isolators are classified by tolerance on shear properties as shown in Table 4.

Table 4 — Classification by tolerance of shear properties

Class	Individual	Global
S-A	$\pm 15 \%$	$\pm 10 \%$
S-B	$\pm 25 \%$	$\pm 20 \%$

6 Requirements

6.1 General

Elastomeric isolators for buildings and the materials used in their manufacture shall meet the requirements specified in this clause. For test items (see Table 5) that have no specific required values, the manufacturer shall define the values and inform the purchaser prior to production.

The standard temperature for determining the properties of elastomeric isolators is 23 °C in accordance with prevailing International Standards. However, it is advisable to establish a range of working temperatures taking into consideration actual environmental temperatures and possible changes in temperature at the work site where the elastomeric isolators are installed.

Table 5 — Test pieces for type testing

Properties	Test item	Test piece
Compressive properties	Compressive stiffness	Full-scale only
Shear properties	Shear stiffness	Full-scale only
	Equivalent damping ratio	
Tensile properties	Tensile fracture strength	Scale B
Dependency of shear properties	Shear strain dependency	Full-scale only
	Compressive stress dependency	Full-scale only
	Frequency dependency	Scale A, STD, SBS
	Repeated loading dependency	Scale B
	Temperature dependency	Scale A, STD, SBS
Dependency of compressive properties	Shear strain dependency	Scale B
	Compressive stress dependency	
Ultimate properties	Breaking strain	Scale B
	Buckling strain	
	Roll-out strain	
Durability	Ageing	Scale A, STD, SBS
	Creep	Scale A
Scale A: Scaling such that, for a circular bearing, diameter ≥ 150 mm, for a rectangular bearing, side-length ≥ 100 mm, and, for both types, rubber layer thickness $\geq 1,5$ mm and thickness of reinforcing steel plates $\geq 0,5$ mm. Scale B: Scaling such that, for a circular bearing, diameter ≥ 500 mm, for a rectangular bearing, side-length ≥ 500 mm and, for both types, rubber layer thickness $\geq 1,5$ mm and thickness of reinforcing steel plates $\geq 0,5$ mm. Minimum scale factor 0,5. STD = standard test piece (see Tables 10 and 11 of ISO 22762-1:2005). SBS = shear-block test piece specified in ISO 22762-1:2005, 5.8.3. With LRB, SBS shall only be used for ageing tests.		

NOTE Some of these properties may be determined using one of the standard test pieces detailed in Tables 10 and 11 in ISO 22762-1:2005. The standard test pieces are used for non-specific product tests, such as testing in the development of new materials and products.

6.2 Type tests and routine tests

Testing to be carried out on elastomeric isolators is classified into “type tests” and “routine tests”.

Type tests shall be conducted either to ensure that project design parameters have been achieved (in which case the test results shall be submitted to the structural engineer for review prior to production) or to verify isolator performance and material properties during development of the product. The test piece for each type test shall be full-scale or one of the options specified in Table 5. The test piece shall not have been subjected to any previous test programme. The tests shall be performed on test pieces not subjected to any scragging, unless the production isolators are to be supplied after scragging. In that case, the test pieces shall be subjected to the same scragging procedure as the production isolators.

Previous type test results may be substituted provided the following conditions are met:

- a) Isolators are fabricated in a similar manner and from the same compound cured under the same conditions.
- b) All corresponding external and internal dimensions are within 10 % of each other.
- c) The second shape factors are within ± 10 %.
- d) The test conditions, such as maximum vertical load applied in the ultimate property test (see 6.5.7), are more severe.
- e) For the ultimate property test (6.5.7) and compressive stress dependency test (6.5.5.2), the previous test results were obtained on isolators with a smaller or equal second shape factor S_2 in the cases of that S_2 is less than 5.
- f) The previous test results were obtained within a period accepted by the structural engineer.

Routine tests are carried out during production for quality control. Sampling is allowed for routine testing. Sampling shall be conducted randomly and cover not less than 20 % of the production of any isolator design. For a given project, tests shall cover not less than four test pieces for each size and not less than 20 test pieces in total. If isolators are supplied after scragging, the routine test shall be performed on scragged isolators.

6.3 Functional requirements

Elastomeric isolators for buildings are designed and manufactured to have the performance characteristics required so that they deform in all directions with the proper stiffness (with damping, if required) during an earthquake.

In the application of elastomeric isolators, attention shall be paid to the following points:

- a) The isolators shall be installed horizontally between the structure and foundation.
- b) Once installed, the isolators shall not be subjected to a constant shear force.
- c) When isolators are to be installed under relatively flexible columns, the rotation at the top of the isolator caused by bending deformation shall be carefully considered.
- d) Exposed steel surfaces, such as the surfaces of mounting flanges, shall be properly painted or galvanized to prevent rusting.
- e) Proper maintenance shall be carried out on installed isolators to prevent any abnormalities such as distortion, cracks or rust occurring.
- f) Fire protection of the isolators may be required.
- g) The seismic gap shall be maintained at all times.

6.4 Design compressive force and design shear displacement

The design stress and strain of an isolator are defined by the following relationships with the design force and the displacement:

$$\sigma_0 = \frac{P_0}{A}, \quad \sigma_{\max} = \frac{P_{\max}}{A}, \quad \sigma_{\min} = \frac{P_{\min}}{A}$$

$$\gamma_0 = \frac{X_0}{T_r}, \quad \gamma_{\max} = \frac{X_{\max}}{T_r}$$

The design compressive forces P_0 , $P_{\max}$ and $P_{\min}$ and design shear displacements X_0 and $X_{\max}$ for an isolator shall be provided by the structural engineer. If the P_0 , $P_{\max}$, $P_{\min}$, X_0 and $X_{\max}$ are not known at the time of type testing, the design stress and design strain to be used for testing can be determined as follows:

$$\sigma_0 = \sigma_{\text{nom}}, \quad \sigma_{\max} = 2\sigma_{\text{nom}}$$

$\sigma_{\min}$, γ_0 and $\gamma_{\max}$ as determined by the manufacturer.

6.5 Performance requirements

6.5.1 General

The isolators shall be tested and the results recorded by the specified test methods. They shall satisfy all of the requirements listed below. The design value for each isolator shall be specified prior to the tests. The test items are summarized in Table 6 which indicates those type tests that are optional, where a material test piece may substitute for an isolator, and the tests to be performed as routine tests.

6.5.2 Compressive properties

a) Requirements:

The compressive stiffness K_v shall be within $\pm 30\%$ of the design value.

b) Test piece:

The test piece shall be a full-scale isolator for the type test and a production isolator for the routine test.

c) Test conditions:

As specified in ISO 22762-1:2005, 6.2.1.5.2, method 2, cyclic loading with the design compressive stress $\sigma_0 \pm 30\%$ shall be carried out for three cycles.

The compressive stiffness K_v shall be computed from the third cycle.

The standard test temperature is 23 °C. If the test is carried out at a different temperature, the result shall be corrected to the value of the property at 23 °C by an appropriate method.

Table 6 — Tests on isolators

Properties	Test items	Test method	Routine test	Type test
Compressive properties	Compressive stiffness	ISO 22762-1:2005, 6.2.1, Method 2	X	X
Shear properties	Shear stiffness Equivalent damping ratio	ISO 22762-1:2005, 6.2.2	X	X
Tensile properties	Tensile fracture strength	ISO 22762-1:2005, 6.5	N/A	Opt.
Dependency of shear properties	Shear strain dependency	ISO 22762-1:2005, 6.3.1	N/A	X
	Compressive stress dependency	ISO 22762-1:2005, 6.3.2	N/A	Opt.
	Frequency dependency	ISO 22762-1:2005, 6.3.3	N/A	X(m)
	Repeated loading dependency	ISO 22762-1:2005, 6.3.4	N/A	X
	Temperature dependency	ISO 22762-1:2005, 6.3.5 (m) ISO 22762-1:2005, 5.8	N/A	X(m)
Dependency of compressive properties	Shear strain dependency	ISO 22762-1:2005, 6.3.6	N/A	Opt.
	Compressive stress dependency	ISO 22762-1:2005, 6.3.7	N/A	Opt.
Ultimate properties	Breaking strain Buckling strain Roll-out strain	ISO 22762-1:2005, 6.4	N/A	X
Durability	Property change	ISO 22762-1:2005, 6.6.1	N/A	X(m)
	Creep	ISO 22762-1:2005, 6.6.2	N/A	X
X = test to be conducted with isolators; X(m) = test can be conducted either with isolators or with shear-block test pieces. N/A = not applicable; Opt. = optional.				

6.5.3 Shear properties

a) Requirements:

The following properties shall be within the specified range of design value corresponding to the adopted tolerance class specified in 5.4.

The test items specified for each type of isolator are shown in Table 7. The properties measured for LRB may be selected from either L-1 or L-2, as given in the table.

Table 7 — Shear property test items

Isolator type	Test items	
LNR	Shear stiffness K_h	
HDR	Shear stiffness K_h , equivalent damping ratio h_{eq}	
LRB	L-1	Shear stiffness K_h , equivalent damping ratio h_{eq}
	L-2	Post-yield stiffness K_d , characteristic strength Q_d