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## Furniture — Storage units — Test methods for the determination of strength, durability and stability

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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 136, *Furniture*.

This third edition ~~cancels and replaces the second edition (ISO 7170:2005)~~, which has been technically revised, and ISO 7171:2019, which has been merged into this document.

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

- addition of the Introduction;
- normative reference ISO 48-5:2018 replaces ISO 7619-2:2010;
- deletion of the pneumatic slamming apparatus for slam open and slam shut tests of extension elements;
- introduction of sideward detachment tests for units mounted to the building or other structure;
- introduction of a stability test for units with doors, extension elements and flaps, opened and unlocked with storage areas partly loaded;
- introduction of definitions, figures and additional an stability test method for units intended to support a TV-set;
- revision of the guidance for the choice of loads, cycles, etc. for strength, durability and stability testing in [Annex A](#);
- loads and forces for different applications have been merged in [Annex B](#).

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

This document has been developed with the objective of promoting relevant test methods for determining the strength, durability and stability of storage furniture, simulating normal functional use, as well as foreseeable misuse, that might reasonably be expected to occur. The tests are designed to evaluate properties without regard to materials, design/construction or manufacturing processes and intended to demonstrate the ability of the item to give satisfactory service in its intended environment.

The test results are only valid for the unit/component tested. These results can be used to represent the performance of production models prior to use, provided that the tested unit/component is representative of the production model. Only when properly justified, they can be used for failure analysis of a unit that has been in use.

The strength and durability tests do not assess the structure of the building, e.g. the strength of wall hanging cabinets includes only the cabinet and the parts used for the attachment. The wall and the attachment into the wall are not included.

Assessment of ageing and environmental degradation is not included.

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# Furniture — Storage units — Test methods for the determination of strength, durability and stability

## 1 Scope

This document specifies test methods for determining the strength, durability and stability of storage units, when fully assembled prior to use, including their movable and non-movable parts.

Acceptance criteria for the strength, durability and stability of the storage furniture is not specified by the test methods. Instead, suggested loads, cycles and forces are provided in [Annex B](#), depending on the applicability of the furniture.

## 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 48-5:2018, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 5: Indentation hardness by IRHD pocket meter method*

## 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 <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1

#### **adjustable friction stay**

*component* (3.7) to hold open a door or a *flap* (3.13) with a feature that keeps the door or flap open without any further assistance at a multitude of positions

### 3.2

#### **bracket**

rigid device to prevent overturning

Note 1 to entry: Normally made of metal; not a flexible device such as strap or cable tie.

### 3.3

#### **built-in stop**

device of the *component* (3.7) that limits the travel of *extension element* (3.12) or doors

### 3.4

#### **catch device**

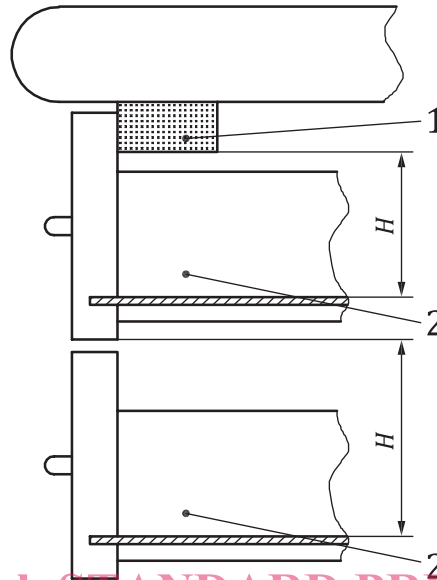
device that keeps or pulls a *component* (3.7) in place but does not require a second action in order to release it

EXAMPLE A magnetic catch or a self-closing-mechanism.

**3.5  
clear height**

unobstructed height above the top of the bottom surface, or the structure of the *unit* (3.27)

Note 1 to entry: For example, the top of the *extension element* (3.12) below and the lower edge of the extension element above (see Figure 1).



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- Key**
- 1 structure of the unit
  - 2 extension element
  - H clear height

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**Figure 1 — Clear height**

**3.6  
coat hook**  
*component* (3.7) to support an outer garment

**3.7  
component**  
part of a *unit* (3.27) including hardware, e.g. *extension element* (3.12), door and *flap* (3.13)

**3.8  
configuration**  
arrangement of *components* (3.7) in a particular figure, form or combination

**3.9  
damper mechanism**  
mechanism that gently brings the *component* (3.7) to a stop

**3.10  
distance device**  
device intended to keep an item of wall-mounted furniture vertical

**3.11  
excessive heating**  
result of repeated friction such that a *component* (3.7) is adversely compromised



**3.12****extension element**

*component* (3.7) that can be pulled out and pushed in

EXAMPLE Drawers, suspended pocket files, keyboard *tray* (3.25).

**3.13****flap**

horizontally hinged door, which opens upwards or downwards

**3.14****free-standing unit**

*unit* (3.27) not intended to be attached to a load bearing structure

**3.15****height adjustment device**

adjustable device intended to enable height adjustment of a *unit* (3.27), such as a work surface

**3.16****interlock**

device that restrains the opening of more than one *extension element* (3.12) at a time

**3.17****latching mechanism**

mechanism that retains an *extension element* (3.12) or a door in the closed position and that requires a second action to release it and can require a key or a combination in order to activate it

**3.18****levelling device**

adjustable device intended to keep an item of furniture horizontal with a limitation of 40 mm of vertical range

EXAMPLE Adjustable feet or similar. <https://standards.iteh.ai/catalog/standards/sist/f23e3cd2-7554-4b95-bd5d-7e727dc7dbf8/iso-fdis-7170>

**3.19****locking mechanism**

mechanism that limits access to the interior of a *unit* (3.27) or a storage element and that requires a key or a combination in order to activate it or to make it possible to activate it

**3.20****overturn**

condition where an unrestricted storage *unit* (3.27) does not return to its upright normal position

**3.21****runners**

*component* (3.7) that is used to facilitate the movement of an *extension element* (3.12)

Note 1 to entry: Includes smooth surfaces, roller and ball bearing slides.

**3.22****self-locking stay**

*component* (3.7) to hold open a door or a *flap* (3.13) with a feature that keeps the door or flap open without any further assistance

**3.23****structural member**

*component* (3.7) to enhance the strength of the assembled *unit* (3.27)

**3.24****suspended filing pockets**

*extension element* (3.12) usually without a bottom such that contents are suspended by a frame

**3.25**

**tray**

storage element that is designed, under normal use, to be removed from the storage *unit* (3.27) and used independently

**3.26**

**TV-furniture**

*unit* (3.27) intended to, or marketed for, supporting a monitor, TV set or similar item

**3.27**

**unit**

complete furniture intended to be tested

EXAMPLE Bookcases, wardrobes, cabinets, wall-mounted or exterior-mounted elements, free-standing and mobile pedestals, lateral and vertical files.

**3.28**

**wall attachment device**

device including the component that is attached to the cabinet and the component that is attached to the wall

Note 1 to entry: A component that is attached to the cabinet is, for example, a suspension *bracket* (3.2).

Note 2 to entry: A component that is attached to the wall is, for example, a hook, a rail.

**3.29**

**worst case**

condition most likely to cause failure, e.g. the *configuration* (3.8) of a *unit* (3.27) most likely to cause it to *overturn* (3.20)

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**4 General test conditions**

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**4.1 Preliminary preparation**

The unit(s)/component(s) shall be tested as delivered. The unit(s)/component(s) shall be assembled and/or configured according to the instructions supplied. Unless otherwise stated, the most adverse configuration (3.8) shall be used for each test. If mounting or assembly instructions are not supplied, the mounting or assembly method shall be recorded in the test report. Fittings shall be tightened before testing and shall not be re-tightened unless specifically required in the manufacturer's instructions. If the configuration needs to be changed in order to produce the worst-case (3.26) conditions, this shall be recorded in the test report.

During testing, the unit shall be placed on the floor and levelled, unless otherwise specified. The levelling device (3.18) shall be set to the mid position but not more than 13 mm from fully closed.

A combination of tests can be necessary to cover the properties of multifunction components (e.g. a receding door shall be tested both as a sliding door and as a pivoted door).

Unless otherwise specified by the manufacturer, the sample for test shall be stored in indoor ambient conditions for at least 24 h immediately prior to testing.

The tests shall be carried out in indoor ambient conditions at a temperature between 15 °C and 27 °C. If during a test the temperature is outside of the range of 15 °C to 27 °C, the maximum and/or minimum temperature shall be recorded in the test report.

In addition, the test for deflection of shelves (6.1.4) and sustained load tests (6.2.1) except metal, stone and glass shelves, shall be carried out at a relative humidity of 45 % to 55 %. If during a test the relative humidity is outside this range, the maximum and/or minimum shall be recorded in the test report.

If a test cannot be carried out as specified (e.g. because a loading pad cannot be used for the application of a force due to the design of a product), the test shall be carried out as closely as possible to that specified.

Before beginning the testing, visually inspect the unit thoroughly. Record any defects so that they are not assumed to have been caused by the tests. Carry out measurements, if specified.

It is not necessary that all tests be carried out on the same unit, but all tests specified for a particular component shall be carried out on the same component.

In [Annex C](#), rationale for selected test methods is provided.

## 4.2 Application of forces

The test forces shall be applied sufficiently slowly to ensure that negligible dynamic force is applied. Unless otherwise specified, each specified force shall be maintained for not less than 10 s and not more than 15 s.

The test forces in durability tests shall be applied at a rate to ensure that excessive heating ([3.11](#)) does not occur. Unless otherwise specified, each test force shall be maintained for  $(2 \pm 1)$  s.

Forces shall be applied in a manner that ensures normal functioning of self-closing and damping mechanisms. The forces can be replaced by masses. The relationship  $10 \text{ N} = 1 \text{ kg}$  shall be used.

In [Annex B](#), loads, forces and cycles are suggested to ensure that the test methods are of use where no requirements document is available, or to assist in the development of one. See also [Annex A](#) for guidance to develop requirements documents.

## 4.3 Tolerances

Unless otherwise stated, the following tolerances are applicable to the test equipment:

- forces:  $\pm 5$  % of the nominal force;
- velocities:  $\pm 10$  % of the nominal velocity;
- masses:  $\pm 1$  % of the nominal mass;
- dimensions: all dimensions less than 200 mm shall have an accuracy of  $\pm 1$  mm of the nominal dimension; the other dimensions shall have an accuracy of  $\pm 0,5$  %; the dimension of the spherical curvature of 300 mm radius on the loading pad ([5.5](#)) shall have an accuracy of  $\pm 5$  mm;
- angles:  $\pm 2^\circ$  of the nominal angles.

The accuracy for the positioning of loading pads shall be  $\pm 5$  mm.

Test forces, masses, dimensions, velocities and angles used to perform the test shall be targeted at the nominal values specified and shall be subjected to the above tolerances.

NOTE For the purposes of uncertainty measurement, test results are not considered to be adversely affected when the above tolerances are met.

## 4.4 Prevention of movement during test

If a free-standing unit ([3.14](#)) tends to overbalance during the tests specified in [Clauses 6](#) and [7](#), load the unit until this tendency stops, unless otherwise specified.

If a free-standing unit tends to slide during the tests specified in [Clauses 6](#) and [7](#), with the exception of [6.4.2](#) and [6.4.3](#), the unit shall be restrained by stops ([5.2](#)).

## 4.5 Loading

Unless otherwise specified, for strength and durability tests, all storage components that are not subject to testing shall be uniformly loaded according to [Table 1](#).

**Table 1 — Loads for strength and durability tests**

Component	Load
All horizontal storage areas, including shelves, bottoms, tops and flaps	0,65 kg/dm <sup>2</sup>
Extension element ( <a href="#">3.12</a> ), tray ( <a href="#">3.25</a> ) and baskets	0,2 kg/dm <sup>3</sup>
Suspended filing pockets ( <a href="#">3.24</a> )	<sup>a</sup> 1,5 kg/dm
Clothes rails	2 kg/dm
Storage area/-volume for heavy appliances (e.g. refrigerator, washing machine)	<sup>b</sup> 0,5 kg/ dm <sup>3</sup>
<sup>a</sup> Measured perpendicular to the plane of the filing pockets.	
<sup>b</sup> Maximum load 200 kg per unit.	

Unless otherwise specified, for stability tests, all storage components shall be uniformly loaded with the specified load(s) according to [Table 2](#).

**Table 2 — Loads for stability tests**

Component	Load
All horizontal storage areas, including shelves, bottoms, tops and flaps	0,325 kg/dm <sup>2</sup>
Extension elements, trays and baskets with clear height ( <a href="#">3.5</a> ), $H \leq 1$ dm	0,2 kg/dm <sup>3</sup>
Extension elements, trays and baskets with clear height ( <a href="#">3.5</a> ), $H$ between 1 dm and 2,5 dm ( $H$ in dm)	$(0,2667 - 0,0667H)$ kg/dm <sup>3</sup>
Extension elements, trays and baskets with clear height ( <a href="#">3.5</a> ), $H \geq 2,5$ dm	0,1 kg/dm <sup>3</sup>
Suspended filing pockets ( <a href="#">3.24</a> )	<sup>a</sup> 1,25 kg/dm
Clothes rails	2 kg/dm
Storage area/-volume for heavy appliances (e.g. refrigerator, washing machine)	<sup>b</sup> 0,5 kg/ dm <sup>3</sup>
<sup>a</sup> Measured perpendicular to the plane of the filing pockets.	
<sup>b</sup> Maximum load 100 kg per unit.	

## 5 Test equipment and apparatus

**5.1 Unless otherwise specified**, the tests can be applied by any suitable device, because results are dependent only upon correctly applied forces and not on the apparatus.

The equipment shall not inhibit deformation of the unit/component, i.e. it shall be able to move so that it can follow the deformation of the unit/component during testing, so that the loads are always applied at the specified points and in the specified directions.

**5.2 Floor surface**, a rigid, horizontal and flat surface.

**5.3 Wall surface**, shall be rigid, vertical and flat.

**5.4 Stops**, devices to prevent the article from sliding but not tilting, not higher than 12 mm, except in cases where the design of the unit necessitates the use of higher stops, in which case the lowest stop that prevents the item from moving shall be used. For stability tests, the lowest height that prevents the item from moving shall be used.

**5.5 Loading pad**, a rigid disc 100 mm in diameter, with a flat face and a 12 mm front edge blend radius. Where space prevents the use of a 100 mm diameter loading pad, a 50 mm diameter loading pad with similar properties can be used.

**5.6 Apparatus for slam shut/open of extension elements**, as given in [Annex D](#).

**5.7 Masses**, shall be designed so that they do not reinforce the structure or re-distribute the stresses.

NOTE For the deflection of shelves ([6.1.4](#)), steel masses with a mass of 1 000 g and with a length of 85 mm, a width of 50 mm, and a thickness of 30 mm are suitable.

**5.8 Spherical objects**, such as glass marbles with 10 mm to 15 mm diameter. They shall be loosely packed in a flexible bag large enough to allow them to move in the bag during the test.

NOTE A bag that is approximately 50 % filled is considered loosely packed.

**5.9 Loads for suspended filing pockets** ([3.24](#)), shall be loaded with paper or an equivalent alternative as shown in [Figure 20](#).

**5.10 Steel impact plates**, 200 mm in length, with one surface faced with a 3 mm thick layer of rubber with a hardness of  $(85 \pm 10)$  IRHD according to ISO 48-5:2018. Other properties of steel impact plates are as defined in [Table 3](#).

**Table 3 — Steel impact plates**

Plate parameter	Unit	Plate no. 1	Plate no. 2
Mass (excluding rubber)	kg	1,7	2,5
Approximate width	mm	109	160
Approximate thickness	mm	10	10
Length	mm	200	200

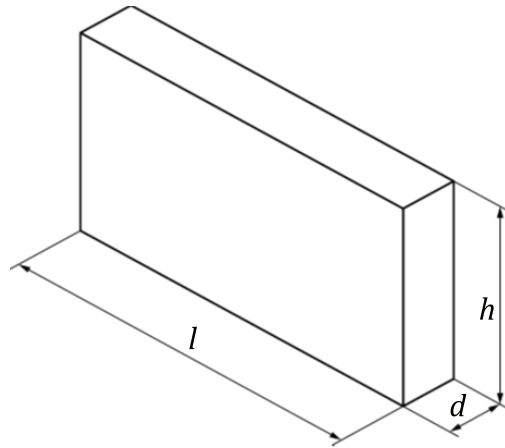
**5.11 Obstacles for castor durability tests**, use two steel strips 50 mm wide and 2 mm high with the edges having a radius of 2 mm, 500 mm apart and parallel on the floor surface and perpendicular to the test direction.

**5.12 TV Template** ([3.25](#)), two templates constructed as frame or box as shown in [Figure 2](#), with dimensions as defined in [Table 4](#), able to support a load acting through the centre of gravity of the TV template. The weight of the unloaded template shall be  $(10 \pm 0,2)$  kg.

The centre of gravity of the unloaded template shall be the geometric centre of the unloaded template.

When a load is added to the template, the variation of the position of the centre of gravity to that of the unloaded template shall be restricted to 5 mm.

When testing, the template shall remain in its initial position.



**Key**  
*l* length  
*h* height  
*d* depth

**Figure 2 — TV template**

**Table 4 — TV template dimensions**

Parameter	TV template 1	TV template 2
length (mm)	710 ± 2	1 100 ± 2
height (mm)	400 ± 2	620 ± 2
depth (mm)	65 ± 10	65 ± 10

## 6 Test procedures for non-movable parts

### 6.1 Shelves

#### 6.1.1 General

For units with an indeterminate number of shelves, unless otherwise specified, divide the internal height of the unit, in millimetres, by 200 and take the nearest integer. This number, minus one, shall then be the number of shelves to be fitted.

The number of shelves (*N*) that shall be fitted is calculated by the following formula:

$$N = \text{integer of } (h/200) - 1$$

where *h* is the internal height of the unit.

#### 6.1.2 Shelf retention test — Horizontal outward force

This test is only applicable to shelves that are movable within the unit.

Apply the horizontal outward force specified to the middle of the front edge of the shelf.

#### 6.1.3 Shelf retention test — Vertical downward force

This test is only applicable to shelves that are not fixed.

By means of a 50 mm diameter loading pad (5.5), apply the vertical downward force specified to a point 25 mm from the front edge of the shelf at the position most likely to cause failure.

#### 6.1.4 Deflection of shelves

Testing of the deflection of shelves, which are not made of metal, glass or stone, shall be carried out in a controlled humidity atmosphere (4.1).

Place the shelf on its supports in the unit.

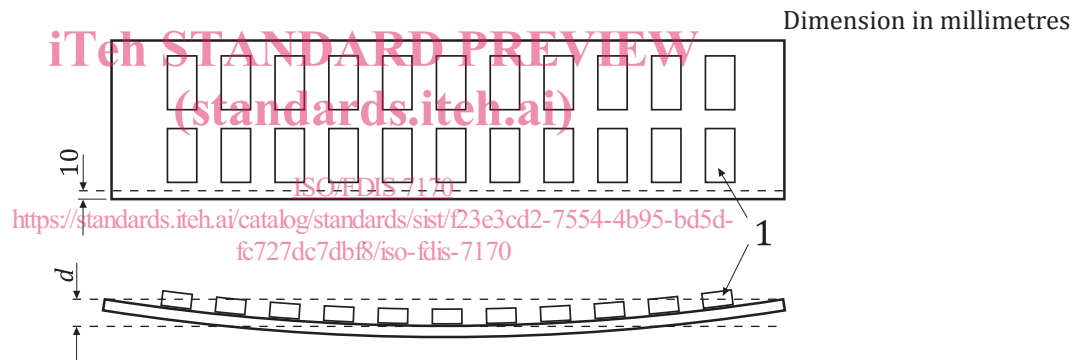
The deflection of the shelf shall be measured at a point 10 mm from the front edge where the deflection is greatest.

The deflection shall be measured to an accuracy of  $\pm 0,1$  mm with reference to a straight line parallel to the front edge drawn between two adjacent supports.

Load the shelf uniformly (see Figure 3) with the load specified and apply for

- one hour for shelves made of metal, glass and stone, and
- one week for all other shelves.

At the same points as specified above, measure and record the deflection under load to an accuracy of  $\pm 0,1$  mm and as a percentage of the distance between the supports.



#### Key

- 1 load
- d* deflection

Figure 3 — Deflection test of shelves

#### 6.1.5 Strength of shelf supports

Load the shelf uniformly with half the load specified for the deflection of shelf test (6.1.4), except at 220 mm from one support, where the impact plate (5.10) shall be tipped over 10 times over the support (see Figure 4). The striking surface of the impact plate (5.10) shall be that faced with rubber. All supports of the shelf shall be tested.

If the clear height (3.5) is less than 205 mm, the test is not carried out.

This test is not applicable to shelves, tops and bottoms that are fully supported by the structure of the unit or have a length of less than 230 mm.

This test shall be carried out on all horizontal surface (e.g. shelves, tops and bottoms that can be used as storage area).