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STANDARD

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**Furniture — Storage units —
Determination of strength and durability**

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*Ameublement — Éléments de rangement — Détermination de la
résistance et de la durabilité*

ISO 7170:1993

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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.

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.

International Standard ISO 7170 was prepared by Technical Committee ISO/TC 136, *Furniture*, Sub-Committee SC 1, *Test methods*.

Annexes A and B of this International Standard are for information only.

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Introduction

This International Standard is one of a series being prepared on the strength, durability and stability of furniture. The series currently consists of the following International Standards:

ISO 7170:1993, *Furniture — Storage units — Determination of strength and durability.*

ISO 7171:1988, *Furniture — Storage units — Determination of stability.*

ISO 7172:1988, *Furniture — Tables — Determination of stability.*

ISO 7173:1989, *Furniture — Chairs and stools — Determination of strength and durability.*

ISO 7174-1:1988, *Furniture — Chairs — Determination of stability — Part 1: Upright chairs and stools.*

ISO 7174-2:1992, *Furniture — Chairs — Determination of stability — Part 2: Chairs with tilting or reclining mechanisms when fully reclined, and rocking chairs.*

ISO 8019:—¹⁾, *Furniture — Tables — Determination of strength and durability.*

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1) To be published.

Furniture — Storage units — Determination of strength and durability

1 Scope

This International Standard describes test methods for determining the strength and durability (mainly regarding fatigue and wear) of storage units that are fully assembled and ready for use, including their movable and non-movable parts. Assessment of ageing and degradation is not included.

The tests consist of the application, to various parts of the items, of loads, forces and velocities simulating normal functional use, as well as misuse, that might reasonably be expected to occur.

The tests are designed to evaluate properties without regard to materials, design/construction or manufacturing processes.

The test results are only valid for the article tested. When the test results are intended to be applied to other similar articles, the test specimen should be representative of the production model.

In the case of designs not catered for in the test procedures, the test should be carried out as far as possible as described, and deviations from the test procedure recorded in the test report.

Tests carried out according to this International Standard are intended to demonstrate the ability of the item to give satisfactory service in its intended environment. It should be understood that such tests do not ensure that structural failure will not eventually occur as a result of habitual misuse or after an excessively long period of service.

This International Standard specifies test methods only; it does not specify requirements to be met. The annexes A and B are for information only. Annex A contains parameters which may be applied to any type or design of storage unit.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions

of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications.*

ISO/IEC Guide 45:1985, *Guidelines for the presentation of test results.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 static test: Test consisting of heavy loads applied several times to ensure that the furniture has sufficient strength to perform its function under the highest levels of loading that might reasonably be expected to occur.

3.2 impact test: Test to assess the strength of the article under the rapid rates of loading that occasionally occur.

3.3 durability test: Test simulating the repeated movement of components occurring during long-term use and assessment of the strength of the article under such conditions.

4 Test procedures

Two different types of test procedure exist.

4.1 For determining the level of strength and durability, testing may be carried out in sequence through the test parameters until failure occurs.

4.2 For checking compliance with stated requirements, testing may be carried out by directly applying the appropriate test to meet the stated requirement.

5 General test conditions

5.1 Preliminary preparation

Before any test is begun, the item shall be old enough to ensure that it has developed its full strength. At least four weeks in normal indoor conditions shall have elapsed between manufacturing and testing in the case of glued joints in timber and the like. See also clause 10 for preliminary noting of existing defects.

If a standard atmosphere is to be used for conditioning, it shall have a temperature of $23\text{ °C} \pm 2\text{ °C}$ and a relative humidity of $(50 \pm 5)\%$ according to ISO 554. Testing of shelves, except metal and glass shelves, shall take place in this standard atmosphere.

The furniture shall be tested as delivered. If of knockdown type, it shall be assembled according to instructions supplied with the furniture. If the furniture can be assembled or combined in different ways, the most adverse combination shall be used for each test. The same is valid for furniture that can be combined with other pieces. For furniture attached to or hanging on walls, all tests shall be carried out with the furniture mounted as specified by the manufacturer. Should there be no mounting or assembly instructions, the manner in which the unit was built and/or mounted shall be recorded in the test report.

Tighten any assembly fittings before testing.

The tests refer to furniture parts with conventional function. Combination of tests may be necessary to cover the properties of some parts; e.g. a shelf that can be pulled out on runners can be tested for deflection as an ordinary shelf and tested for durability as a drawer.

5.2 Test equipment

The forces in strength tests shall be applied sufficiently slowly to ensure that negligible dynamic load is applied. The forces in durability tests shall be applied sufficiently slowly to ensure that kinetic heating does not occur.

Unless otherwise specified, the tests may be applied using any suitable device, because results are not dependent upon the testing apparatus.

5.3 Tolerances

Unless otherwise stated, all forces and velocities shall have an accuracy of $\pm 5\%$, all masses an accuracy of $\pm 0,5\%$ and all dimensions an accuracy of $\pm 0,5\text{ mm}$.

5.4 Sequence of testing

The tests shall be carried out in the sequence laid down in this International Standard.

All tests specified for a particular part shall be carried out on the same sample.

6 Test environment and apparatus

6.1 Floor surface, horizontal and flat.

6.2 Wall surface, vertical and flat.

6.3 Stops, to prevent the article from sliding but not tilting, no higher than 12 mm except in cases where the design of the item necessitates the use of higher stops, in which case the lowest that will prevent the item from moving shall be used.

6.4 Loading pad, rigid cylinder, 100 mm in diameter (or 50 mm if space is limited), having a flat face of 12 mm edge radius.

6.5 Apparatus for slam shut of drawers.

The pneumatic circuit for a suitable apparatus is shown in annex B.

6.6 Loads (weights), which do not reinforce the structure or redistribute the stresses. If bags containing lead shot, etc. are used, the bags shall be divided into small compartments to prevent the contents moving during test.

This does not apply to the glass marbles in 8.5.2 and 8.5.3, which shall be in a flexible bag large enough to permit the marbles to move during the test. The marbles shall be between 10 mm and 15 mm in diameter.

Suspended filling pockets shall be loaded with typing paper or a suitable alternative.

6.7 Steel impact plates.

A suitable range of steel plates is shown in table A.4.

7 Test procedures for non-movable parts

7.1 Shelves

Testing of shelves, except metal and glass shelves, shall take place in the standard atmosphere for conditioning and testing as specified in 5.1.

Load all parts intended for storage purposes, except the shelf being tested, with the load specified in the requirement documents.

When shelves are structurally interconnected (other than at their ends) all the shelves shall be equally loaded.

For units with an indeterminate number of shelves unless otherwise specified, divide the internal height of the article, in millimetres, by 300 and round to the nearest integer. This number, minus 1, shall then be the number of shelves to be fitted.

7.1.1 Strength of shelf supports

Load the shelf with the load specified in the requirement documents.

Distribute the masses used to apply the load uniformly, except at approximately $h + 20$ mm from one

support, where a steel impact plates, as specified in the requirement documents, shall be tipped over 10 times at a point as close to the support as possible (see figure 1).

Inspect the shelf and the supports before and after the test. Inspection may include measurement.

Assess defects according to clause 10.

7.1.2 Deflection of shelves

Place the shelf on its supports in the unit and load it uniformly with the load specified in the requirement documents. Distribute the load uniformly and apply for one week (see figure 2).

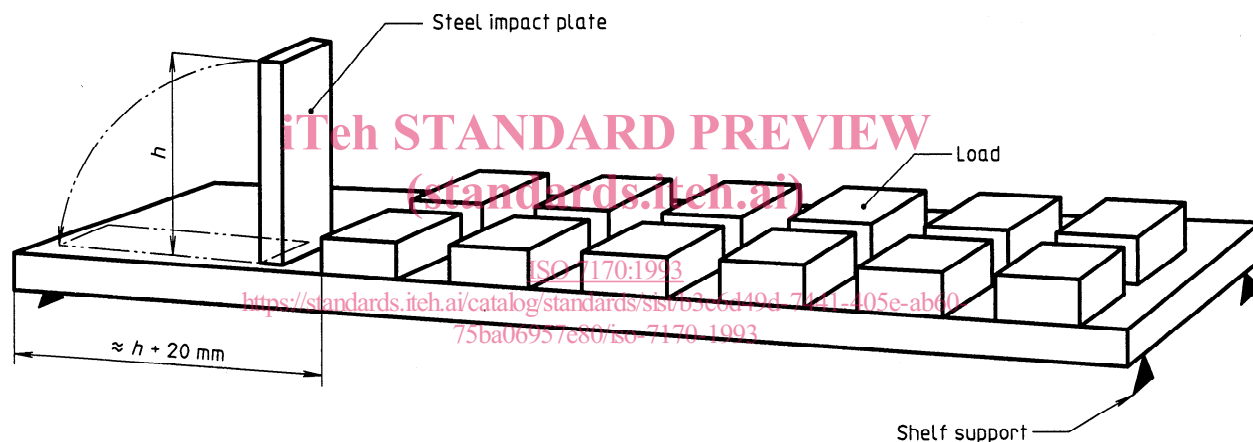


Figure 1 — Strength test of shelf supports

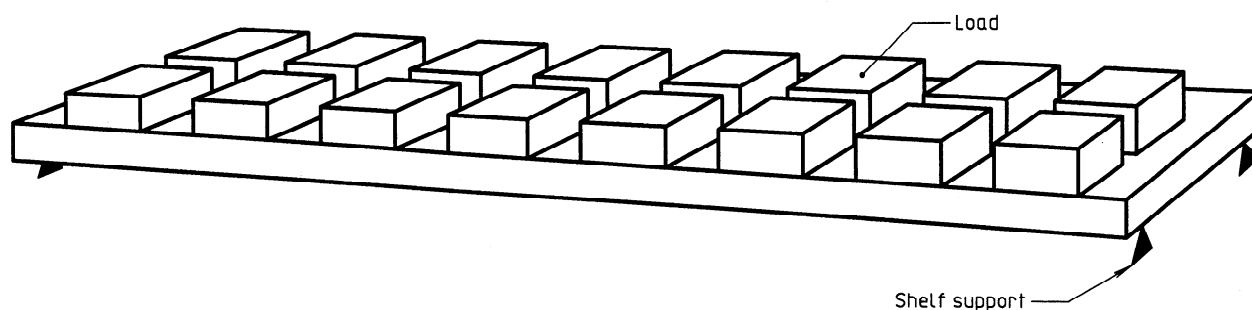


Figure 2 — Deflection test of shelves

Measure the deflection of the shelf as close as possible to the middle of the front edge or at any other point according to requirement specifications. If the shelf has one or more centre supports, the deflection shall be measured where it is greatest.

The following deflections from a straight line drawn between two adjacent supports shall be reported to an accuracy of $\pm 0,1$ mm and as a percentage of the distance between the supports:

- a) deflection before loading, and
- b) deflection after one week under load.

Assess defects according to clause 10.

7.2 Clothes rails

Load all parts intended for storage purposes, except the rail being tested, with the load specified in the requirement documents.

7.2.1 Strength of clothes rail supports

Place the rail on its supports in the unit.

Load the rail with the load specified in the requirement documents. Concentrate this load at the weakest support [see figure 3 a)].

If there are three or more supports [see figure 3 b)], load each section with the load specified in the requirement documents.

Inspect the rail and the supports before the test and after one week under load. Inspection may include measurements.

Assess defects according to clause 10.

7.2.2 Deflection of clothes rails

Place the rail on its supports in the unit and load it with the load specified in the requirement documents. Distribute the load uniformly and apply for one week (see figure 4).

Measure the deflection of the rail at the middle of the rail or the middle of each span between supports.

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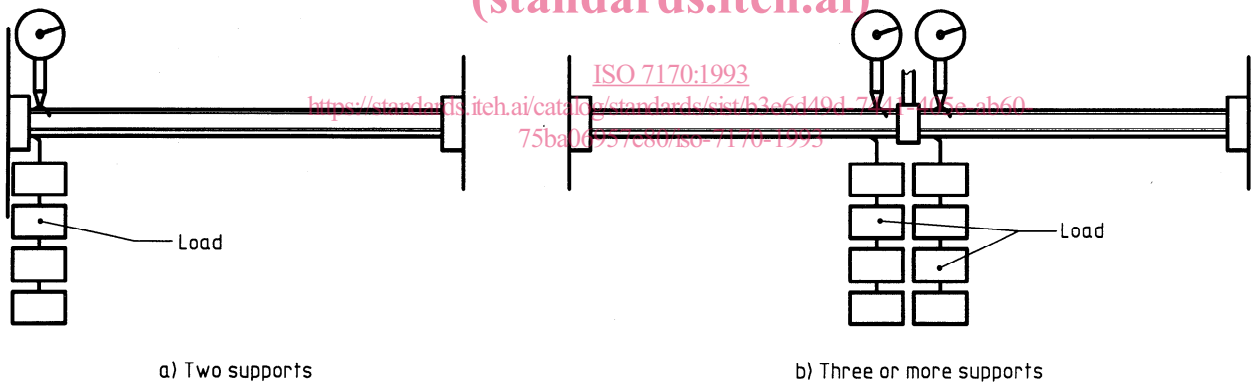


Figure 3 — Strength test of clothes rail supports

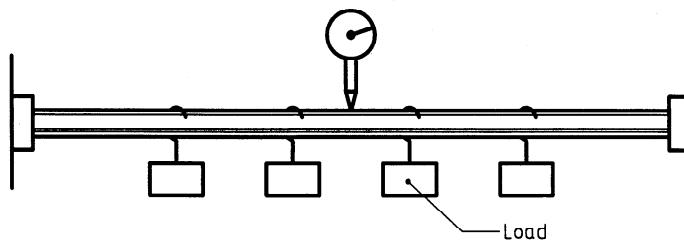


Figure 4 — Deflection test of clothes rails

The following deflections from a straight line drawn between two adjacent supports shall be reported to an accuracy of $\pm 0,1$ mm and as a percentage of the distance between supports:

- deflection before loading, and
- deflection after one week under load.

Assess defects according to clause 10.

7.3 Strength of tops and bottoms

Load all parts intended for storage purposes, except the part being tested, with the load specified in the requirement documents.

Subject the top or bottom of the storage unit to 10 vertical applications of the force specified in the requirement documents, with the force acting through a loading pad (6.3). Maintain the load for at least 10 s. Apply the load to any position likely to undergo failure. If there are several such positions, apply the load 10 times to a maximum of three positions.

If the top or bottom is adjustable, place it in the position most likely to result in failure.

Assess defects according to clause 10.

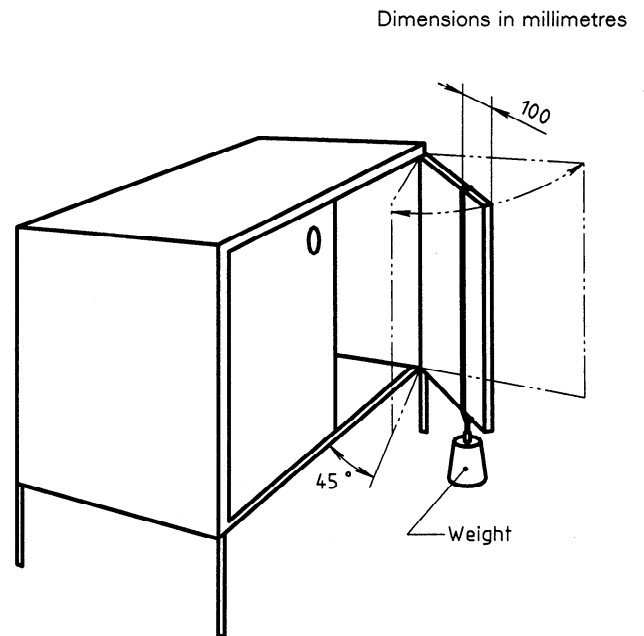


Figure 5 — Vertical load test of pivoted doors

8 Test procedures for movable parts

8.1 Pivoted doors

Mount stops around the legs or base in order to prevent the unit from moving on the floor during the tests.

Load all parts intended for storage purposes and restrain the unit as specified in the requirement documents.

8.1.1 Strength of pivoted doors

8.1.1.1 Vertical load

Load the door as shown in figure 5 with a weight specified in the requirement documents suspended 100 mm from the edge furthest from the hinge.

Swing the door gently 10 full cycles (back and forth) from a position 45° from fully closed to a position 10° from fully opened, but to a maximum of 135° .

Opening and closing can be done by hand using 3 s to 5 s for opening and 3 s to 5 s for closing.

Before and after the test, inspect the appearance and function of the door (without added load), readjusting if possible. Inspection may include measurement.

Assess defects according to clause 10.

8.1.1.2 Horizontal load

Apply the horizontal load specified in the requirement documents perpendicular to the plane of the door on its horizontal centreline 100 mm from the edge furthest from the hinge, as shown in figure 6.

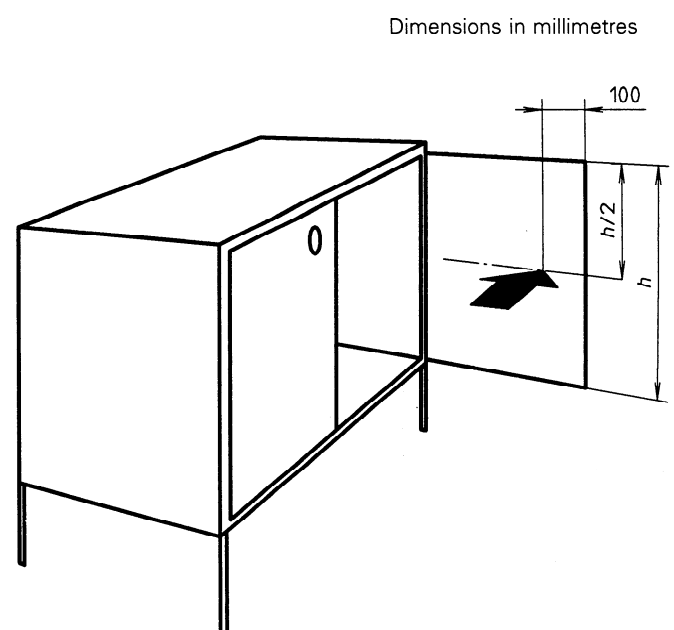


Figure 6 — Horizontal load test of pivoted doors

Apply the load 10 times for at least 10 s a each time.

Before and after the test, inspect the appearance and functioning of the door, readjusting if possible. Inspection may include measurement.

Assess defects according to clause 10.

8.1.2 Durability of pivoted doors

Attach two weights with a mass of 1,5 kg each, one on each side of the door on the vertical centreline (see figure 7).

Swing the door the number of cycles (back and forth) specified in the requirement documents, without forcing built-in stops in the open position.

If the door has a catch device²⁾ at any position, operate this mechanism at every cycle.

The maximum angle of swing shall not exceed 130°.

The door shall be gently opened and closed at each cycle using approximately 3 s for opening and 3 s for closing the door. The recommended rate is a maximum of 6 cycles per minute with the pause in the closed position.

Before and after the test, inspect the appearance and functioning of the door. Inspection may include measurement.

Assess defects according to clause 10.

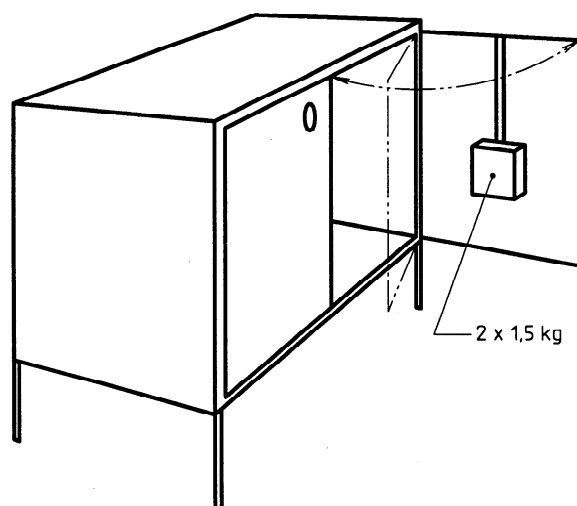


Figure 7 — Durability test of pivoted doors

2) The catch device does not include any locking mechanism.

8.2 Sliding doors and horizontal roll fronts

Mount stops around the legs or base in order to prevent the unit from moving on the floor during the tests.

Load all parts intended for storage purposes and restrain the unit as specified in the requirement documents.

8.2.1 Slam shut/open of sliding doors and horizontal roll fronts

The door shall be opened/closed by means of a string or cord attached to the centre of the handle. If the handle has a length greater than 200 mm, the string shall be attached 100 mm below the top of the handle up to a maximum height from the floor of 1 200 mm.

Determine the mass, m_1 , of the weight, required to just move the door. The test mass shall be the mass m_2 , specified in the requirement documents plus the mass m_1 .

Close/open the door/roll front 10 times towards the fully closed/opened positions using the test mass ($m_1 + m_2$).

Start the movement 300 mm from the closed/opened positions respectively. The force exerted by the weight shall be removed 10 mm before the door/roll front is fully closed/opened. The test shall be carried out as shown in figure 8.

Dimensions in millimetres

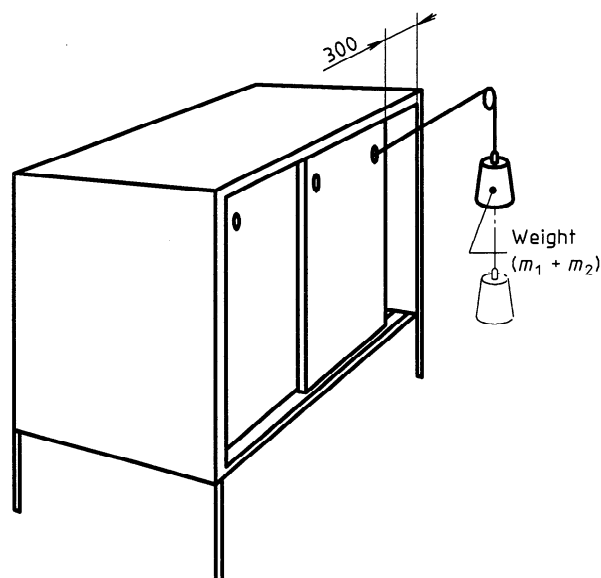


Figure 8 — Slam shut/open test of sliding doors

Before and after the test, inspect the appearance and functioning of the door/roll front and runners.

Assess defects according to clause 10.

8.2.2 Durability of sliding doors and horizontal roll fronts

Apply an opening and closing force by means of a chord or string attached to the centre of the handle (or as near the centre of the handle as possible outside the door/roll front) and open and close the door or roll front the number of cycles specified in the requirement documents from the fully closed position to a position approximately 50 mm from the fully open position (see figure 9).

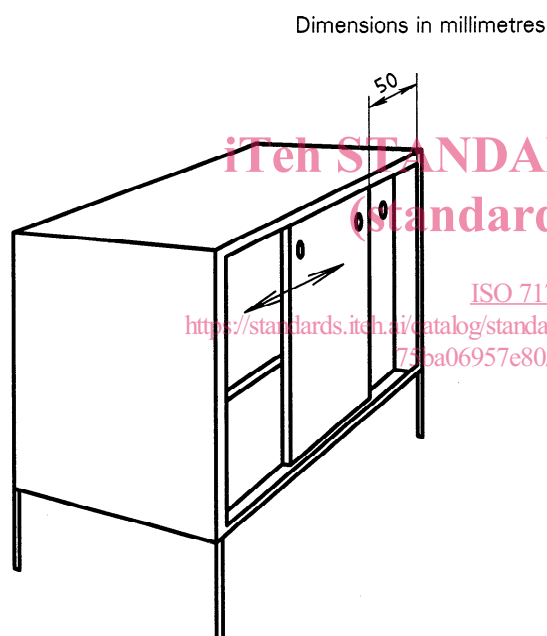


Figure 9 — Durability test of sliding doors

Open and close the door/roll front gently for the number of cycles specified in the requirement documents at an average speed of approximately 0,25 m/s. The recommended rate is maximum 6 cycles per minute with the pause in the closed position.

If the door/roll front has a catch device²⁾ at any position, operate this mechanism at every cycle.

Before and after the test, inspect the appearance and functioning of the door/roll front and runners.

Assess defects according to clause 10.

8.3 Flaps

Load all parts intended for storage purposes and restrain the unit as specified in the requirement documents.

8.3.1 Strength of flaps

With the flap in its fully opened/extended position, load with the force specified in the requirement documents. Apply the force 10 times, 50 mm from the weakest corner, and maintain the force for at least 10 s (see figure 10).

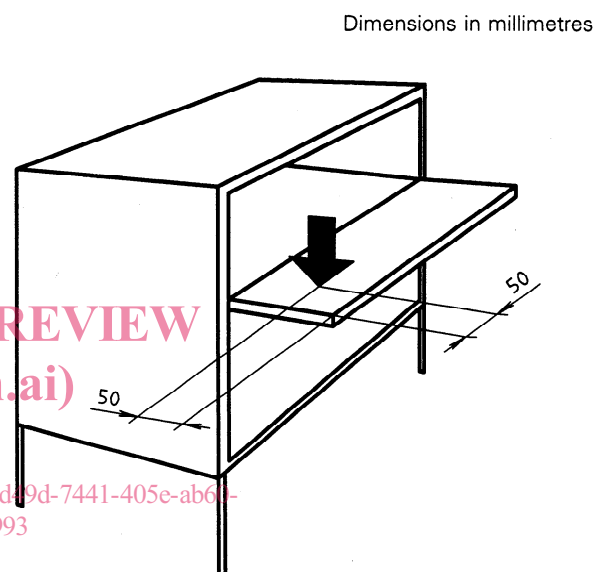


Figure 10 — Strength test of flaps

Inspect the unit before and after the test. Inspection may include measurement.

Assess defects according to clause 10.

8.3.2 Durability of flaps

Open and close the flap fully and gently for the number of cycles specified in the requirement documents. Use approximately 3 s for opening and 3 s for closing the flap. The recommended rate is maximum 6 cycles per minute with the pause in the closed position.

If the flap has a catch device²⁾ at any position, operate this mechanism at every cycle.

When the flap is fitted with an adjustable friction stay, it shall be adjusted so that the flap will just open under its own weight, and be readjusted not less than 10 times during the test.