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Bunk beds for domestic use — Safety requirements and tests —

Part 2:
Test methods

ICS: 97.140

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Foreword

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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).

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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 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 136, Furniture.

This second edition cancels and replaces the first edition (ISO 9098-2:1994), which has been technically revised.

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

— Standard was fully revised;

— Expansion of scope;

— Normative references revised;

— General test requirements revised;

— Increase of apparatus;

— Increase of test procedures;

— Test report revised.

A list of all parts in the ISO 9098 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.

Bunk beds for domestic use — Safety requirements and tests —

Part 2: Test methods

1 Scope

This part of ISO 9098 specifies test methods for the safety, strength and durability of bunk beds and high beds for domestic and non-domestic use. The test apply to beds with an internal length greater than 1 400 mm and a maximum bed base width of 1 200 mm, and with the upper surface of a bed base 600 mm or more above the floor.

The tests are designed to be applied to a bed that is fully assembled and ready for use.

The applicable safety requirements are given in ISO 9098-1:202X.

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 2439:2008, *Flexible cellular polymeric materials — Determination of hardness (indentation technique)*

ISO 9098-1:202X, *Bunk beds and high beds — Safety requirements and tests — Part 1: Safety requirements*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

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

4 General test requirements

4.1 Preliminary preparation

For furniture that includes hygroscopic materials, at least one week in normal indoor conditions shall have elapsed between manufacturing (or assembly) and testing.

For all other furniture, at least 48 hours in normal indoor conditions shall have elapsed prior to testing.

The sample shall be tested as delivered. Knock-down beds shall be assembled according to the manufacturer's instructions. If the instructions allow the bed to be assembled or combined in different ways, the most adverse combination shall be used for each test. Knock-down fittings shall be tightened before testing. Further tightening shall not take place unless specifically required by the manufacturer. If the configuration shall be changed to produce the worst-case conditions, this shall be recorded in the test report.

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

The tests shall be carried out on the same sample and following the order of the clauses of ISO 9098-1:202X.

If a test cannot be carried out as specified in this standard, e.g. because a loading pad cannot be used for the application of a force due to the design of the product, the test can be carried out as closely as possible to the specified procedure. Any modification to the test method shall be technically justified and recorded in the test report.

4.2 Application of forces

The test forces in durability and static load 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, static loads shall be maintained for (10 ± 2) s. Unless otherwise specified, durability loads shall be applied for (2 ± 1) s.

The forces may be replaced by masses. The relationship of 10 N = 1 kg shall be used.

4.3 Tolerances

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

— forces shall have an accuracy of ±5 % of the nominal force;

— masses shall have an accuracy of ±1 % of the nominal mass;

— dimensions less than 200 mm shall have an accuracy of ±1 mm of the nominal dimension;

— other dimensions shall have an accuracy of ±0,5 % of the nominal dimension;

— angles shall have an accuracy of ±2° of the nominal angle.

The tolerance for the positioning of loading pads shall be ±5 mm.

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

5 Test apparatus

5.1 General

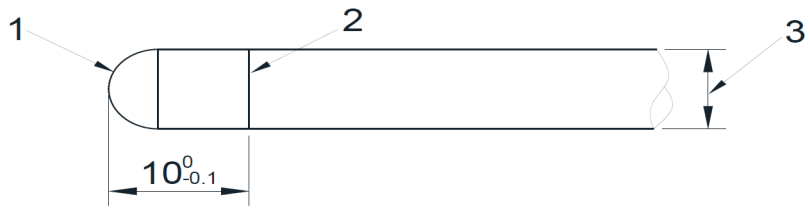
The test forces may, unless otherwise stated, be applied by any suitable device because results are dependent only upon correctly applied forces and loads, and not upon the apparatus.

The equipment shall be capable of following the deformation of the unit/component during testing so that the loads are always applied at specified points and in specified directions.

5.2 Test probes

5.2.1 Finger probes with hemispherical end

Probes with hemispherical ends made of plastic or other hard, smooth material, mounted on a force-measuring device, see Figure 1.



Key

1 hemispherical end

2 line around circumference

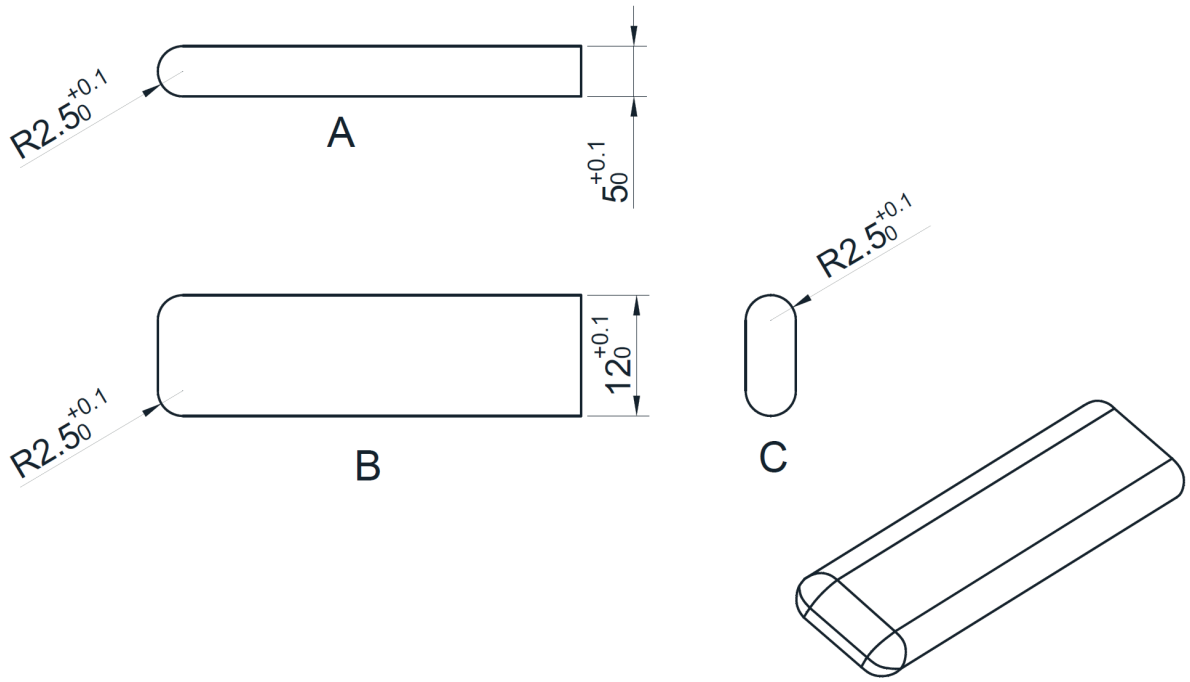
3 $\varnothing 7_{-0,1}{}^{+0}$mm and$\varnothing 12_{0}{}^{+0,1}$mm

Figure 1 — Finger probe with hemispherical end

5.2.2 Shape assessment probe

Probe made of plastics or other hard smooth materials with the dimensions shown in Figure 2.

Dimensions in millimetres



Key

A side view

B top view

C end view

D isometric view

Figure 2 — Shape assessment probe

5.2.3 Other probes

Probes with the ends at an angle of 30° ± 0,5° made of plastic or other hard, smooth material each with a diameter ($25_{0}^{+0,1}$) mm, ($60_{+0,1}^{0}$) mm and ($75_{0}^{-0,1}$) mm with rounded or conical ends, see Figure 3.

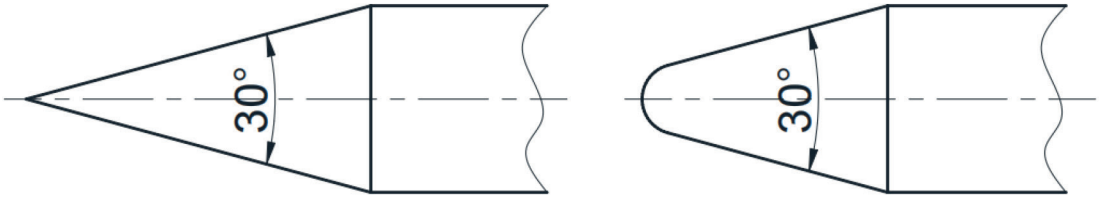
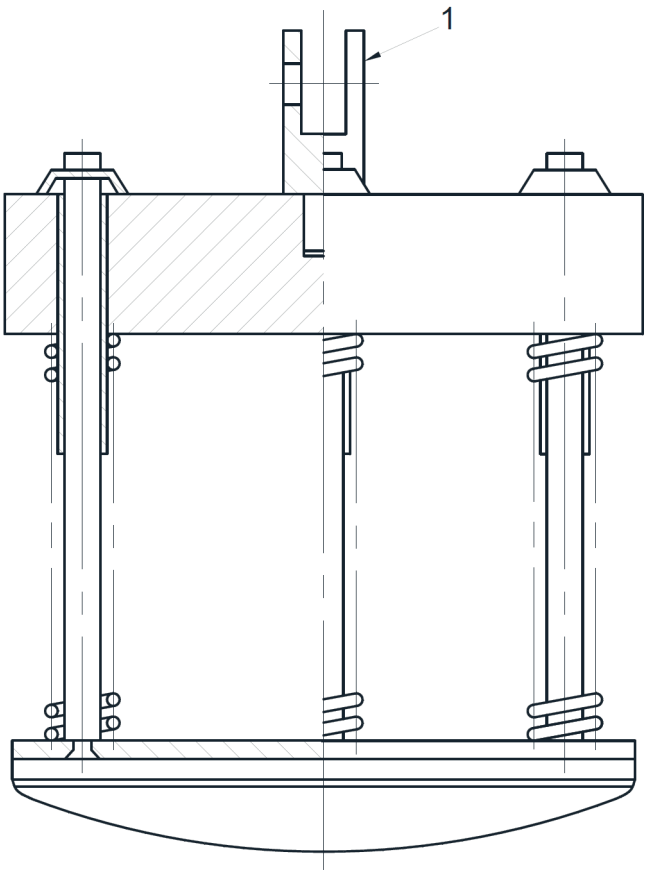


Figure 3 — Other probes

5.3 Bed base impactor

The bed base impactor shall be as shown in Figure 4 and comprised of the following:



Key

1 joint of lifting device not inhibiting free fall

Figure 4 — Bed base impacter

5.3.1 Circular body

The circular body is 200 mm in diameter separated from the striking surface by helical compression springs and free to move relative to it on a line perpendicular to the plane of the central area of the striking surface.

The body and associated parts minus the springs shall have a mass of (17 ± 0,1) kg and the whole apparatus, including mass, springs and striking surface, shall have a mass of (25 ± 0,1) kg.

5.3.2 Springs

Springs shall be such that the nominal spring rate of the combined sping system is (7 ± 2) N/mm and the total friction resistance of the moving parts is less than 1 N.

The spring system shall be compressed to an initial load of (1 040 ± 5) N (measured statically), and the amount of spring compression movement available from the initial compression point to the point where the springs become fully closed shall be not less than 60 mm.

5.3.3 Striking surface

Rigid circular object, 200 mm in diameter, the face of which has a convex spherical curvature of a (300 ± 5) mm radius with a 12 mm front edge radius.

5.4 Loading pads

5.4.1 Loading pad, 200 mm in diameter, which is a rigid circular object , the loading surface of which has a convex spherical curvature of a (300 ± 5) mm radius with a 12 mm front edge radius (see Figure 5).

Dimensions in millimetres

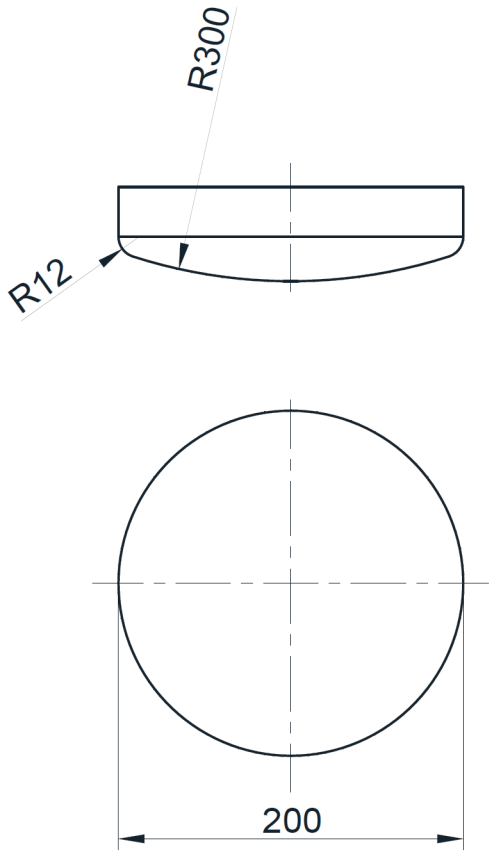


Figure 5 — Loading pad

5.4.2 Loading pad, 100 mm in diameter, which is a rigid circular object, with a flat surface and a 12 mm edge radius.

5.5 Test mattress

5.5.1 General

A foam sheet with a thickness of 100 mm, a bulk density of (35 ± 5) kg/m^3 and an indentation hardness index of (170 ± 40) N $HA_{(40\ \%/30\ s)}$ in accordance with ISO 2439:2008.

The mattress shall be at least 700 mm x 700 mm.

— The test mattress shall have a cover having the following characteristics;

— composition: 100 % cotton;

— mass per unit area: 120 ± 20 g/m^2;

— cover make up: tight fit, but with no restrictions on the foam.

NOTE Above definition according to CEN/TR 17538:2020.

5.5.2 Usage

The same part of the test mattress should not be re-used within 30 min of completing a test, The mattress should be replaced if damaged, or in any case after 30 complete bed tests, unless it can be demonstrated that the mattress specification has not been degraded.

5.6 Test mass

A mass of 75 kg distributed over an area of (300 ± 30) mm × (300 ± 30) mm or a diameter of (340 ± 30) mm.

5.7 Stops

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

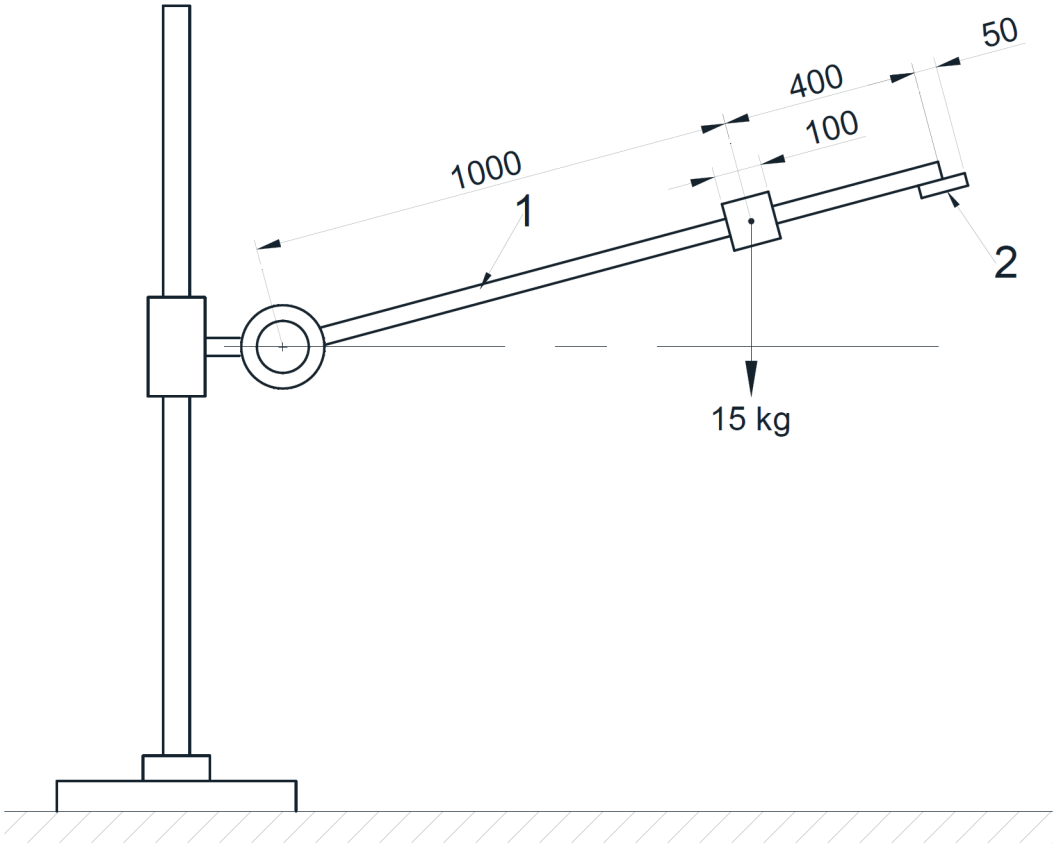
5.8 Floor surface

Horizontal, rigid, flat and smooth.

5.9 Tread impactor

Apparatus as shown in Figure 6.

Dimensions in millimetres



Key

1 HTS (High Tensile Steel) tube
outer diameter: 25
wall thickness: 2
mass: 1,6 kg

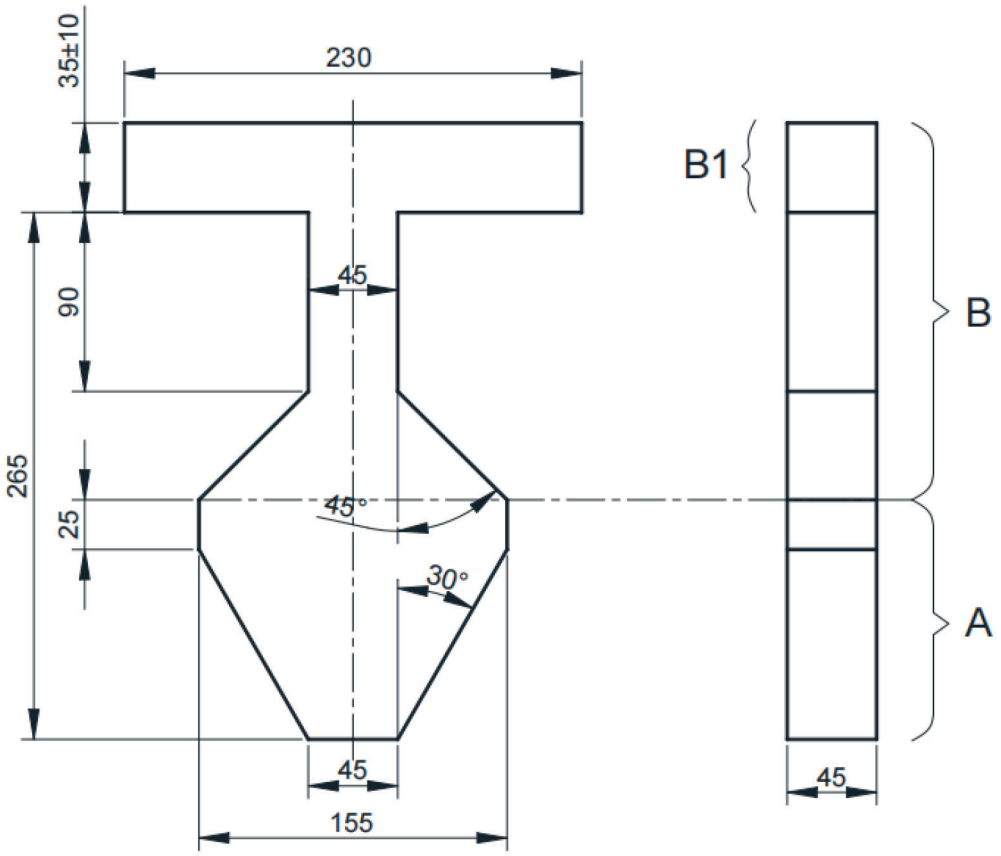
2 impact pad (100 x 100 x 6) mm steel plate fitting
total mass: 0,5 kg

Figure 6 — Tread impactor

5.10 Template for V-shaped openings

The template for V and irregular shaped openings shall be made from plastics or other hard, smooth material with the dimensions given in Figure 7. The tolerance for the angles shall be ±1°.

Dimensions in millimetres



Key
B1 shoulder section

Figure 7 — V and irregular shaped openings template

5.11 Foam

A foam sheet with a thickness of 25 mm and a bulk density of (120 ± 25) kg/m^3.

The test foam shall not be re-used within 30 min of completing a test. The test foam shall be replaced if damaged, or in any case after 100 impact tests, unless it can be demonstrated that the foam specification has not been degraded.

NOTE Above definition according to CEN/TR 17538:2020.

6 Test procedures

6.1 Inspection before testing

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.

6.2 Inspection of product

Inspect the bed to determine whether exposed edges, screws, bolts, zips and other fittings are rounded or chamfered and free of burr and sharp edges.

6.3 Measurement

6.3.1 Holes, gaps and openings

Check gaps and opennings listed in ISO 9098-1:202X with the applicable test probes (5.2) and the forces specified in Table 1.

Table 1 — Probes and forces

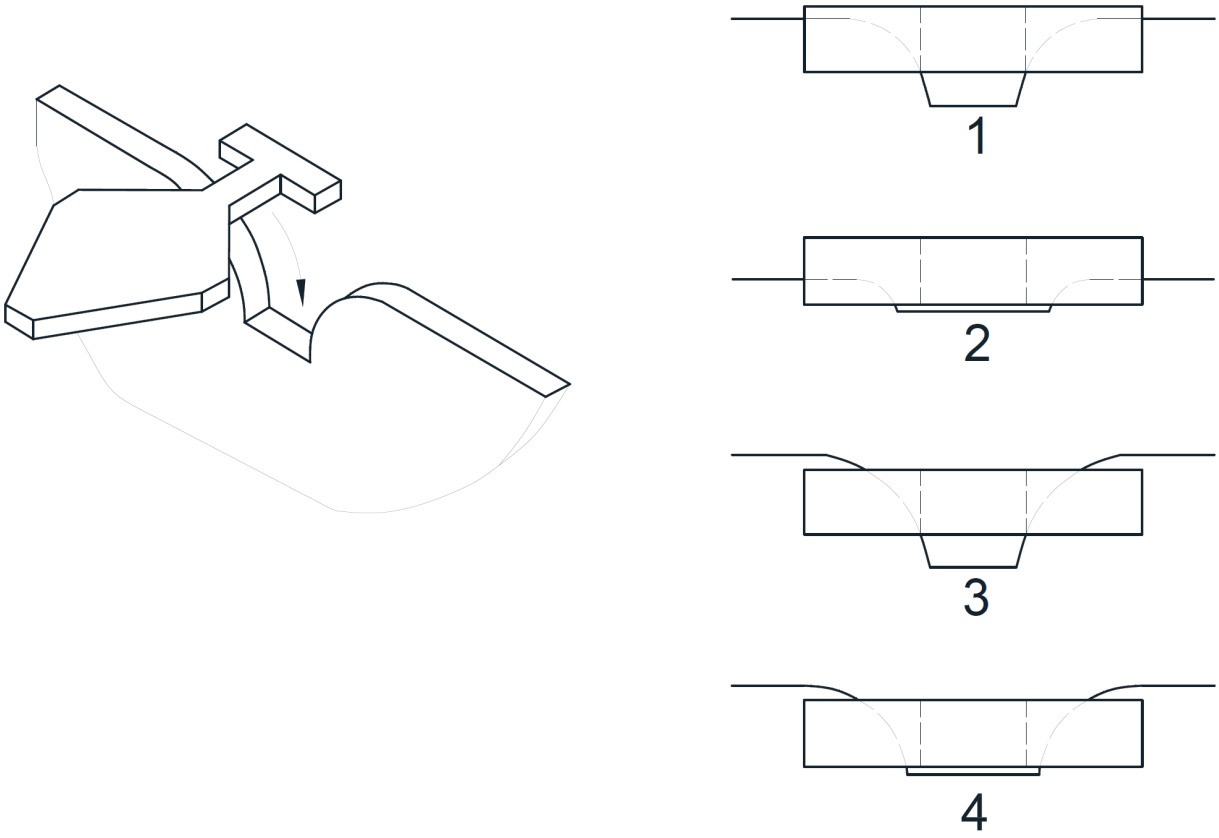
Probe	Force	ISO 9098-1: 202X, clause
7 mm	30 N	4.1.2.1, 4.1.4.2, 4.1.4.3, 4.1.5.2, 4.1.6.3, 4.1.6.4
12 mm	No force	4.1.2.1, 4.1.5.2, 4.1.7
25 mm	100 N	4.1.3.2, 4.1.5.2, 4.1.7
60 mm	No force	4.1.4.2, 4.1.5.2, 4.1.7
75 mm	100 N	4.1.3.2, 4.1.4.2, 4.1.5.2, 4.1.7
Shape assessment probe	No force	4.1.2.1

6.3.2 V and irregular shaped holes, gaps and openings

Check whether portion 'B' of the template (5.10) enters the opening to the full thickness of the template (45 mm), as shown in Figure 8 or Figure 9 as appropriate.

If the template (5.10) can be inserted to a depth greater than the thickness of the template (45 mm), apply the 'A' portion of the template, so that its centre line is in line with the centre line of the opening, as shown in Figure 10.

Ensure that the plane of the template is parallel and applied in line with the opening, as shown in Figure 10. Insert the template along the centre line of the opening until its motion is arrested by contact with the boundaries of the opening. Check whether the apex of portion A of the template contacts the base of the opening.

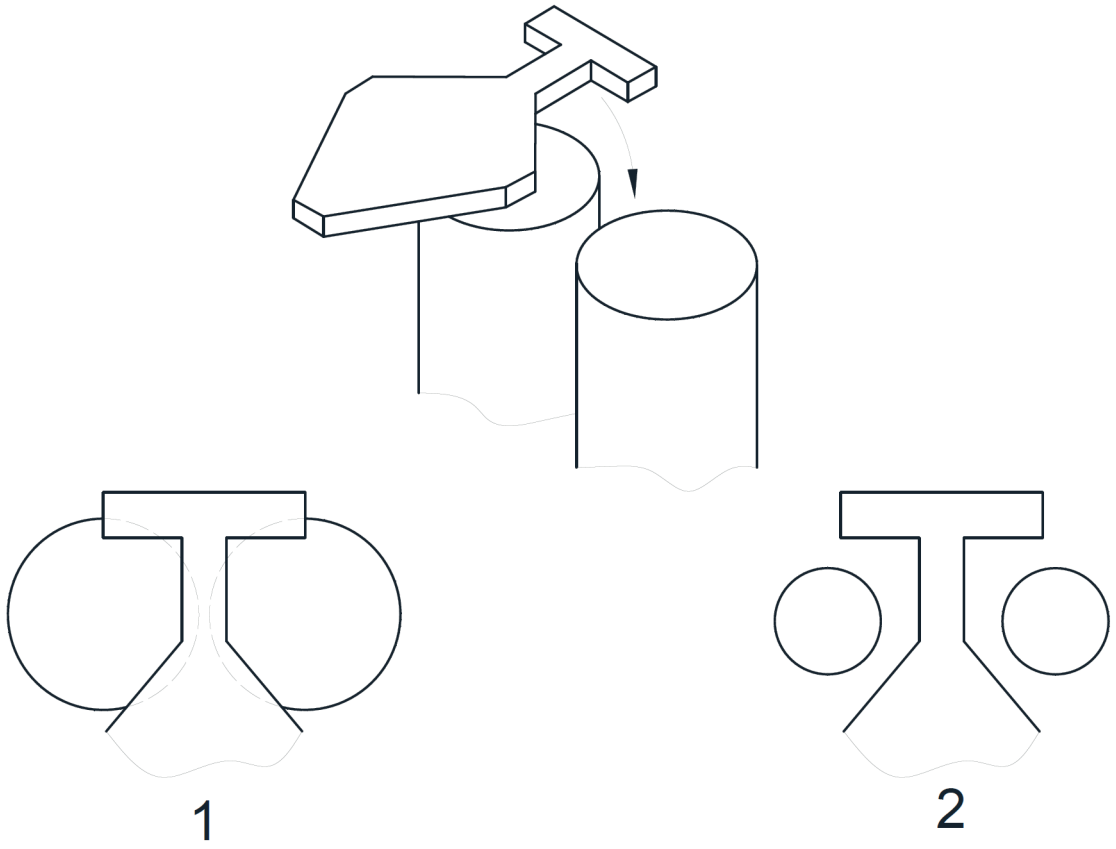


Key

1 and 2 do not enter to the full thickness of the template

3 and 4 enter more than the full thickness of the template

Figure 8 — Method of insertion of portion B

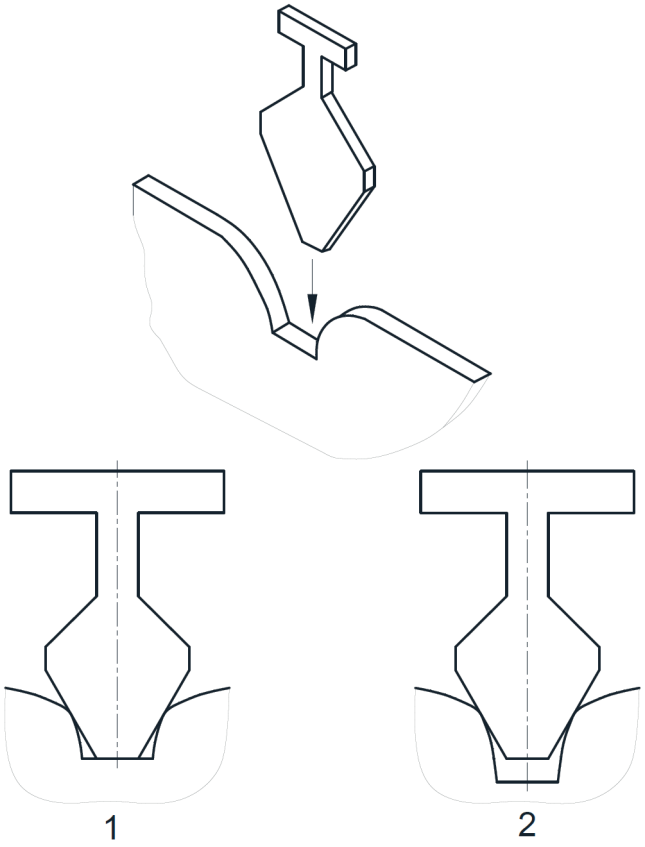


Key

1 does not enter

2 enters

Figure 9 — Method of insertion of portion B



Key

1 contacts the base of the opening

2 does not contact the base of the opening

Figure 10 — Method of insertion of portion A

6.4 Strength and durability tests

6.4.1 Positioning of the bed

If the bed tends to move during the tests specified in 6.4.2, 6.4.3, 6.4.4, 6.4.5 and 6.4.6, the bed shall be positioned on the floor with all legs against stops (5.7).

6.4.2 Test of bed base and safety barrier

6.4.2.1 Horizontal outward static load test

Place the test mass (5.6) on the upper bed base where it is most likely to prevent overturning. If this mass is not sufficient to prevent overturning, additional mass(es) shall be placed on the bed until overturning is prevented. The additional mass(es) may be placed on any suitable part of the bed.

Apply a specified horizontal outwards force to the centre of the safety barrier at the side of the upper bed and then separately to the safety barrier at the end of the upper bed using the loading pad (5.4.2). The loading point shall be 50 mm below the top edge of the structure at each position.

When the construction or fastening of the top safety barrier differs between ends, both ends shall be tested.

Apply the force 10 times in each position. Maintain the force for 30 s for each application.

6.4.2.2 Upwards and downwards static loads test

Place the test mattress (5.5) on the bed base(s).

Apply a specified vertical force downwards using the 200 mm loading pad (5.4.1). Apply the load 10 times, maintain it for 30 s for each application, at any point on the bed base where failure is considered likely to occur. For bunk beds, this test shall be carried out on all bed bases if the construction differs.

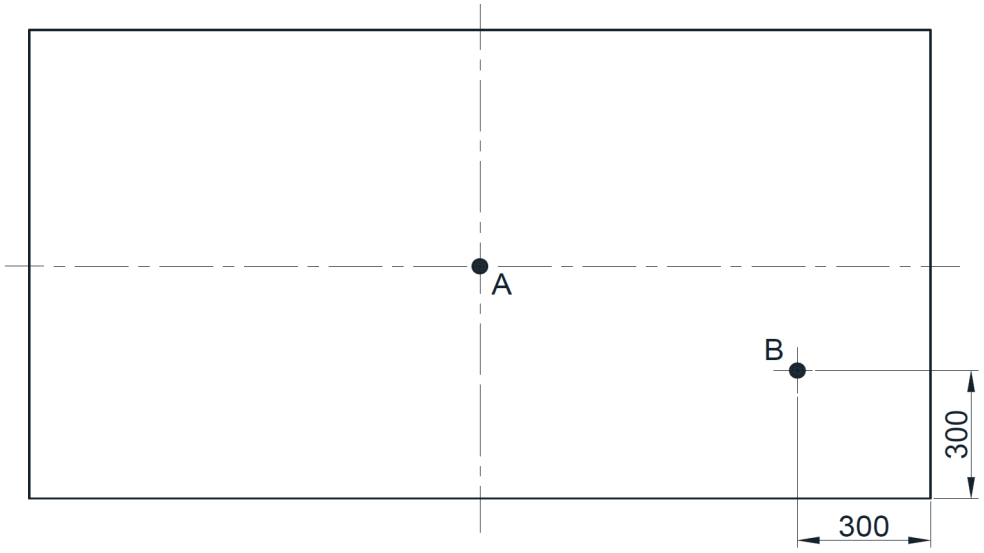
Apply a specified vertical force of upwards using the 200 mm loading pad (5.4.1). Apply the load 4 times of 30 s at any point on the bed base where failure is considered likely to occur. If the bed tends to lift from the floor during this test, it shall be prevented from lifting without loading the bed base.

6.4.2.3 Durability test

Place the test mattress (5.5) on the bed base(s).

Apply a specified vertical force downwards using the 200 mm loading pad (5.4.1) for specified times. Apply the load at a rate not more than 15 loads/min. The loading positions shall be each of the two positions shown Figure 11 in and at one position where failure is most likely to occur. For bunk beds, this test shall be carried out on all bed bases if the construction differs.

Dimensions in millimetres



Key

A, B loading positions

Figure 11 — Durability of bed base loading positions

6.4.2.4 Impact test

Place the test mattress (5.5) flat on the bed base(s).

The impacts shall be positioned as follows(see Figure 12):

a) centre of the bed base (point A);

b) one-third along the longitudinal axis from the middle (point B);

c) point opposite b (point C);

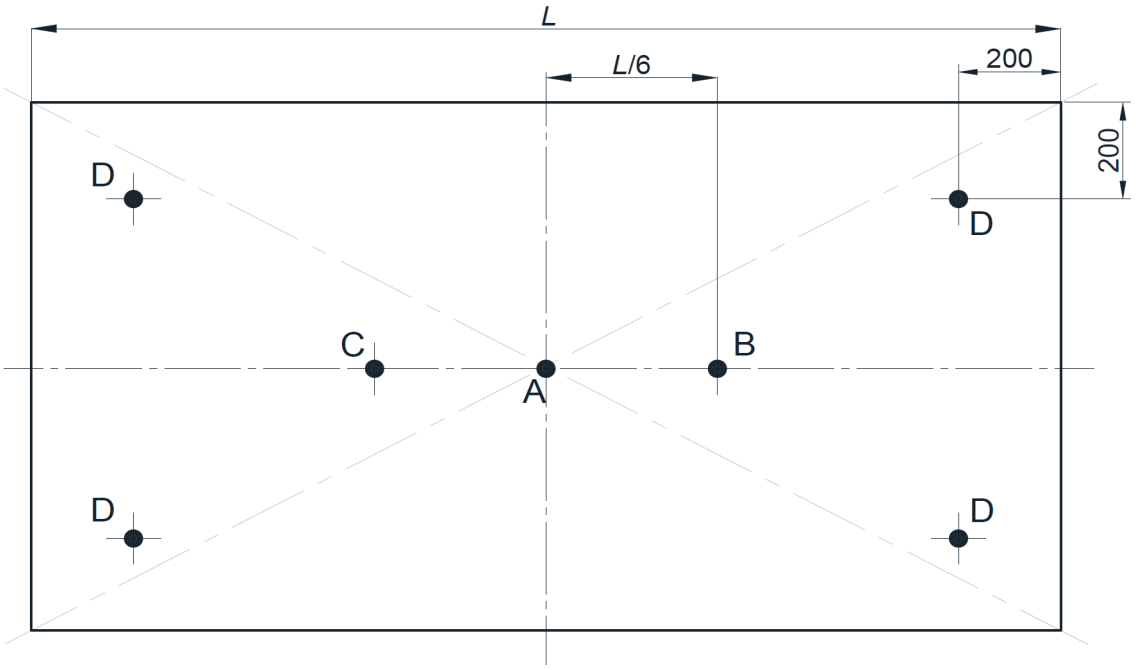
d) points 200 mm from the adjacent edges (points D);

e) any place where the bed base appears weakest.

Drop the impactor (5.3) 10 times from a specified distance above the bed base on to the test mattress at each of the selected positions of impact (see Figure 12). The impactor shall be permitted to fall freely but may be guided by a guide rail.

For bunk beds, this test shall be carried out on all bed bases if the construction differs.

Dimensions in millimetres



Key

L internal length

A, B, C, D impact positions

Figure 12 — Position of impacts

6.4.3 Test of the safety barriers around bed

For each test, place the test mass (5.6) on the upper bed base where it is most likely to prevent overturning. If this mass is not sufficient to prevent overturning, additional mass(es) shall be placed on the bed until overturning is prevented. The additional mass(es) may be placed on any suitable part of the bed.

Apply the specified vertical upwards force, horizontal outwards force and horizontal inwards force separately.

The forces shall be applied to the centre and to one end of the top safety barrier using the 100 mm loading pad (5.4.2). The loading point shall be 50 mm below the top edge of the structure at each position.

When the construction or fastening of the top safety barrier differs between ends, both ends shall be tested.

Apply the forces 10 times in each position. Maintain the force for 30 s for each application.

Apply a specified vertical downwards force to the top safety barrier. Apply the forces 10 times in each position. Maintain the force for 30 s for each application. The loading point shall be at the top of the

safety barrier, 250 mm from the intersection point of the centre lines of the adjacent side and end members.

Repeat the test on each top safety barrier.

Where the construction or fastening of other elements of the safety barrier differs from the top safety barrier, apply the forces at the point most likely to cause failure.

6.4.4 Durability test of frame and fastenings

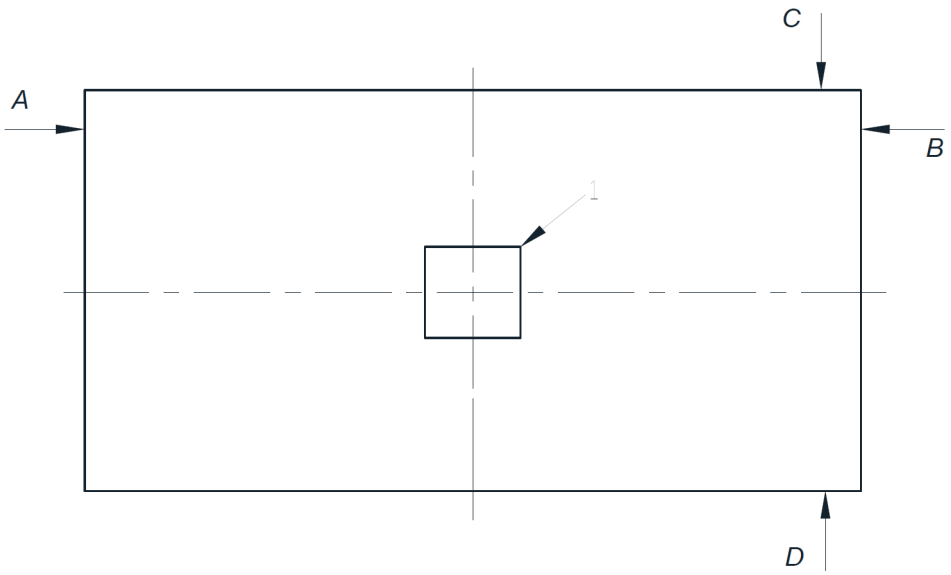
Restrain the bed with stops(5.7) in all directions at the bottom of each corner.

Position the test mass (5.6) at the centre of the base of the upper bed.

The loading points shall be at the height of the upper bed base, 50 mm from the intersection point of the centre lines of adjacent side and end members.

Apply by means of the 100 mm loading pad (5.4.2) specified alternating force for specified cycles (see Figure 13) at each point in the order A- B- C- D at a maximum rate of 6 cycles/min or A-B followed by C-D at a maximum rate of 12 cycles/min.

If bunk bed/high bed tends to lift, increase the test mass at the centre of the bed base until lifting is prevented. Record the test mass used.



Key

1 test mass: 75 kg

A, B, C, D horizontal forces

Figure 13 — Durability of frame — Application of load and forces

6.4.5 Test of means of access

6.4.5.1 Vertical static load on treads

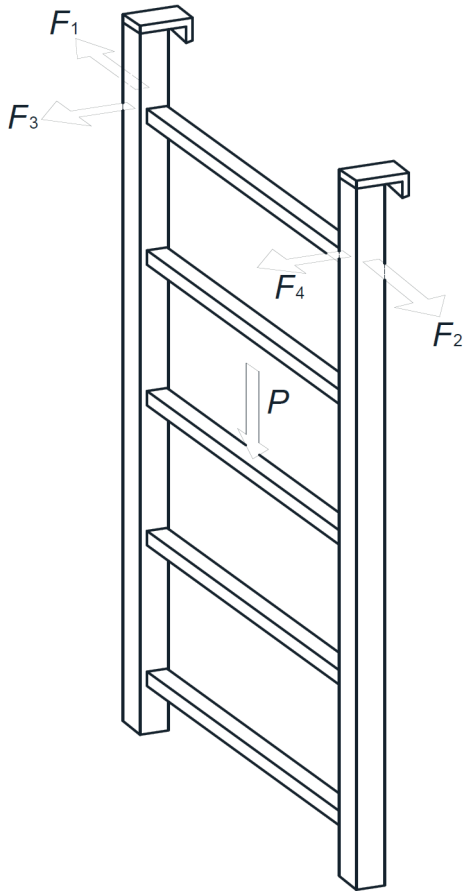
Position the bed on the floor with the legs against stops (5.7) but without restraining the upright components of the means of access.

Apply by means of the 100 mm loading pad (5.4.2) a specified vertical downwards force to the tread most likely to cause failure. The load application shall be at the mid-point of the tread. Apply the force 10 times. Maintain the force for 30 s for each application.

6.4.5.2 Horizontal static loads on treads of ladders

Apply a specified vertically downward force to the centre of the mid-tread or two mid-treads together with horizontal specified force, one after the other, for a load duration of 60 s in the order shown in Figure 14.

The loads shall be applied to the side members of the ladder at the height of the top tread, or, if this is not possible, just above the top tread (the upper most horizontal ladder component).



Key

P	vertical downward force
F_1, F_2, F_3, F_4	horizontal forces

Figure 14 — Vertical and horizontal static loads on treads

6.4.5.3 Durability of treads

Using the 100 mm loading pad (5.4.2) apply a vertical specified force to the tread nearest the centre of the means of access, in its intended position of use, for specified cycles at a rate not more than 24 loads per minute.

6.4.5.4 Treads impact test

Set the means of access in its position of use.

Position the tread impactor (5.9) on the longitudinal centreline of the tread and as close to one side as possible, so that it can be dropped freely onto the tread.

Apply the impact rest as illustrated in Figure 15 with a specified drop height. The tread impactor shall not be allowed to bounce.

Carry out the test 10 times. Repeat the test at the middle of the tread.

Test the top and bottom treads as well as the most central one.

Dimensions in millimetres

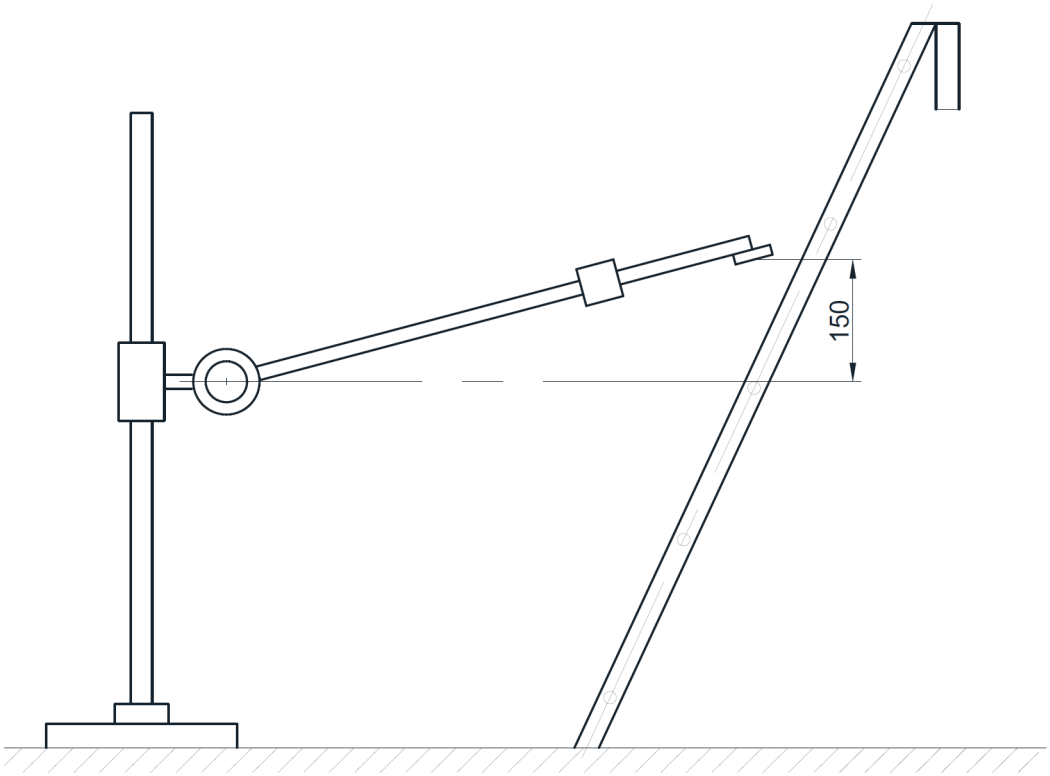


Figure 15 — Tread impact test

6.4.5.5 Handrails

Apply specified horizontal outward force to one end of the handrail most likely to cause failure, using the 100 mm loading pad (5.4.2). The loading point shall be 50 mm below the top edge of the handrail and 250 mm from the handrail support point.

Apply specified horizontal inward force to one end of the handrail most likely to cause failure, using the 100 mm loading pad (5.4.2). The loading point shall be 50 mm below the top edge of the handrail and 250 mm from the handrail support point.

When the construction or fastening of the handrail differs between ends, both ends shall be tested.

Apply the force 10 times. Maintain the force for 30 s for each application.

By means of the 100 mm loading pad (5.4.2), apply a specified downwards force perpendicular to the handrail, on the upper surface. Apply the force 10 times. Maintain the force for 30 s for each application. The load shall be applied at the point most likely to cause failure.

6.4.6 Test of platforms, and platform barriers

For each test, place the test mass (5.6) on the upper bed base where it is most likely to prevent overturning. If this mass is not sufficient to prevent overturning, additional mass(es) shall be placed on the bed until overturning is prevented. The additional mass(es) may be placed on any suitable part of the bed.

6.4.6.1 Static load on platform barriers

Apply a specified horizontal outward force consecutively to the centre and to one end of the platform barrier most likely to cause failure, using the 100 mm loading pad (5.4.2). The loading point shall be 50 mm below the top edge of the barrier at each position.

Apply a specified horizontal inward force consecutively to the centre and to one end of the platform barrier most likely to cause failure, using the 100 mm loading pad (5.4.2). The loading point shall be 50 mm below the top edge of the barrier at each position.

When the construction or fastening of the platform barrier differs at each end of the barrier, both ends of the barrier shall be tested.

Apply the force 10 times in each position. Maintain the force for 30 s for each application.

Apply a specified vertical downwards force to the top platform barrier. Apply the force 10 times in each position. Maintain the force for 30 s for each application. The loading point shall be 250 mm from a support point.

6.4.6.2 Platform static load test

Apply a specified vertical downward force using the 200 mm loading pad (5.4.1) and one layer of foam (5.11) in the following positions:

— 100 mm inwards at the centre of the entry point from the means of access

— 100 mm outwards at the centre of the opening for access to the bed

— At the point on the platform that is most likely to cause a failure, but not less than 100 mm from any edge.

Apply the force 10 times in each position. Maintain the force for 30 s for each application.

6.4.6.3 Platform impact test

Impact the platform in the following positions:

— 100 mm inwards at the centre of the entry point from the means of access

— 100 mm outwards at the centre of the opening for access to the bed

— At the point on the platform that is most likely to cause a failure, but not less than 100 mm from any edge.

For each position place one layer of foam (5.11) on the platform.

Determine the specified drop height from the position where the bed base impactor is resting on the surface of that layer of foam.

Place a second layer of foam (5.11) between the striking surface and the platform.

Allow the bed base impactor (5.3) to fall freely from the drop height onto the foam surface.

Impact the platform 10 times in each position.

6.5 Stability test

The stability test shall be carried out without mattress(es).

Position the bed on the floor with the legs against stops (5.7). The tilting tendencies shall not be restrained.

Apply a specified horizontal force at those points most likely to cause overturning.

6.6 Fastening of the upper bed to the lower bed

This test applies only to bunk beds where the upper and lower beds can be separated and used individually.

Apply the specified upward vertical static force at any position most likely to cause the beds to separate and maintain the force for 30 s.

If the lower bed tends to lift from the floor during this test, place a load on the lower bed sufficiently heavy to prevent it from lifting.

Bibliography

CEN/TR 17538:2020, *Furniture - Common test equipment - Test foams and mattresses*