BS EN 1957:2012

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Furniture — Beds and mattresses — Test methods for the determination of functional characteristics and assessment criteria

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National foreword

This British Standard is the UK implementation of EN 1957:2012. It supersedes BS EN 1957:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FW/0/2, Domestic and Contract Furniture.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Meubles - Lits et matelas - Méthodes d'essai pour la détermination des caractéristiques fonctionnelles et critères d'évaluation

Möbel - Betten und Matratzen - Prüfverfahren zur Bestimmung der funktionellen Eigenschaften und Leistungskriterien

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Foreword

This document (EN 1957:2012) has been prepared by Technical Committee CEN/TC 207 “Furniture”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

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The main change with respect to the previous edition is the correcting of the dimensions of the roller (Figure 3) to enable the roller to be manufactured.

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1 Scope

This European Standard specifies test methods for the determination of the durability and hardness of mattresses and all types of fully erected beds with mattresses (and mattress pads when they form a unit with the mattress). It does not apply to water beds, air beds and children cots.

It includes a method for the determination of the firmness rating of a mattress or a bed correlating to the subjective assessment made by people (see Annex A). It needs to be emphasized that the firmness rating cannot be used to demonstrate comfort and/or quality of a mattress or a complete bed.

Ageing and degradation caused by air, light, humidity and temperature is not included. The test results are only valid for the article tested. When test results are intended to be applied to other similar articles, the test specimen shall be representative of them.

2 Normative references

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

EN 1334, *Domestic furniture — Beds and mattresses — Methods of measurement and recommended tolerances*

EN 1725:1998, *Domestic furniture — Beds and mattresses — Safety requirements and test methods*

3 Terms and definitions

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

3.1
test unit
mattress or mattress/bed combination

3.2
durability test
test simulating the repeated application of loads and/or movement of components occurring during long-term use and assessing the strength of the article under such conditions and is a test is a procedure mainly intended to evaluate the change of the properties of the test unit caused by repeated loadings

3.3
load/deflection curve
curves that are obtained by pressing a load pad into the test unit and measuring the associated value of indentation and force simultaneously

3.4
hardness value *(H)*
determined from load/deflection measurement, in N/mm

3.5
firmness rating *(H_s)*
expression of the subjective assessment by persons determined from the hardness value upon results from empiric studies

3.6
height loss
change in the height of a test unit, in mm, caused by the durability test

4 General test conditions

4.1 Preliminary preparation

Unless otherwise specified by the manufacturer, the test unit shall be conditioned for at least one week in a standardised climate of (23 ± 2) °C and (50 ± 5) % RH immediately prior to testing. Subsequent conditioning shall also take place in this climate.

The tests shall be carried out at indoor ambient conditions but if during a test the temperature is outside the range 15 °C to 25 °C the maximum and/or minimum temperature shall be recorded in the test report.

During conditioning and handling, mattresses shall be kept flat and unloaded.

If a test cannot be carried out as specified in this European Standard, 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 far as possible as specified.

Complete beds shall be tested as delivered. Knock-down type beds shall be assembled according to the instruction supplied with the test unit. If the test unit can be assembled or combined in different ways, the most adverse combination shall be used for the test. Knock-down fittings shall be tightened before testing.

If necessary, mattress pads shall be prevented from moving during testing by a suitable means, e.g. adhesive tape or pins.

In cases where bed bases are adjustable in hardness, the setting during the test shall be recorded in the test report.

If the production information states that the mattress has a soft side and a firm side, both sides shall be tested using separate mattresses.

4.2 Tolerances

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

a) all forces shall have an accuracy of ± 5 % of the nominal force;

b) all masses an accuracy of ± 0,5 % of the nominal mass;

c) all dimensions an accuracy of ± 1 mm of the nominal dimension;

d) the tolerance for position of loading pads shall be ± 5 mm.

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

4.3 Sequence of testing

All tests shall be carried out on the same test unit and in the following sequence:

a) conditioning, at least one week (according to 4.1);

b) durability pre-conditioning: 100 cycles (according to 7.2);

c) conditioning, at least 5 h (according to 4.1);

d) measurement of unit height (according to 8.1) at 100 cycles and hardness measurement (according to 7.3 and 8.2) beginning within 5 min from moving the mattress from the standardised climate (according to 4.1);

e) durability test : 29 900 cycles (according to 7.2);

f) conditioning, at least 5 h (according to 4.1)[1)];

g) determination of hardness (according to 8.2) and height loss between 100 cycles and after the test (according to 8.1);

h) bed edge test:

   1) durability test at 100 cycles (according to Clause 9);

   2) measurement of unit height at 100 cycles (according to 8.1);

   3) durability test on bed edge: 4 900 cycles (according to Clause 9);

   4) measurement of unit height and height loss (according to 8.1).

5 Test apparatus

5.1 Floor surface

Rigid, horizontal and flat.

5.2 Stops

Stops shall be used to prevent a complete bed or bed frame from sliding but not tilting and shall be 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.

5.3 Standard test bed base for mattresses (durability test)

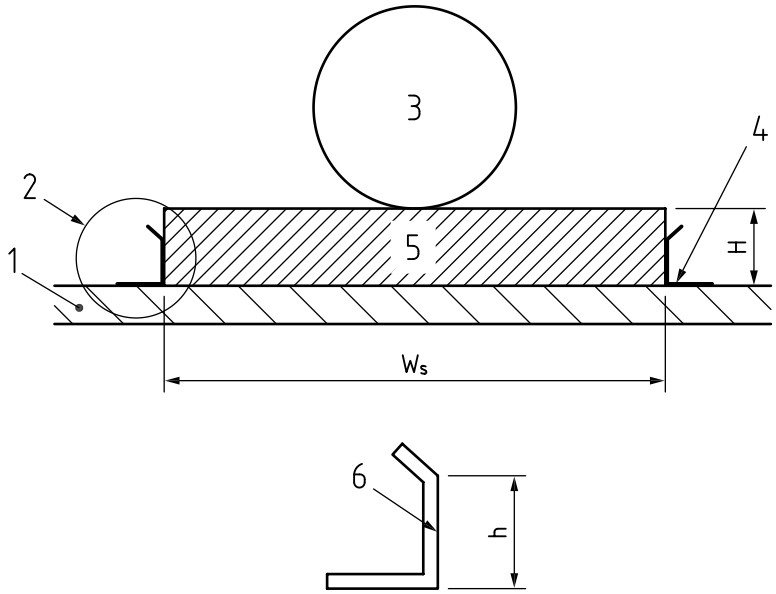
Rigid, horizontal, flat and smooth.

5.4 Side support profile

If the mattress is not prevented from moving during the durability test by the bed structure, it shall be prevented from moving by two side support profiles as illustrated in Figure 1. The internal distance between the supports (W_s) shall be equal to the width of the mattress measured according to EN 1334, ± 2 mm. The height of the support profiles (h) shall not exceed one third of the mattress thickness (H), measured according to EN 1334. The length of the support profiles shall be at least equal to the length of the test unit.

If necessary, mattress pads shall be fixed during the tests by a suitable manner.

1) Intermediate measurements may be carried out under these conditions.



Key

1 standard test bed base
2 side support profile
3 roller
H height of mattress
W_s distance between supports
4 side support profile
5 mattress
6 enlargement of side support profile (2)
h height of support profiles

Figure 1 — Side support profile

5.5 Standard table/test board (measuring)

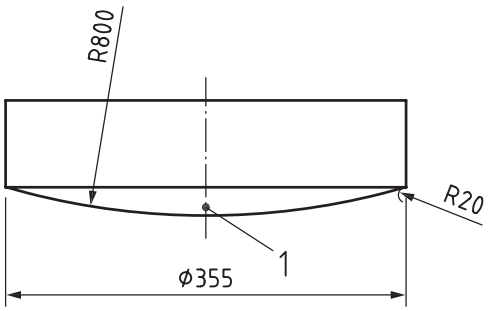
Horizontal, flat and smooth surface, large enough to fully support the mattress in any measuring position. At the loading position, the deflection shall not exceed 1 mm under 1000 N load. The overall flatness tolerance of the test board shall be 2 mm/1000 mm.

5.6 Loading pad

Rigid circular object 355 mm in diameter the face of which has a convex spherical curvature of 800 mm radius with a 20 mm front edge radius (see Figure 2).

The loading pad shall have a smooth surface and shall be mounted to the loading system of the test machine (5.7) by a ball joint as close as possible to the indentor surface (see Figure 2).

Dimensions in millimetres



Key

1 ball joint as low as possible

Figure 2 — Loading pad

5.7 Equipment for recording the load/deflection curves

The equipment for recording the load/deflection curves shall be a loading pad (5.6) and a testing machine capable of applying a vertical downward load up to 1000 N.

The travel speed for both loading and unloading shall be (90 ± 5) mm/minute.

Load and height with reference to a fixed datum shall be measured.

The accuracy of the height measuring system shall be ± 0,5 mm or better.

The accuracy of the load measuring system shall be ± 1 % of the max load (1000 N) or better.

The equipment shall be so that horizontal forces do not influence the measurement.

5.8 Equipment for the durability test

The equipment consists of a roller with dimensions and a shape illustrated in Figure 3 and a mechanism capable of relative horizontal movement of the roller on the unit surface.

The roller surface shall be hard, smooth and without scratches or other surface defects.

The total rolling system shall apply a load of (1400 ± 7) N measured in the static condition.

The roller shall have a rotation moment of inertia of 0,5 kgm² ± 0,05 kgm². The roller shall be free to pivot along its longitudinal and lateral axis relative to the horizontal.

The roller shall be capable of following the surface of the mattress, and it shall be free to move up and down to follow the mattress surface.

The forces on the roller shall act horizontally (see 7.2) at the centre point. The motion shall be approximately sinusoidal (within ± 10 %) and symmetrical along the longitudinal symmetry axis of the unit. The frequency shall be (16 ± 2) cycles per minute.

Dimensions in millimetres

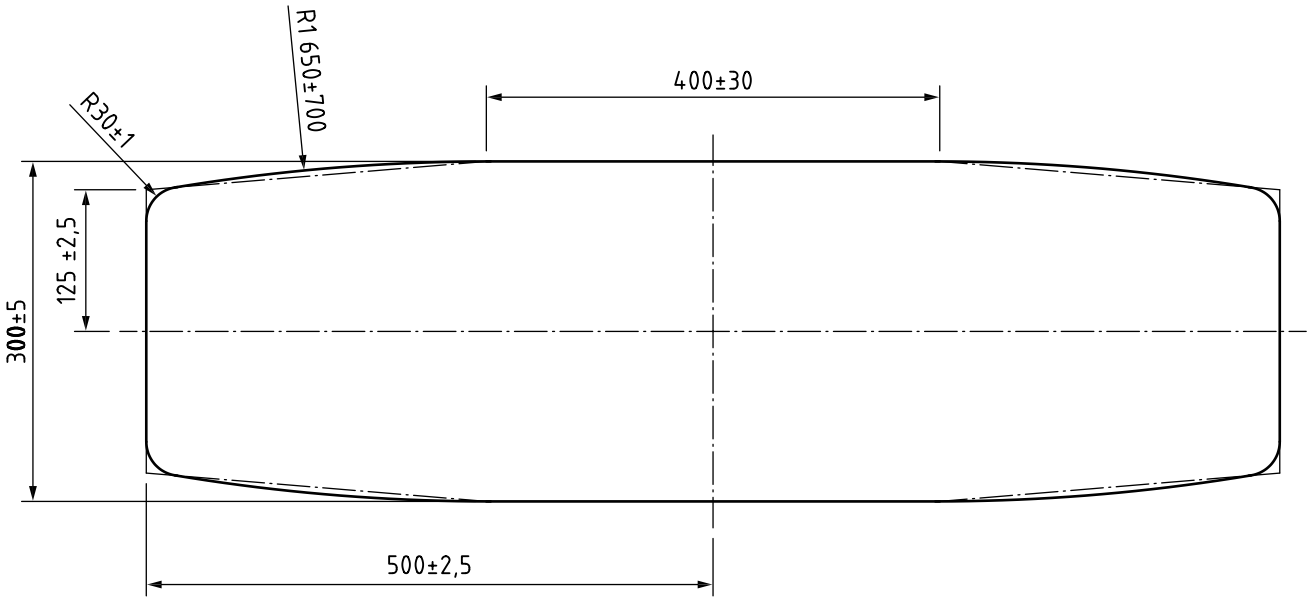


Figure 3 — Roller

6 Functional characteristics

6.1 Measurable functional characteristics

The measurable functional characteristics are determined or calculated before and after the durability test (see 7.2) and are based on the load/deflection curve as in 7.3 and also shown in Table 1. They may also be performed at intermediate intervals when applicable.

Table 1 — Measurement sequence

Test step	Time of evaluation	Functional properties					
		Unit height	Height change	Hardness value	Hardness change	Firmness rating	Firmness change
1	Initial measurement at 100 cycles	^	-	^	-	^	-
2	Intermediate measurement (if required)	^	^	^	^	^	^
3	After the test	^	^	^	^	^	^
^ to be measured							
- Not to be measured							

6.2 Visual inspection

The unit shall be inspected before, during and after the durability tests (see 7.2 and Clause 9) in order to detect changes caused by the test.

Special attention shall be given to tears in seams, seam splits, displacement or lumpiness in filling materials, broken springs, protrusion of the springs as well as holes and tears in ticking material in the mattress surface inflicted by the durability test. Internal inspection shall be carried out only at the end of the test and after all measurements have been taken.

7 Test methods

7.1 General

When mattress, bed base and frame (if applicable) are supplied together as a bed set, they shall be tested together. All tests and measurements shall be done on the complete unit standing on the floor surface (5.1).

Where a mattress is supplied separately, it shall be tested for durability with the standard test bed base for mattress (5.3) with side support profile (5.4).

If necessary, the same support profile shall be used for complete units. For the assessment of the load/deflection curves, the mattress shall be placed on the table/test board (5.5).

7.2 Durability test

The test shall be carried out with the roller apparatus (5.8).

Before beginning the test, adjust the roller mechanism so that:

a) The driving forces act horizontally (- 0°, + 2°) when the roller rests on the centre line of the sleeping area.

b) The length of travel of the roller shall be 250 mm on either side of the longitudinal centre line of the sleeping area and perpendicular to its longitudinal axes.

The test unit shall be rolled for 100 cycles before initial measurements are taken.

The test shall be carried out for a total of 30 000 cycles and shall not be discontinued except to take measurements.

One cycle includes one travel back and forth.

7.3 Load/deflection curve

The load/deflection curve shall be obtained using the equipment specified in 5.6 and 5.7.

Hardness measurement shall begin within 5 min from moving the mattress from the standard climate (see 4.1).

The initial measurement shall be taken after 100 cycles of durability test (see 7.2 or clause 9).

The measuring point shall be in the centre of the roller tested area, as well as at the load application point of the edge test (see Clause 9).

The measuring procedure shall be as follows:

a) Before carrying out any measurements, the test item shall be allowed to recover for at least 5 h in the standard climate (see 4.1).

b) Preload the measuring point with 1000 N and unload. Repeat the preload and unload sequence a further 2 times, with the time between each preload cycle not exceeding 30 s. The measurement shall begin within 30 s of the end of the last preload cycle.

c) The measurement shall consist of paired observations of deflection and load, whilst the load is increased up to 1000 N.

When logging data for the load deflection curve, there should be no less than 250 points from 0 to 1000 N. From 0 to 450 N, the distance between the points should not be more than 2 N. When calculating the slopes, this can be done by taking 5 points above and 5 points below each measuring valve and calculating the slopes by linear regression.

It may be of interest to record the Hysteresis curve by taking load/deflection measurement with the load decreasing from 1000 N to 0.

8 Evaluation of characteristic parameters

8.1 Determination of height loss

The height of the unit shall be measured by the equipment for the assessment of the load/deflection curve (see 5.6 and 5.7). The height is the distance in mm from the test-board (5.5) or floor surface (5.1) to a point on the top surface of the unit, where the force, acting on the unit from the load pad, equals 50 N.

NOTE The height measured by this procedure is used only for the determination of the height loss, and it should not be used for e.g. consumer information. The height of the mattress for consumer information is determined according to EN 1334.

The height loss is the difference between the initial measurement at 100 cycles and after testing.

8.2 Determination of hardness value

The hardness value (H), in N/mm, is the average of the slopes of the load/deflection curves at 210 N, 275 N and 340 N (see Figure 4) as shown in Formula 1:

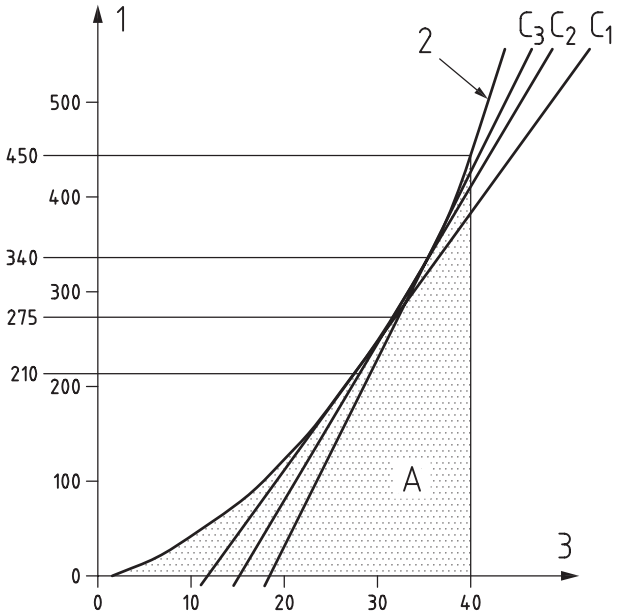
$$H = \frac{C_1 + C_2 + C_3}{3} \quad (1)$$

where:

C_1 = slope at 210 N load

C_2 = slope at 275 N load

C_3 = slope at 340 N load



Key

1 force [N]
2 load/deflection curve
3 indentation depth [mm]
A area under the load/deflection curve

Figure 4 — Determination of hardness value

8.3 Determination of firmness rating

The firmness rating (H_s) is a number (1 decimal) on a scale from 1 to 10 which expresses the firmness of a unit.

H_s = 1 is a firm unit

H_s = 10 is a soft unit

H_s is determined by Formula 2:

$$\left(H_S\right) = 10\left(1 - \exp^{-(Ka+b)}\right)^2 \quad (2)$$

where:

K is calculated from the load/deflection curve by Formula 3:

a = 5,92 10^{-4}

b = 0,148

$$K = \frac{A}{H} \quad (3)$$

A = area under the load/deflection curve (under the load curve from 0 to 450 N)

H = hardness value (see 8.2)

9 Durability of bed edge

Testing shall be carried out according to 7.5 of EN 1725:1998.

Measurement shall include the loss of height, according to 8.1.

10 Test report

The test report shall include at least the following information:

a) reference to this European Standard;

b) piece of furniture tested;

c) details of defects observed before testing;

d) any variation from the specified temperature range;

e) test results;

f) name and address of the test facility;

g) date of test.

Annex A
(informative)

Basis of determination of firmness rating

The method for the determination of firmness rating (subjective firmness) has been based upon empirical research carried out in several European countries.

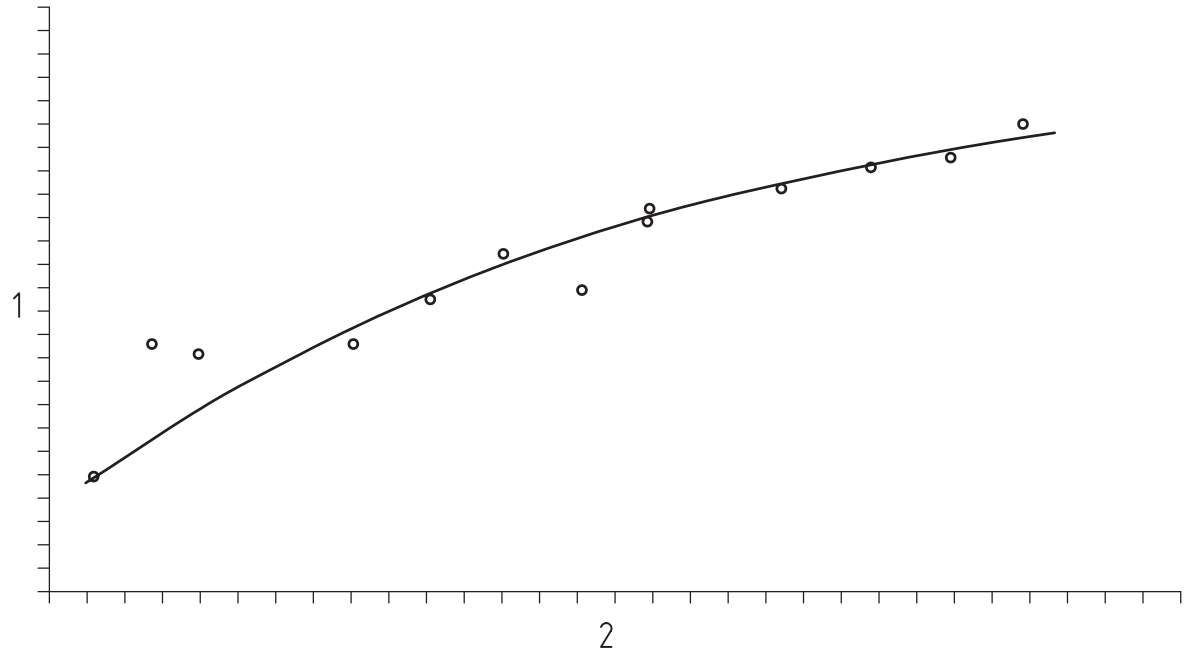
In these research programmes, measurement values as specified in this European Standard have been related to the subjective assessments made by a number of persons lying on a number of mattresses of varying degrees of firmness.

A typical relation between the firmness rating (the subjective firmness) and the K value is shown in Figure A.1.

Due to the difference in the subjective assessment, the expected standard deviation should be within approximately 10 %.

It is important to stress that the method in this standard is related to persons lying on the mattress/bed and not to feeling by hand, lying on the knees, standing or sitting on the mattress/bed.

Research has also shown that the indentation depth obtained by the method specified corresponds well with the indentation of people lying on the mattress. People standing or kneeling on the mattress may of course cause a higher indentation depth.



Key

1 scale for subjective firmness
2 scale for K value

Figure A.1 — Fit curve

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