

Strength and stability of furniture —

Part 3: Methods for determination of strength of settees

UDC 684.433.3:645.412.3:620.1

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The preparation of this British Standard was entrusted by the Furniture and Household Equipment Standards Committee (FHM/-) to Technical Committee FHM/1 upon which the following bodies were represented:

- British Rubber Manufacturers' Association
- Business Equipment Trade Association
- Consumer Standards Advisory Committee of BSI
- Consumers' Association
- Department of Education and Science
- Design Council
- Furniture Industry Research Association
- Greater London Council
- Local Authorities Management Services and Computer Committee
- Mail Order Traders' Association of Great Britain
- National Bedding Federation

This British Standard, having been prepared under the direction of the Furniture and Household Equipment Standards Committee, was published under the authority of the Board of BSI and comes into effect on 30 September 1985

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First published, as part of BS 4875-1, October 1972
First revision, as Part 3, September 1985

The following BSI references relate to the work on this standard:
Committee reference FHM/1
Draft for comment 82/36676 DC

ISBN 0 580 14645 6

Amendments issued since publication

Amd. No.	Date of issue	Comments

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Foreword

This Part of BS 4875 has been prepared under the direction of the Furniture and Household Equipment Standards Committee, and forms a revision of part of BS 4875-1:1972. Together with Parts 1, 2 and 4 it supersedes BS 4875-1:1972 which is withdrawn.

The major changes introduced by this revision are that the realism of the tests has been improved by specifying the use of more realistic apparatus, and a template is specified to determine the loading points. The opportunity has been taken to align the standard with an international standard in course of preparation in ISO/TC 136/SC 1 “Furniture — Test methods”.

The tests described in this Part of BS 4875 reproduce normal use and common types of mis-use to which seating may be subjected. As a result the methods are applicable to nearly all seating. Four test levels are given for the tests to cover the variations in severity of end-use that arises from the use of delicate styles, short life furniture, robust serviceable styles, etc. Whilst the tests reproduce normal use and common types of mis-use they do not reproduce any abuse to which the article may be subjected.

Appendix A gives an explanation of the furniture test levels used in this standard. The tests are designed to be applied to an article that is fully assembled and ready for use and are only intended to determine strength of the structure; they do not assess durability of filling materials, upholstery fabrics or foam cushions. The tests also do not reproduce the effects caused by degradation of structural materials by sunlight or chemical attack.

Other Parts of BS 4875 are as follows:

- *Part 1: Methods for determination of strength of chairs and stools;*
- *Part 2: Methods for determination of stability of chairs and stools;*
- *Part 4: Methods for determination of stability of settees;*
- *Part 5: Methods for determination of strength of tables and trolleys;*
- *Part 6: Methods for determination of stability of tables and trolleys;*
- *Part 7: Methods for determination of strength of storage furniture;*
- *Part 8: Methods for determination of stability of storage furniture.*

Attention is drawn to BS 6250 which specifies performance requirements for domestic and contract furniture using this standard as the method of test, and to BS 5459 and BS 5873 which specify performance requirements for office and educational furniture using methods that are very similar to those in this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 4875 describes methods for determination of strength of the structure of all types of settees, and other articles such as benches with seats for from two to four persons.

This standard does not apply to chairs or stools which are covered by BS 4875-1. It does not apply to multiple seating units for stadium seating as the loads applied are not representative of this type of use.

NOTE 1 Tests carried out according to the requirements of this 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 mis-use or after an excessively long period of service.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Principle

2.1 General

The principle is to determine the strength of the structure of an article of furniture by applying to various parts loads or forces simulating normal functional use, as well as acceptable mis-use, according to a graded scale of severity (see Appendix A).

The interrelation of the tests is shown in Table 1 and a summary is given in Table 2.

The sequence as a whole determines the following:

- a) static strength and initial damage;
- b) fatigue strength and damage propagation;
- c) ability to withstand acceptable mis-use and demonstration of sufficient residual strength.

The severity of loading is graded by varying the number of applications or the magnitude of forces applied.

2.2 Static tests

The principle of static tests is to assess the static strength of the article under the high levels of loading that only occasionally occur.

2.3 Fatigue tests

The principle of fatigue tests is to assess the strength of the component parts of the article under the repeated operations, movement, or applications of loads occurring during daily use.

2.4 Impact tests

The principle of impact tests is to assess the impact strength of the article under the rapid rates of loading that only occasionally occur.

3 General requirements for tests

3.1 Test loading

All loads and forces shall be measured to an accuracy of $\pm 5\%$.

NOTE The tests may in certain cases be carried out by means of loads or forces. For practical purposes, a force of 10 N may be taken to be equal to the downward force due to a mass of 1 kg.

The apparatus used to apply seat loading shall not restrain the article from overturning, nor hinder horizontal movement of the article when the back force is applied.

3.2 Moisture content and conditioning

Before the tests are commenced the article shall be sufficiently old to ensure that all component materials have developed their full strength. At least 4 weeks in normal conditions shall elapse from manufacture in the case of glued joints in timber, plastics moulded parts, etc.

Parts made of timber products shall be checked with an electric moisture meter to ensure that the moisture content is between 8 % and 12 %. If the moisture content is too high the article shall be allowed to dry out in a warm ventilated room until the moisture content is between 8 % and 12 %.

If a standard atmosphere is required for conditioning or testing, that atmosphere shall be at a temperature of $23 \pm 3^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

3.3 Emergency tests

When there is not time for furniture to be aged or to reach equilibrium the moisture content shall be measured where applicable at the beginning and at the end of the testing sequence, and these measurements shall be included in the report if they are outside the limits specified, together with the age of the article when testing commenced.

3.4 Rate of carrying out the tests

The forces shall be applied at a sufficiently slow rate to ensure that negligible dynamic load is applied and also to ensure that kinetic heating does not occur.

During the static load tests described in 7.1 to 7.3 the forces shall be maintained for at least 10 s during each cycle.

NOTE It is recommended that the tests are carried out at a maximum rate of six cycles per minute.

3.5 Setting-up of furniture

The articles shall be tested as delivered. Self-assembly furniture shall be assembled according to instructions supplied with the article. If the article can be combined in different ways the most adverse combination shall be used for each test.

Table 1 — Test data (purpose of each test)

Sequence	Number	Title	Primary purpose	Secondary purpose	Type		
1	1a	Seat static load test	Basic strength	Damage initiation	Functional		
	1b	Back static load test					
2	2	Arm and wing sideways static load test					
3	3	Arm downwards static load test					
4	4a	Seat fatigue test	Service durability	Damage propagation			
	4b	Back fatigue test					
5	5a	Leg forwards and sideways test	Handling strength	Residual strength	Acceptable misuse		
	5b	Static load test					
	5c	Diagonal base test					
6	6	Seat impact test	Impact strength				
7	7a	Back impact test					
	7b	Arm impact test					
8	8	Drop test					

Table 2 — Summary of test procedures

Number	Title	Description	Test level ^a (see Appendix A)			
			2	3	4	5
1a	Seat static load test	Seat force (in N)	1 100	1 300	1 600	2 000
1b	Back static load test	Back force (in N) at each pad	410	560	760	760
		Balancing seat force (in N) at each pad	1 100	1 300	1 600	2 000
2	Arm sideways static load test	Force applied (in N)	300	400	600	900
	Wing sideways static load test	Force applied (in N)	200	300	400	500
3	Arm downwards static load test	Force applied (in N)	700	800	900	1 000
4a	Seat fatigue test	Number of cycles 950 N seat force	25 000	50 000	100 000	200 000
4b	Back fatigue test	Number of cycles 400 N back force	25 000	50 000	100 000	200 000
5a	Leg forwards static load test	Maximum forward force (in N)	375	500	620	760
5b	Leg sideways static load test	Maximum forward force (in N)	300	390	490	760
		Balancing seat force (in N)	780	1 000	1 250	1 800
5c	Diagonal base force test	Force applied (in N)	250	375	500	620
6	Seat impact test	Drop height (in mm)	140	180	240	300
7a	Back impact test and	Drop height (in mm)	120	210	330	620
7b	Arm impact test	Angle (in degrees)	28	38	48	68
8	Drop test	Drop height (in mm)	75	100	150	200

^a Test level 1 does not apply to this standard; the remaining test levels are numbered 2 to 5 to correspond with the tests described in BS 4875-1.

4 Inspection before and after testing

Immediately before commencement of testing, each article shall be thoroughly inspected. Any defects in the members, joints or attachments shall be noted so that they are not attributed to the effect of the tests when the tests have been completed. A complete dimensional check shall be carried out on all articles that may suffer permanent deformation as a result of testing.

Immediately after completion of the tests, the article shall again be thoroughly inspected. Any apparent defects shall be noted and a determination made of any changes that have taken place since the initial inspection.

Fittings in self-assembly furniture shall be tightened before testing, and after each test level if testing is carried out at more than one test level.

NOTE Fittings in self-assembly furniture that come loose during the tests do not constitute a test failure. Manufacturers of self-assembly furniture should be recommended to issue instructions with the furniture that fittings should be tightened occasionally.

Each article shall be subjected to each of the tests at the same test level in the order specified and the occurrence of any of the following shall be recorded as defects affecting the strength of the article:

- a) any fracture of any member, joint or component, including seat suspensions and castors;
- b) any fracture or cracking through the thickness of any part of a structural shell;
- c) any loosening, shown to be permanent by hand pressure applied to suitable members, of joints intended to be rigid;
- d) any loosening of the underframe or base inserts moulded into a structural shell relative to the shell surface, shown to be permanent by means of hand pressure applied to the underframe or base;
- e) any free movement in the back, arms, legs or other components of the article greater than that noted in the initial inspection;
- f) any deformation of any part of the article or any cracks that will adversely affect its appearance or strength;
- g) any impairment of the operation of any mechanical part;
- h) any clearly audible noise developed during testing.

NOTE 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. Information on the scale of sampling to be employed can be obtained from BS 6001.

¹⁾ All loading pads should be capable of pivoting at least in the vertical plane and if design constrictions allow it, also in the horizontal plane.

5 Apparatus

NOTE For details of the sources of suitable test equipment write to Enquiry Section (London), BSI, 2 Park Street, London W1A 2BS enclosing a stamped addressed envelope for reply.

5.1 Means of applying required loads or forces.

5.2 Means of measuring dimensions to an accuracy of ± 0.2 mm.

5.3 Loading point template, (see Figure 1, Figure 2 and Figure 3) consisting of two shaped members fastened together by a pivot at one end. The contours of the shaped surfaces are so devised as to sink into the upholstery for a representative distance under moderate loads. For this purpose the seat loading arm shall have a total mass of 20 kg, applied through the seat loading point. The apparatus is marked as shown in Figure 1 so that the template can be positioned easily with the two members at an angle of 90°; to each other.

5.4 Stops, to prevent the article from sliding but not from overturning. Stops shall be not higher than 12 mm, except in cases where the design of the article necessitates the use of higher stops, where the lowest stop which will prevent the article from moving shall be used.

5.5 Seat loading pad¹⁾, a naturalistically shaped indenter as illustrated in Figure 4, consisting of a rigid shaped surface.

NOTE The shape, being complex, is defined not in a drawing but in existing moulds.

5.6 Smaller seat loading pad¹⁾, a rigid circular object 200 mm in diameter having a face with a convex spherical curvature of 300 mm radius and a 12 mm front edge radius (see Figure 5).

5.7 Back loading pad¹⁾, a rigid rectangular object 200 mm high and 250 mm wide having a face curved across the width of the pad with a convex cylindrical curvature of 450 mm radius and with a 12 mm radius on all front edges (see Figure 6).

5.8 Foam for facing pads, the seat and back loading pads (5.5, 5.6 and 5.7) are faced with a 25 mm thick layer of polyether foam with a hardness index, when measured in accordance with BS 4443-2, of 135/660 N at a density of 27 kg/m³ to 30 kg/m³. Alternatively a layer of the polyether foam described above may be positioned between the loading pad and the test structure.

5.9 Local loading pad¹⁾, a rigid cylindrical object 100 mm in diameter having a flat face with a 12 mm radius on the front edge.