

Educational furniture —

Part 2: Specification for strength and stability of chairs for educational institutions

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Consumer and Contract Goods Standards Policy Committee (CCM/-) to Technical Committee CCM/5, upon which the following bodies were represented:

- British Educational Equipment Association
- British Furniture Manufacturers' Federation
- Chartered Society of Designers
- Clasp Development Group
- Counties Furniture Group
- Department of Education and Science
- Department of Trade and Industry (Consumer Safety Unit, CA Division)
- Furniture Industry Research Association
- ICE (Ergonomics)
- Kent County Council

This British Standard, having been prepared under the direction of the Consumer and Contract Goods Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 30 April 1991

© BSI 08-1999

First published April 1980
Second edition April 1991

The following BSI references relate to the work on this standard:
Committee reference CCM/5
Draft for comment 90/39719 DC

ISBN 0 580 19307 1

Amendments issued since publication

Amd. No.	Date	Comments
6809	August 1991	Indicated by a sideline in the margin

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Definitions	1
3 Force-application devices	1
4 Strength tests	1
5 Stability tests	2
6 Marking	3
Appendix A Co-ordination of tests with BS 4875-1	5
Appendix B Seat static load test (Test 1a)	5
Appendix C Back static load test (Test 1b)	6
Appendix D Seat fatigue load test (Test 2a)	7
Appendix E Back fatigue load test (Test 2b)	7
Appendix F Tipping forward on one front leg test (Test 3)	7
Appendix G Seat impact test (Test 4)	8
Appendix H Back impact test (Test 5)	8
Appendix J Chair drop test (Test 6)	9
Appendix K Seat shell impact and frame detachment tests (Test 7)	9
Appendix L Ferrule test (Test 8)	11
Appendix M Footrail test (Test 9)	11
Appendix N Stability tests (Tests 10a and 10b)	11
Figure 1 — Illustration of a linkage arrangement for constraining seat loading pad	3
Figure 2 — Seat static load test (Test 1a)	5
Figure 3 — Back static load test (Test 1b)	6
Figure 4 — Seat fatigue load test (Test 2a)	7
Figure 5 — Back fatigue load test (Test 2b)	7
Figure 6 — Seat impact test (Test 4)	8
Figure 7 — Back impact test (Test 5)	8
Figure 8 — Chair drop test (Test 6)	9
Figure 9 — Impact test to top corner of back (Test 7a)	9
Figure 10 — Impact test to top of back (Test 7b)	10
Figure 11 — Impact test to rear face of back (Test 7c)	10
Figure 12 — Impact test to front corner of seat (Test 7d)	10
Figure 13 — Forwards overbalancing and sideways overbalancing tests (Test 10a)	13
Figure 14 — Rearwards overbalancing test (Test 10b)	14
Table 1 — Summary of strength tests	4
Table 2 — Equivalence to BS 4875-1	5
Table 3 — Seat loads and overturning forces	13
Publications referred to	Inside back cover

Foreword

This Part of BS 5873 has been prepared under the direction of the Consumer and Contract Goods Standards Policy Committee. It is a revision of BS 5873-2:1980 which is withdrawn.

BS 5873-1 specifies the requirements for the functional dimensions, identification and finish of chairs for teaching and dining purposes and lecture assembly halls in educational institutions. This Part specifies the strength and stability requirements for such chairs and has been prepared to provide assurance that chairs complying with it are sound and durable.

Individual purchasers may well be able to judge the general suitability of a chair by inspection but, if they are non-technical, they may not be able to assess its strength and stability in use. It is for this reason that this standard specifies objective criteria for strength and stability of chairs which are based on the simulation of conditions in use.

This standard requires that chairs be capable of passing a number of specified tests for strength and stability. The tests have a graded scale of severity that relates to the chair sizemarks and are designed to simulate two conditions of use: regular normal use; and occasional specially severe circumstances. Regular normal use is tested by functional loadings that are designed to assess the stability and the fatigue strength of chairs under prolonged normal use. Occasional specially severe circumstances are tested by acceptable misuse tests involving high and rapidly applied loadings that assess the ability of the chairs to withstand the misuses and mishaps, termed acceptable misuse, that inevitably occur during the life of any seating.

The tests in this Part of BS 5873 are based on BS 4875-1 and BS 4875-2 and additional research by the Furniture Industry Research Association. Both normal and severe strength ratings have been specified for the larger sizes of chair (sizemarks 4 and 5 respectively). The relationship between the tests in this standard and those in BS 4875-1 and BS 4875-2 is shown in Appendix A. Where the use of these chairs is expected to be exceptionally severe, purchasers are advised to specify the severe rating in the interests of longer life and lower replacement cost.

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 14, 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 5873 specifies strength and stability requirements for the six sizes of chair for educational institutions specified in BS 5873-1.

Two strength ratings, normal and severe, are specified for the two largest sizes. In the assessment of forwards and sideways overturning, two methods are described, one being experimental and the other calculative. Either of these methods can be used, depending on circumstances.

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

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1

functional loadings

test loadings applied to a chair to cause stresses to simulate those caused by the use of the chair as a support for the body when sitting

2.2

acceptable misuse tests

test loadings applied to a chair to simulate stresses that may be applied to it when it is used other than as a support for the body

NOTE This category of loadings is thus intended to cater for such foreseen abuse of a chair as may occur mainly during handling and transport or, for example, when a chair supports more than one person or supports a person using a chair in an unconventional way.

2.3

static loading

the steady and gradual application, up to the maximum that the chair may be required to withstand, of a test loading, repeated a sufficient number of times to make sure of the static strength of the chair

2.4

flexibility criterion

the maximum allowable flexibility between seat and backrest

2.5

fatigue loading

the reiterated application to the chair, in a steady and gradual manner, of the load which is likely to occur most frequently

2.6

stability

the ability of a chair to withstand forces that tend to cause it to tip over

2.7

point of intersection of the seat and back surfaces

the point at which the centre line of the seat plane from the front edge meets a vertical line dropped from the foremost point of the backrest

3 Force-application devices

Force-application devices used in the tests, e.g. spring scales, shall have an accuracy of ± 0.5 N.

4 Strength tests

4.1 Inspection before and after testing and criteria for failure

4.1.1 Inspection before testing

Immediately before commencement of testing, each chair 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.

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 issue instructions with the furniture that fittings should be tightened occasionally.

4.1.2 Inspection after testing

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

4.1.3 Criteria for failure

At the end of each test, the chair shall be examined and the occurrence of any of the following shall be recorded as failure of the chair:

- 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;
- i) a flexibility quotient of less than 0.6 (see C.4).

4.2 Moisture content and conditioning

Before strength tests are commenced, the chair shall be sufficiently old to ensure that all component materials have developed their full strength. At least 4 weeks 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 chair 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 a temperature of 23 ± 3 °C and a relative humidity of 50 ± 5 %.

4.3 Order of strength tests

Each chair shall be subjected to each of the strength tests at the same level and in the order specified in 4.4 to 4.14.

NOTE Tests 1a and 1b (see 4.4 and 4.5) and 2a and 2b (see 4.6 and 4.7) may be combined if so desired. Whether the seat and back static load tests and/or the seat and back fatigue load tests are combined or not, it is important that the application of the seat loading pad in the back loading tests (Tests 1b and 2b) does not prevent any force deformation of the chair caused by the back load. A schematic diagram of a simple linkage to achieve this purpose is shown in Figure 1.

4.4 Seat static load test (Test 1a)

After testing in accordance with Appendix B and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.5 Back static load test (Test 1b)

After testing in accordance with Appendix C and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.6 Seat fatigue load test (Test 2a)

NOTE This test is applicable to chairs of sizemarks 4 and 5 only.

After testing in accordance with Appendix D and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.7 Back fatigue load test (Test 2b)

NOTE This test is applicable to chairs of sizemarks 4 and 5 only.

After testing in accordance with Appendix E and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.8 Tipping forward on one front leg test (Test 3)

After testing in accordance with Appendix F and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.9 Seat impact test (Test 4)

NOTE This test is applicable to chairs of sizemarks 2.5, 3, 4 and 5 only.

After testing in accordance with Appendix G and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.10 Back impact test (Test 5)

NOTE This test is applicable to chairs of sizemarks 2.5, 3, 4 and 5 only.

After testing in accordance with Appendix H and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.11 Chair drop test (Test 6)

After testing in accordance with Appendix J and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.12 Seat shell impact and frame detachment tests (Test 7)

After testing in accordance with Appendix K and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.13 Ferrule test (Test 8)

After testing in accordance with Appendix L and Table 1, the chair shall be assessed in accordance with 4.1.3.

4.14 Footrail test (Test 9)

NOTE This test is applicable to chairs with footrails only.

After testing in accordance with Appendix M and Table 1, the chair shall be assessed in accordance with 4.1.3.

5 Stability tests

5.1 General

With the exception of those chairs identified in note 2, which shall be tested by the experimental method, stability shall be determined by either the experimental method or the calculative method. The stability tests shall be as specified in 5.2 and 5.3.

NOTE 1 These methods are compatible in as much as they employ the same forces and positions of application.