

Educational furniture

Part 4. Specification for strength and stability of storage furniture for educational institutions

Mobilier scolaire
Partie 4. Résistance et stabilité du mobilier de
rangements pour établissement
d'enseignement — Spécifications

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- 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, C A Division)
- Furniture Industry Research Association
- Institute of Consumer Ergonomics
- Kent County Council

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Foreword

This Part of BS 5873 has been prepared under the direction of the Consumer and Contract Goods Standards Policy Committee.

This Part specifies the strength and stability requirements for storage furniture.

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

The strength tests described in this standard reproduce normal use and common types of misuse to which storage furniture for educational institutions may be subjected. 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. Two test levels are given for the tests: general and heavy. The general grade applies to furniture for normal use. The heavy grade applies only to bulk storage or storage of extremely heavy items such as large books.

The stability tests described in this standard determine the ability of the furniture to remain stable in normal use.

This standard applies specifically to school furniture and not to office furniture used by the administrative staff.

While the tests reproduce normal use and common types of misuse, they do not reproduce any abuse to which the article may be subjected.

Attention is drawn to BS 4875 : Part 7, which describes methods of test for domestic and contract furniture that are very similar to those in this standard.

The other Parts of this standard are as follows:

Part 1. Specification for functional dimensions, identification and finish of chairs and tables for educational institutions;

Part 2. Specification for strength and stability of chairs for educational institutions;

Part 3. Specification for strength and stability of tables for educational institutions.

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

Specification

1 Scope

This Part of BS 5873 specifies strength and stability requirements for storage furniture for educational institutions, including lockers.

Two strength ratings, general and heavy, are specified.

NOTE 1. Requirements for the durability of locks are to be included at a later date.

NOTE 2. Tests carried out in accordance with 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 misuse or after an excessively long period of service.

NOTE 3. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 5873 the following definitions apply.

2.1 stability

Test loadings applied to storage furniture to demonstrate its ability to withstand forces that tend to cause it to tip over.

2.2 functional loadings

Test loadings applied to storage furniture to cause stresses to simulate those caused by use of the furniture for storage purposes.

2.3 acceptable misuse tests

Tests loadings applied to storage furniture to simulate stresses that may be applied to it when it is used to store items of greater mass than the furniture was intended for.

2.4 static loading

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

2.5 fatigue loading

Reiterated application to storage furniture, in a steady and gradual manner, of the load which is likely to occur most frequently.

3 Strength tests

3.1 Inspection before and after testing, and criteria for furniture

3.1.1 Inspection before testing

Immediately before testing, each article shall be thoroughly inspected. Any defects in the members, joints or attachments of such components as flaps and extensions shall be noted so that they are not attributed to the effect of the tests when the tests have been completed.

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 test do not constitute a test failure. Manufacturers of self-assembly furniture should issue instructions with the furniture that fittings should be tightened occasionally.

3.1.2 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 should be made of any changes that have taken place since the initial inspection.

3.1.3 Criteria for failure

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

- (a) any fracture of any member, joint or component;
- (b) any loosening, shown to be permanent by hand pressure applied to suitable members, of joints intended to be rigid;
- (c) any deformation or wear of any component that will essentially affect its function;
- (d) any loosening of any means of fixing components to the article;
- (e) any moveable parts that do not open or close freely, or catches that do not operate smoothly.

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.

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 have a moisture content of between 8 % and 12 %. If the moisture content is above 12 % 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 a temperature of 23 ± 2 °C and a relative humidity of 50 ± 5 %.

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 test report if they are outside the limits specified, together with the age of the article when testing commenced.

3.3 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. This requirement shall also apply to furniture that can be combined with other articles. Articles intended for wall attachment shall be mounted on a wall so that secure attachment is achieved in every mounting position specified by the manufacturer. Articles intended to be floor standing shall be placed on a flat and level floor.

3.4 Rate of carrying out 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.

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

3.5 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.

3.6 Combinations of tests

3.6.1 Components of the article shall be subjected to each of the strength tests in the order specified in 3.7 to 3.14. Components that have a dual function shall be subjected to the relevant tests for each component, e.g. a shelf that can be pulled out on runners shall be subjected to the tests for shelves and additionally to the wear and fatigue tests for drawers and runners. The strength tests shall be carried out on the same article of furniture.

NOTE 1. To reduce testing time, the wear and fatigue tests can be carried out on different articles.

NOTE 2. The component parts of an item can be tested in any order and do not necessarily have to be carried out in the order given in this clause. However, for each component part, the tests should be carried out in the order in which they appear in the appropriate subclause.

3.6.2 For an article fitted with a number of flaps, drawers or doors that are identical in every respect (apart from the direction of opening and closing), it is necessary to test only one of the relevant flaps, doors or drawers. Other flaps, drawers or doors fitted to the article shall each be tested separately.

3.6.3 When tests are intended to prove a range of equipment, this may be achieved by testing the most highly stressed units or parts of units. It is therefore possible at the discretion of the test authority to cover the testing of the whole range by carrying out the test programme given in table 1.

Table 1. Order of tests for ranges of equipment

Item	Order of tests
The largest floor unit and the largest hanging unit (if this does not include the longest shelf span unit then the unit containing this item is also tested)	Deflection of shelves Strength of carcass and underframe Strength of top and bottom surfaces Strength of shelf supports Strength of wall attachment devices
The largest drawer	Wear and fatigue of drawers Slam shut of drawers Slam open of drawers Displacement of drawer bottoms Strength of runners
The relevant door whose geometry creates the greatest bending moment on the hinge	Performance of pivoted doors Slam open of pivoted doors Slam shut of pivoted doors
The largest sliding door	Wear and fatigue of sliding doors Slam shut/open of sliding doors
The largest hinged flap	Wear and fatigue of flaps Slam shut/open of flaps
The largest roll front (vertical)	Fatigue of roll front Slam shut of roll front
The longest clothes hanging rail	Strength of clothes hanging rails supports Deflection of clothes hanging rails

3.7 Tests on shelves, horizontal surfaces and clothes hanging rails

3.7.1 Strength of shelf supports

After testing in accordance with A.1, the shelf supports shall be assessed in accordance with 3.1.3.

3.7.2 Deflection of shelves

After testing in accordance with A.2, the shelf shall be assessed in accordance with 3.1.3. The deflection of the shelves shall be as follows:

- (a) less than $\frac{\text{span}}{200}$ for particle board;
- (b) less than $\frac{\text{span}}{150}$ for wood;
- (c) less than $\frac{\text{span}}{100}$ for other materials.

3.7.3 Strength of top and bottom surfaces

After testing in accordance with A.3 and table 2, the top and bottom surfaces shall be assessed in accordance with 3.1.3.

3.7.4 Strength of clothes hanging rail supports

After testing in accordance with A.4, the clothes hanging rail supports shall be assessed in accordance with 3.1.3.

3.7.5 Deflection of clothes hanging rails

After testing in accordance with A.5, the clothes hanging rail shall be assessed in accordance with 3.1.3. The deflection of the clothes hanging rail shall be less than $\frac{\text{span}}{100}$.

Table 2. Summary of test procedures (see also table 5)

Test	Test level	
	General	Heavy
	Number of applicants and test forces	
Strength of top and bottom surface		
Top surface		
Height above floor:		
less than 1050 mm	1250 N	2×900 N
1050 mm and above	450 N	700 N
Bottom surface		
Wall units	1000 N	1250 N
floor units, unrestricted headroom	1000 N	1250 N
floor units, headroom less than 1050 mm	450 N	700 N
Wear and fatigue of pivoted doors	80 000 cycles	80 000 cycles
Strength of pivoted doors	35 kg	70 kg
Slam open of pivoted doors (opening force)	$20^{+0}_{-0.5}$ N	$30^{+0}_{-0.5}$ N
Slam shut of pivoted doors (closing force)	$25^{+0}_{-0.5}$ N	$30^{+0}_{-0.5}$ N
Wear and fatigue of sliding doors	80 000 cycles	80 000 cycles
Slam open/shut of sliding doors	4.0 kg	6.0 kg
Wear and fatigue of flaps	40 000 cycles	40 000 cycles
Strength of flaps	300 N	500 N
Wear and fatigue of roll fronts	40 000 cycles	40 000 cycles
Slam shut of roll fronts	40 cycles	50 cycles
Wear and fatigue of drawers and runners	50 000 cycles	50 000 cycles
Displacement of bottom surface of drawers	70 N	70 N
Slam open/slam shut of drawers		
Velocities at calibration points		
slam open 5 kg	1.85 m/s	2.05 m/s
slam shut 5 kg	1.25 m/s	1.40 m/s
Strength of runners	350 N	350 N
Strength of carcase and underframe	450 N	600 N
Strength of coat hooks	460 N	460 N

NOTE. These tests are for both static and fatigue loading.

3.8 Tests on pivoted doors

3.8.1 *Strength of pivoted doors*

After testing in accordance with **B.1** and table 2, the pivoted doors shall be assessed in accordance with **3.1.3**.

3.8.2 *Wear and fatigue of pivoted doors*

After testing in accordance with **B.2** and table 2, the pivoted doors shall be assessed in accordance with **3.1.3**.

3.8.3 *Slam open/shut test of pivoted doors*

After testing in accordance with **B.3** and table 2, the pivoted door shall be assessed in accordance with **3.1.3**.

3.9 Tests on sliding doors

3.9.1 *Wear and fatigue of sliding doors*

After testing in accordance with **C.1** and table 2, the sliding doors shall be assessed in accordance with **3.1.3**.

3.9.2 *Slam open/shut test of sliding doors*

After testing in accordance with **C.2** and table 2, the sliding doors shall be assessed in accordance with **3.1.3**.

3.10 Tests on flaps

3.10.1 *Strength of flaps*

After testing in accordance with **D.1** and table 2, the flaps shall be assessed in accordance with **3.1.3**.

3.10.2 *Wear and fatigue of flaps*

After testing in accordance with **D.2** and table 2, the flaps shall be assessed in accordance with **3.1.3**.

3.11 Tests on roll fronts

3.11.1 *Slam shut test for roll front*

After testing in accordance with **E.1** and table 2, the roll front shall be assessed in accordance with **3.1.3**.

3.11.2 *Wear and fatigue of roll front*

After testing in accordance with **E.2** and table 2, the roll front shall be assessed in accordance with **3.1.3**.

3.12 Tests on drawers

3.12.1 *Strength of runners*

After testing in accordance with **F.1** and table 2, the runners shall be assessed in accordance with **3.1.3**.

3.12.2 *Slam open/shut test of drawers*

After testing in accordance with **F.2** and table 2, the drawers shall be assessed in accordance with **3.1.3**.

The force required to move the drawers during the test shall not exceed 70 N and the force to maintain movement shall not exceed 45 N.

3.12.3 *Displacement of bottom surface of drawers*

After testing in accordance with **F.3** and table 2, the drawers shall be assessed in accordance with **3.1.3**.

3.12.4 *Wear and fatigue of drawers and runners*

After testing in accordance with **F.4** and table 2, the drawers and runners shall be assessed in accordance with **3.1.3**.

The force required to move the drawers during the test shall not exceed 70 N and the force to maintain the movement shall not exceed 45 N.

3.13 Tests on carcass and underframe

3.13.1 *Strength of carcass and underframe*

After testing in accordance with **G.1** and table 2, the carcass and underframe shall be assessed in accordance with **3.1.3**.

3.13.2 *Strength of wall attachment devices*

After testing in accordance with **G.2**, the wall attachment devices shall be assessed in accordance with **3.1.3**.

3.14 Strength of coat hooks

After testing in accordance with appendix H and table 2, the coat hooks shall be assessed in accordance with **3.1.3**.

4 Stability tests

NOTE. No conditioning is required for stability tests.

4.1 Overturning test for unloaded carcass

When testing in accordance with **J.1** the article shall not overturn.

4.2 Overturning test for loaded carcass

When testing in accordance with **J.2** the article shall not overturn.

5 Marking

Each article of furniture shall be clearly and indelibly marked, or shall have an indelible label permanently attached, to show the following information:

- (a) the name, trade mark or other means of identification of the manufacturer;
- (b) the number and date of this British Standard, i.e. BS 5873 : Part 4 : 1991¹⁾;
- (c) the test level that the article has been tested against, i.e. G (general) or H (heavy).

¹⁾Marking BS 5873 : Part 4 : 1991 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.