BRITISH STANDARD

Strength and stability of furniture –

Part 1: Requirements for the strength and durability of the structure of domestic seating

ICS 97.140

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 4875 is published by BSI and came into effect on 31 October 2007. It was prepared by Technical Committee FW/0, *Furniture*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

Together with BS EN 15373:2007, this part of BS 4875 supersedes BS 4875-1:2001, which is withdrawn.

Information about this document

This new edition of this part of BS 4875 incorporates changes made necessary by the publication of BS EN 15373. It does not represent a full review or revision of the standard, which will be undertaken in due course.

BS EN 15373 specifies strength and durability requirements for non-domestic seating. Therefore, this new edition of this part of BS 4875 has been prepared to cover domestic seating only.

The performance requirements are verified by tests which reproduce normal use and common types of misuse to which seating can be subjected. They apply to a wide range of seating. Five test levels are given, corresponding to the variations in severity of end-use to be expected for various types of seating, e.g. delicate styles, short-life furniture, robust serviceable types. Whilst the tests reproduce normal use and common types of misuse, they do not reproduce any abuse to which the article may be subjected.

Annex A explains the test levels used in this standard.

The requirements apply only to the durability of the structure. They do not apply to the durability of filling materials, upholstery fabrics or foam cushions. The tests are designed to be applied to an article that is fully assembled and ready for use. The tests do not reproduce the effects of degradation of structural materials by sunlight or chemical attack.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This part of BS 4875 specifies performance requirements for the strength and durability of the structure of domestic seating, including swivel/pedestal chairs intended for use in the home, and pouffes and stools.

It does not apply to multiple seating units for stadium seating, non-domestic seating, seating intended for educational institutions, office visitor chairs and office work chairs.

It does not include requirements for the durability of upholstery materials or the durability of mechanisms as used in convertible sofa beds, nor for resistance to degradation by ageing of structural materials or upholstery materials. It does not include requirements for seat height adjustment and swivelling durability of pedestal seating.

NOTE 1 Requirements for seat height adjustment and swivelling durability of pedestal seating are given in BS 5459-2:2000.

NOTE 2 Test methods from BS EN 1728 are specified where appropriate.

NOTE 3 The requirements of this standard are intended to demonstrate the ability of the item to give satisfactory service in its intended environment. Conformity to the standard does not ensure that structural failure will not eventually occur as a result of habitual misuse or after an excessively long period of service.

2 Normative references

The following referenced documents are indispensable for the application 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.

BS EN 1728:2001, *Domestic furniture – Seating – Test methods for the determination of strength and durability*

3 Principle of the performance tests

3.1 General

Conformity to the requirements given in Clause **4** for the strength and durability of the structure of an article of furniture is verified by applying to various parts, loads or forces simulating normal functional use, as well as acceptable misuse, according to a graded scale of severity (see Annex A).

The interrelation between the tests is shown in Table 1.

The test sequence as a whole determines the following:

a) static strength and initial damage;

b) fatigue strength and damage propagation;

c) ability to withstand acceptable misuse; and

d) demonstration of residual strength.

The magnitude of the forces applied, or the number of applications, varies according to the grade to which conformity is being tested.

Table 1 **Purpose of tests**

Name of test	Primary purpose	Secondary purpose	Type of test
Seat static load Back static load	Basic strength	Damage initiation	Functional (normal use)
Arm and wing sideways static load			
Arm downwards static load			
Seat fatigue Back fatigue	Service durability	Damage propagation	
Leg forwards and sideways Static load Diagonal base	Handling strength	Residual strength	Acceptable misuse
Seat impact	Impact strength		
Back impact Arm impact			
Drop			

3.2 Static tests

Static tests assess the static strength of the article under the highest levels of loading that can reasonably be expected to occur.

3.3 Fatigue tests

The strength of the component parts of the article are tested by simulating the repeated application of loads and movement of components that occur during long-term use.

3.4 Impact tests

Impact tests assess the impact strength of the article under the rapid rates of loading that occur only occasionally.

4 Requirements

4.1 After the seating has been tested in accordance with Clause **5**, at the selected test level, none of the following shall have occurred:

a) any fracture of any member, joint or component, including seat suspensions and castors;

b) any fracture or cracking through the full 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, relative to the shell surface, of the underframe or base inserts moulded into a structural shell, 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 (see **5.3**);

f) any deformation or cracks that will adversely affect the appearance or strength of any part of the sample;

g) any impairment of the operation of any mechanical part;

h) the development of any clearly audible noise as a result of testing.

4.2 When the seating is tested in accordance with Annex B, at the declared test level, the flexibility quotient (see Annex B) shall not exceed $0.000\ 8 \times F$, where F is the applied back static force given in Table 2 (see Figure B.1).

Additionally for all-foam chairs, the distance measured in **B.5** shall not exceed 100 mm.

5 Tests

NOTE For the purpose of these tests, pouffes are considered to be stools.

5.1 Samples

All the tests shall be carried out on the same sample. If any failure occurs during the sequence of tests, all the tests shall be repeated on a completely new test sample.

NOTE The test results are valid only for the article tested. When the test results are intended to cover 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.

5.2 Moisture content of timber components

Before testing, 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 higher than 12%, the sample shall be allowed to dry out in a warm ventilated room until the moisture content is between 8% and 12%.

5.3 Inspection before testing

Immediately before testing, the sample shall be thoroughly inspected. Any defects in the members, joints or attachments shall be noted so that they are not attributed to the tests. A complete dimensional check shall be carried out on all articles likely to suffer permanent deformation as a result of testing. The dimensions shall be recorded.

Any minor defects detected as a result of this inspection shall be recorded in the test report. If the sample is found to have a major defect as described in **4.1**, the sample shall be rejected.

5.4 Procedure

The sample shall be tested in accordance with BS EN 1728:2001 and with Annex B and Annex C of this standard, as specified in Table 2. All tests shall be carried out at the same test level (see Table 2), and in the sequence given in Table 2.

5.5 Inspection after testing

Immediately after completion of the tests, the sample shall again be thoroughly inspected. Any apparent defects as given in **4.1** shall be noted, together with any other changes that have taken place since the initial inspection.

Table 2 **Tests**

Test[A]	**Test description**	**Loading**	**Test level**				
			1	2	3	4	5
BS EN 1728, **6.2**	Seat static load	Force, N: 10 times	—	1 200	1 300	1 600	2 000
	Back static load	Force, N: 10 times	—	410	450	550	700
Annex B[B]	Flexibility assessment	Measurement made after back static load test (BS EN 1728:2001, **6.2**)					
BS EN 1728, **6.3**	Additional static load	See BS EN 1728:2001, **6.3**					
BS EN 1728, **6.4**	Foot rail static load	Force, N: 10 times	—	700	1 000	1 250	1 500
BS EN 1728, **6.5**	Arm sideways static load	Force, N: 10 times	200	300	400	600	900
	Wing sideways static load	Force, N: 10 times	100	200	300	400	500
BS EN 1728, **6.6**	Arm downwards static load	Force, N: 10 times	300	700	800	900	1 000
BS EN 1728, **6.7**	Seat fatigue	Number of cycles: Seat load 950 N	12 500	25 000	50 000	100 000	200 000
	Back fatigue	Number of cycles: Back load 330 N	12 500	25 000	50 000	100 000	200 000
BS EN 1728, **6.8**	Seat front edge fatigue	Number of cycles:[C] Seat load 950 N	12 500	25 000	50 000	100 000	200 000
BS EN 1728, **6.9**	Additional seat and back fatigue	See BS EN 1728:2001, **6.9**					
BS EN 1728, **6.11**	Leg-rest fatigue	Number of cycles: Load 950 N	—	25 000	50 000	100 000	200 000
BS EN 1728, **6.12**	Leg forward static load	Force, N: 10 times	300	375	500	620	760
	Balancing seat load	Force, N:	780	780	1 000	1 250	1 800
BS EN 1728, **6.13**	Leg sideways static load	Force, N: 10 times	250	300	390	490	760
	Balancing seat load	Force, N:	780	780	1 000	1 250	1 800
BS EN 1728, **6.14**	Diagonal base load	Force, N: 10 times	125	250	375	500	620
BS EN 1728, **6.15**	Seat impact test	Drop height, mm: 10 times	—	140	180	240	300
BS EN 1728, **6.16**	Back impact test	Height, mm:	70	120	210	330	620
		Angle, degrees: 10 times	20	28	38	48	68
BS EN 1728, **6.17**	Arm impact test	Height, mm:	70	120	210	330	620
		Angle, degrees: 10 times	20	28	38	48	68
Annex C[B]	Drop test for single-seat units (including stacking chairs)	Nominal drop height, mm: 10 times	100	150	200	300	450
BS EN 1728, **6.18**	Drop test for multi-seat units	Nominal drop height, mm: 5 times on each end	—	150	200	300	450

[A] Subclause number of BS EN 1728:2001, unless otherwise stated.

[B] Annex of this standard, BS 4875-1:2007.

[C] One cycle consists of the application of the load once on each side of the seat.

6 Test report

The test report shall include the following:

a) the number and date of this British Standard, i.e. BS 4875-1:2007;

b) details of the article tested, e.g. specification and photographs;

c) the test level at which the article has been tested;

d) details of any defects observed before the tests;

e) details of any defects and damage observed after the tests;

f) if appropriate:

   1) the flexibility quotient (see **4.2** and Annex B);

   2) details of any damage which does not impair the function of the article;

g) for all-foam chairs, the back deflection in millimetres;

h) the test result;

i) details of any deviation from the test procedures;

j) for articles which have adjustable components, the tightness and positioning of the adjustment used during testing.

Annex A (informative) Test levels in relation to application

Table A.1 shows the type of use that might be expected from furniture in relation to the five test levels.

Table A.1 **Relationship of test levels to use of furniture**

Test level	Performance category	Example of use
1	Delicate	Seats of delicate appearance
2	Light	Bedroom, occasional folding chairs
3	General	Living/dining room
4	Heavy	Seating where rough treatment and careless handling occur
5	Severe	Seating intended for exceptionally severe use

Annex B (normative) Flexibility assessment

*NOTE This assessment of flexibility is made at the final stage of the back static load test given in BS EN 1728:2001, **6.2**. This ensures that any plasticization of plastics components has been taken into account.*

B.1 When the back static load test from BS EN 1728:2001, **6.2** is applied to an article fitted with a spring rocking action base that has a tension adjustment, increase the tension so that the least possible rocking movement is obtained during the test.

B.2 If it is not possible to apply the back force at the back loading point due to the construction of the article, e.g. if the back is constructed of cross-members positioned above and/or below the back loading point, use a suitable panel to spread the load over the back cross-members, ensuring that the panel used does not overlap the side upright members of the article.

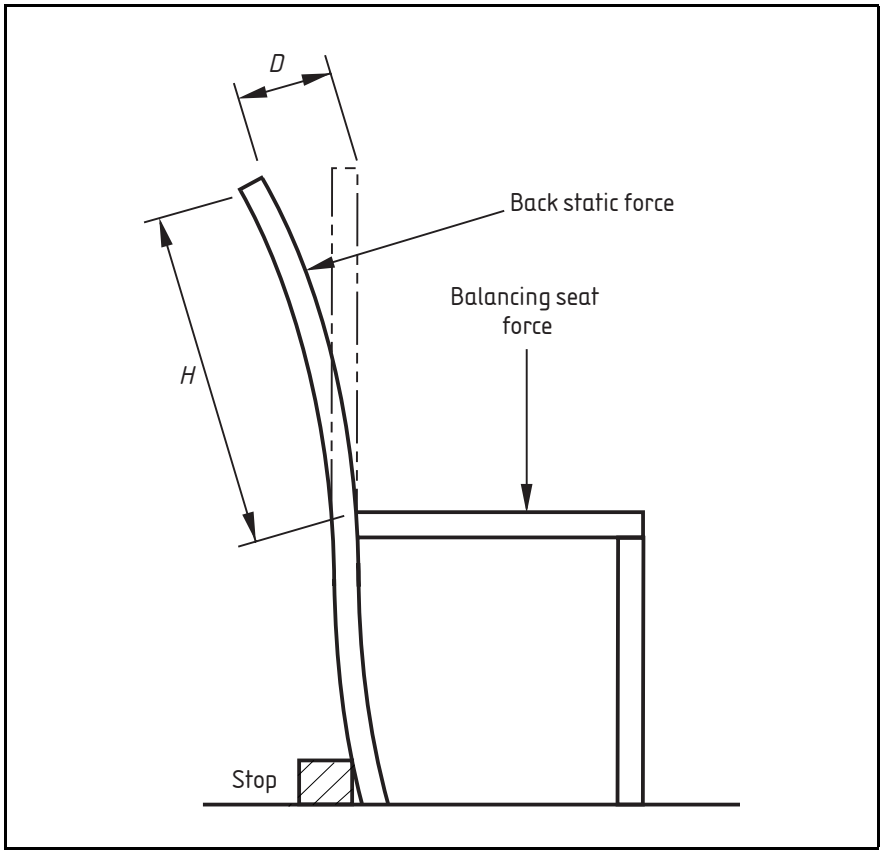
B.3 Perform the back static load test as specified in BS EN 1728:2001, **6.2**, using the appropriate back force specified in Table 2. On the tenth application of the back force, measure the deflection, D, of the top of the back from the unloaded position (see Figure B.1).

B.4 Calculate the flexibility quotient D/H, where H is the distance from the seat surface to the top of the back (see Figure B.1).

B.5 Additionally, for all-foam chairs, record the position of the front face of the seat loading pad when it is just in contact with the back. Apply the back force (see Table 2) once again and maintain it for 5 min or until creep movement has stopped, whichever is the longer. Then measure the distance, in millimetres, between the face of the loading pad whilst the load is applied, and the surface of the back when unloaded (i.e. the position of the loading pad determined before applying the force).

NOTE All-foam chairs are composed essentially of flexible cellular material. Internal or external reinforcement or stiffening is sometimes incorporated, but this does not function as a frame, i.e. loads applied are transmitted to the floor or base platform by the flexible foam, and not by structural components or other material. All-foam chairs are subject to creep, i.e. slow distortion under sustained load. Therefore, while support may be adequate immediately on sitting down, it is likely to be reduced after a period of sitting.

Figure B.1 **Back static load test with flexibility assessment**



Annex C (normative) Drop test for single-seat units

C.1 Support the sample so that one foot is just in contact with the floor, whilst the line joining that foot to the foot diagonally opposite is inclined at 10° ± 2° to the horizontal and the line joining the remaining feet is horizontal (see Figure C.1). In the case of three-legged stools, support the stool so that the line joining two feet is horizontal and the line from the third foot, i.e. the one receiving impact, to the mid-point of the line joining the other two feet is inclined upwards at 10° ± 2° to the horizontal. For chairs having five-star bases, use the nearest diagonally opposite foot.

C.2 Lift up the sample to the nominal drop height specified in Table 2 for the appropriate test level (with a tolerance of ±1.0 mm), as indicated in Figure C.1, maintaining the orientation specified in **C.1**.

NOTE Positioning for the drop may be achieved by lifting the sample by three cords that are adjusted in length while the sample stands in the correct orientation on a plane inclined at 10° from the horizontal.

Drop the sample on to the floor 10 times so that a front leg takes the initial impact, and a further 10 times so that a rear leg takes the impact; or, in the case of three-legged articles, so that two separate legs in turn take the impact.

Stacking chairs shall be dropped as described in **C.1** and **C.2**, but in a stack of six chairs, using the drop height calculated in accordance with Figure C.2 in relation to the total mass of the stack and the appropriate nominal drop height specified in Table 2.

Figure C.1 **Drop test**

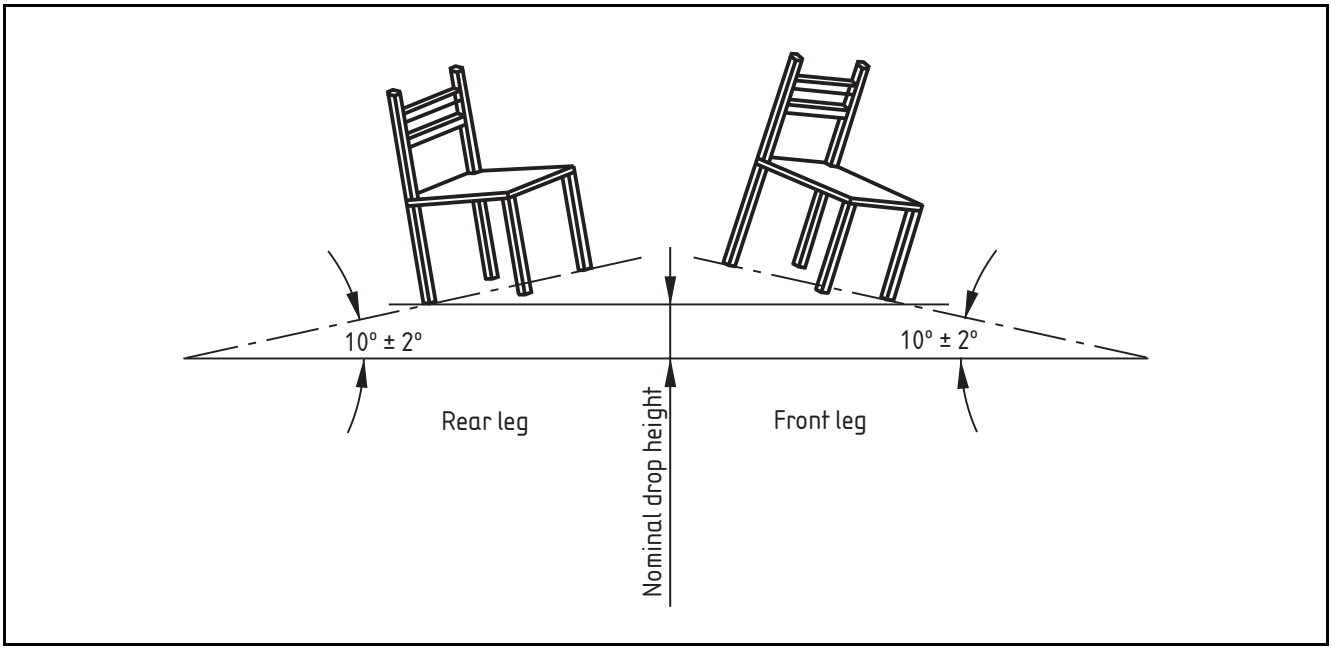
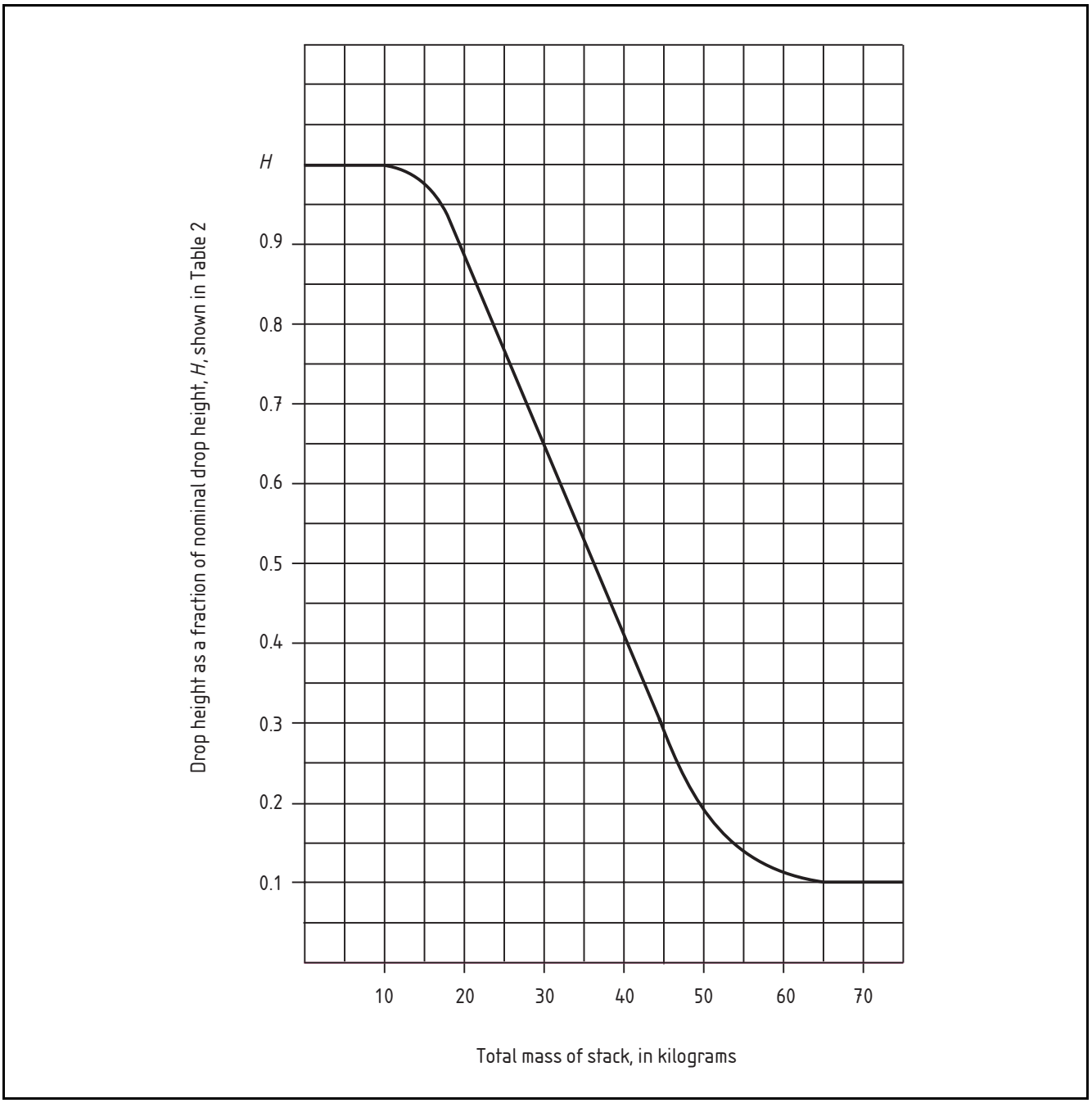


Figure C.2 **Drop test for stacking chairs – Drop height relative to mass of stack**



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BS 5459-2:2000, *Specification for performance requirements and tests for office furniture – Part 2: Office pedestal seating for use by persons weighing up to 150 kg and for use up to 24 hours a day, including type-approval tests for individual components*

BS 6001 (all parts), *Sampling procedures for inspection by attributes*

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