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British Standard Specification for

Portable aluminium ladders, steps, trestles and lightweight stagings

Echelles, escabeaux, chevalets et échafaudages légers en aluminium portatifs —
Spécifications

Tragbare Leitern, Tritte, Gestelle und Gerüste in Leichtbauweise aus Aluminium

British Standards Institution

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Foreword

This British Standard has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee. It is a complete revision of the 1964 edition, which is withdrawn, and several major changes have been introduced.

The scope of the standard has been extended to include platform steps and ladder backed steps. While earlier editions of this standard were concerned with products for use in building and civil engineering, the present standard introduces three classes according to the duty rating: class 1, suitable for industrial purposes; class 2 for less demanding applications such as the light trades; and class 3, which is intended for domestic users.

The possibility of adopting performance requirements for the finished product as a means of allowing a wider choice of aluminium alloys, their condition and form has been considered. However, it was decided that this would be impractical in the light of existing experience and hence the permitted materials have been listed, with some changes to those given in the earlier edition.

As many of the accidents associated with ladders have occurred from misuse, especially overloading, the standard now requires the class and duty to be marked on the products. Appendix M gives information on the care, use and maintenance of the products covered by the standard that may be provided by the manufacturer or supplier.

Appendix A gives general information relating to the tests described in subsequent appendices.

The UK has been participating in the preparation of a European Standard for portable ladders and although this has not been completed the points already receiving general agreement have been taken into account in finalizing the revision of this British Standard.

Certification. Attention is drawn to the certification facilities described on the inside back cover of this standard.

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

British Standard Specification for

Portable aluminium ladders, steps, trestles and lightweight stagings

Section one. General

1. Scope

This British Standard specifies requirements for materials, details of construction and performance for portable aluminium ladders, steps, trestles and stagings of the following types:

- (a) single-section ladders, including shelf ladders;
- (b) extending ladders;
- (c) standing step ladders, including swing back steps, folding platform steps and ladder backed steps;
- (d) folding trestles;
- (e) lightweight stagings.

This standard does not apply to ladders for special professional use such as fire brigade ladders, or to mobile ladders which require mechanical aids for erection.

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 leaning ladder.** A ladder supported in use by a separate structure, e.g. a wall.
- 2.2 single-section ladder.** A leaning ladder constructed and used as a single unit.
- 2.3 shelf ladder.** A single-section ladder fitted with treads that are intended to be horizontal in use.
- 2.4 extending ladder.** A leaning ladder consisting of two or three sections constructed so that the height can be varied, in increments of one rung spacing, by sliding the sections relative to each other.
- 2.5 standing step ladder.** A self-supporting ladder consisting of a front and back hinged together, the ascendable front being in the form of a shelf ladder.
- 2.6 swing back steps.** A standing step ladder in which the top is in the form of a tread and the back is merely a supporting frame.
- 2.7 folding platform steps.** A standing step ladder in which the top is constructed in the form of a working platform.
- 2.8 ladder backed steps.** A standing step ladder in which the back is fitted with cross-bearers suitable for supporting a working platform.
- 2.9 folding trestles.** An arrangement of two frames hinged together, each fitted with cross-bearers suitable for supporting a working platform.

2.10 lightweight stagings. A working platform constructed of stiles, cross-bearers and decking, to provide a flat working surface.

2.11 stiles. The side members to which the rungs, treads or cross-bearers are fitted.

2.12 spacing (of rungs, treads or cross-bearers). The distance, measured along the longitudinal axis of the stiles between the same relative positions of the members.

3. Classification of duty rating

The articles covered by this standard shall be classified by the general conditions and probable frequency of use as given in (a) to (c).

(a) *Class 1: industrial.* For heavy duty where relatively high frequency and onerous conditions of use, carriage and storage occur. Suitable for industrial purposes. Duty rating 130 kg.

(b) *Class 2: light trades.* For medium duty where relatively low frequency and reasonably good conditions of use, storage and carriage occur. Suitable for light trade purposes. Duty rating 110 kg.

(c) *Class 3: domestic.* For light duty where frequency of use is low and good storage and carriage conditions pertain. Suitable for domestic and household purposes. Duty rating 95 kg.

4. Materials

4.1 General. The materials from which the component parts are made shall be in accordance with 4.2 to 4.6.

4.2 Guide brackets and fixed and latching hooks. Guide brackets and fixed and latching hooks shall be made from the materials given in either (a), (b) or (c) as follows:

- (a) aluminium alloys, as specified in 4.6;
- (b) mild steel;
- (c) whiteheart malleable cast iron complying with BS 6681.

4.3 Hinges. Hinges shall be made from the materials given in either (a), (b) or (c) as follows:

- (a) aluminium alloys, as specified in 4.6;
- (b) forged steel or steel strip;
- (c) whiteheart malleable cast iron complying with BS 6681

4.4 Feet of stiles and capping for upper ends of stiles or ends of treads. Feet of stiles and capping for upper ends of stiles or ends of treads shall be made from the materials given in either (a), (b) or (c) as follows:

- (a) plastics;
- (b) rubber;
- (c) timber.

4.5 Decking of lightweight stagings. Decking of lightweight stagings shall be made from the materials given in either (a), (b) or (c) as follows:

- (a) aluminium alloys, as specified in 4.6;
- (b) plastics;
- (c) timber (see 13.3).

4.6 Other components. Other components shall be made from aluminium alloys as given in (a) to (f) as follows:

- (a) drawn tube: designation 6063 (HT9) and 6082 (HT30) of BS 1471;
- (b) extruded sections: designation 6063 (HE9), 6082 (HE30), 6063A, 1200 (E1C) and 6061 (HE20) of BS 1474;
- (c) longitudinally welded tube: designation 5251 (NJ4) of BS 4300 : Part 1, and 3005*, 5040*, 5049* and 5454*;
- (d) castings: LM6 and LM25 of BS 1490;
- (e) components formed from sheet and strip: designation 1200 (S1C), 3103 (NS3), 5154A (NS5), 5251 (NS4) and 6082 (HS30) of BS 1470;
- (f) forgings: 6082 (HF30) of BS 1472.

 **NOTE 1.** When used for class 1 articles, ferrous components should be protected against corrosion preferably to the standards required for external exposure by any of the materials and methods given in BS 729, BS 1706 or BS 4921. In the case of class 2 and class 3 articles, protection against internal environments should suffice pre-coated steel is acceptable and enamelling or plastics coating have been found to be adequate.

NOTE 2. Plastics materials and rubber should be selected having regard to the stresses to which they may be subjected and their resistance to environmental deterioration, especially that due to ultraviolet light.

NOTE 3. The four digit identification designation of aluminium alloys in this standard is as given in other British Standards and in the International Registration Record for Aluminium Alloys. Care should be taken not to confuse proprietary or manufacturer's four digit designations with the aligned BS, IRR, or ISO designations. Further information on this identification system may be found in the BS 1470 series.

5. Tolerances on sizes

5.1 The dimensional tolerances on the aluminium alloys used to fabricate ladders, steps, trestles and stagings shall comply with those given in the appropriate British Standard.

5.2 The spacing of rungs and treads on an individual ladder shall not vary by more than 2.0 mm from the nominal spacing selected by the manufacturer from the range specified in section two.

5.3 A tolerance of ± 25 mm shall be permitted on the nominal length of all ladders covered by this standard.

6. Marking

6.1 Equipment shall be clearly and durably marked with the information specified in 6.2, 6.3 and 6.4 as appropriate. Compliance shall be checked by inspection and by rubbing the marking lightly, first for 15 s with a cloth soaked in water and then for 15 s with a cloth soaked in petroleum spirit. There shall be no reduction in legibility at the

conclusion of the test. Adhesive labels, where used, shall not have worked loose or become curled at the edges.

Tie on labels shall not be used to provide the information specified in 6.2 and 6.3.

6.2 Ladders, steps, trestles and lightweight stagings shall be marked with the following particulars:

- (a) the name, trade mark or other means of identification of the manufacturer or supplier;
- (b) the number and date of this British Standard, i.e. BS 2037 : 1984†;
- (c) the class and duty rating, e.g. 'Class 1 — Industrial duty rating 130 kg'.

6.3 Ladders, steps and trestles shall be provided with a separate label displaying the following wording on a background coloured blue for class 1, yellow for class 2 or red for class 3.

'Inspect for damage before use.

Lean ladder at approximately 75° from horizontal (1 m out for each 4 m height).

Ensure firm level base.

Check safety at top.

Avoid electrical hazards.

Avoid over-reaching.

Keep a secure grip.

Never stand on top of swing back steps.

Tie at top and bottom wherever possible.'

6.4 Lightweight stagings shall bear a label fitted to the outside of one stile incorporating in letters not less than 4 mm high the following:

'Maximum load three men spaced apart and hand tools or 270 kg uniformly distributed.'

Section two. Specific types of ladders, steps, trestles and stagings

7. Single-section ladders and extending ladders

7.1 Construction

7.1.1 Lengths. The lengths of single-section ladders and extending ladders when fully extended shall not exceed the lengths given in (a) to (c), as appropriate to the class.

- (a) Class 1: 17 m;
- (b) Class 2: 10.7 m;
- (c) Class 3: 9.1 m.

7.1.2 Distance between stiles. The clear stiles at any point (in mm) shall be not less than that determined by the following equation:

$$\text{Minimum width at any point} = \frac{L}{200} + 230$$

where

L is the distance from any point to the top of the ladder (in mm).

*See appendix N.

†Marking BS 2037 : 1984 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, Quality Assurance Division, BSI, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

NOTE. This requirement applies whether the ladders have parallel or converging stiles and for extending ladders is based on the length when fully extended. For example, the minimum width of a 4.5 m parallel ladder would be $\frac{4500}{200} + 230 = 252 \text{ mm}$ (to the nearest millimetre).

A tapered ladder of the same length would be at least 230 mm wide at the top $\frac{2250}{200} + 230 = 241 \text{ mm}$ (to the nearest millimetre) at the middle and $\frac{4500}{200} + 230 = 252 \text{ mm}$ (to the nearest millimetre) at the bottom.

An extended ladder with two sections of different widths each 3.5 m long and with an extended length of 6.2 m would have a top section at least $\frac{3500}{200} + 230 = 248 \text{ mm}$ wide (to the nearest millimetre) and a bottom section at least $\frac{6200}{200} + 230 = 261 \text{ mm}$.

The width of the sections of extending ladders shall be such as to provide a minimum clearance consistent with the operation of the ladder.

7.1.3 Feet. The lower end of each stile shall be closed by blocks of hardwood, plastics or rubber or fitted with an articulated foot soled with slip resistant material. The feet shall project to form a wearing surface and shall be securely fixed but easily removable for renewal. The length of projection of the blocks or fittings shall be taken into account when determining the overall length of the ladder.

7.1.4 Rungs. Each rung shall have a textured surface on the working face to reduce slipping. All rungs shall be securely fixed so as not to rotate in their supports and if the ends of the rungs protrude through the stiles they shall be smoothly finished so as not to injure a user's hands.

7.1.5 Spacing of rungs. Rungs shall be uniformly spaced at 250 mm to 300 mm centres. The distance from the ends of the stiles to the nearest rung centre shall be 125 mm to 300 mm.

7.1.6 Fittings for extending ladders. Fittings for extending ladders shall be such that the width of parts bearing on the rungs is not less than that given in table 1.

The shape of hooks shall be such as to require upward movement of the upper section to disengage them from the rungs. The fittings shall have no sharp edges liable to cause indentation. Latching devices, if fitted, shall not be dependent for their operation on springs and, if of the rope-operated type, they shall be such that in the event of the rope breaking or being released they engage automatically and prevent uncontrolled closure of the ladder. Where the latches are acting as a pair, they shall be connected to ensure movement in unison. The latches or fixed hooks shall bear equally on the rungs. Guide brackets shall be formed with no tool marks that would affect their strength or performance. Any sharp corners shall be removed.

Table 1. Fittings for extending ladders

Major horizontal rung dimension or diameter	Minimum width of fitting bearing on surface of rungs
mm	mm
Up to and including 31	12.0
Over 31 and under 39	9.5
39 and greater	6.0

7.1.7 Ropes. The strength of rope attachments shall be such as to provide a factor of safety of not less than 8 times the mass of the extending section or sections.

Ropes shall be hemp sash cord, made from yarn, complying with table 1 of BS 6125 : 1982 or other material of equivalent strength. The nominal diameter of the ropes and breaking load shall be not less than the appropriate values given in table 2.

Table 2. Ropes for extending ladders

Ladder duty rating	Minimum nominal diameter of ropes	Minimum breaking load
	mm	kg
Class 1	10	410
Class 2	8	260
Class 3	7	215

7.1.8 Overlap of sections of extending ladders. When fully extended, the effective overlap between adjacent sections of the ladder shall be not less than the following:

- (a) 1.5t for closed lengths up to and including 5 m;
- (b) 2.5t for closed lengths over 5 m and up to and including 6 m;
- (c) 3.5t for closed lengths over 6 m.

where

t is the spacing of rungs (in mm) (see also figure 1).

7.2 Performance of single-section standing ladders and extending ladders

7.2.1 Deflection under load. When tested in accordance with appendix B the deflection of the loaded stiles shall not exceed the limit determined from the graph shown in figure 2. In addition, after removal of the test load there shall be no permanent damage and the residual deflection shall not exceed 1 mm per metre of test span.

7.2.2 Torsional rigidity. When tested in accordance with appendix B the difference between the deflections of the two stiles shall not exceed the limit determined from the graph shown in figure 3.

7.2.3 Strength. When tested in accordance with appendix C, after removal of the test load the residual deflection shall not exceed 1 mm per metre of length between the supports plus 1 mm.

7.2.4 Twist. When tested in accordance with appendix D, the angle of twist shall not exceed the value given in table 3.

Table 3. Maximum allowable angle of twist

Duty rating	Type	Maximum allowable angle of twist
		Degrees (°)
Class 1	Industrial	18
Class 2	Light trades	20
Class 3	Domestic	22

7.2.5 Sideways bending. When tested in accordance with appendix E, the deflection measured midway between supports shall not exceed $(0.0033L + 18 \text{ mm})$, where L is the effective span (in mm) and the residual deflection shall not exceed 1 mm per metre.

7.2.6 Cantilever bending. When tested in accordance with appendix F, the residual deflection of either stile shall not exceed 6 mm.

7.2.7 Rungs. When tested in accordance with appendix G the rungs shall support the load. In addition, after removal of the test load there shall be no damage or permanent deflection.

8. Shelf ladders

8.1 Construction

8.1.1 Lengths. The lengths of shelf ladders shall be as specified in 7.1.1.

8.1.2 Distance between stiles. The distance between stiles for parallel-sided ladders and tapered ladders shall be as given in (a) and (b).

(a) *Parallel-sided ladders.* The working width between the inner edges of the stiles shall be not less than 355 mm.

(b) *Tapered ladders.* The working width between the inner edges of the stiles at the level of the uppermost tread shall be not less than 250 mm. This dimension shall be increased by 12 mm to 25 mm per tread for each successive tread below the uppermost tread.

8.1.3 Feet. The lower ends of the stiles shall be fitted with feet of hardwood, plastics or rubber. The feet shall project to form a wearing surface, and shall be securely fixed but easily removable for renewal.

8.1.4 Treads. Treads shall be not less than 75 mm wide from back to front and shall have textured upper surfaces. When the ladder is inclined at any one angle within 65° to 77° to the horizontal the treads shall be horizontal.

8.1.5 Spacing of treads. Treads shall be uniformly spaced at 225 mm to 300 mm. The distance from the bottom of the stiles to the upper surface of the lowest tread shall be 125 mm to 300 mm.

8.2 Performance of shelf ladders

8.2.1 Deflection under load. When tested in accordance with appendix B, the deflection of the loaded stiles shall not exceed the limit determined from the graph shown in figure 2. In addition, after removal of the test load there shall be no permanent damage and the residual deflection shall not exceed 1 mm per metre of the test span.

8.2.2 Torsional rigidity. When tested in accordance with appendix B, the difference between the deflections of the two stiles shall not exceed the limit determined from the graph shown in figure 3.

8.2.3 Strength. The strength of shelf ladders shall be as specified in 7.2.3.

8.2.4 Twist. When tested in accordance with appendix D, the angle of twist shall not exceed the value given in table 3.

8.2.5 Sideways bending. When tested in accordance with appendix E, the deflection measured midway between supports shall be as specified in 7.2.5.

8.2.6 Cantilever bending. When tested in accordance with appendix F, the residual deflection of either stile shall not exceed 6 mm.

8.2.7 Test for treads. When tested in accordance with appendix H the tread shall support the load. In addition, after removal of the test load there shall be no damage or permanent deflection.

9. Swing back steps

9.1 Construction

9.1.1 Distance between stiles. The minimum working width between the inner edges of the stiles at the level of the uppermost tread shall be not less than 250 mm. This dimension shall be increased by 12 mm to 25 mm per tread for each successive tread below the uppermost tread.

9.1.2 Stiles. Stiles shall be of sufficient width to provide secure bearing for the treads. The steps shall be designed so that when fully open the inclination of the front stiles to the horizontal is within the following limits:

(a) steps of heights up to 1675 mm: not less than 65° and not more than 70° ;

(b) steps of heights over 1675 mm: not less than 65° and not more than 75° .

For class 1 steps the stiles shall be at least 75 mm from front to back.

9.1.3 Back. A back shall be hinged to the top by means of:

(a) a single hinge extending across the full width of the steps; or

(b) a pair of hinges of wrought or forged aluminium alloy, steel or malleable cast iron; or

(c) pin hinges.

The back shall be constructed of either:

(1) stiles and rails; or

(2) stiles and rungs in accordance with 7.1.4, 7.1.5 and 9.1.2. Rungs shall be spaced such that the top of the rungs and treads are at the same level when the steps are opened.

9.1.4 Feet. The four feet of the steps shall all be effectively on the same plane when the steps are standing in the open position such that when three feet are in contact with a horizontal surface and the tread surface is horizontal the gap below the fourth foot shall not be greater than 5 mm. The feet shall be soled with hardwood, plastics or rubber.

9.1.5 Treads. Treads shall be not less than 75 mm wide from back to front and shall have textured upper surfaces. The steps shall be so designed that when they are in use on a level surface the treads are horizontal $\pm 2^\circ$.

9.1.6 Number of treads. Swing back steps shall have any number of treads up to a maximum of the following, as appropriate to the class.

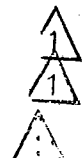
(a) Class 1: 16 treads;

(b) Class 2: 10 treads;

(c) Class 3: 9 treads;

9.1.7 Spacing of treads. Treads shall be uniformly spaced at 225 mm to 300 mm centres, measured along the stiles. The distance from the bottom of the feet to the upper surface of the lowest tread shall be 125 mm to 300 mm.

9.1.8 Top. The top shall be not less than 100 mm wide from back to front and may overhang at the back, front or sides, except that any projection at the front shall not exceed 30 mm. The upper face shall have a textured surface.



9.1.9 Restriction of opening. The degree of opening of the steps shall be limited by means of a locking bar on each side between the front stile and the back so that when fully extended the inclination of the front stiles is that specified in 9.1.2, for steps of the appropriate height, and that of the back not less than 72° and not more than 80°. The locking bar or device shall engage positively in the open position to form a rigid connection between the front and back sections. Folding stay bars shall positively engage in the open position by locking over centre.



NOTE. One piece type locking bars (or tie bars) may be used providing that they are designed and fixed higher on the front stiles lower on the back stiles to ensure that forces are transmitted to the lower part of the back leg assembly.

9.2 Performance of swing back steps

9.2.1 Rigidity. When tested in accordance with J.1, the steps shall show no damage or permanent deflection on removal of the load except that a residual spread of up to 8 mm, measured between the ends of the front and rear stiles, is acceptable.

9.2.2 Test for treads. When tested in accordance with J.2, the tread shall support the load. In addition, upon removal of the test load the residual deflection of the tread shall not exceed 1.0 mm.

9.2.3 Deflection under load. When the front is tested in accordance with appendix B, the deflection of the loaded stiles shall not exceed the limit determined from the graph in figure 2. In addition, in the case of the front assembly, upon removal of the test load there shall be no permanent damage and the residual deflection shall not exceed 1 mm per metre of test span.

9.2.4 Strength. The strength of swing back steps shall be as specified in 7.2.3.

9.2.5 Sideways bending. When tested in accordance with appendix E, the deflection measured midway between supports shall be as specified in 7.2.5.

9.2.6 Cantilever bending. When tested in accordance with appendix F, the residual deflection of either stile shall not exceed 6 mm.

10. Folding platform steps

10.1 Construction

10.1.1 General. The construction of folding platform steps shall be as specified in 9.1.2 to 9.1.5 and 9.1.7 together with 10.1.2 to 10.1.6.

10.1.2 Distance between stiles. The minimum working width between stiles at the level of the uppermost tread which is the platform shall be sufficient to allow the platform to be situated, and be capable of folding, between the stiles. The actual value of this dimension shall be increased by at least 12 mm for classes 1 and 2 and by at least 22 mm for class 3 per tread for each successive tread below the uppermost tread.

10.1.3 Number of treads. The number of treads shall be as specified in 9.1.6 except that in determining the limitation of the number of treads the platform shall be counted as one tread.

10.1.4 Horizontal rail. The uppermost part of the top horizontal rail of the platform steps, which may be a hinge or simply a horizontal connecting rail, shall not be situated at a greater distance measured along the axis of the stiles than two multiples of the step tread centre distance.

NOTE. The top rail is intended to be a rail at approximately knee height to give confidence to the user. It is not intended to be a

handrail at waist height in order to avoid the danger of the steps tipping forward.

10.1.5 Platform. The platform shall be not less than 250 mm x 250 mm. The upper face shall have a textured surface.

10.1.6 Restriction of opening. The method used to restrict the opening of folding platform steps shall comply with 9.1.9 except that:

(a) for platform steps with no more than five treads (including the platform) it shall not be necessary to use tie bars provided the platform or its supports engage when open to prevent further opening or closure of the steps;

(b) for platform steps with more than five treads it shall be acceptable for the tie bars to restrict only the opening of the steps provided the platform engages to prevent closure.

10.2 Performance of folding platform steps

10.2.1 General. The performance of folding platform steps shall be as specified in 9.2 together with 10.2.2.

10.2.2 Test for platform. When tested in accordance with J.3, the platform shall support the load. In addition, upon removal of the test load there shall be no damage and the residual deflection at the centre shall not exceed 1.0 mm.

11. Ladder backed steps

11.1 Construction

11.1.1 General. The construction of ladder backed steps shall be as specified in 9.1.1, 9.1.2 and 9.1.4 to 9.1.9 together with 11.1.2 and 11.1.3.

11.1.2 Back. The back shall be constructed of stiles and rungs and shall comply with clause 7.1. In addition, the rungs shall be spaced so that the top of the rungs and treads are at the same level when the steps are open.

The hinge device joining the back to the front shall be of a type that will limit the extent of opening.

11.1.3 Working height. The maximum working height provided for a scaffold board shall be 1785 mm above floor level.

11.2 Performance of ladder backed steps

11.2.1 Rigidity. When tested in accordance with J.1, the rigidity of ladder backed steps shall be as specified in 9.2.1.

11.2.2 Front. The performance of the fronts of ladder backed steps shall be as specified in 9.2.2 to 9.2.6.

11.2.3 Back. The performance of the backs of ladder backed steps shall be as specified in 7.2.1 to 7.2.3, 7.2.5 and 7.2.6.

12. Folding trestles

12.1 Construction

NOTE. Preferred heights of folding trestles, measured on the closed stiles, are 1.9 m, 2.5 m and 3.1 m.

12.1.1 Stiles. The stiles of both halves shall be of equal length and shall be adequate to provide secure anchorage and enable the cross-bearers to support the test load specified in appendix K. The inside width at the top of the trestle shall be not less than 500 mm and shall be increased by not less than 30 mm in each 300 mm of length of the stiles.