

GENERAL STANDARD**FOR****SAFETY PORTABLE LADDERS****ORIGINAL EDITION****OCT. 1996**

This standard specification is reviewed and updated by the relevant technical committee on Aug. 2002. The approved modifications are included in the present issue of IPS.

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0. INTRODUCTION

This Standard prescribes the minimum requirements for the construction, testing, care and use of the industrial types of portable aluminum and wood ladders in order to ensure safety under normal conditions of usage.

Accidents caused by falls from ladders have a high rate of frequency and many of them have occurred from misuse especially overloading. In clause 11, safe handling, storage, transport, maintenance and inspections are briefly discussed and it is emphasized that these guide lines to be thoroughly observed when ladders are handled.

For timber ladders risks associated for different types of test to pass are too great, therefore, it is strongly recommended that these tests which will harm the structure of the ladder being left and dealt with by the manufacturers.

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

1. SCOPE

This Standard specifies the minimum requirements for the materials, dimensions and workmanship for aluminum and timber ladders. It also prescribes rules for construction, testing and care of ladders under normal conditions of usage.

Note:

This standard specification is reviewed and updated by the relevant technical committee on Aug. 2002. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 178 on Aug. 2002. These modifications are included in the present issue of IPS.

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

BSI (BRITISH STANDARD INSTITUTION)

BS 309	"Whiteheart Malleable Iron Castings"
BS 1203	"Specification for Synthetic Resin Adhesives (Phenolic and Aminoplastic) for Plywood"
BS 1204	"Synthetic Resin Adhesives (Phenolic and Aminoplastic) for Wood, Part 1 Specification for Gap-Filling Adhesives, Part 2 Specification for Close-Contact Adhesives"
BS 1210	"Specification for Wood Screws"
BS 1449	
BS 1470	"Wrought Aluminum and Aluminum Alloys for General Engineering Purposes-Plate, Sheet and Strip"
BS 1471	"Wrought Aluminum and Aluminum Alloys for General Engineering Purposes-Drawn Tube"
BS 1472	"Wrought Aluminum and Aluminum Alloys for General Engineering Purposes-Forging Stock and Forging"
BS 1474	"Wrought Aluminum and Aluminum Alloys for General Engineering Purposes-Bars, Extruded Round Tubes and Sections"
BS 1490	"Aluminum and Aluminum Alloy Ingots and Castings"
BS 4300	"Specification (Supplementary Series) for Wrought Aluminum and Aluminum Alloys for General Engineering Purposes"
BS 4471	"Specification for Sizes of Sawn and Processed Softwood"
BS 6125	"Specification for Natural Fiber Cords, Lines and Twines"
BS 6681	"Specification for Malleable Cast Iron"

3. DEFINITIONS AND TERMINOLOGY

For the purpose of this Standard the following definitions shall apply.

3.1 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.

3.2 Folding Trestles

An arrangement of two frames hinged together, each fitted with cross-bearers suitable for supporting a working platform (see Appendix M Fig. e).

3.3 Ladder Backed Steps

A standing step ladder in which the back is fitted with cross-bearers suitable for supporting a working platform [see Appendix M (d)].

3.4 Leaning Ladder

A ladder supported in use by a separate structure, e.g. a wall.

3.5 Lightweight Stagings

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

3.6 Shelf Ladder

A single-section ladder fitted with treads which are intended to be horizontal in use.

3.7 Single-Section Ladder

A leaning ladder constructed and used as a single unit.

3.8 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.

3.9 Standing Step Ladder

A self supporting ladder consisting of a front and back hinged together and capable of being folded, the ascendable front being in the form of a shelf ladder.

3.10 Stiles

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

3.11 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.

3.12 Wood Characteristics

Distinguishing features, the extent and number of which determine the quality of a piece of wood.

3.13 Wood Irregularities

Natural characteristics in or on the wood that may lower its durability, strength, or utility.

3.13.1 Bark Pocket

An opening between annual growth rings that contains bark. Bark pockets appear as dark streaks on radial surfaces and as rounded areas on tangential surfaces.

3.13.2 Check

A separation of the wood along the fiber direction that usually extends across the rings of annual growth, commonly resulting from stresses set up in the wood during seasoning.

3.13.3 Compression failure

A deformation (buckling) of the fibers due to excessive compression along the grain. This deformation may appear as a wrinkle across the surface. In some cases, compression failures may be present but not visible as wrinkles; in such cases they are often indicated by "fiber breakage" on end grain surfaces.

3.13.4 Compression wood

An aberrant (abnormal) and highly variable type of wood structure occurring in softwood species.

3.13.5 Cross grain (slope of grain)

A deviation of the fiber direction from a line parallel to the sides of the piece. Cross grain may be diagonal or spiral, or both.

3.13.6 Decay

The disintegration of wood due to the action of wood-destroying fungi; also known as dote and rot.

3.13.7 Knot

A portion of a branch or limb, embedded in the tree and cut through in the process of lumber manufacture. It is classified according to size, quality, occurrence, and location in the cross section of a piece. The size of the knot is determined by its average diameter on the surface of the piece.

3.13.8 Low-Density wood

Wood that is exceptionally light in weight and usually deficient in strength properties for the species. In softwood species, low density is frequently indicated by exceptionally wide, or some times by extremely narrow, rings and generally has a low proportion of latewood. On the other hand, low density hardwood, at least in ring-porous species, is most commonly indicated by excessively narrow annual rings in which the earlywood portion predominates.

3.13.9 Pitch pocket

An opening extending parallel to the annual growth rings that contains, or that has contained, either solid or liquid pitch.

3.13.10 Shake

A separation along the grain, occurring most often between the rings of annual growth.

3.13.11 Split

A separation of the wood parallel to the fiber direction due to tearing apart of the wood fibers, normally caused by external forces.

3.13.12 Wane

Bark, or lack of wood, on the corner of a piece.

4. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

5. TYPES AND CLASSES**5.1 Types**

In this Standard ladders fall into the following categories:

- a) aluminum ladders;
- b) wooden ladders;
- c) specific types of ladders.

5.2 Classes

According to general condition and frequency of use portable ladders are in three different classes as given below:

Class 1: Industrial

For heavy duty where relatively high frequency and onerous conditions of use, carriage and storage occur. Suitable for industrial purposes.

Class 2: Light trades

For medium duty where relatively low frequency and reasonably good conditions of use, storage and carriage occur. Suitable for light trades purposes.

Class 3: Domestic

For light duty where frequency of use is low and good storage and carriage conditions occur. Suitable for domestic and household purposes.

Notes:

1) Single-section and extending ladders of class (2) are designed for ease of handling if the load does not exceed 105 kg. They are suitable for light trades and domestic applications and therefore are not recommended for use in construction or other heavy industry.

2) Class 3 as stated above is for domestic and both classes 2 and 3 are not covered in this Standard.

6. MATERIALS (INDUSTRIAL)

6.1 Aluminum Ladders

6.1.1 General

The materials from which the component parts are made shall be in accordance with 6.1.2. to 6.1.6.

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

- a) aluminum alloys, as specified in 6.1.6;
- b) mild steel;
- c) whiteheart malleable cast iron complying with BS 6681.

6.1.3 Hinges

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

- a) aluminum alloys, as specified in 6.1.6;
- b) forged steel or steel strip;
- c) whiteheart malleable cast iron complying with BS 6681.

6.1.4 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, (See note below);
- b) rubber, (See note below);
- c) timber, as specified in 6.2.2.

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

- a) aluminum alloys, as specified in 6.1.6;
- b) plastics, (See note below);
- c) timber, as specified in 6.2.2.

6.1.6 Other components shall be made from aluminum alloys as given in (a) to (f) as follows:

- a) **drawn tube:** designation 6063 (HT9) and 6082 (HT30) of BS 1471, or equivalent;
- b) **extruded sections:** designation 6063 (HE9), 6082 (HE30), 6063A, 1200 (E1C) and 6061 (HE20) of BS 1474 or equivalent;
- c) **longitudinally welded tube:** designation 5251 (NJ4) of BS 4300: Part 1 or equivalent;
- d) **castings:** LM6 and LM25 of BS 1490 or equivalent;
- e) **components formed from sheet and strip:** designation 1200 (S1C), 3103 (NS3),

5154A (NS5), 5251 (NS4) and 6082 (HS30) of BS 1470, or equivalent;

f) forgings: 6082 (HF30) of BS 1472, or equivalent.

Note:

Plastic 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.

6.2 Wood Ladders

6.2.1 Species of timber

6.2.1.1 General

The timber used shall be selected by the manufacturer from the species given in (6.2.2.2) to (6.2.3.7). All like components, e.g. stiles, rungs, etc. in any single article shall be of the same species of timber, as far as can be achieved by visual examination.

6.2.1.2 Stiles for builders pole ladders: Stiles shall be made from European whitewood (*Picea abies*, *Abies alba*) or European redwood (*Pinus sylvestris*), or equivalent.

6.2.1.3 Stiles for other ladders, trestles and stagings: Stiles for other ladders shall be made from European redwood, Douglas fir, imported Sitka spruce, Eastern Canadian spruce, European whitewood, western hemlock or hembal, or equivalent.

Laminated stiles shall be permitted provided these are made from the above timbers and glued with phenolic or resorcinol resin adhesives to comply with the weather-proof and boil-proof (WBP) resistance requirements of BS 1204: Part 1.

6.2.1.4 Rungs for builders' pole ladders, single-section and extending ladders. Rungs shall be made from European oak, American white Oak, European ash, American white ash, hornbeam, yellow birch, hickory, robinia, keruing, pau marfim, ramin, or equivalent.

Note:

Farsi Version of woods is included in the Appendix.

6.2.1.5 Treads for shelf ladders and standing step ladders

Treads shall be made from any of the timbers specified in (6.2.1.3) with the addition of Parana pine, ramin and keruing.

6.2.1.6 Cross-Bearers for stagings and trestles

Cross-bearers shall be made from any of the timbers specified in (6.2.1.3) and (6.2.1.4).

6.2.1.7 Decking for stagings

Deckings shall be made from any of the timbers specified in (6.2.1.3) and (6.2.1.5). Plywood of moderately durable rating or better with WBP bending, aluminum or other man-made material shall be permitted provided that the deadweight of the staging does not exceed that for a wood slatted staging and that the material used for decking is capable of supporting a load of 90 kg when supported at 380 mm centers.

6.2.2 Quality of timber

6.2.2.1 General

Sapwood shall be permitted in all species of timber except oak. All timber shall be free from apparent damage, fungal decay and insect attack, except for an occasional ambrosia beetle hole.

Kiln dried timber shall be free from cases-hardening and honeycombing. Pieces abnormally light in weight shall be excluded, as shall timber abnormally heavy; like components shall be reasonably matched. Edges of sawn faces shall be so finished that there is no rough surface which might constitute a hazard for the hands of the user.

Note:

Ambrosia beetle is a forest beetle which cannot live in timber other than freshly felled trees, the hole is circular and not more than 2 mm diameter and the lining of the hole is stained a blue color.

6.2.2.2 Rate of growth

For stiles, treads, rails and bracings the number of growth rings per 25 mm shall not be less than 6. In addition, in the case of oak and ash the number of growth rings per 25 mm shall not exceed 16.

6.2.2.3 Rungs

6.2.2.3.1 Knots

Rungs of builders' pole ladders, single-section ladders and extending ladders shall be free from knots.

6.2.2.3.2 Slope of grain

The combined slope of grain shall not be steeper than 1 in 10, when determined in accordance with the method described in appendix A and figure 10.

6.2.2.4 Stiles of builders' pole ladders

6.2.2.4.1 Knots

The total diameter of the knots within 30 mm of each side of the center of a rung hole shall not exceed, when measured on the convex side of the stiles, one-quarter of the depth of the flat face of the stiles at this point (see figure 1).

The total diameter of knots allowed in the remaining region between the 30 mm bands shall not be more than the depth of the flat face of the stile measured at a point midway between adjacent rung holes.

No knot shall exceed 12 mm diameter, in its greater axis, in the top 4 m of a stile and 20 mm between that point and the base.

6.2.2.4.2 Surface checks

Surface checks shall be permitted provided that the checks do not deviate more than 1 in 10 to the axis of the stile and shall not be more than 1.5 mm in width or 200 mm in length at the time of manufacture.

6.2.2.4.3 Spiral grain

Spiral grain having a deviation not steeper than 1 in 10 shall be permitted. Tests shall be carried out on the convex face of the stile.

6.2.2.5 Stiles of single-section ladders, extending ladders and lightweight stagings**6.2.2.5.1 Knots**

Sound knots not over 7 mm in class 1 on their greater axis shall be permitted provided they do not occur in the outer quarters of the face.

6.2.2.5.2 Surface checks

Surface checks not exceeding 130 mm long or 1.5 mm wide shall be permitted provided they do not run out to the edge of the face in which they occur.

6.2.2.5.3 Selection of stiles (single-section and extending ladders)

Each stile shall be inspected visually for quality and finish before assembly.

6.2.2.5.4 Resin pockets

Resin pockets shall be permitted if their length is not more than 1½ times the width of the face in which they occur and that the width does not exceed 3 mm and the depth does not extend to the opposite face.

6.2.2.5.5 Slope of grain

As specified in paragraph (6.2.2.3.2).

6.2.2.6 All component parts of shelf ladders, step ladders, trestles and stagings (other than stiles of stagings)**6.2.2.6.1 Knots****a) Knots other than staging slats**

Sound knots not larger than one-sixth of the width of the face in which they appear shall be allowed providing the edge of the knot is not closer to the edge of the component than the diameter of the knot. No knot shall be nearer than 25 mm to any joint.

b) Staging slats

Sound knots not larger than 12 mm in diameter shall be allowed providing they are at least 50 mm apart. Edge knots shall be allowed providing they extend no further than 6 mm from the edge. Splayed knots shall not be allowed.

6.2.2.6.2 Surface checks

Surface checks not exceeding 1.5 mm wide and 60 mm long shall be permissible, providing the check does not deviate by more than 1 in 10 and does not run out to the edge of the component.

6.2.2.6.3 Slope of grain

Combined slope of grain on components other than treads, when determined in accordance with the method given in Appendix A shall not exceed 1 in 8 for Douglas fir and 1 in 10 for other species. On treads, the grain starting from the top face at one end shall not run out on the underside before

entering the housing at the other end.

6.2.3 Moisture content

The moisture content at the time of manufacture shall be in the range of 16% to 22% (see BS 4471).

6.2.4 Other components and material

6.2.4.1 Tie rods

Tie rods, shall be of mild steel, and be as specified in either (a) or (b).

a) Plain tie rods shall be not less than 3.9 mm in diameter, except in the case of folding trestles, when the rods shall not be less than 5.9 mm in diameter.

The ends shall be passed through mild steel washers of 15 mm minimum outside diameter and not less than 1.4 mm thick, and shall be securely riveted over them and smoothly finished.

b) Threaded tie rods shall not be less than 2.9 mm diameter with 4 mm rolled threads and buttons, except in the case of tie rods for folding trestles, which shall have 6 mm rolled threads on rods not less than 4.9 mm diameter.

6.2.4.2 Ladder buttons

Ladder buttons shall be of malleable cast iron, or pressed steel.

6.2.4.3 Reinforcing wire (for rung reinforcement)

Rung reinforcement is optional but when used the reinforcing wire shall consist of two galvanized mild steel wires, of not less than 3.5 mm diameter twisted together. Wires shall be properly tensioned and anchored into the stiles or retained in position by buttons or other equally efficient tensioning devices.

6.2.4.4 Reinforcing wire for ladder stiles

Reinforcing wire for ladder stiles shall consist of a seven wire strand, of mild steel wire having a characteristic strength of 425 N/mm² minimum, and of the appropriate overall diameter as given in tables 3,5 and 6 of any other suitable reinforcement of equivalent strength. When such reinforcement is specified in these tables it shall be fitted under tension into grooves in the stiles and anchored securely so as to pretension the stiles. The material shall pass through the stiles beyond the end rungs and be not less than 100 mm from the stile ends and shall be anchored so that the stiles are not cut into when under load.

6.2.4.5 Nails

Nails for securing treads of steps and the tops of swing back steps shall be either wire, twisted, or screw nails nominally 60 mm long and 2.5 mm diameter, or annular ring shank nails nominally 60 mm long with a 2 mm diameter shank.

6.2.4.6 Screws

Screws shall be of steel and shall comply with the strength requirements of BS 1210.

6.2.4.7 Fittings for extending ladders

6.2.4.7.1 General

All metal fittings shall be of steel, wrought iron, malleable cast iron, or aluminum of suitable strength, and shall be well finished and securely fitted. On rope-operated ladders the pulley wheel may be of cast iron or nylon, or other material of adequate strength and durability to provide a factor of safety of not less than eight times the weight of the extending section or sections.

All bearing and rubbing surfaces of the hooks shall be finished smooth and shall be free from sharp edges liable to cause indentation of the stiles or rungs.

6.2.4.7.2 Fixed and latching hooks

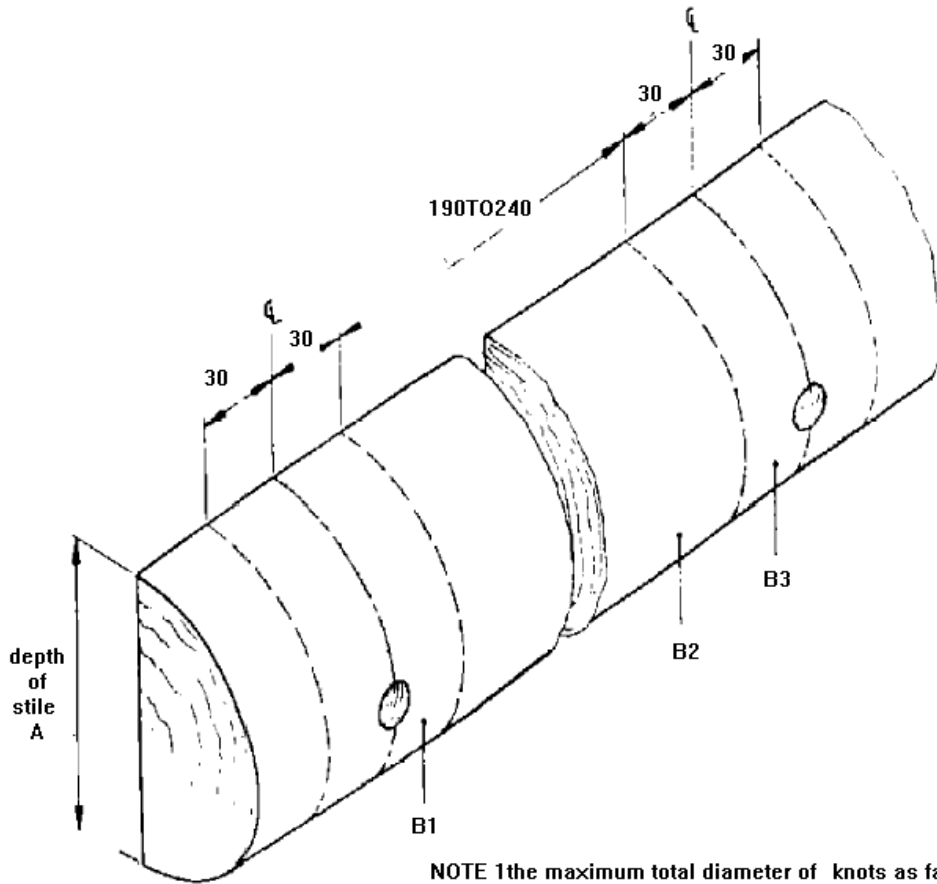
Fixed and latching hooks shall be such that they bear evenly over a length of not less than 12 mm along each end of the engaged rung.

Note:

Where aluminum alloy fixed hooks or latching hooks are used in conjunction with rungs or treads treated with a copper containing preservative, the intermittent contact between the hooks and the preservative is not considered to be deleterious to the aluminum.

6.2.4.7.3 Guide brackets

The brackets shall enclose one side and 75% of the back of the stile to which they are fixed and provide a bearing on the front of the sliding stile of not less than 75% of the stile width. The brackets shall be properly formed with no tool marks that could affect their strength or performance and shall have all sharp corners removed. The internal radius of any bend shall not be less than the thickness of the material.



NOTE 1 the maximum total diameter of knots as follows

BAND	maximum total diameter of knots
B1	$\frac{A1}{4}$
B2	$\frac{A2}{4}$
B3	$\frac{A3}{4}$

all dimensions are in millimetres

note 2 A1 A2 and A3 are the values of A at the centres of the bands B1 B2 and B3

KNOTS IN STILES OF BUILDERS POLE LADDERS

Fig. 1

When tested in accordance with Appendix M a bracket shall show no sign of distortion or permanent deflection and the bracket fixings shall not have become loosened or be damaged.

Each bracket shall be securely fitted by at least one bolt and one countersunk wood screw.

A pair of guide brackets shall be fitted to each section other than the top section.

6.2.4.7.4 Guide groove

Where a guide groove is employed and it is necessary for a cut out to be formed adjacent to the groove, the openings so formed by the cut away portion, to facilitate the removal of an upper section from the lower section, shall be protected by a mild steel plate, designed to protect the sides

and edges of the openings.

6.2.4.7.5 Latching device

The design of the latching device in ladders of the rope-operated type shall be such that in the event of the rope breaking or being released accidentally, it engages and arrests the descent of the ladder section.

7. SPECIFIC TYPES

The following types are included in this Standard.

- a) Single section and extending (aluminum) refer to Appendix. M(a).
- b) Single section and extending (wood) refer to Appendix. M(a).
- c) Shelf ladders (aluminum) refer to Appendix. M(b).
- d) Shelf ladders (wood) refer to Appendix. M(b).
- e) Swing back steps (aluminum) refer to Appendix. M(c).
- f) Swing back steps (wood) refer to Appendix. M(c).
- g) Backed steps (aluminum) refer to Appendix. M(d).
- h) Backed steps (wood) refer to Appendix. M(d).
- i) Folding trestles (aluminum) refer to Appendix. M(e).
- j) Folding trestles (wood) refer to Appendix. M(e).
- k) Lightweight stagings (aluminum) refer to Appendix. M(f).
- m) Lightweight stagings (wood) refer to Appendix. M(f).

7.1 Single Section and Extending (Aluminum)

7.1.1 Construction

7.1.1.1 Lengths

The lengths of single-section ladders and extending ladders when fully extended shall not exceed the 17m in class 1.

7.1.1.2 Distance between stiles

The clear distance between the stiles at any point (in mm) shall not be 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).

7.1.1.3 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.

7.1.1.4 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.

7.1.1.5 Spacing of rungs

Rungs shall be uniformly spaced at 250 mm to 300 mm centers. The distance from the ends of the stiles to the nearest rungs center shall be 125 mm to 300 mm.

7.1.1.6 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 of the stiles or rungs. 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

7.1.1.7 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 not be 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
Class 1	mm 10	kg 410

7.1.1.8 Overlap of sections of extending ladders

When fully extended, the effective overlap between adjacent sections of the ladder shall not be less than the following:

- a) 1.5t for closed lengths up to and including 5 m;
- b) 2.5t for closed lengths over 5m and up to and including 6m;
- c) 3.5t for closed lengths over 6m (see also Fig. 3).

Where:

t is the spacing of rungs (in mm).

7.2 Single Section and Extending Sections (Wood-Class I)

7.2.1 Single-Section

7.2.1.1 Stiles

The finished sizes of stiles shall be in accordance with Table 3. The ends of the stiles shall be suitably chamfered or rounded, and the edges shall have a small radius to remove the sharp corners.

TABLE 3 - STILE SIZES OF CLASS 1 SINGLE-SECTION LADDERS

LENGTH OF LADDER		MINIMUM CROSS SECTION	STILE REINFORCEMENT OVERALL DIAMETER
OVER	UP TO AND INCLUDING		
m	m	mm	mm
—	5.0	69 x 31	None
5.0	6.0	82 x 31	5.38
6.0	7.3	89 x 35	5.9

Note:

Ladders designed for use where there may be electrical hazards may have the stile reinforcement omitted provided the width of the stile is increased by 6 mm.

7.2.1.2 Distance between stiles

The minimum width between the inner surface of the stiles at any point shall not be less than 235 mm and at the bottom not less than the appropriate value in table-4.

TABLE 4 - MINIMUM INSIDE WIDTH OF LADDERS

LENGTH OF LADDER		MINIMUM INSIDE WIDTH AT BOTTOM
OVER	UP TO AND INCLUDING	
m	m	mm
—	3.0	242
3.0	3.5	247
3.5	4.0	252
4.0	4.5	257
4.5	5.0	262
5.0	5.5	267
5.5	6.0	272
6.0	6.5	277
6.5	7.0	282
7.0	7.4	287

7.2.1.3 Rungs

7.2.1.3.1 General

Rungs shall be either rectangular or circular. Typical rung patterns are shown in Fig. 2.

All rungs shall be a drive fit into their holes and shall not rotate. The end of the rungs or the holes in the stiles, or both, shall be coated with the adhesive specified in BS 1204 Part 1, 2.

7.2.1.3.2 Rectangular rungs

Rectangular rungs shall not be less than 36 mm × 22 mm and shall be housed full section 5 mm to 8 mm deep into the stile, through tenoned and double wedged. The tenons shall be the full depth of the rungs and not less than 12 mm thick.

7.2.1.3.3 Circular rungs

Circular rungs shall be as given in either (a) or (b):

- a) tapered, with a minimum center diameter of 35 mm;
- b) parallel, with a minimum diameter of 31 mm.

The ends of circular rungs shall be as given in (1) to (3):

- 1) Cylindrical; See Fig. 2, (b), (d) and (e)
- 2) Tapered; See Fig. 2, (b), (d) and (e)
- 3) Shouldered; See Fig. 2, (b), (d) and (e)

A cylindrical end shall have a diameter at the point of entry into the stile between 25 mm and 28 mm and shall butt against the end of a blind hole, terminating between 9 mm and 12 mm from the outer face of the stile.

A tapered end shall have a diameter at the point of entry into the stile of between 25 mm and 31 mm and reduce to between 16 mm and 19 mm.

A shouldered end shall have a diameter at a point of entry into the stile of between 28 mm and 35 mm. It shall be housed between 5 mm and 8 mm full section into the stile reducing thereafter to between 16 mm and 22 mm. In no case shall a shoulder butt closely against the inner face of the stile without housing.

Tapered and shouldered ends of rungs shall be finished flush with the outer surfaces of the stiles, or if in blind holes, between 6 mm and 12 mm from the outer surface.

7.2.1.4 Spacing of rungs

Rungs shall be uniformly spaced at centers of 250 mm to 300 mm, except in the case of the top and bottom rung, which may be positioned at a distance of between 125 mm and 300 mm measured from the end of the stile to the center of the nearest rung.

7.2.1.5 Tie-Rod and rung reinforcement

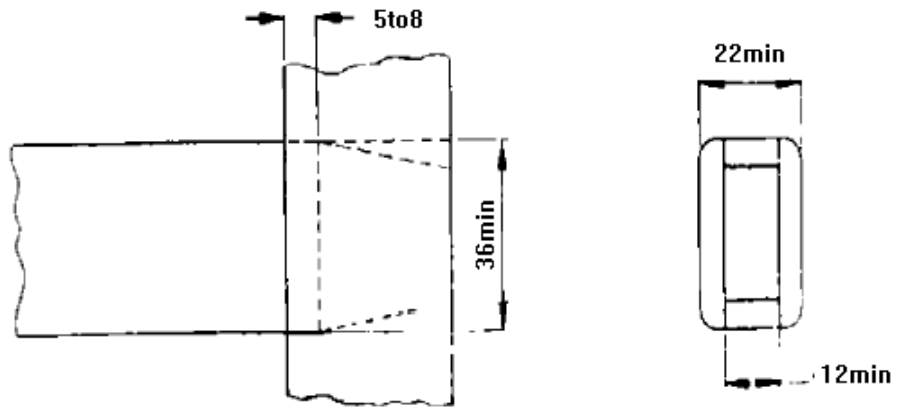
7.2.1.5.1 General

The ladders shall be provided with tie-rods or reinforcing wires. Any projection of tie-rods, reinforcing wires or washers above the surface of the stiles shall be smoothed off to prevent injury to the hands of the user.

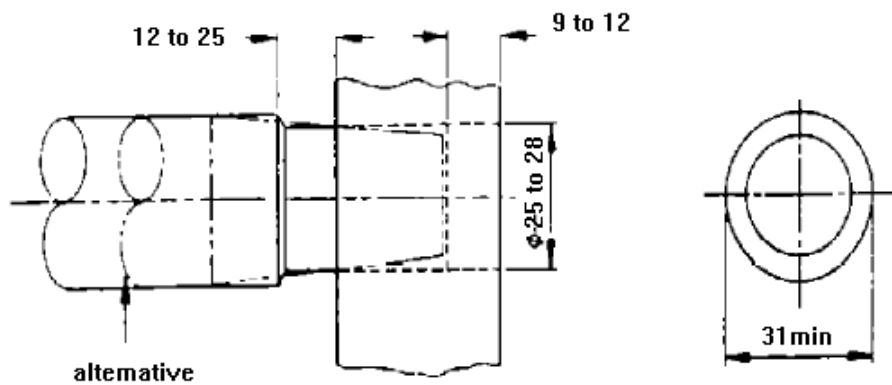
7.2.1.5.2 Tie-Rods

Tie-rods, if used, shall be fitted immediately below the first or second rung from each end of the ladder and below intermediate rungs at points not more than nine rungs apart.

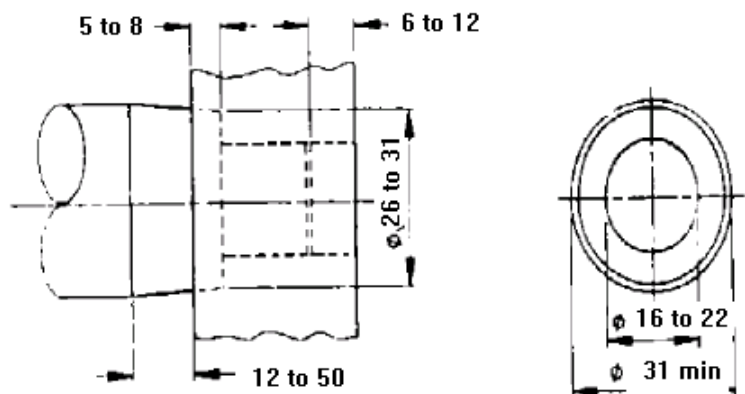
(a) rectangular rung housed full section into stile through tenoned and double wedged



(b) parallel rung cylindrical end



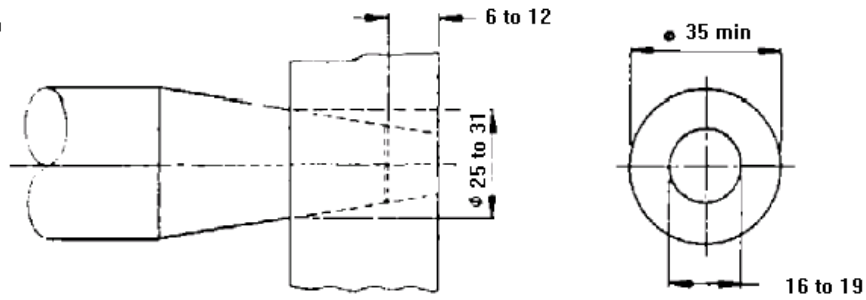
(c) parallel rung shouldered end housed full section into stile finish flush with outside surface of stile or blind hole



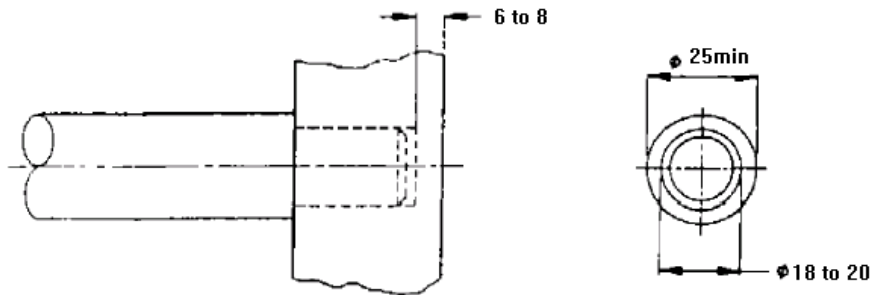
TYPICAL RUNG PATTERNS

Fig. 2

(d) tapered rung
tapered end
finish flush with
outside surface
of stile or
blind hole



(e) parallel rung shouldered end for class 2 ladders only



all dimentiones are in millimeters

TYPICAL RUNG PATTERNS
Fig. 2 (continued)

7.2.1.5.3 Reinforcing wires

Reinforcing wires, if used, shall be fitted adjacent to and underneath each rung centrally in the width of the stile.

7.2.1.6 Back reinforcement of stiles

Back reinforcement shall be fitted and shall be in accordance with Table 3.

7.2.2 Extending sections

7.2.2.1 Stiles

The finished sizes of stiles shall be in accordance with Table 5. The ends of the stiles shall be chamfered or rounded and edges shall have a small radius to remove the sharp corners.

7.2.2.2 Distance between stiles

The width between the inner surfaces of the stiles of the top section shall be not less than 235 mm and not more than 360 mm. The stiles shall be parallel. The width of the sections of extending ladders shall be such as to provide a minimum clearance consistent with the operation of the ladder.

7.2.2.3 Overlap of sections, rungs, rung spacing and tie-rods

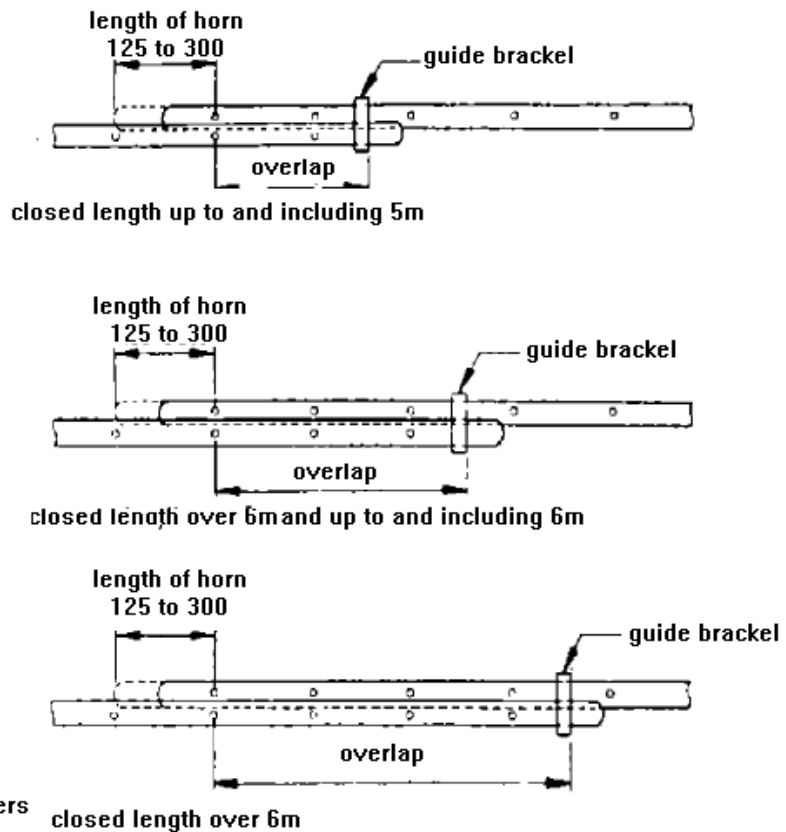
Items of the above headline shall comply with clauses 7.1.1.8, 7.2.1.3, 7.2.1.4 and 7.2.1.5.

TABLE 5 - PRINCIPAL DIMENSIONS FOR CLASS 1 EXTENDING LADDERS

LADDER TYPE	LENGTH OF LADDER CLOSED		MINIMUM CROSS SECTION STILES	STILES REINFORCEMENT OVERALL DIAMETER	ROPE DIAMETER (NOMINAL)
	OVER	UP TO AND INCLUDING			
Doubles	m	m	mm	mm	mm
(a) ropeless	—	3.0	69 × 28	—	—
(b) with ropes or ropeless*	3.0	5.0	69 × 31	—	Rope optional 10
	5.0	6.25	82 × 31	5.38	10
(c) with ropes	6.25	7.3	89 × 35	5.38	10
Trebles					
(a) ropeless	—	3.0	69 × 31	—	—
(b) with ropes	—	3.0	69 × 31	—	10
	3.0	4.5	69 × 31	5.38	10
	4.5	6.0	93 × 31	6.40	10

* It is strongly recommended that extension ladders longer than 4.5 m should be rope-operated and that care be taken to avoid compression damage by bumping against a wall or support.

Note:
see Note on page 18



OVERLAPS OF EXTENDING LADDERS

Fig. 3

7.3 Shelf Ladders (Aluminum)

7.3.1 Construction

7.3.1.1 Lengths

The lengths of shelf ladders shall be as specified in 7.1.1.1.

7.3.1.2 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.

7.3.1.3 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.

7.3.1.4 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.

7.3.1.5 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.

7.4 Shelf Ladders (Wood Class 1)

7.4.1 Wood type shelf ladders shall comply with the appropriate requirements of paragraph (6.2) and the following clauses.

7.4.2 Stiles

The finished sizes of stiles shall be in accordance with table 6. The bottom ends of the stiles shall be cut parallel with the treads and suitably chamfered.

7.4.3 Distance between stiles

The width at the top of the ladder between the inner faces of the stiles shall not be less than 250 mm and not more than 375 mm. When the stiles are not parallel, the distance between them at any point on the ladder shall not exceed 550 mm.

7.4.4 Treads

Treads shall consist of machined timber 89 mm x 22 mm minimum section (see Fig. 16). They shall be housed 5 mm to 6 mm full section into the stile and shall be secured in position with two nails or two 50 mm no. 8 gage screws. A pair of corner blocks or brackets shall be fitted underneath of the bottom tread. Shelf ladders shall be so designed that when the treads are horizontal the ladder is inclined at an angle of 75 ±2° to the horizontal.

7.4.5 Spacing of treads

As specified in paragraph (7.2.1.4) in addition, if a cross bar is fitted then the distance from the top tread to the top of the stiles shall be a maximum of 600 mm.

TABLE 6 - DIMENSIONS OF STILES FOR CLASS 1 SHELF LADDERS

LENGTH OF SHELF LADDERS		MINIMUM CROSS-SECTIONAL AREA
OVER	UP TO AND INCLUDING	
m	m	mm
—	2.5	69 x 28
2.5	4.0	69 x 31

7.4.6 Tie-Rods and tread reinforcement

Shelf ladders shall be fitted with tie-rods or reinforcing wires. Any projection of the rods, reinforcing wires or washers above the surface of the stiles shall be smoothed off to prevent injury to the hands of the user.

Tie-rods, if used, shall be fitted, at least immediately below the second tread from the bottom of the ladder and below other treads at points not more than four treads apart.

Reinforcing wire, if used, shall be fitted adjacent to and underneath each tread centrally in the width of the stiles.

7.5 Swing Back Steps (Aluminum)

7.5.1 Construction

7.5.1.1 Distance between stiles

The requirements given in paragraph (7.3.1.2(b)) shall apply.

7.5.1.2 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.

7.5.1.3 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 aluminum 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 (7.1.1.4), (7.1.1.5) and (7.5.1.2). Rungs shall be spaced such that the top of the rungs and treads are at the same level when the steps are opened.

7.5.1.4 Feet

The four feet of the steps shall all be on the same plane when the steps are in the open position and shall be soled with hardwood, plastics, or rubber. The soling material shall be securely fixed but easily removable for renewal.

7.5.1.5 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 $\pm 2^\circ$.

For class 1 steps the whole of the tread section shall be within the outline of the stiles.

7.5.1.6 Number of treads

Swing back steps shall have any number of treads up to maximum of 16 steps in class 1.

7.5.1.7 Spacing of treads

The procedure given in paragraph (7.3.1.5) shall be followed.

7.5.1.8 Top

The top shall not be 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.

7.5.1.9 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 (7.5.1.2) 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 center.

Note:

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

7.6 Swing Back Steps (Wood)

7.6.1 Wood type swing back steps class 1

7.6.1.1 Wood type swing back steps class 1 shall comply with the appropriate requirements of paragraph (6.2) and of the following clauses.

7.6.1.2 Front stiles

The finished sizes of front stiles shall be those specified in Table 7. The bottom ends of the stiles shall either be cut parallel with the treads and suitably chamfered, or shall be rounded.

TABLE 7 - DIMENSIONS OF STILES FOR CLASS 1 SWING BACK STEPS

LENGTH OF STEPS		MINIMUM CROSS SECTION DIMENSIONS	
OVER	UP TO AND INCLUDING	FRONT	BACK
m	m	mm	mm
—	1.8	69 x 28	64 x 25
1.8	4.0	69 x 31	69 x 31

7.6.1.3 Distance between front stiles

The width between the inner surfaces of the front stiles shall not be less than 250 mm and not more than 375 mm at the top of the steps. The width shall be greater by between 25 mm and 50 mm for each 500 mm of stile length below the top of the steps such that the longest unsupported tread does not exceed 550 mm.

7.6.1.4 Treads

Treads shall consist of wrought rectangular timber 89 mm x 22 mm minimum section (see Fig. 16).

They should be housed 5 mm to 6 mm full section into the stiles and shall be secured in position with two nails or two 50 mm no. 8 gage screws.

A pair of corner blocks or brackets shall be fitted underneath the bottom tread. Steps shall be so designed that the treads are horizontal when the steps are fully opened. The top of the steps shall be included in the number of treads for ordering purposes.

7.6.1.5 Spacing of treads

Spacing of treads shall comply with (7.3.1.5).

7.6.1.6 Tie-Rods and tread reinforcement

Tie-rods and tread reinforcement shall comply with 7.4.6.

7.6.1.7 Back hanging board

A back hanging board, 120 mm minimum wide and of no less thickness than the back stile, shall be secured to each front stile by at least one 6 mm bolt and at least one countersunk wood screw, not less than 50 mm long and of no. 10 gage. The width of the hanging board may be made from two pieces, glued with the adhesive specified in BS 1204 part 1 or 2.

7.6.1.8 Top

The front stiles shall be housed 5 mm to 6 mm full section into a top which shall be secured to each stile and the back hanging board by glue and either nails or screws.

The top shall not be less than 125 mm x 28 mm thick and shall be either a single piece or two pieces glued with the adhesive specified in BS 1204 part 1 or 2.

7.6.1.9 Back

The back shall consist of stiles of the minimum dimension specified in table 7. The length of the back stiles shall be such that when the steps are fully opened the front stiles are inclined at an angle to the horizontal of :

- a) for heights up to and including 1375 mm: not less than 65° and not more than 70°;
- b) for heights over 1375 mm : not less than 65° and not more than 75°.

At the same time the back shall be inclined at an angle to the horizontal of not less than 72° and not more than 80°.

The distance between the back stiles shall vary in the same proportion as the front stiles.

7.6.1.10 Top rail

A top rail, not less than 69 mm wide and of the same thickness as the back stiles, shall be either:

- a) Through tenoned into the back stiles and double wedged with tenons of 10 ±1 mm; or
- b) lapped at both ends to a depth of 6 mm and at an angle suitable for a snug fit over the back stiles to which the top rail is secured by gluing with the adhesive specified in BS 1204 part 1 or 2 and, after assembly, by screwing with two 38 mm no. 10 gage C/sunk head steel screws staggered diagonally.

7.6.1.11 Lower rails

Steps not exceeding 2.28 m long shall have one lower rail: steps over 2280 mm but not over 3800 mm shall have two lower rails. The bottom rail shall be so positioned that its center line shall not be less than 250 mm and not more than 500 mm from the ends of the stiles. Lower rails shall not be less than 69 mm wide, of the same thickness as the back stiles and shall be either:

- a) lapped at both ends to a depth of 6 mm, each joint being secured by gluing with adhesive specified in BS 1204 part 1, 2 and screwing with two 38 mm no. 10 gage screws staggered diagonally; or
- b) through tenoned into back stiles, double wedged and glued, having tenons of 10 mm +1 mm thick.

7.6.1.12 Hinges

The back shall be hinged to the back hanging board by two mild steel back flaps or strap hinges having not less than 50 mm length of joint for steps up to 2.5 m long, and not less than 63 mm length of joint for steps over 2.5 m long. Each hinge flap shall be secured with one bolt or rivet and at least two steel countersunk headed screws not less than 19 mm long. The end of the bolt shall be riveted over the nut unless self locking nuts are used. The bolt securing the top flap may be the

same bolt referred to in (7.6.1.7).

7.6.1.13 Cords

The steps shall be fitted with two plaited or braided cords of equal length not less than 6 mm diameter, in accordance with BS 6125, or material of equivalent strength. The length of the cords shall be such that when fully extended the front and back stiles are at the angles specified in 7.6.1.9. Cords shall be fixed by passing them through the sides of the front and back stiles or lower back rail and shall be either knotted at both ends or knotted at one end and stapled at the other.

7.7 Backed Steps (Aluminum)

7.7.1 Construction

7.7.1.1 The construction of aluminum ladder backed steps shall be as specified in (7.5.1.1), (7.5.1.2) and (7.5.1.4) to (7.5.1.9) together with (7.7.1.2) and (7.7.1.3).

7.7.1.2 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.

7.7.1.3 Working height

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

7.8 Wood Type Backed Steps Class 1

7.8.1 General

Wood type ladder backed steps shall comply with the appropriate requirements of section 6.2 and paragraphs (7.6.1.2) to (7.6.1.5) , (7.6.1.8) and the following clauses.

7.8.2 Back hanging board

A back hanging board, not less than 66 mm deep and 28 mm thick, shall be secured to each front stile, and immediately beneath the top, by one countersunk wood screw not less than 50 mm long, and one nail.

7.8.3 Back

The back shall be constructed of stiles and rungs. The stiles shall consist of wrought rectangular timber and shall be of the dimensions specified in table 3. The rungs shall be either rectangular or circular as specified for standing ladders in (7.2.1.3).

The length of the back stiles shall be such that when the steps are fully opened the front and back stiles are inclined at the appropriate angles as specified in (7.6.1.9) and that when the steps are fully closed and used as a shelf ladder they shall stand on the front stile.

The width between the back stiles shall be the same as between the front stiles or they may be parallel with the width determined at the top.

7.8.4 Spacing of rungs

The rungs in the back stiles shall be so spaced that when the steps are fully opened the top surfaces of the rungs are level with the top surfaces of the treads in the front stiles.

7.8.5 Tie-Rods and rung reinforcement

The back shall be provided with tie-rods or reinforcing wires fitted adjacent to and underneath the center of each rung. Any projection of the tie-rods, reinforcing wires or washers above the surfaces of the stiles shall be smoothed off to prevent injury to the hands of the user.

7.8.6 Hinges

The front and the back of the steps shall be connected by means of shouldered or lipped trestle hinges of steel, wrought iron or malleable cast iron which limit the extent of opening of that specified in (7.6.1.9). The minimum length of hinges shall be as given in table 9.

7.8.7 Check blocks

To relieve the hinges of strain when ladder backed steps are being moved in the closed position, check blocks shall be fitted to the inside faces of both front stiles, each secured by one bolt and one countersunk wood screw, or they may be glued and fixed by two countersunk wood screws.

7.9 Folding Trestles (Aluminum)

7.9.1 Construction

Note:

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

7.9.1.1 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 not be less than 500 mm and shall be increased by not less than 30 mm in each 300 mm of length of the stiles.

7.9.1.2 Feet

The four feet of the trestles shall all be on the same plane when the trestles are in the open position and shall be soled with hardwood, plastics or rubber. The soling material shall be securely fixed but easily removable for renewal.

7.9.1.3 Side plates

Side plates shall be fitted to keep the stiles in register when the trestle is closed.

7.9.1.4 Hinges. The hinges shall be of:

- a) Cast or forged aluminum; or
- b) forged steel or steel strip complying with type CR4 of BS 1449: Part 1; or
- c) whiteheart malleable cast iron complying with BS 309.

They shall be trestle hinges of the locking type and shall limit opening to a contained angle of not less than 30° and not more than 40°.

Note:

Ropes or locking bars or similar devices as used for swing back steps or platform steps may be fitted to reduce concentration of load on hinges.

7.9.1.5 Cross-Bearers

Cross-Bearers shall be spaced not more than 610 mm apart and shall be staggered alternately on each half of the trestle at half of this distance except that there shall be a top cross-bearer at the same level on each half.

7.10 Wood Type Folding Trestles (Class (1))

7.10.1 Wood type folding trestles class 1 shall comply with the requirements of section 6-2 and the following clauses.

7.10.1.1 Stiles

The finished sizes of stiles shall be not less than those given in Table 8.

**TABLE 8 - DIMENSIONS OF STILES FOR CLASS 1
FOLDING TRESTLES**

LENGTH OF STILES		MINIMUM CROSS SECTION
OVER	UP TO AND INCLUDING	
m	m	mm
3.0	3.0	69 x 31
	4.6	69 x 35

7.10.1.2 Distance between stiles

The width between the inner surfaces of the stiles shall be not less than 500 mm at the level of the top cross-bearer and shall be increased by not less than 50 mm for each 500 mm length of stile. The taper of the two halves of the trestle shall be identical.

7.10.1.3 Cross-Bearers

The cross-bearers shall consist of timber not less than 69 mm x 28 mm. The tenons shall be 15 mm to 16 mm thick and the full width of the cross-bearer; the tenons shall pass through the stile and be double wedged. The tenons and/or the mortises shall be glued with the adhesive specified in BS 1204 Part 1 or 2.

7.10.1.4 Spacing of cross-bearers

The top of the top cross-bearer on each half of the trestle shall be not less than 110 mm from the top of the stiles. The other cross-bearers shall be spaced so that those on one half of the trestle lie midway between those on the other half of the trestle. Except for the spacing of the top two cross-bearers on one half, the spacing of the cross-bearers on each half of the trestle shall be 500 mm to 610 mm.

Where uniform spacing as specified would bring the bottom cross-bearer less than half of the bearing spacing from the bottom of the stiles, the bottom cross-bearer shall be positioned on the same level as the lowest cross-bearer of the other half of the trestle.

7.10.1.5 Contained angle between halves

The combined angle between the halves of the trestle when fully open shall not be less than 24° or more than 36°.

7.10.1.6 Tie-Rods

Tie-Rods shall comply with (6.2.4.1) and shall be provided at a frequency of at least two on each half of trestles with stiles under 3.0 m long, and three on each half of trestles with stile length over 3.0 m. The tie-rods shall be fitted immediately below the second cross-bearer from the top and either under the bottom cross-bearer or under the second crossbearer from the bottom. When fitted, the third tie-rod shall be fitted under the cross-bearer nearest to the center of the length of the stile.

7.10.1.7 Hinges

The two halves of the trestle shall be connected by means of shouldered or lipped trestle hinges of steel, wrought iron or malleable cast iron which limit the extent of opening to that specified in (7.10.1.6). The minimum length of the hinges shall be in accordance with Table 9.

TABLE 9 - LENGTH OF HINGES FOR CLASS 1 FOLDING TRESTLES

STILE LENGTH		HINGE LENGTH	No. OF SCREWS	No. OF BOLTS
OVER	UP TO AND INCLUDING			
m	m	mm		
—	1.8	200	2	1
1.8	2.5	250	2	1
2.5	3.3	300	2	2
3.3	4.6	375	2	2

7.10.1.8 Check blocks

To relieve the hinges of strain when the trestles are being moved in the closed position, check blocks shall be fitted to the inside faces of both stiles of one half of the trestle, each shall either be secured by one bolt and one countersunk wood screw, or shall be glued and fixed by two countersunk wood screws.

7.11 Aluminum Type Lightweight Stagings

7.11.1 General

When tested in accordance with Appendix L the residual deflection shall not exceed 1/500 of the span or 3 mm, whichever is the greater.

The width of stagings shall be 450 mm $\begin{matrix} +5mm \\ -10mm \end{matrix}$.

Note :

This Standard does not specify the length of lightweight staging, but the preferred lengths are 1.8, 2.4, 3.0, 3.6, 4.2, 4.8, 5.4, 6.0, 6.6 and 7.3 m, each length with a tolerance of +0 mm, -50 mm.

7.11.2 Croos-Bearers

Cross-Bearers shall be of aluminum or timber; where timber is used the cross-bearers shall comply

with the appropriate requirements of (7.12.3).

7.11.3 Decking

When subjected to a mass of 90 kg applied to an area 50 mm × 50 mm mid-way between two adjacent bearers, the decking shall not fracture and there shall be no permanent distortion.

The decking shall consist of either:

- a) Aluminum or timber slats not less than 60 mm wide with a maximum gap between the slats of 7 mm. The gap between the slats and stiles shall not be more than 10 mm.
- b) Plywood of minimum thickness 9 mm bonded with an adhesive complying with type WBP of BS 1204:

Part 1. The face veneer of the plywood shall run longitudinally with the staging. Where plywood is scarf jointed to form a continuous length, any such scarf shall be at least 90 mm long.

The top of the decking if metal or plastics shall be textured to provide a slip resistant surface.

7.12 Wood Type Lightweight Stagings Class 1

7.12.1 General

Lightweight staging shall comply with the appropriate requirements of section 6.2 and the following clauses.

Note:

The stagings covered by this Standard are intended to be capable of supporting three workmen of average weight, reasonably spaced apart, and their hand tools.

The load should not exceed 270 kg if distributed over the length of the staging or 180 kg if concentrated in the middlethird.

The length and width shall comply with paragraph (7.11.1).

7.12.2 Stiles

7.12.2.1 General

The stiles shall be planed on the outer face and the two edges and may be fine sawn on the inner face. The finished sizes shall be in accordance with Table 10.

**TABLE 10 - DIMENSIONS OF STILES FOR CLASS 1
LIGHTWEIGHT STAGINGS**

LENGTH OF STAGING (NOMINAL OVER		MINIMUM CROSS SECTION DIMENSION OF STILES
	UP TO AND INCLUDING	
m	m	mm
—	4.3	69 × 31
4.3	5.5	93 × 31
5.5	7.3	93 × 35

7.12.2.2 Jointed stiles

Stiles for stagings 4.3 m and over may be scarf jointed in which case they shall comply with (a) to

(g).

a) Where jointed stiles are used, the joint shall be a scarf and shall have the slope visible along the edges not steeper than 1 in 18, and there shall not be more than one joint per stile. Test evidence shall be available to show that at least a 95% efficiency in bending strength can be obtained from the joint when manufactured under normal production conditions in the relevant wood species (see Appendix C of BS 1129 for test procedure).

b) Both portions of a jointed stile shall be of the same species of timber, and shall match, i.e. quarter sawn to quarter sawn or flat sawn to flat sawn. Joints shall be positioned so that they have no part nearer to the center of the stile than 450 mm. Where both stiles are jointed, the centers of the joints shall be separated by at least one quarter of the stile length.

c) The moisture content of the pieces for jointing shall not vary by more than 3% from each other, and shall not exceed 17% moisture content.

d) The faces of the scarfs shall be cleanly cut by fine set saw or planing, to give a flat surface without tearing or crushing the fibers. The slope of the scarf shall run in the general direction of any slope in the grain. Care should be taken to keep the cut surfaces clean to assist in this and also to avoid distortion, joints should be assembled as soon as possible on the same day.

e) The adhesive used shall be of type WBP in accordance with BS 1204: Part 1. The method used in mixing the adhesive shall be in accordance with the manufacturer's instructions, as shall the spreading, open and assemble times, curing temperature, cramping and conditioning times. Any cramping arrangement shall be such that the pressure is uniform over all the glue line, so causing a continuous film of adhesive. The pressure shall be as specified in the adhesive manufacturer's written instructions, but in no case shall be less than 0.69 N/mm² and there shall be a continuous squeeze out along the full length of the glue line.

f) After release from the cramp and subsequent machining, a visual inspection shall take place to ensure that all glue lines are continuous, and that there is perfect bonding of the fibers on the faces where the joints appear.

g) A sample joint shall be made in each batch for testing to destruction, to ensure that the glue mix for the batch is correct (see Appendix D of BS 1129 for procedure). Should the glue joint fail under test and the timber remain intact, the glue mix shall be regarded as unsatisfactory and the batch rejected.

7.12.3 Cross-Bearers

The cross-bearers shall be of timber and of cross section not less than 31 mm deep and not less than 22 mm wide; they shall have tenons or pins on each end not less than 22 mm × 22 mm or not less than 25 mm diameter in cross section and not less than 22 mm long. They shall be spaced at centers not exceeding 381 mm except in the case of the space between the end three cross-bearers when a maximum space of 475 mm is permissible. The distance between the center of the end cross-bearer and the end of the stile shall not be more than 75 mm.

7.12.4 Decking

The decking staging shall be constructed using one of the following materials and methods.

a) Wood slats having a width not less than 60 mm and not more than 150 mm and a thickness not less than 12 mm. The finish shall be either wrought or fine sawn. The gaps between the slats shall not exceed 10 mm and the gaps between the slats and the stiles shall not exceed 15 mm.

Both end fixing of each slat shall be by two countersunk wood screws 32 mm long and of no. 8 gage when fixing to softwood cross-bearers and 25 mm and of no. 8 gage when fixing to hardwood cross-bearers. When fixing slats wider than 75 mm then three screws at each end are required. Fixing of all other cross-bearers shall be by two nails, staples, or wood

screws not less than 32 mm long and 16 swg. No fixing shall protrude above the surface of the slats. Joined slats and decking are permitted provided that each joint occurs over a bearer not less than 34 mm wide and not more than two joints occur on any one cross-bearer (see Fig. 4).

b) Wood laminates bonded with a type WBP adhesive in accordance with BS 1203 : Part 1. The face veneer of plywood shall run longitudinally with the staging.

The plywood shall be a minimum of 9 mm thick and be capable of sustaining a load of 90 kg when supported by the cross-bearers at 380 mm spacing. The wood laminates may be scarf jointed to form a continuous length, any such scarf shall be 90 mm long. Joints required to form a continuous length of decking shall be either:

- I) 30 mm half lap located centrally over a bearer fixed with at least 4 countersunk no. 8 screws 32 mm long through the laps into the bearer; or
- II) butted and screwed with 4 countersunk no. 8 screws 32 mm long as in Fig. 4(a).

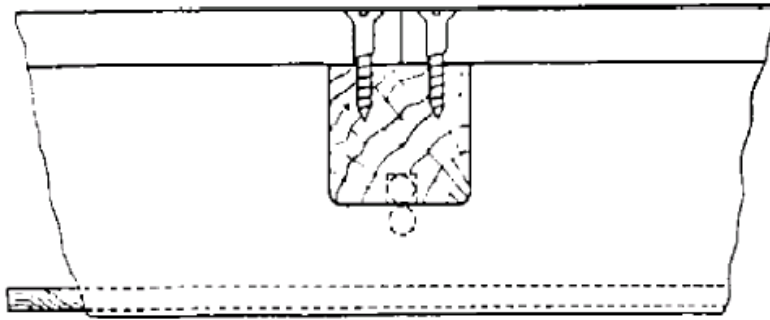
7.12.5 Tie-Rods

A tie-rod shall be fitted immediately below, immediately alongside, or into a groove beneath, each cross-bearer.

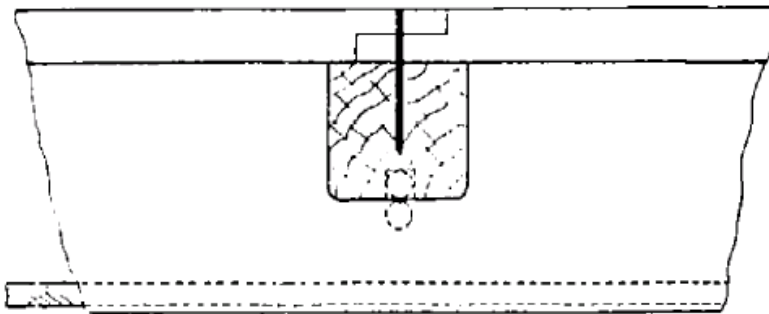
7.12.6 Stile reinforcement

The reinforcement shall be fitted in grooves running centrally along the lower edge of the stiles and shall be properly tensioned and secured in position. Reinforcement may pass over ends of stiles or pass through each stile 100 mm to 150 mm from the end of the stile.

Stiles for lengths up to and including 5.4 m shall be reinforced with a 7 wire mild steel strand of 5.38 mm overall diameter having a minimum characteristic strength of 425 N/mm² or a single wire, strip or different strand of equivalent strength. Stiles for lengths over 5.4 m shall be reinforced with a 7 wire mild steel strand of 6.4 mm overall diameter having a minimum characteristic strength of 460 N/mm² or a single wire, strip or different strand of equivalent strength.



(a) Butted and screwed (For Screwes length see clause 7.12.4 (a))



(b) Halved and glued (nailed or stapled) (For length of nails see clause 6.2.4.5)

DECKING JOINTS FOR LIGHTWEIGHT STAGINGS

Fig. 4

8. PERFORMANCE TESTS

Performance tests described below are for specific types of wood and aluminum ladders.

8.1 Performance Test for Aluminum Type of Single-Section Standing and Extending Ladders

8.1.1 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 Fig. 5. 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.

8.1.2 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 Fig. 6.

8.1.3 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.

8.1.4 Twist

When tested in accordance with Appendix D, the angle of twist shall not exceed the value given in table-11.

TABLE 11 - MAXIMUM ALLOWABLE ANGLE OF TWIST

DUTY RATING	TYPE	MAXIMUM ALLOWABLE ANGLE OF TWIST
Class 1	Industrial	Degrees (°) 18

8.1.5 Sideways bending

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

8.1.6 Cantilever bending

When tested in accordance with Appendix F, the residual deflection of either stile shall not exceed 6 mm.

8.1.7 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.

8.2 Performance Test of Aluminum Type Shelf Ladders

8.2.1 The type of tests given in paragraphs (8.1.1) to (8.1.6) shall be followed for aluminum shelf ladders plus the treads test below.

8.2.2 Test for treads

When tested in accordance with Appendix H the tread shall support the load. In addition after removal of the test load the residual deflection of the tread shall not exceed 1 mm.

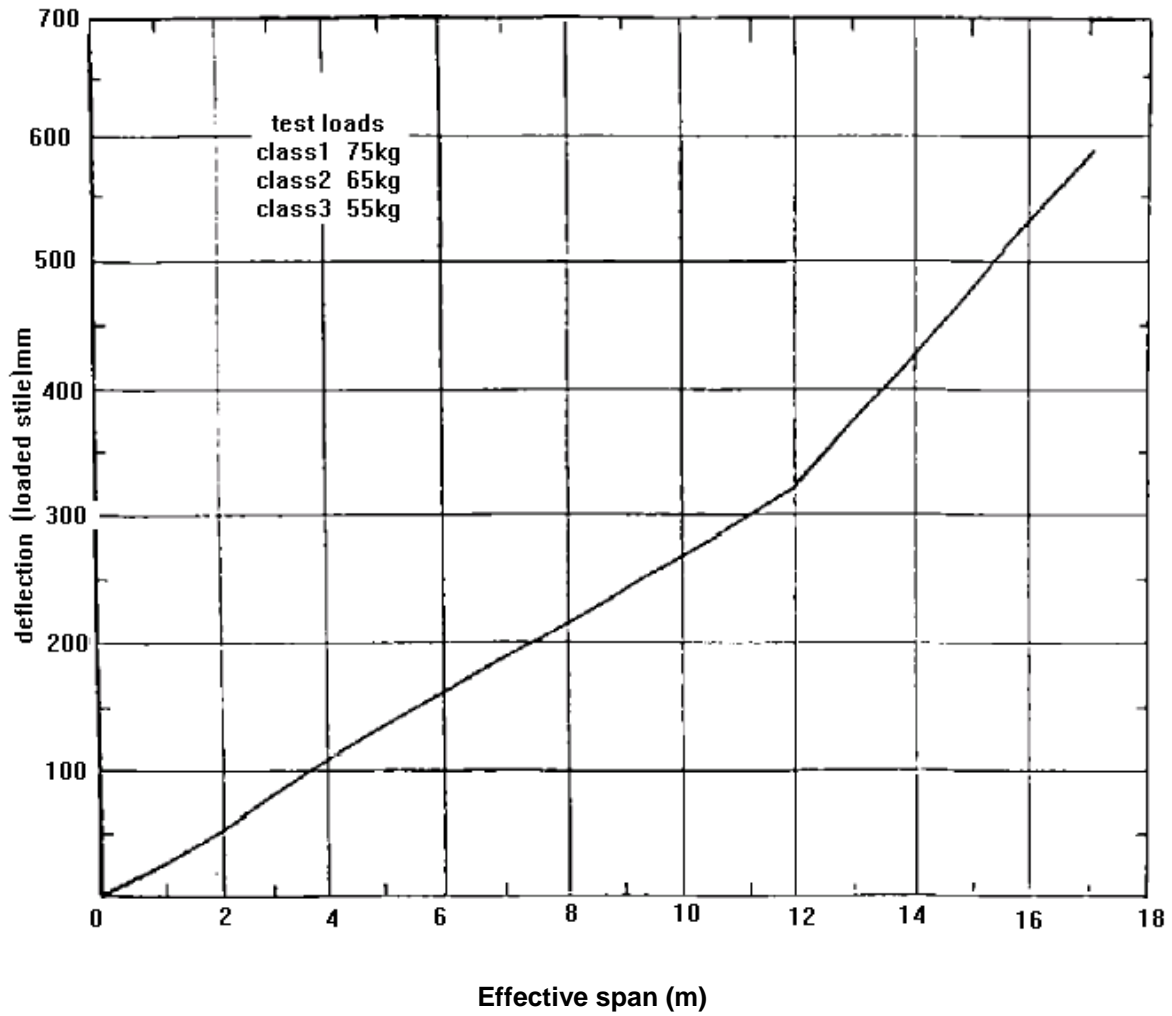
8.3 Performance Test of Aluminum Swing Back Steps

8.3.1 Rigidity

When tested in accordance with Appendix I.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.

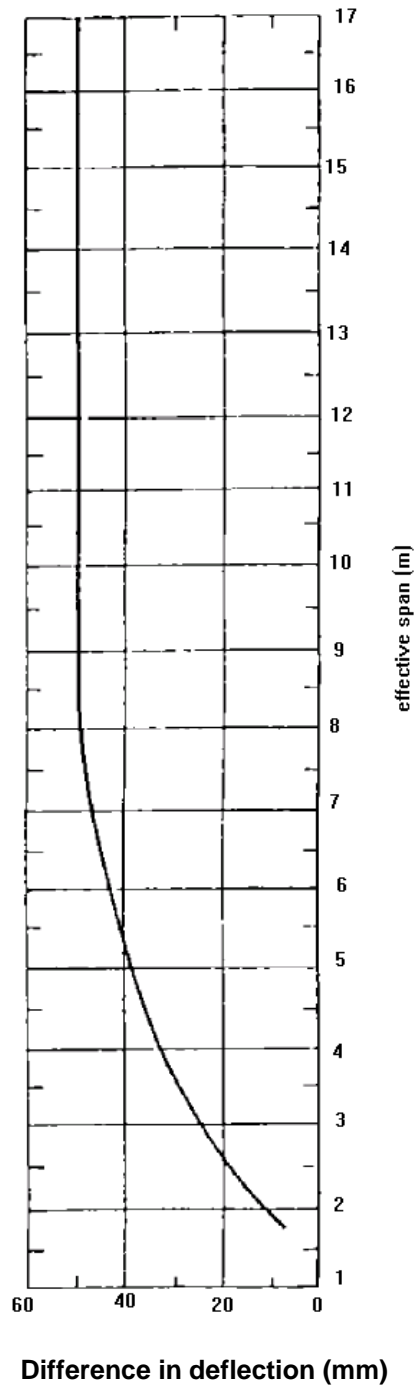
8.3.2 Test for treads

When tested in accordance with Appendix I.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.



MAXIMUM STILE DEFLECTION UNDER LOAD

Fig. 5



TORSIONAL RIGIDITY: MAXIMUM DIFFERENCE IN DEFLECTION BETWEEN STILES

Fig. 6

8.3.3 Tests for deflection under load, strength, sideways bending and cantilever bending shall be as specified in (8.1.1), (8.1.3), (8.1.5) and (8.1.6).

8.4 Performance Test of Aluminum Ladder Backed Steps

8.4.1 Tests for rigidity, front and back are given below:

- a) for rigidity, see clause (8.3.1);
- b) for front, see clauses (8.3.2) and (8.3.3);
- c) for back, see clauses (8.1.1) to (8.1.3), (8.1.5) and (8.1.6).

8.5 Performance Test of Aluminum Type Folding Trestles

8.5.1 Strength of cross-bearers, when tested in accordance with Appendix J shall have no permanent distortion. And shall be as specified in (8.1.1), (8.1.2), (8.1.3) (8.1.5) and (8.1.6).

9. TOLERANCES ON SIZES

9.1 The overall length of wood type ladders shall be subjected to the following tolerances:

- ± 50 mm for sections up to and including 3m;
- ± 75 mm for sections over 3 m and up to and including 6 m;
- ± 100 mm for section over 6m;
- ± 5 mm for rung and tread centers on a single product.

Where a size is specified as a nominal dimension a tolerance of ±5% applies when determining the acceptable actual size.

When checking the dimensional requirements of ladders, any cut outs for joining members, fitting guide brackets or similar purposes shall be discounted.

Where treads have a rectangular cross section the dimensions specified in this standard are overall dimensions (see Fig.16 (a)). The dimensions of other shapes of tread shall be measured as shown in Fig. 16 (b) and (c). The maximum loss of section due to sloping is defined in Fig. 16.

9.2 For aluminum types of ladder a tolerance of 25 mm shall be permitted on the nominal length of all ladders.

9.2.1 Spacing of rungs and treads shall not vary by more than 2.0 mm from the nominal spacing selected by the manufacturer.

10. MARKINGS

Equipment shall be clearly and durably marked. 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.

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

- The name, trade mark or other means of identification of the manufacturer or supplier;
- The number and date of standard followed for manufacturing this product.
- The class and duty rating.

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

- Inspect for damage before use.
- Lean ladder at approximately 75° from horizontal (1 m out for each 4m height).
- Ensure firm level base.
- Check safety at top.
- Avoid electrical hazards.

- Avoid over reaching. (Do not push or pull, from the ladder or climb higher than the third rung from the top).
- Keep a secure grip.
- Never stand on top of swing back steps or step ladders.
- Secure at top and bottom wherever possible.

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

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

11. CARE AND USE OF LADDERS

11.1 Handling

Equipment should be handled with care and not subjected to unnecessary dropping, jarring or misuse. If it has fallen or received a heavy blow, it should be examined immediately and any damage should be eliminated and repaired by a competent person before putting back into service.

11.2 Storage

Equipment should be stored in such a manner as to provide ease of access and inspection and to prevent danger of accident when withdrawing for use.

Ladders should be stored horizontally on racks designed for their protection when not in use. These racks should have supporting points at every 2 m to prevent any possibility of excessive sagging. At no time should any material be placed on the ladder whilst in store. Timber plant should be stored in a location where it will not be exposed to the elements but where there is good ventilation; it should not be stored near radiators, stoves, steam pipes or other places subject to excessive heat or dampness.

11.3 Transport

Ladders carried on vehicles should be adequately supported to avoid sagging and there should be minimum overhang beyond supporting points, which should be of resilient material. Ladders should be tied to each support point to minimize rubbing and the effects of road shock. Other plant should be carefully loaded so that the ladder will not be subject to shock or abrasion.

11.4 Maintenance

Equipment should be maintained in good condition at all times. Hardware, fittings and accessories should be checked frequently to ensure that they are securely attached and in proper working condition. Moving parts, such as pulleys, locks, hinges and wheels, should operate freely without binding or undue play and should be oiled frequently and kept in good working order. All bolts and rivets should be in place and tight before use. Ropes or cables should be inspected frequently and those frayed or badly worn or defective should be replaced.

11.5 Inspection

Equipment should be inspected before and after use and periodically by a competent trained person. Those items found to be defective should be suitably labelled or marked, and should be withdrawn from service. The inspection should include checking the rungs, treads, cross-bars and stiles for damage, defects and dents, checking the rung to stile connections, checking ropes and cables and all fittings, locks, wheels, pulleys, connections, rivets, screws and hinges.

11.6 Painting

Timber equipment other than inserts may be coated with a transparent non-conductive finish such as varnish, shellac or a clear preservative, but should not be coated with any opaque covering. Preservatives for the treatment of timber components in aluminum plant should not contain copper salts. Aluminum should not be used in corrosive conditions.

11.7 Electrical Hazards

Aluminum ladders should not be used where any electrical hazard exists.

11.8 Inspection

The ladder should always be inspected carefully before use.

11.9 Angle of Ladder

The ladder should be erected at an angle of 75° from the horizontal, i.e. the distance of foot from the vertical surface should be as near as possible one-quarter of the height reached by the top of the ladder.

11.10 Support

Equipment should be placed on a secure footing on a firm level base. It should not be used on ice, snow or slippery surfaces, unless suitable means to prevent slipping are employed. It should not be placed on boxes, barrels or other unstable bases to obtain additional height.

11.12 Fixing of the Ladder

The point on which the top of a ladder rests should be reasonably rigid and have ample strength to support the applied load. The ladder should be securely fixed to this point. If such a fixing is impracticable the ladder should be securely fixed at or near the lower end either by staking or by roping.

11.13 Overlap

On extension ladders there should be an overlap of at least:

- 1½ rung spacings for ladders with closed lengths up to 5 m;
- 2½ rung spacings for ladders with closed lengths over 5 m and up to 6 m;
- 3½ rung spacings for ladders with closed lengths over 6m.

The ladder should be raised and lowered by the user at the base of the ladder so that it can be seen that the locks are properly engaged. When extension ladders have been used previously as single ladders, care should be taken to ensure that the re-assembly of the ladder is properly carried out and that interlocking brackets and guides are correctly engaged.

APPENDICES

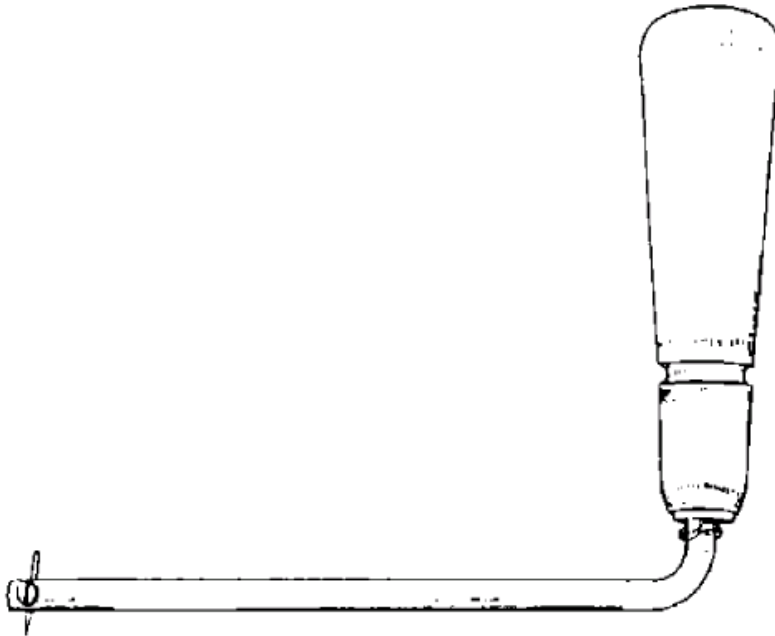
APPENDIX A

DETERMINATION OF SLOPE OF GRAIN

To ascertain the slope of grain in timber it is necessary to study both faces and edges of the member over the length disregarding any slight local deviations. If any seasoning checks are present, these will indicate the slope of grain, as will resin ducts. Slope of grain can be determined by means of a tool called a grain detector which consists of a handle that swivels on a cranked rod with a gramophone needle set at a trailing angle at the tip of the rod, as shown in Fig. 7. The needle is pressed into the wood between 1 mm and 2 mm deep and the scribe is pulled along with a steady action parallel to the edge of the wood: the needle will deviate in the direction of the grain. If there are any steps in the groove produced by the needle this indicates that the needle is climbing over the grain, it is then essential that another scribe is made to make sure the two grooves are parallel to each other.

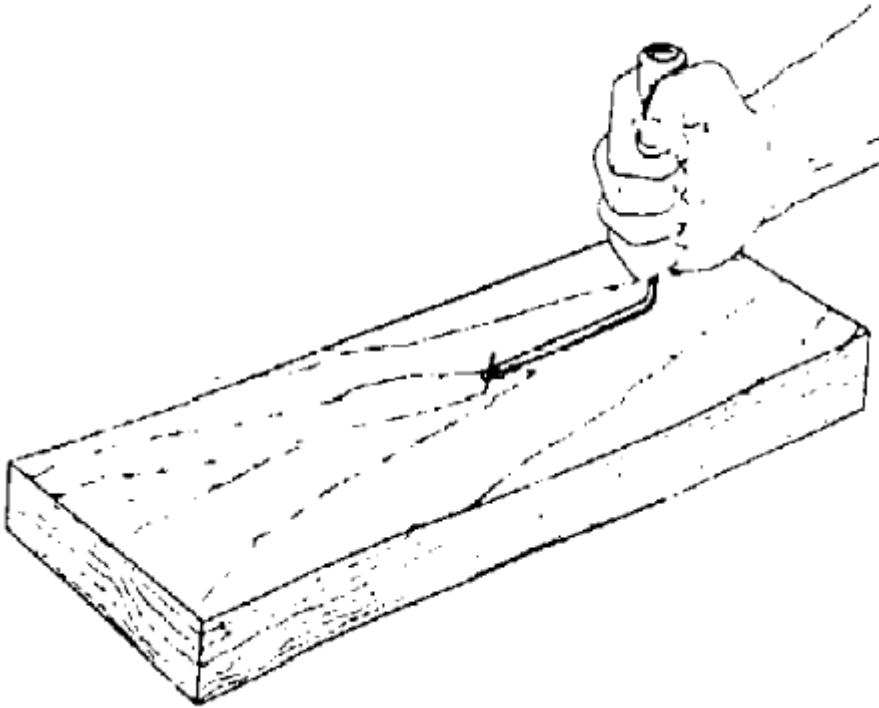
The inclination of grain on a face is measured as shown in Fig. 8 and Fig. 9 in which AB is the line indicating grain direction, AC is a line drawn parallel to the edge of the member, BC is of length one unit (any convenient unit may be used) and is at right angles to AC. Grain inclination is expressed as 'one in x' where x is the length of AC measured in terms of BC.

When sloping grain occurs on two adjacent surfaces, the slope may be determined on both. The acceptance limits of both slopes considered together are shown in Fig. 10.



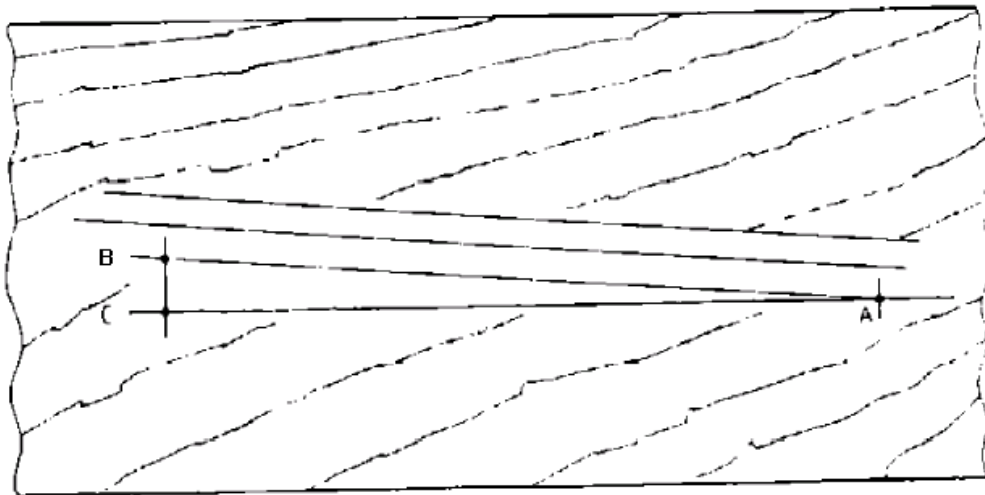
SWIVEL-HANDLED SCRIBE FOR DETERMINATION OF SLOPE OF GRAIN IN WOOD

Fig. 7



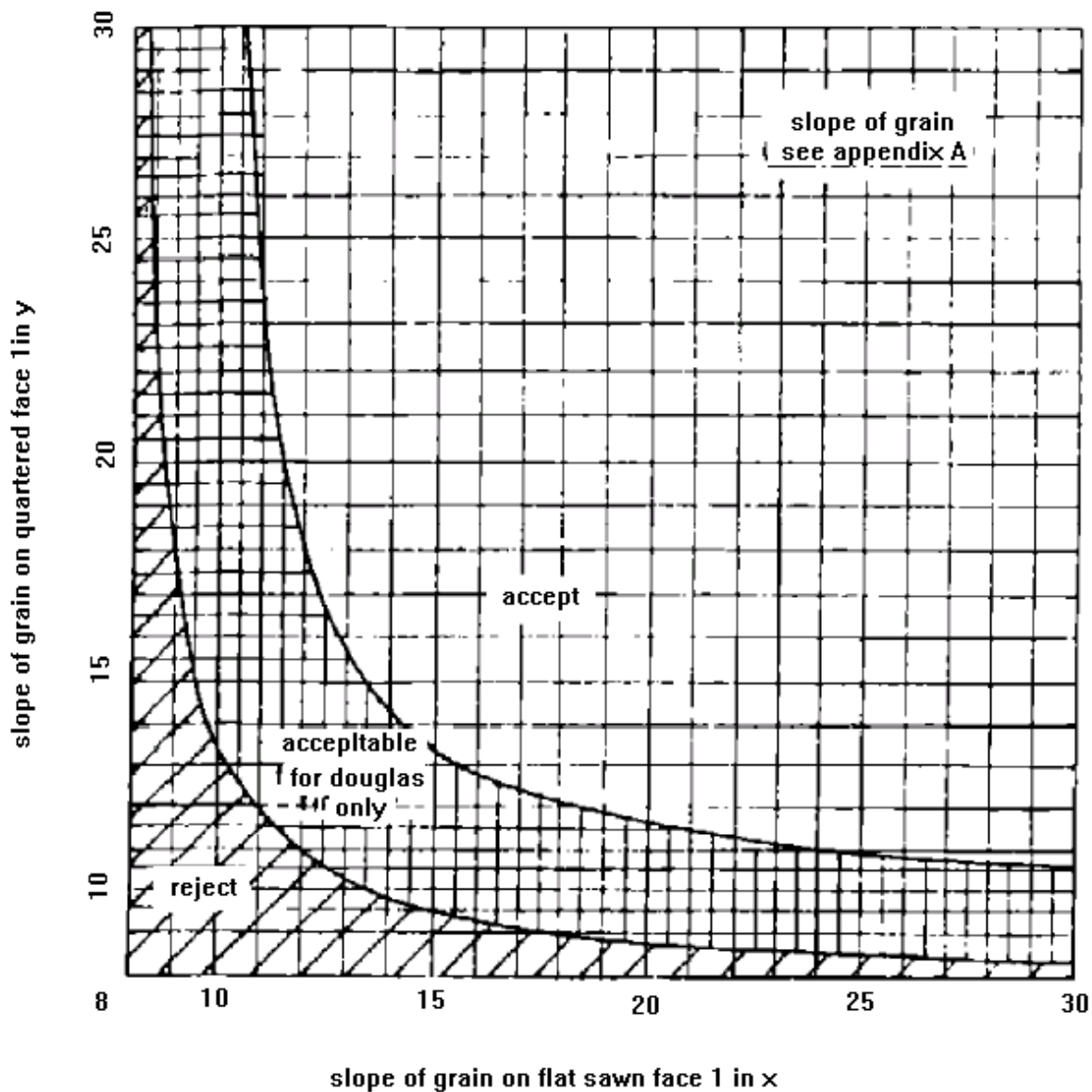
USE OF SCRIBE

Fig. 8



MEASUREMENT OF SLOPE OF GRAIN

Fig. 9



ACCEPTANCE LIMITS OF SLOPE OF GRAIN ON ADJACENT SURFACES

Fig. 10

**APPENDIX B
TEST FOR DEFLECTION OF LADDERS AND STEP FRONTS**

If this test is being applied to an extending ladder, extend it fully to the appropriate overlap specified in (7.1.1.8) before the test is commenced.

With the climbing face uppermost, support the ladder or steps horizontally under the stiles at each end rung or tread, or in the case of steps, where the hand or knee rail is an integral part of the step front, under the bottom tread and at a point 200 mm in from the hinge point. Measure the clear span between the supports. This is regarded as the effective span for the purpose of this test. Apply a preload as given in table 12, according to the class, to the centre point of both stiles distributed over 50 mm for a duration of 30 s. Remove this load and establish datum. Then apply a test load as given in table 12, according to the class, to the center point of one stile distributed over 50 mm. By any convenient means measure the vertical deflection at the center of the effective span of both stiles between the unloaded condition and after a period of not less than 30 s from the application of the full test load.

TABLE 12 - LOADS FOR DEFLECTION TEST

DUTY RATING	PRELOAD	TEST LOAD
Class 1: industrial	kg 55	kg 75

APPENDIX C

STRENGTH TEST FOR LADDERS, STEP FRONTS AND TRESTLE FRAMES

If this test is being applied to an extending ladder, extend it fully to the appropriate overlap specified in (7.1.1.8) before the test is commenced.

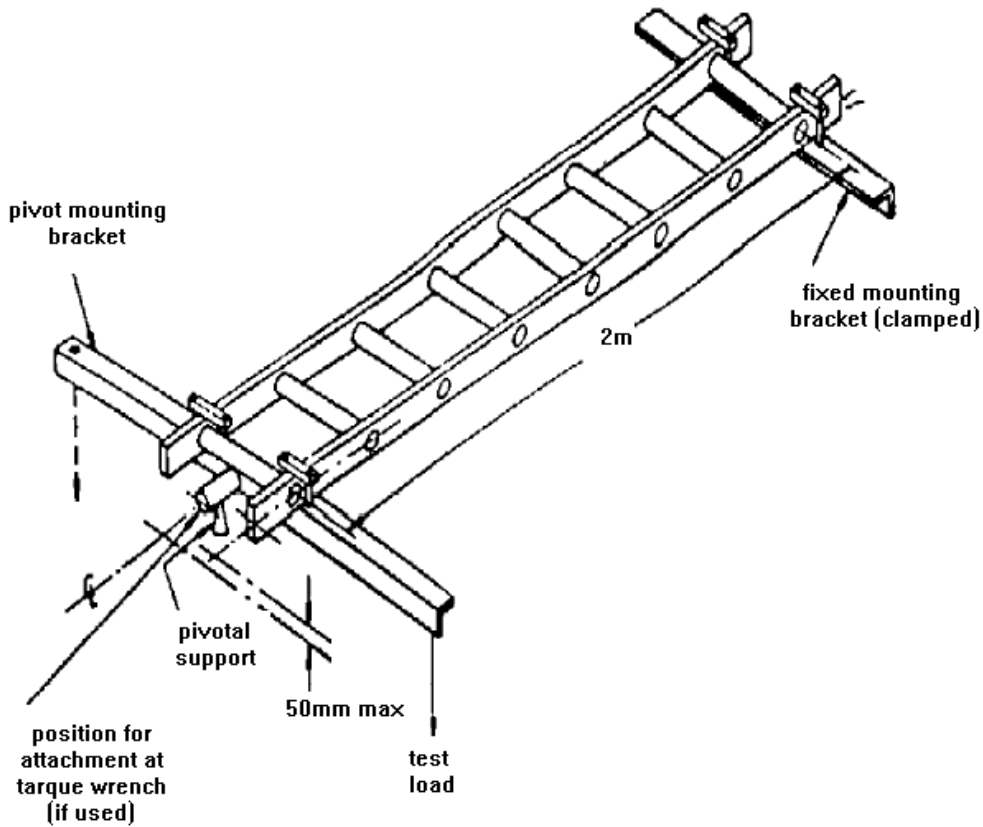
With the climbing face uppermost, support the ladder or steps horizontally under the stiles at each end rung or tread, or in the case of steps, where the hand or knee rail is an integral part of the step front, under the bottom tread and at a point 200 mm in from the hinge point. Apply a preload, as given in table 13, according to the class, vertically at the middle of the ladder, distributed over a length of 50 mm for a duration of 1 min., so that the stiles are loaded equally. Remove this load and establish a datum point. Then apply a test load, as given in table 13, according to the class, in the same way as the preload for a duration of 1 min. Remove the load. By any convenient means measure the residual deflection at the datum point.

TABLE 13 - LOADS FOR STRENGTH TEST

DUTY RATING	PRELOAD	TEST LOAD
Class 1: industrial	kg 95	kg 130

**APPENDIX D
LADDER TWIST TEST**

The test unit shall consist of a ladder base section of any length, supported over a 2 m test span. Place the ladder in a flat horizontal position and support it at each end, as shown in Fig. 11. The distance between the pivot point center and the plane of the centerline of the rungs shall not be more than 50 mm. Apply a preload torque of 6.5 kg m gently and then remove. The residual angle of pivotal support shall be noted as datum position to establish a reference for angular deflection. Apply a test torque of 13 kg m in the same direction as the preload by either using a torque wrench or by applying a test load at the end of the arm. Measure the angle of twist from the datum position. Apply a second load of the same torque as the preload in the opposite direction and then remove. The residual angle of pivotal support shall be noted as datum position. Apply a second test load in the opposite direction to the first test load. Measure the angle of twist from the second datum position.



ARRANGEMENT FOR TWIST TEST ON SINGLE OR EXTENSION LADDER

Fig. 11

Note:

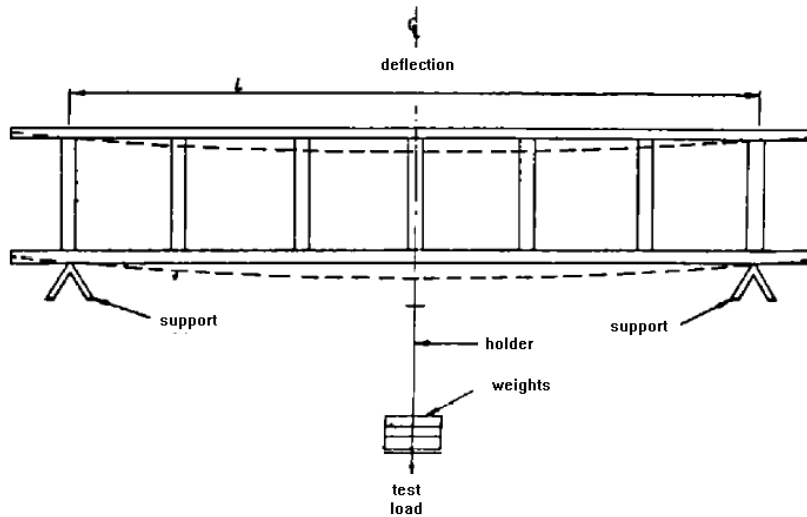
The test span is 2m, but any ladder section that is at least 2 m in length may be tested.

APPENDIX E

SIDEWAYS BENDING (SWAY) TEST FOR LADDERS, STEP FRONTS AND TRESTLE FRAMES

Place the ladder, step or trestle on its side with the rungs or treads vertical. Measure each section of the ladder individually, the bottom stile being supported as for the strength test of Appendix C under the end rungs (see Fig. 12, or in the case of steps, where the hand or knee rail is an integral part of the step front, under the bottom tread and at a point 200 mm in from the hinge point. Apply a preload of 15 kg for 1 min. and then remove it to determine the datum for measurement on the lower edge of the lower stile. Apply a test load as given in table 14, according to the class, at the center points of the span of the stiles distributed over 50 mm. By any convenient means measure the vertical deflection at the datum point on the lower edge of the ladder and then remove the test load. After 1 min. measure the residual deflection at the same point.

DUTY RATING	PRELOAD	TEST LOAD
	KG	KG
Class 1: industrial	15	27
Class 2: light trades	15	25
Class 3: domestic	15	23



ARRANGEMENT FOR SIDEWAYS BENDING (SWAY) TEST (SEE ALSO Fig. 5)

Fig. 12

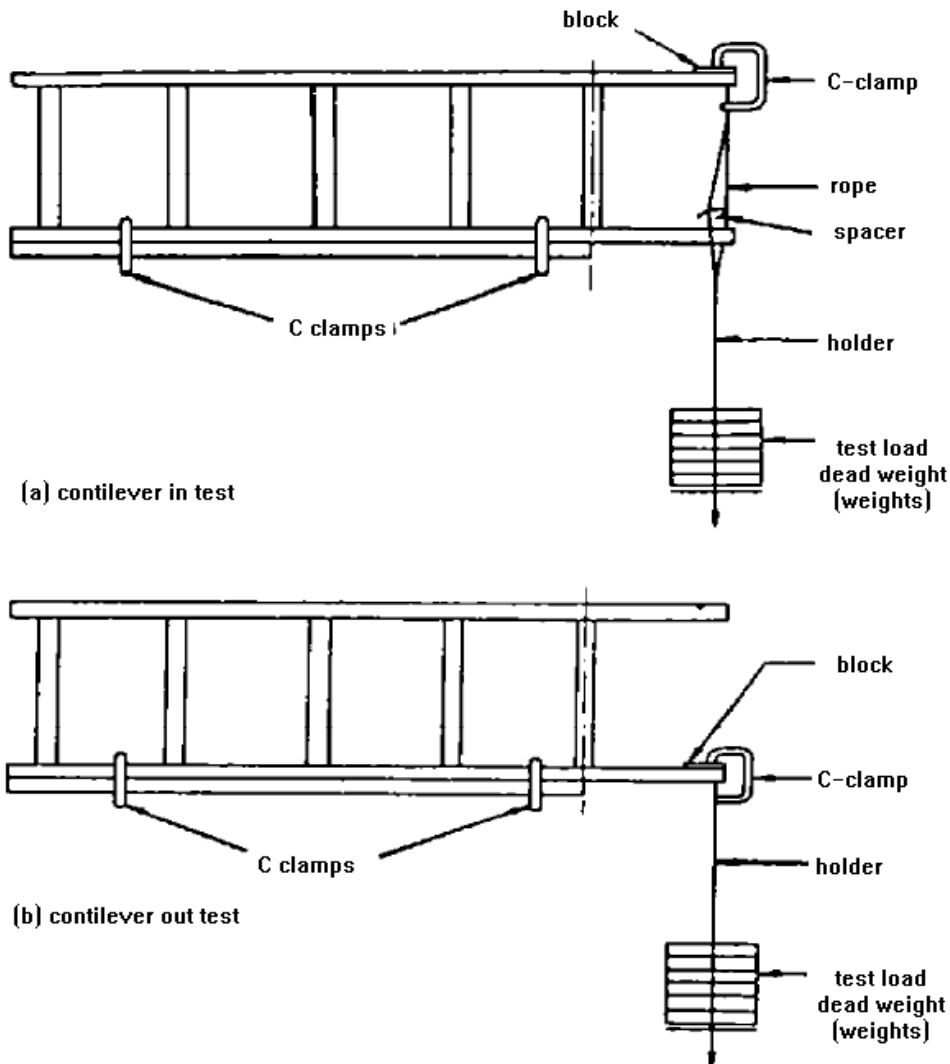
Note:

The deflection is the difference between the height of the lower edge of the ladder side when unloaded (solid line) and when loaded (dotted line). L is the effective span (in mm).

APPENDIX F

CANTILEVER BENDING (HORN END STRENGTH) TEST FOR LADDERS, STEP FRONTS AND TRESTLE FRAMES

The test unit shall consist of either a step front, trestle frame, single ladder section or the base section of an extension ladder. Any safety shoes or spikes affixed to the section shall be removed before the test is conducted. The test unit shall be placed on edge with the rungs or treads in a vertical plane. The lower stile shall be clamped to a support and shall be unsupported from the bottom end to the midpoint of the lowest rung or tread. If the rung has a flat surface, that surface shall be parallel to the end of the support (see Fig. 13). Establish a datum point on the end of the stile to which the test load is to be applied. Apply a test load, as given in table 15, according to the class, for a minimum period of 1 min. to the extreme bottom end of the upper stile. Apply the load to a block resting on the full width of the stile web and hold in place by a clamp.



ARRANGEMENT FOR CANTILEVER BENDING (HORN END STRENGTH) TEST

Fig. 13

The block shall be 25 mm thick, 50 mm long measured along the stile and of width equal to the clear distance between flanges. Ensure that the load is suspended so that it is acting through the vertical neutral axis of the stile (see Fig. 13(a)). Remove the test load and after 1 min. measure the residual deflection at the datum point. Repeat the loading and measurement procedure on the lower stile (see Fig. 13 (b)).

**TABLE 15 - TEST LOADS FOR CANTILEVER BENDING
(HORN END STRENGTH) T EST**

DUTY RATING	TEST LOAD
Class 1: industrial	kg 125

**APPENDIX G
TEST FOR RUNGS**

Support the ladder at an angle of 75° from the horizontal and with continuous support for both stiles over a length equal to three rung spacings. To the center rung of the three, apply a vertical load as given in table 16, appropriate to the class of the ladder, distributed over a length of 50 mm for 1 min. as follows:

- a) At the centre of the rung; and then
- b) close to one end.

Remove the load and examine the rungs for permanent deflection or visible damage.

**TABLE 16 - TEST LOADS FOR RUNGS,
TREADS AND PLATFORMS**

DUTY RATING	TEST LOAD
Class 1: industrial	kg 225

APPENDIX H
TEST FOR TREADS OF SHELF LADDERS

Place the shelf ladder in the normal working position, supported so as to prevent movement of the feet or deflection of the stiles. To a typical tread apply a vertical load, as given in table 16 over a length of 50 mm for 1 min. as follows:

- a)** At the centre of the tread; and then
- b)** close to one end.

Remove the load and examine the ladder for permanent deflection or visible damage.

**APPENDIX I
TESTS FOR STEPS**

1.1 Test for rigidity. Attach securely, by any convenient means, a wheel (or roller) to the outer side of one of the back stiles. The wheel shall be of metal and have a diameter of 50 mm; it shall be mounted so that it can rotate freely, with its axis parallel to the treads, and raises the foot of the stile by 10 mm (see Fig. 14)

Place the steps in the fully open position on a smooth level surface and apply the appropriate preload given in table 17 to the top tread but one, adjacent to the stile on the same side as the wheel. In the case of platform steps, apply the preload to the tread immediately below the platform.

Maintain the load on the tread for 1 min., then remove the preload and then apply the appropriate test load given in table 17 using the same procedure. After the 1 min. has elapsed remove the test load and the wheel before inspecting the steps for damage and deformation.

Examine the steps for visible deformation or damage.

TABLE 17 - TEST LOADS FOR STEPS AND TRESTLES

DUTY RATING	PRELOAD	TEST LOAD
	kg	kg
Class 1: industrial	95	130

1.2 Test for treads. After completing the test given in I.1, apply to a typical tread a vertical load as given in table 16 over a length of 50 mm for 1 min. as follows:

- a) at the centre of the tread; and then
- b) close to one end.

Remove the load and examine the ladder for visible damage. Place a 6 mm thick straight edge on the centreline of the tread climbing surface so that it is symmetrically positioned and covers 95% of the length of the tread and the mid span point of the tread. Measure any space between the latter point and the straight edge.

1.3 Test for platform. After completing the tests given in I.2 apply to the center of the platform a load as given in table 16 over an area of 50 mm x 50 mm for 1 min.

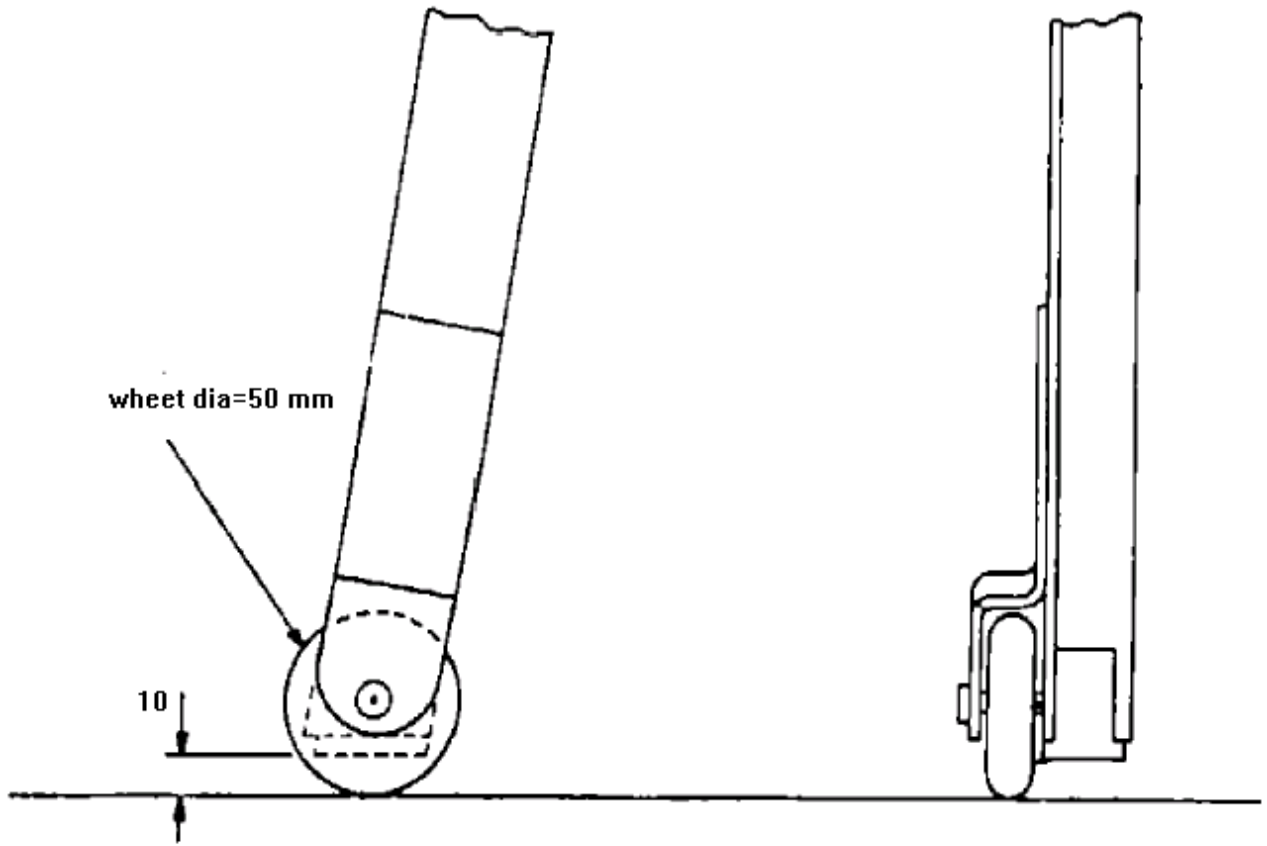
Remove the load and examine the platform and the ladder for permanent deflection or visible damage.

Apply a load of 54 kg uniformly distributed as before. Take an initial reading for deflection measurements at the mid span position on each stile, (reading 1).

Increase the load to a total of 540 kg and maintain it for 1 min.

Reduce the load to 54 kg again and take a further deflection reading as above, (reading 2).

Calculate the residual deflection as reading 2 minus reading 1.



METHOD OF FIXING WHEEL TO BOTTOM OF BACKLEG FOR STEP TEST

Fig. 14

APPENDIX J
TEST FOR TRESTLES

Place the trestles in the fully opened position on a level surface. Apply the appropriate preload given in table 9 at the load center of the cross-bearer and spread over a length of 50 mm. Maintain the preload for 1 min. then remove it. Apply a test load as given in table 9 in three equal increments at the load center of the bearer, the load being spread over a length of 50 mm. Maintain the load for 1 min.

Remove the load and examine the cross-bearers and the whole trestle for permanent deflection or visible damage. Repeat the procedure for each cross-bearer.

APPENDIX K
TEST FOR LIGHTWEIGHT STAGINGS

With the decking uppermost, support the lightweight staging, in a horizontal position, under both stiles at 150 ± 5 mm from each end.

Apply a preload of 400 kg uniformly distributed over the area of the decking between the supports and maintain the load for 1 min. before removing the load.

Apply a load of 54 kg uniformly distributed as before. Take an initial reading for deflection measurements at the mid span position on each stile, (reading 1).

Increase the load to a total of 540 kg and maintain it for 1 min.

Reduce the load to 54 kg again and take a further deflection reading as above, (reading 2).

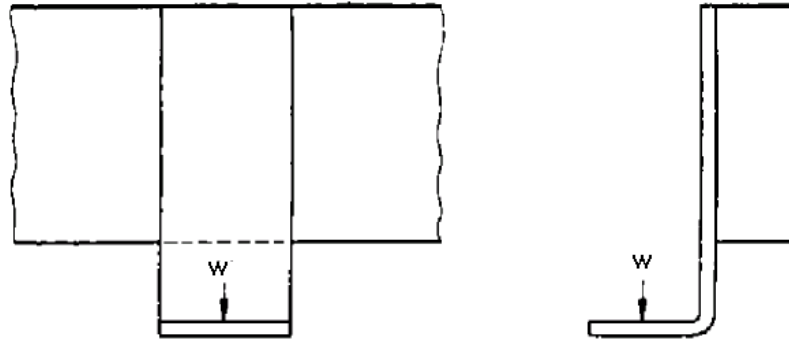
Calculate the residual deflection as reading 2 minus reading 1.

**APPENDIX L
TEST FOR EXTENSION LADDER GUIDE BRACKETS**

The sample to be tested shall take the form of a length of stile to which a single guide bracket is attached using the normal method of fixing. Secure the stile by means of a clamping device or devices so that it is fixed rigidly in position. Apply the following load at the center of the overhang of the bracket for 1 min. (see Fig. 15).

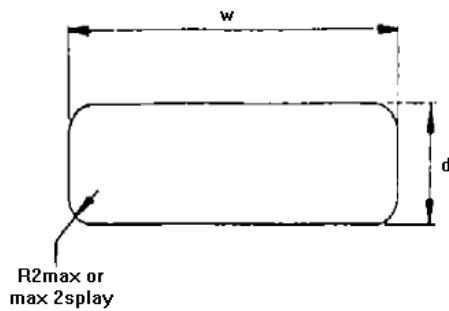
Class 1 extending ladders 130 kg

Measure and record any movement and distortion of the bracket and its fixing and whether any remains after removal of the load.

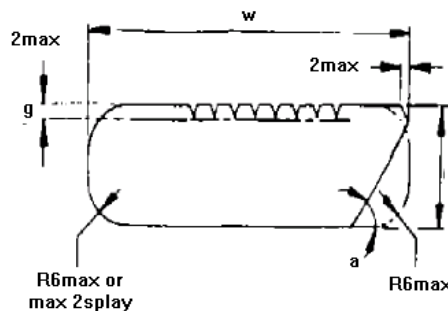


APPLICATION OF LOAD IN TEST FOR EXTENSION BRACKETS

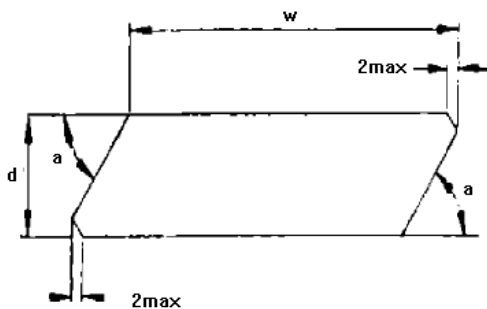
Fig. 15



(a) rectangular fixed



(b) Part or fully rounded treads with non-slip surface



a is not less than the angle of the front stile
w is the width specified in the standard
d is the thickness specified in the standard
g is the depth of grooves to form a non-slip surface,
which shall not exceed 2 mm on any tread.

all dimensions are in millimeters

(c) treads with straight sides other than rectangular

REQUIREMENTS FOR TREAD DIMENSIONS

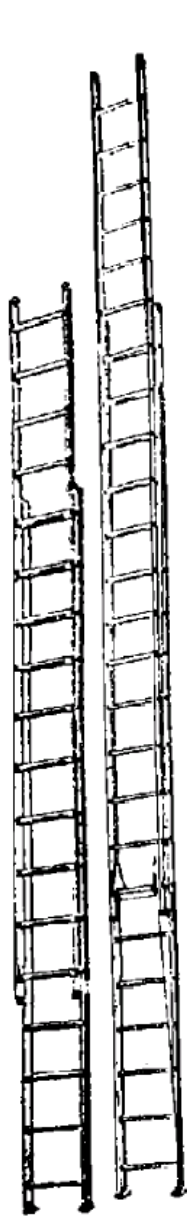
Fig. 16

**APPENDIX M
SPECIFIC TYPES OF LADDERS**

EXTENSION LADDER

(a)

SINGLE-SECTION LADDER



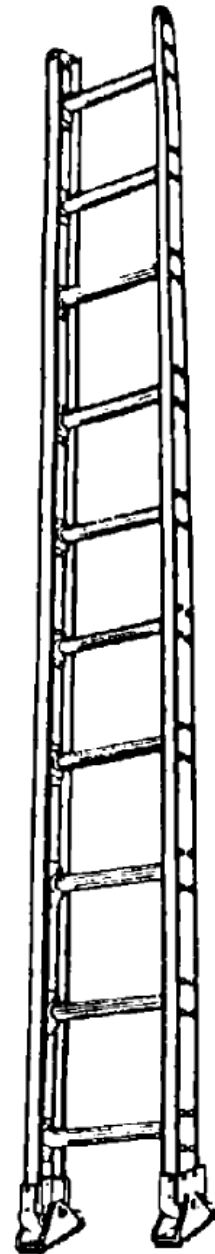
ALUMINUM



WOOD



WOOD

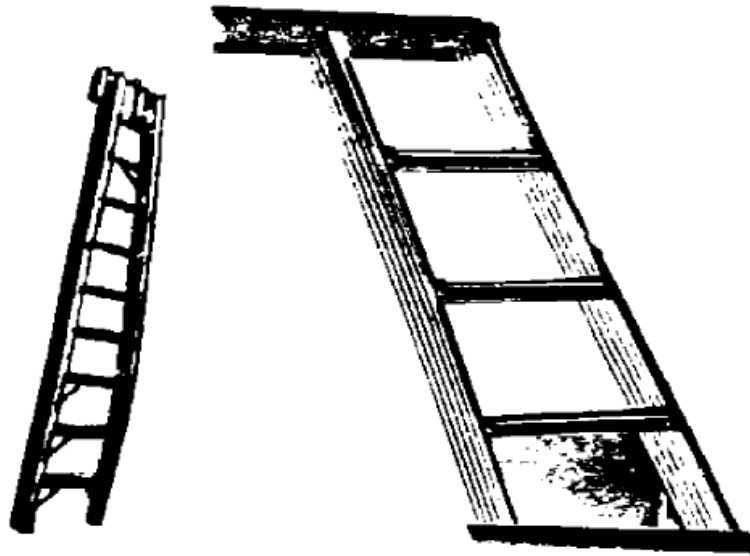


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Fig. 17

SHELF LADDER

(b)



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SWING BACK STEPS



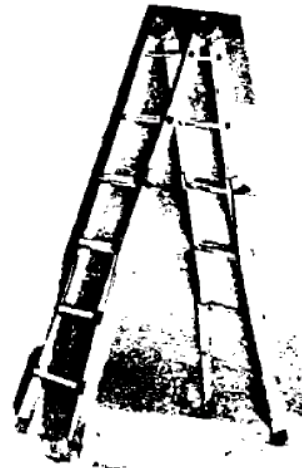
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BACK STEPS LADDERS
(d)

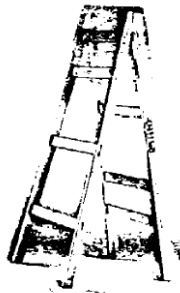


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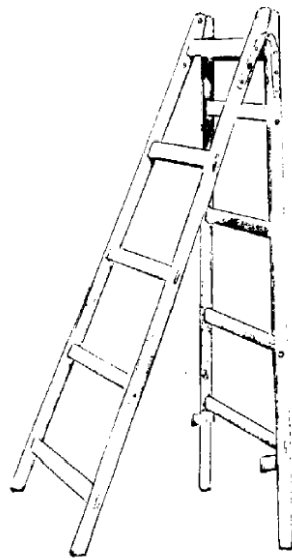


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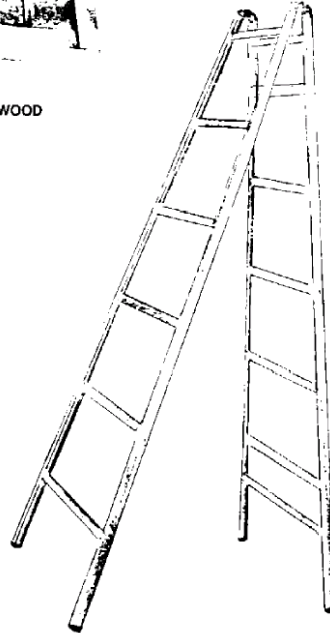
FOLDING TRESTLES
(e)



WOOD



WOOD



ALUMINUM

LIGHTWEIGHT STAGINGS

(f)

