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DP/DER.A/01
7 April 1977
English

07723

**EXPERT SERVICES
IN SAW DOCTORING,
TIMBER PREFAB TECHNOLOGY
AND CHIPBOARD TECHNOLOGY**

DP/SRL/78/080

(R) SRI LANKA.

Technical report:
SPECIFICATIONS FOR DOMESTIC FURNITURE PRODUCTION, (1977).

-- AUG 1977

Prepared for the Government of Sri Lanka by the
United Nations Industrial Development Organization,
executing agency for the
United Nations Development Programme



United Nations Industrial Development Organization

United Nations Development Programme

EXPERT SERVICES IN SAW DOCTORING, TIMBER PREFAB
TECHNOLOGY AND CHIPBOARD TECHNOLOGY

DP/SRL/73/020

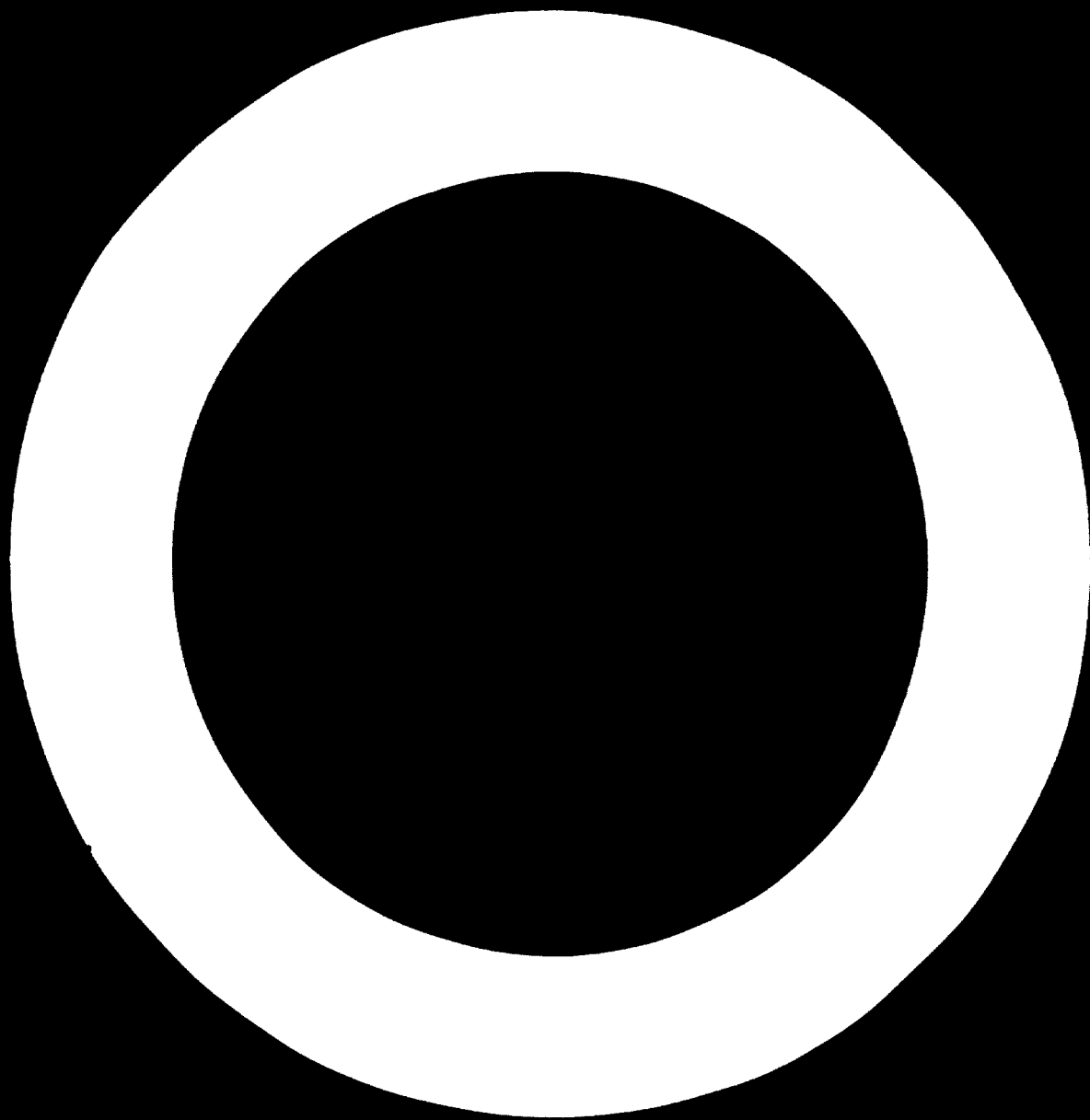
SRI LANKA

Technical report: Specifications for domestic
furniture production

Prepared for the Government of Sri Lanka
by the United Nations Industrial Development Organisation,
executing agency for the United Nations Development Programme

Based on the work of Desmond P. Cody, furniture technologist

United Nations Industrial Development Organisation
Vienna, 1977



ABSTRACT

This technical report giving specifications for domestic furniture production was prepared by an expert of the United Nations Industrial Development Organization (UNIDO) during his assignment to the project "Expert Services in Saw Doctoring, Timber Prefab Technology and Chipboard Technology" (DP/SRL/73/020) of the United Nations Development Programme (UNDP).^{1/} The specifications relate to household furniture, excluding metal-framed or plastic furniture, hospital or garden furniture or children's cots. They cover both domestic and contract furniture, for which different performance requirements have to be observed.

^{1/} See also the technical reports "Furniture design and production" (DP/ID/SER.A/90) and "Technology of furniture and joinery production" (DP/ID/SER.A/92).

Explanatory notes

The following technical abbreviations are used in this document:

N newton
SWG standard wire gauge

Copies of the standards referred to in this report can be obtained from:

British Standards Institution, Sales Branch, 101 Pentonville Road,
London NI 9 ND, United Kingdom;

Deutscher Normenausschuss, Uhlandstrasse 175, 1 Berlin 15, Federal
Republic of Germany;

Institute for Industrial Research and Standards, Ballyman Road,
Dublin 9, Ireland.

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INTRODUCTION

In response to a request by the Government of Sri Lanka to the United Nations Development Programme (UNDP), an expert in the design and production of furniture was sent on a six-month mission to advise the management of the Ceylon Plywoods Corporation on improving the design and production technology, on rationalizing production methods and on introducing new materials for use in domestic and contract furniture production. His assignment, which was part of the project entitled "Expert Services in Saw Doctoring, Timber Prefab Technology and Chipboard Technology" (DP/SRL/73/020) began on 3 September 1976 and ended on 2 April 1977. The United Nations Industrial Development Organization (UNIDO) was the executing agency. The government agency coordinating the project was the Ministry of Industries and Scientific Affairs.

The chief objective of the mission was to identify the major shortcomings of the Corporation's furniture plant at Salawa, Kosgama, and to suggest how they could be rectified.^{1/} This technical report, giving specifications for domestic furniture production, was prepared by the expert during his assignment with a view to help to improve the quality of the furniture produced by the Corporation. The specifications relate to household furniture, excluding metal-framed or plastics furniture, hospital or garden furniture or children's cots. They cover both domestic and contract furniture, for which different performance requirements have to be observed.

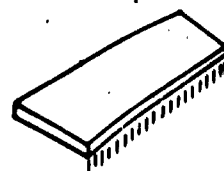
^{1/} See also the technical reports "Furniture design and production" (DP/ID/SER.A/90) and "Technology of furniture and joinery production" (DP/ID/SER.A/92).

I. DEFINITIONS

Seasoning defects in timber

Bow

A curvature of a piece of timber in the direction of its length.



Check

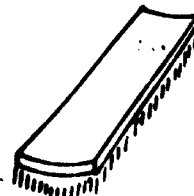
A separation of the fibres along the grain forming a crack or fissure in the timber not extending through the piece from one surface to the other.

Case hardening

A condition of timber in which the outer layers have undergone drying and become set without corresponding shrinkage in the timber as a whole, causing stress between the inner and the outer layers.

Cup

A curvature occurring across the width of a piece.

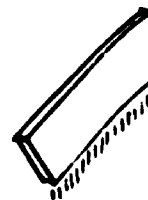


Honeycombing

Separation of the fibres in the interior of the timber induced by drying stresses when the outer layers have become case hardened.

Spring

A curvature of a piece in the plane of its edge.



Split

A separation of the fibres along the grain forming a crack or fissure extending through the piece from one surface to the other.

Twist

Spiral distortion.



Other defects in timber

Blue stain

A bluish discolouration of the sapwood resulting from fungal infection.

Boxed heart

A piece of square-sawn timber cut so that the pith (i.e. first year's growth of the tree) falls entirely within the four surfaces throughout its length.

Share

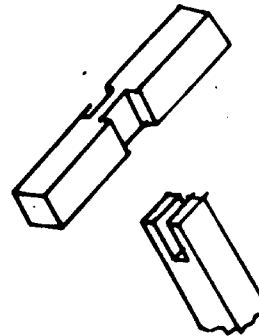
A separation of the fibres along the grain due to stresses developing in the standing tree, or in felling or seasoning.

Joints of furniture

The illustration of joints in this section are diagrammatic and are intended to show only the general form of the joint.

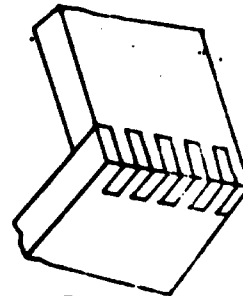
Bridle joint

The timber is generally divided into three in thickness. One piece consists of two bare-faced tenons with a common central shoulder. These fit into a cross-piece which is housed on both sides to take the tenons.



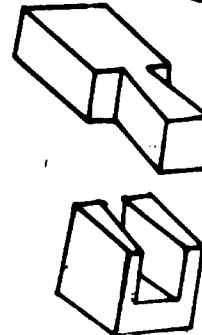
Combed joint

An angle joint in which parts of the meeting sections of the respective members are cut away so that the remaining projections on each fit into the slots formed in the other.



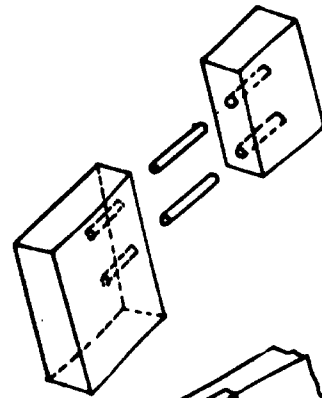
Dovetailed joint

A joint in which a splayed shape, wider at the extreme end than at the shoulder, cut upon the end of one member is fitted into a corresponding recess in another member.



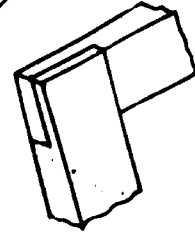
Dowelled joint

A joint in which two members are connected by one or more dowels inserted and glued into counter-balanced drilled holes in the members.



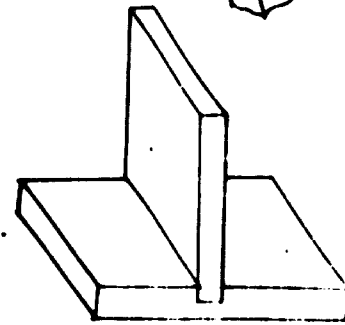
Halving joint

A joint at the intersection of two members of equal thickness, flush with one another, in which half the thickness of each is removed so that they fit together.



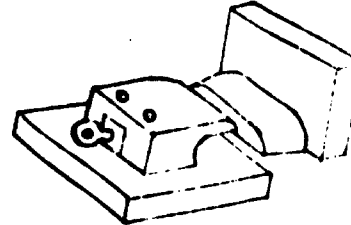
Housed joint

A joint in which the full thickness of the edge or end of one member is inserted in a housing or groove in the other members.



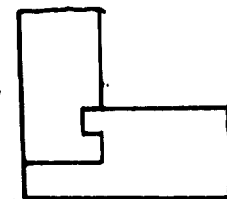
Knock-down fitting

Mechanical method of jointing using a metal fitting and which can be easily dismantled.



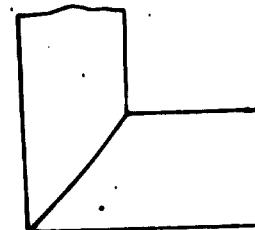
Lock joint

A corner joint used to join two boards at right angles; a groove is cut across the grain of one piece and a tongue is formed on the end of the other piece.



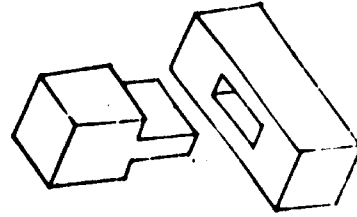
Mitre joint

A joint of two members meeting at an angle whose respective ends are cut to complementary angles and do not pass one another.



Mortice and tenon joint

A joint in which a tenon or projection at the end of one member is close fitted into a mortice or slot cut into the other. The tenon is at least $1/3$ - $3/8$ of the thickness of the other member to be jointed.



Miscellaneous

Arris

A sharp external angle formed by the meeting of two surfaces of a piece.

Carcase

The body, shell or frame of a piece of furniture exclusive of ornamentation, doors or fittings.

Edge veneering

The fixing to an edge of a solid hardwood strip of up to 6 mm thickness.

Kicker

A strip of wood set above a drawer to prevent its tilting when opened.

Laminated wood

An assembled product made up of layers of wood and adhesives in which the grain of adjacent layers is parallel.

Lipping

The fixing to an edge of a solid hardwood strip of at least 6 mm thickness.

Runner

The supports of a drawer side on which the drawer slides.

Sapwood

The outer layers of wood which in the growing tree contained living cells and reserve material (e.g. starch); generally lighter in colour than the inner layer.

Wane

The original rounded surface of a tree remaining on a piece of converted timber.

II. MATERIALS

Timber

The finished timber for use in furniture production shall comply with the following requirements:

Density

Where exposed on the surface, hardwoods shall have a density of not less than 480 kg/m^3 and softwoods shall have a density of not less than 430 kg/m^3 both measured at a moisture content of 8-12 per cent.

Rate of growth

There shall be between 5 and 20 growth rings per 20 mm measured radially.

Moisture content

The timber shall have a moisture content of 8-12 per cent calculated on the dry weight.

Seasoning

Seasoning and conditioning shall be carried out in such a way that case-hardening, honeycombing, bow, cup, spring or twist do not occur.

Slope of grain

For load-bearing structural members the slope of grain shall not diverge from the longitudinal direction of the member by more than 1 in 10.

Knots and knot-holes

Knots and knot-holes shall be completely absent from load-bearing structural members. Sound knots may occur elsewhere provided that they are free from signs of decay, sound across the face, at least as hard as the surrounding wood and do not exceed 20 mm or $\frac{1}{4}$ of the width of the face on which they occur, whichever is the smaller. Cluster or pin knots for decorative purposes may occur in non-load-bearing components.

The timber shall be free from checks, splits and shakes, boxed heart, exposed pith, dead, black or loose knots, knot-holes and wane. It shall also be free from signs of decay and fungal or insect attack; timber affected by "blue-stain" may be used when appearance is not important.

Sapwood of hardwoods such as oak, teak, mahogany and rosewood may be used, provided that it does not detract from the appearance of the furniture.

Plywood

Plywood shall be of balanced construction i.e. it shall contain either an uneven number of plies symmetrically disposed about the centre ply with the grain of adjacent plies perpendicular to the centre ply; or an even number of similarly disposed plies but with the grain of the two middle layers parallel.

Facing plies shall be unjointed and shall be free from knots, surface irregularities, pinholes or patching.

Adhesives used in the construction of plywood shall be at least of type "interior" (INT) conforming to the British Standard 1203:1963 "Synthetic resin adhesives (phenolic and aminoplastic) for plywood" published by the British Standards Institution, London.

Laminated components

Laminated components and associated corewood, where present, shall have no defects of any kind such as knots, checks, splits, shakes or boxed heart. Adhesives shall be at least of type "moisture resistant" (MR) conforming to the British Standard 1204 "Synthetic resin adhesives (phenolic and aminoplastic) for wood, part 2:1965, close-contact adhesives".

Veneers

Veneers shall be free from visible defects or surface irregularities. Backing veneers may contain discolorations.

Blockboard

Blockboard, where used, shall conform to the requirements prescribed in the British Standard 3444:1961 "Blockboard and laminboard" for blockboard faced with grade 1 veneer and bonded with interior (INT) type adhesive.

Particle board

Particle board shall be of the flat pressed type and not of the extruded type. It shall conform either to the requirements for platen pressed particle

board laid down in the British Standard 2604:1963 "Resin-bonded wood chipboard or to the ones prescribed in the German Standard DIN 68761 "Holzspanplatten" published by Deutscher Normenausschuss, Berlin.

Hardboard

Hardboard shall comply with the requirements for hardboard laid down in the Irish Standard 62:1955 "Wood fibre building boards".

Dowels

Dowels shall be made of a hardwood with properties similar to European beech and shall be multi-grooved lengthwise, preferably at an angle of not more than 25° to their axes. The moisture content shall be 3 to 10 per cent calculated on the dry weight.

Plastics laminates

Plastics laminates shall conform to the requirements for the appropriate class of sheet as laid down in the British Standard 3794:1964 "Decorative laminated plastics sheet".

Upholstery fabric

Upholstery fabrics shall conform to the requirements laid down in Irish Standard 169:1970 "Upholstery fabric".

Webbing

Webbing shall be made from flax, hemp or jute and shall conform to the requirements for types 1, 2 or 4 respectively, of the British Standard 2953:1958 "Flax, jute and hemp webbing". Alternatively, polyester fibre webbing of 50 mm width may be used.

Rubberized webbing

Rubberized webbing shall contain a core of cords laid on the bias i.e. with warp and weft threads at an angle. It shall have a breaking strength of not less than 14 newtons per mm of width. In the test the distance between grips shall be 200 mm and the width of the specimen shall be the full width of the webbing.

Rubberized webbing shall be used in accordance with the manufacturer's instructions.

Rubber webbing

Rubber webbing shall have a breaking strength of not less than 20 N per mm of width when tested as described for rubberized webbing. It should be adequately protected against premature degradation and shall be used in accordance with manufacturer's instructions.

Hessian

Hessian cloth shall weigh not less than 300 g per square metre.

Polyurethane foam

Flexible polyurethane foam shall conform to the requirements of the Irish Standard 159:1967 "Polyether type urethane foam for cushioning". Crumbed foam shall be well bonded and shall be free from skin.

Latex foam

Latex foam shall conform to the requirements of the British standard 3129:1959 "Latex foam rubber components for furniture".

Flock for upholstery filling

Flock for upholstery filling shall not contain more than 1.8 per cent soluble extractable matter when tested by the method described in Appendix C

of Supplement No. 1 (1966) of British Standard 1425:1960 "Cleanliness of fillings and stuffings for bedding, upholstery, toys and other domestic articles".

Thread for upholstery

Sewing thread for upholstery shall have a breaking strength of at least 20 N and shall be suitable for the upholstery fabric with which it is used.

Adhesives

The adhesive shall consist of:

(a) Phenolic or aminoplastic gap-filling or close-contact adhesive of at least moisture resistant (MR) type, as defined in the British Standard 1204 - "Synthetic resin adhesives (phenolic and aminoplastic) for wood, part 1:1964 - Gap-filling adhesives and part 2:1965 - Close-contact adhesives";

(b) Polyvinyl acetate conforming to the British Standard 4071:1966 "Polyvinyl acetate (PVA) emulsion adhesives for wood";

(c) Hot melt adhesives for edge lipping of particle board used in accordance with manufacturer's instructions.

Spring wire

All springs shall be manufactured from hard drawn carbon steel wire and shall be given a low temperature heat treatment at approximately 250°C in order to relieve the stresses set up during cooling.

Hardware

All hardware fillings shall be corrosion resistant and shall be suitable for the purpose for which they are used.

III. MANUFACTURE

The manufacturer shall ensure that all the materials used in the manufacture of the furniture comply with the requirements of this specification and shall hold, for inspection purposes, documentary evidence of such compliance. He shall have adequate facilities for the storage of the materials and for the manufacture of the furniture in accordance with this specification. He shall satisfy himself by regular periodical tests that the furniture conforms to the requirements of this specification and shall hold, for inspection purposes, documentary evidence of such compliance with the requirements.

The manufacturer shall, if requested by the purchaser, make good or replace without charge, any article or articles sold as complying with this specification and in which defects appear within 12 months from the date of delivery of the article or articles, provided that in the meantime the article or articles shall have been subjected only to fair wear and tear and reasonable storage conditions.

IV. CABINET FURNITURE

General construction

The carcass of cabinet furniture shall generally be constructed using one of the following three methods of construction or a combination of these: (a) frame; (b) stool; (c) box. The measurements given in this chapter are minimum finished dimensions unless otherwise stated.

Framed construction

A framed construction consists of components which are jointed together. The components are made from frames to which facings are glued or to which panels are set in.

The frames shall be of solid hardwood of 45 mm x 18 mm in cross-section. The joints of the frame shall be mortised and tenoned or doweled; for double-faced frames corrugated fasteners of galvanized steel may be used. Cross rails of 38 mm x 16 mm hardwood shall be used if the area within the frame members is over 0.75 m² and 3 mm plywood is used as facing. Alternatively, if a 5 mm plywood facing is used, the area may be up to 1.1 m² without a cross rail.

The facings shall be of plywood or faced hardwood of 3 mm thickness. Where frames are double faced the closed spaces shall be ventilated. Where glass is used in panelling, the frame shall be made out of show wood. The glass shall be held in place by slips, pinned or screwed to the frames. The adhesive used to attach the facings to the frames shall be of the polyvinyl acetate or urea formaldehyde type.

The components shall be jointed together by one of the following methods:

- (a) Knock-down fittings, not more than 300 mm apart;
- (b) Slips of 18 mm x 18 mm, glued and screwed to both stiles;
- (c) Pocket screws, not more than 300 mm apart;
- (d) Dowelling and glueing.

The length of screw used shall be such that, when inserted, about half of its length is located in each component joined; the point of the screw shall not come closer to the face than 6 mm.

The corners formed by the components shall be finished in such a way that the framing, if not made of show wood, is covered by a lipping or edge veneer. Where facings meet at a corner they shall be mitred to show a clean arris. Components forming projecting tops, unless made of show wood, shall have the edges lipped or veneered.

The edges of all plywood apron pieces, mouldings, shaped tops or bottoms shall be supported all around.

Stool construction

A stool construction consists usually of four main corner posts to which rails are attached, thus giving a rectangular framework.

The joints of the legs to the frame or top shall be of one of the following types: mortice and tenon, bridle joint, halving joint, mitre joint, dowelled joint, housing joint, combed joint or knock-down fitting.

For stool supports for carcasses the legs shall be jointed securely to a base frame or shall form an integral part of the carcass or, alternatively, shall be securely attached to a specially-strengthened part of the carcass. The size and cross-section of the legs and rails shall be related to the type of furniture and to its end use.

The stool bases shall be fixed to the carcasses by pocket screws, dowels or glue blocks.

Box construction

Usually a box construction is used for carcasses. It consists of wide boards jointed at the ends to form a rectangular box-like structure.

Boards of one of the following types shall be used: 20 mm solid timber, 16 mm particle board, 16 mm blockboard or 12 mm plywood.

Nails shall not be used for fixing the structural components together.

Fixed divisions shall not be housed into the face of particle board but may be dowelled or glued into it.

Internal divisions shall be fixed to the outer shell in such a way that the strength of the sides of the carcass is not adversely affected.

Backs shall be grooved in, rebated and screwed or pinned and glued.

Unsupported backs of up to 0.75 m^2 shall be of 3 mm plywood or hardboard and unsupported backs of up to 1.1 m^2 shall be of 5 mm plywood. Backs of greater area shall be supported by muntins (hardwood reinforcing members) or by extruded metal H-sections.

Lipping of edges with wood shall be done in one of the following ways:

- (a) Veneered or edged using at least 0.5 mm veneer;
- (b) Hardwood lip glued to the edge.

Bedsteads

Head boards of bedsteads shall be of solid timber of 18 mm thickness or shall consist of single- or double-faced frames of 40 mm x 14 mm solid timber glued to 5 mm plywood. Where the frame is shaped, the rail shall be not less than 40 mm at any place. Cross rails shall be spaced at not more than 450 mm from centre to centre. The frames shall be mortised and tenoned, dowelled or tongued and grooved. Legs shall be 38 mm x 38 mm. They shall be attached to the head boards by dowels or screwed with at least three countersunk screws.

The rails, if made out of solid timber, shall be 100 mm x 25 mm and shall be attached to the legs by knock-down fittings.

Rails for spring or upholstered bases shall have timber of 38 mm x 25 mm screwed and glued to the inside of the rails to serve as a support for the spring or upholstered base.

Webbed frames shall be made of rails of 75 mm x 50 mm. Two steel U-bars or two 50 mm x 50 mm hardwood rails, reduced in section to allow for depression of the mattress, shall be provided to hold the side rails apart.

Tables

The cross-section of legs for tables having no underframe shall be:

- 45 mm x 45 mm for table tops of less than 1 m^2
- 50 mm x 50 mm for table tops of 1 to 1.5 m^2
- 60 mm x 60 mm for table tops of more than 1.5 m^2

The cross-section of the frame rails for tables having no underframe shall be 90 mm x 22 mm.

Extendable tables shall have a positive locking device to lock the extension into place. Frames for extendable tables and frames of tables with solid timber tops shall be fitted with corner blocks.

Rails of extendable tables shall be supported by corner braces or corner blocks. Tables fitted with drawers shall have rails of 115 mm depth.

Table tops

Table tops of solid timber shall be connected to the frame by a method which permits lateral movement (expansion or contraction).

The thickness of table tops shall be 13 mm for solid timber tops, 12 mm for plywood tops, 13 mm for unveneered particle board tops.

Cross rails shall be used to support the top when the unsupported area of the top is over 0.75 m^2 . Tops shall be secured to the rails by screws. Edges of plywood or particle board table tops shall be edge-veneered with solid hardwood lips of 3 mm thickness.

Components

Shelves

All loose shelves shall be reversible. Solid timber shelves of up to 900 mm length shall be 25 mm thick. Shelves of a length of 900 - 1,200 mm shall be 28 mm thick and longer timber shelves shall be provided with an intermediate support. The thickness and maximum lengths of shelves of plywood or particle board shall be as recommended by the manufacturers.

Drawers

Front

The front shall be of solid hardwood or plywood of 12 mm thickness or of 16 mm thick particle board.

Sides and back

For an internal drawer area of less than 5 dm^2 , 6 mm thick solid wood shall be used, for an area of 5 dm^2 to 16 dm^2 , 9 mm thick solid wood or plywood, and for over 16 dm^2 , 12 mm thick solid wood or plywood.

If the side of the drawer is grooved to take a runner, the side shall be 12 mm thick and the depth of the groove shall be not greater than half the thickness of the side.

Bottom

For internal drawer area of less than 5 dm², 3-mm plywood or hardboard shall be used, for an area of 5 dm² to 16 dm², 3-mm plywood or hardboard, and for over 16 dm², 5-mm plywood or hardboard.

The bottom of drawers wider than 600 mm shall be reinforced with a central muntin (hardwood member) of 45 mm x 16 mm solid hardwood.

Grooves shall be provided in the sides and front to retain the bottom in place. The depth of the groove shall be not more than half the thickness of the sides. Alternatively, drawers may have the bottom grooved half-way into a 9 mm fillet (hardwood strip) glued to the sides.

Joints

Front to side joints shall be dovetailed, lock jointed, comb jointed or dovetail jointed. Back to side joints shall be dovetailed, lock jointed or comb jointed; the back may also be held in grooves of a depth which is half the thickness of the sides; the grooves shall be 12 mm in from the ends of the sides.

Kickers and runners

Kickers and runners shall be of hardwood to resist wear. Runners underneath the drawer shall be at least of such thickness as will support fully the drawer sides. Inserted-type runners shall project into the grooves to not more than half the thickness of the sides. They shall be pointed and glued to the carcass and shall extend the full length of the drawer. The depth of runners, whether below or grooved into drawer sides, shall be 6 mm for drawers of an area under 5 dm², 12 mm for drawers of an area of 5 dm² to 16 dm², and 18 mm for drawers of an area greater than 16 dm².

The wearing surfaces of runners, kickers and drawer sides shall be treated with wax or some other suitable material to improve the sliding properties.

Pulls or handles

Pulls or handles shall be of adequate strength and may be of either the sunken or plant-on type. Drawers of over 600 mm width shall be provided with two-handed-grip plant-on handles.

Stops

One stop shall be fitted at each side of the drawer within 50 mm from the corner at the front or at the back of the drawer.

Clearance

The clearance between the back of the drawer and the carcass shall be not more than 25 mm unless the overall depth of the drawer would be more than 400 mm.

Doors and falls

The thickness of doors and falls shall be:

- 15 mm for particle board and an area of 36 dm^2 and under
- 13 mm for particle board and an area over 36 dm^2
- 12 mm for plywood and an area of 36 dm^2 and under
- 16 mm for plywood and an area over 36 dm^2
- 15 mm for blockboard
- 20 mm (finished thickness) for double or single flush doors
- 18 mm for solid timber framed panelled doors.

Particle board, if hinged on the edge, shall be fitted with a 12 mm lipping.

Three hinges shall be provided for doors with a height of over 900 mm; alternatively, a single piano hinge may be used for all doors, in which case particle board need not be lipped.

Closures

Doors over 1,200 mm high shall be fitted with one closure each at the top and at the bottom, or one at or near the centre. Falls shall be similarly fitted with closures.

Sliding doors

If possible sliding doors shall have a height to width ratio of 9 to 5. The sliding mechanism shall operate smoothly. The bottom of the doors shall be fitted with wear-resistant smooth-running fitments and the upper surface of the bottom frame shall be similarly equipped.

All unframed glass such as for shelves, sliding doors or table tops shall be of 6 mm plate or float glass.

Dimensions of cabinet furniture

Wardrobes

Wardrobes shall have a clear internal depth of 480 mm for face hanging of garments and 530 mm for side hanging of garments. They shall have a hanging height of 1,500 mm; for men's wardrobes the hanging height shall be 1,350 mm.

Chests of drawers and dressing tables

Chests of drawers and dressing tables of 900 mm width and over shall have an internal depth of 430 mm and those less than 900 mm wide shall have a depth of 400 mm.

Bedsteads

The length provided for sleeping shall be 1,930 mm for all types of bedsteads, and the width of the sleeping space shall be 900 mm.

V. CHAIRS

Construction

Dining chairs

Frame

In the construction of dining chairs, mortice and tenon joints or combed joints should be used wherever possible; in joining the side rail to the back leg, however, mortice and tenon joints only shall be used. Dowel joints may be used to connect the side rail to the front leg and for front and back rails, provided that a joint using three dowels can be achieved.

If the chair legs are of less than 625 mm^2 in cross-section an underframe shall be used, preferably all around, but at least joining the back to the front legs. For chairs with arms, however, no underframe is needed. If the chair leg is attached to one rail only it shall be joined by a mortice and tenon joint which is pinned by a dowel perpendicular to the joint.

The underframing connecting the back and front legs shall be mortised and tenoned at both joints and shall have a cross-section of 560 mm^2 .

Drop-in and covered seat

The seat shall be constructed of a 6 mm thick laminated timber or of a dowelled frame having a cross-section of 48 mm x 16 mm. The gap between the seat and the chair frame shall not exceed 1.5 mm when the seat is in place. If a laminated seat is stuffed over it shall be vented.

All dining chairs, except those with solid seats, shall have corner blocks which shall be fixed by rebating or by gluing and screwing or have gussets glued into grooves.

Un-upholstered seat

If the seat forms part of the fixed structure of the chair, it should be made of 6 mm thick laminate supported by rails. If edge-jointed solid timber is used, it shall form part of the structure and the legs shall be fixed to it directly by dowelling or tenoning.

Easy chairs

Dowel joints may be used for all joints provided the height of the seat rails of the chair does not exceed 350 mm. Where the seat rails are higher than this, the side rail shall be connected to the back by mortice and tenon joint.

All rails carrying springing or webbing shall be constructed from close-grown hardwood with good tack-holding properties, at least comparable to beech or birch, and shall be 35 mm x 22 mm in cross-section.

Settees

Timber for rails shall be either 47 mm x 47 mm or 75 mm x 32 mm.

Dowel joints, preferably with three dowels, may be used; where two dowels are applied they should be situated at the top and the bottom of the rail. All joints shall be braced, preferably by corner blocks which should be glued and nailed, or by metal braces.

For settees of a width of 900 mm to 1350 mm, a cross rail of 75 mm x 32 mm or 43 mm x 43 mm cross-section shall be inserted at the centre of the base. The cross rail should be dipped to allow for depression of the springing or webbing. Settees that are wider than 1350 mm shall be fitted with at least two dipped cross rails and an extra pair of legs forming an integral part of the frame structure.

All load-bearing rails shall be made of close-grained hardwood similar to beech. Arms on fully-upholstered settees shall be planed and all arrises rounded to prevent wear of the filling and cover. Backs should form an integral part of the structure and shall be fixed at least at three points. Dowel joints shall be used throughout. The rails shall be 44 mm x 44 mm. The section of bearing members at ground level shall be 38 mm x 33 mm.

Adhesives

For chair joints a gap-filling urea formaldehyde adhesive shall be used in accordance with the manufacturer's instructions. Other adhesives may be used provided that they have equivalent properties of strength and durability.

Upholstering

General assembly

The edges of the front, arm and back frame shall be covered with 25 mm foam, with papercord or with wadding to prevent wear of the covering. Where loose cushions are used over serpentine or tension springs which might damage cushion covers, a layer of felt with quilted-on upholstery fabric shall be attached to the webbing.

Arms shall be padded inside and on top. The covering material on the inside arms of fully upholstered settees shall be supported by webbing.

Upholstery fabric

The fabric used to upholster all parts of chairs and settees, with the exception of the bottoms, shall conform to the requirements of Irish Standard 169:1969 "Upholstery fabric".

Webbing

Jute, hemp or flax webbing shall be attached to the frame at each end with five 12 mm long tacks, and at least two of the tacks shall be driven through a double layer of the webbing. By means of a web strainer the webbing shall be stretched to the full limit.

The number of webbings used for a settee or chair seat shall be the following:

- (a) For settees: not less than twelve lengths of webbing from back to front and five from side to side;
- (b) For easy chairs: not less than five lengths of webbing each way;
- (c) For spring-seated dining chairs: (i) slip-in type - not less than two lengths of webbing each way, (ii) stuff-over type - not less than three lengths of webbing each way.

Rubberized webbing or rubber webbing

Rubberized webbing or rubber webbing shall be used in accordance with the recommendation of the manufacturer or supplier, particularly in regard to the method of attaching, tensioning and spacing of strands.

Serpentine (no-sag) springs

Fixing

Springs shall be attached to the front and back rails, i.e. transversely. All steel fixing clips shall be wrapped with fabric to avoid metal-to-metal contact and to prevent squeaks. Brass clips may be used without fabric insulation.

Number and dimensions of springs

The following number and size of strands shall be used in serpentine springing for any chair or settee:

- (a) Dining chairs: a minimum of three strands 11 SWG (2.95 mm); the strands need not be cross-clipped;
- (b) Easy chairs: a minimum of five strands 9 SWG (3.66 mm) for seats and a minimum of four strands 12 SWG (2.64 mm) for the back. Only the strands of the seats need to be counter or cross-clipped;
- (c) Settees: for seats of settees measuring 1,400 mm between the arms a minimum of twelve strands 10 SWG (3.25 mm) shall be used. For each 125 mm of length below or above 1,400 mm, the number of strands shall be reduced or increased by one. All strands shall be counter or cross-clipped. For the backs of settees measuring 1,400 mm between the arms a minimum of eleven strands 12 SWG (2.64 mm) shall be used. For each 125 mm of length below or above 1,400 mm the number of strands shall be reduced or increased by one. These strands need not be counter or cross-clipped.

Tension springs

Fixing of springs

Tension springs shall be fixed securely to ensure adequate strength and to avoid damage to the upholstery. They shall be continuous between the points of fixing to frame and no metal extensions shall be substituted for any portion of the spring. The amount of stretch in a spring, when fixed, shall be between 35 and 50 mm.

Dimensions and number of springs

The wire used in tension springs shall be at least 16 SWG (1.63 mm) for seats and at least 20 SWG (0.91 mm) for backs.

The coil diameters of tension springs shall be:

- for seats 12 mm when made of 14 SWG (2.03 mm) wire,
and 9 mm when made of 16 SWG (1.63 mm) wire;
- for backs 9 mm when made of 18 SWG (1.22 mm) wire,
and 6 mm when made of 20 SWG (0.91 mm) wire.

The following number of tension springs shall be used for chairs or settees:

- (a) Easy chairs: for seats at least nine tension springs shall be used. If the springs are attached to a steel frame, the number of springs may be reduced to six for seats of 500 mm x 500 mm and under and to eight for seats of a size up to 580 mm x 530 mm. For backs at least eight tension springs shall

be used. If the springs are attached to a steel frame the number of springs may be reduced to five;

(b) Settees: for seats of settees measuring 1,200 mm between the arms at least 21 tension springs shall be used. For each 150 mm of length below or above 1,200 mm the number of springs shall be reduced or increased by three. For backs of settees measuring 1,200 mm between the arms at least 16 tension springs shall be used. For each 150 mm of length below or above 1,200 mm the number of springs shall be reduced or increased by two.

Spring cushion units

The minimum number of compression springs for open-type spring cushion units shall be 24 springs 100 mm x 13 SWG (2.34 mm); for bagged or pocketed units a minimum of 30 springs 125 mm x 14 SWG (2.03 mm) shall be used, either clipped or sewn.

Latex or polyurethane foam cushions shall be not less than 12 mm from the edges of the sewn cushion material, and the thickness of the foam units shall be the same as that of the sewn cushion borders. Where rubberized hair is used in conjunction with latex or polyurethane foam, it shall be firmly attached with adhesive solution to each surface of the foam unit.

Dimensions

Dining chairs

The height of un-upholstered or fully-depressed upholstered seats shall be 430 mm to 460 mm.

Easy chairs

Easy chairs shall have a width of 460 mm and a depth of 495 mm.

Settees

The width of seat at the front, excluding the arms, shall be 900 mm for two-seater settees and 1350 mm for three-seater settees. The depth of the seating area shall be 460 mm.

VI. WORKMANSHIP AND FINISHING

Factory

The factory shall be clean and shall have provision for the removal of dust and chips and shall be well lighted. Means for measuring the moisture content of the air shall be available.

Machining

The machining of woods shall be done precisely and without defects. Special attention shall be directed to the accurate and careful execution of construction and joints.

Joints and gluing

All joints shall be close and without gaps. Joints shall be free from visible splittings, cracks or other defects as a result of jointing. They shall be hand tight and well glued using the required adhesive and following any instructions provided by the manufacturer. All surplus adhesive shall be wiped off.

Veneering

It is important that the room where veneering is done should be free from dirt, dust and draught; the air should be dry.

All veneered man-made boards shall have a balancing backing veneer of similar weight, with the grain running in the same direction. Joints in veneers shall be free from filler.

Finishing

The finishing area shall be kept free from dust and dirt. All furniture shall be free from direct saw marks or rough wood, even in places that are not normally visible. All surfaces shall be planed except the carcass of upholstered furniture. All interior surfaces shall be sanded and coated with sealer, lacquer, or an equally suitable finish to ensure cleanliness and ease of cleaning. Upholstered frames shall have clean surfaces and all edges shall be rounded.

VII. PERFORMANCE REQUIREMENTS

Cabinet furniture (excluding tables)

Static load test

Each horizontal surface and load bearing area greater than 2.25 dm^2 , including glass surfaces, shall be capable of sustaining for one minute the loads set out for the type of surface in the table below when distributed over an area not larger than 150 mm x 150 mm and tested as described in annex I.

Static load tests for cabinet furniture, excluding tables

Type of surface	Load to be sustained by an area of 150 mm x 150 mm (kg)
External horizontal surfaces and bearing areas less than 900 mm above the ground	100
External horizontal surfaces and bearing areas more than 900 mm and less than 1,350 mm above the ground	75
External horizontal surfaces and bearing areas 1,350 mm or more above the ground	25
Case bottom with unrestricted height above it of 1,200 mm or more	75
Case bottom with unrestricted height above it of between 900 mm and 1,200 mm	50
Case bottom with unrestricted height above it less than 900 mm	25
Bottom of drawer or tray with side over 150 mm high	12.5
Bottom of drawer or tray with side 150 mm high or less	6.25
All other horizontal surfaces and bearing areas larger than 2.25 dm^2 other than glass surfaces	12.5

Shelves, drawer bottoms and rails shall comply with the requirements set out below when tested as described in annex I.

For shelves the deflection of the front edge of the shelf under the prescribed static load shall not exceed $1/200$ of the length of that edge, or 3 mm, whichever is the greater. If a shelf has two exposed unsupported edges,

i.e. a front edge and an end edge, the deflection of any point of the exposed edge of the shelf under the load shall not exceed $1/200$ of the sum of the lengths of the adjacent exposed unsupported edges, or 3 mm, whichever is the greater. In addition, the surface of the shelf shall nowhere be inclined to the horizontal with a slope of more than 6 in 100, with the shelf either loaded as above, or unloaded.

The deflection of the drawer bottom when loaded shall not be such as will prevent the free movement of the drawer.

Hanging rails and shoe rails shall support for one minute a load concentrated at the midpoint of the unsupported length of 360 g per 10 mm of length and 130 g per 10 mm of length respectively. The deflection of a hanging rail under this load shall not exceed 0.15 mm for each 10 mm of total length of rail. Each hook shall support for one minute a load of 5.5 kg.

Flexibility

When articles of furniture are tested as described in annex I, the second flexibility measurement shall be not less than $W \times 0.01$ mm, where W is the width of the carcass measured to the nearest 10 mm. Should the second flexibility measurement exceed $W \times 0.04$ mm that piece of furniture shall not be deemed to comply with the requirements of this specification unless the difference between the second and the first flexibility measurements does not exceed $W \times 0.004$ mm or 25 per cent of the first flexibility measurement, whichever is the larger.

This requirement for flexibility shall not apply to articles of furniture having either a depth or a width of less than 500 mm and the other horizontal dimension being less than 150 mm. However, such articles of furniture shall conform to the requirements for freedom from defects after testing as set out below.

Overbalancing and free action of components

Articles of furniture shall not overbalance with loads applied or after removal of the loads when tested as described in annex I. Drawers, trays, doors and falls shall open and close freely before loading for the test, while the article of furniture is loaded, and after unloading. This requirement for compliance with the test for overbalancing shall not apply to articles of furniture supplied with means for fixing and which are so labelled.

Requirements for components

Drawers, trays, hinged or pivoted doors or falls shall comply with the tests for components described in annex I without developing defects in themselves or in their fittings, in the carcass or the carcass fittings. A friction controlled mirror shall remain in any position in which it is placed within any limits imposed by its design. Sliding doors and friction controlled mirrors shall not require a force of more than 36 N to move them in their direction of travel when tested as described in annex I. A clamped mirror shall withstand, without moving, a force of 36 N applied in the direction of its normal action.

Freedom from defects after testing

Articles of furniture shall be capable of withstanding the tests for flexibility and overbalancing described in annex I without developing a fracture or an apparent loosening of a joint intended to be rigid, without any deformation which would adversely affect any of the functions or the appearance of the article and without developing a gap which becomes apparent at the end of the tests that was not apparent at the beginning. Furthermore, in such tests no flaw or gap or looseness in a joint intended to be rigid shall have increased as a result of the tests.

Bookshelves

Bookshelves shall be capable of sustaining a uniformly distributed load of the intensity set out below for a given depth of the shelf, for a period of 6 weeks without developing a deflection at the midpoint of its front edge of more than 3 mm per 1 metre length of shelf and without permanent distortion of the shelf or its supports.

<u>Depth</u> <u>(mm)</u>	<u>Loading per dm of length</u> <u>(kg)</u>
less than 180	2.5
between 180 and 220	3.5
greater than 220	4.5

Tables^{1/}

General requirements

The leaves, flaps or extensions of extendable tables shall operate smoothly. The table tops and the tops of any flaps or extensions in the open or extended position, when the table is standing on a flat horizontal surface, shall not differ in height at any two adjacent points by more than 2.5 mm unless the design of the table is such that the flaps or extensions are not intended to be of the same level as the table top.

Storage fitments and components

If a table includes in its structure an enclosed space such as a drawer or cupboard to which there is normal access and which has a volume greater than the area of the extended table top in square decimetres multiplied by 1.5, the table shall be capable of withstanding the requirements for flexibility of cabinet furniture set out above. Also each drawer, tray, door and shelf of the table shall comply with the requirements set out for such components of cabinet furniture.

Static load tests

The table tops shall be capable of sustaining for one minute the load set out below a given area of the table top when distributed over an area not larger than 150 mm x 150 mm and tested as described in annex II. Furthermore, in the course of application of the load, no part of the table flap or extensions adjacent to another edge shall rise or fall more than 6 mm in relation to the adjacent edge.

<u>Area of table top excluding flaps and extensions (dm²)</u>	<u>Load (kg)</u>
32 or more	100
16 to 32	50
less than 16	25

Overbalancing

Tables should be capable of withstanding for one minute without overbalancing, the test described in annex II.

^{1/} In this section the term table is conceived as including trolleys.

Deflection

Table tops other than glass tops and each flap or extension shall be capable of withstanding a static load of 10 kg separately applied to any point of the surface as described in annex II without causing a deflection exceeding $(L + W)/600$ when L and W are the length and width in millimetres measured to the nearest 10 mm of the structural unit i.e. table top, flap or extension.

Rigidity of construction

Tables supported by four fixed legs or equivalent supports shall comply with the following: when tested as described in annex II none of the four horizontal movements shall exceed a value of 0.25 mm for each 10 mm of height of the table top from the ground and neither the differences between the first and second horizontal movements nor between the third and fourth horizontal movements shall exceed 0.05 mm for each 10 mm of height of the table top.

Tables supported by three fixed legs or supports shall be capable of complying with the following: when tested as described in annex II none of the first or second horizontal movements for each of the three sets of tests shall exceed a value of 0.25 mm for each 10 mm of height of the table top from the ground and the difference between the first and second horizontal movements in each of the three sets of tests shall not exceed 0.05 mm for each 10 mm of height of the table top.

For tables supported by more than four fixed supports the requirements and tests shall be similar to those for tables with three supports or legs.

Tables with fixed legs or supports and having in addition gate legs or similar moveable members for supporting leaves or flaps shall be constructed in such a way that the gate legs shall comply with the test for such components given in annex II, without developing a fracture or apparent loosening of any joints intended to be rigid or any deterioration which would adversely affect the appearance or the free movement of the gate leg. The stop for the gate leg in the open position shall be adequate to restrain the leg during the test.

Tables with moveable legs or supports and no fixed legs, such as those with four gates and tables with two fixed legs and two gates or similar arrangements for supporting the table shall comply with the requirements given above for tables with four fixed supports.

Where gate legs or similar moveable supports for tables are required to withstand the rigidity test for fixed legs or supports, such components shall not be required to comply with the requirements for gate legs too.

Finish of table tops

The finish of table tops, including dressing table tops, shall be such that the table top (or a panel of 250 mm x 360 mm composed of the same material as the table top and having the finish used for the table top applied to it) shall comply with the following requirements:

(a) Resistance to wet heat. When tested in accordance with British Standard 3962, "Methods of test for clear finishes for wooden furniture, part 2:1961, resistance to wet heat", at a temperature of 35°C, the surface finish shall have a mean rating of not greater than 1.5 and shall show no whitening;

(b) Resistance to dry heat. When tested in accordance with British Standard 3962, "Methods of test for clear finishes for wooden furniture, part 3:1961, resistance to dry heat", at a temperature of 160°C, the surface finish shall have a mean rating of not greater than 1.5 and shall show no whitening;

(c) Resistance to liquids. When tested in accordance with British Standard 3962, "Methods of test for clear finishes for wooden furniture, part 4:1970, resistance to liquids", for resistance to potable spirits, toilet spirits, tea and coffee, the surface finish shall have a rating of 3 or better and shall show no colour change.

Chairs and settees

Stability requirements

When tested as described in annex III, chairs and settees shall not overbalance forwards, rearwards or sideways. The requirement for rearwards overbalancing shall not apply to stools without back and the requirement for sideways overbalancing shall not apply to chairs without arms.

Strength requirements

Chairs and settees shall be capable of withstanding the tests stated in annex III without developing during the test:

- (a) Any fracture or loosening of any joint intended to be rigid;
- (b) Any free movement in the back, arms or legs of the article, which is noticeably greater in the final inspection than in the initial inspection;
- (c) Any deformation in any part which will adversely affect the appearance or the function of the article or any other undesirable features including noise.

VIII. FREQUENCY OF TESTS, MARKING, INSTRUCTIONS FOR END USER

The manufacturer shall satisfy himself by regular periodical testing that the furniture complies with the requirements of this specification and shall hold available for inspection by the purchaser, if requested by him, copies of certificates of the results of such tests.

Any article of furniture purporting to conform to the requirements of this specification shall have stamped on it, by burning or other equally durable method, a reference to this specification and a means to identify the manufacturer. This marking shall be in an inconspicuous place.

Where furniture has to be assembled by the purchaser the manufacturer shall provide clear instructions for such assembly.

The manufacturer shall also provide recommendations for the care and maintenance of the furniture and in particular warnings against the use of cleaning or polishing materials known to be harmful to the finish of the furniture.

Annex I

PERFORMANCE TESTS FOR CABINET FURNITURE
OTHER THAN TABLES

Checking of moisture content

The moisture content of articles of furniture to be tested shall be determined by an electrical resistance moisture meter. If the reading is less than 12 per cent the tests may be carried out. If the reading is greater than 12 per cent the reading shall be noted. The article of furniture shall be allowed to dry out gradually in a warm ventilated room until the moisture content is below 12 per cent. Such furniture shall be tested within eight hours and shall not be exposed to extreme conditions of temperature or humidity during testing.

Initial inspection

The article of furniture shall be carefully inspected for flaws, gaps, looseness of joints or any other defects likely to affect adversely the functions or the appearance of the article. Any such defect shall be noted and, if possible, measured. Doors and falls shall be examined for squareness, closeness of fit and proper closing. All drawers, hinged or sliding doors, falls, adjustable mirrors or other moveable parts shall be examined for smoothness and freedom of the action. Any lack of smoothness or malfunctioning shall be noted.

Static load test

A piece of heavy plywood or blockboard of 150 mm x 150 mm shall be used to apply the load. If the required solid weights are not available, a suitable container filled with heavy metal filings or lead shot of the correct weight may be used as the test load. If the horizontal surface to be tested has a laid-on glass top over a wooden or similar surface, the glass shall be removed during this test.

The article of furniture shall be put on a level ground. The 150 mm x 150 mm piece of wood shall be placed at the centre of the horizontal surface

to be tested and the specified test load put on it. The load shall be left in a position for 1 minute. The same load shall be applied for 1 minute at a sufficient number of other places on the surface with the exception of the following: the load should not be applied at any position where the centre of the 150 mm x 150 mm area is within 225 mm of the edge of the surface, except where the surface is less than 450 mm in width. Also, the load should not be applied at positions where it would cause the article to overbalance.

When testing shelves, the length of the longest unsupported edge of the shelf shall be measured and noted. If the shelf has two adjacent unsupported edges the length of the second unsupported edge shall be measured too. One twohundredth part of the length or of the combined lengths shall be calculated and noted. The specified load shall be applied as described above. The greatest deflection of the front edge of the shelf when under the load shall be measured to the nearest 0.5 mm. The slope of the shelf surface when loaded shall be checked to determine if it is greater than the specified maximum permissible slope. For this purpose any convenient article that will be on the point of overturning when put on a slope of 6 in 100, may be placed on the shelf. This device shall be placed in various positions on the shelf when the load is moved into different positions.

When testing drawers or trays the load shall be applied when the drawer or tray is opened to two thirds of its depth, that is with one third of the drawer or tray remaining in the carcass. The loaded drawer or tray shall be moved to check if the deflection of the bottom impedes the free movement of the drawer or tray. If the movement is found to be impeded this shall be noted.

When testing hanging rails and shoe rails, the unsupported length of each rail shall be measured and the specified load shall be hung for one minute at the mid point of its unsupported length. The maximum deflection of the rail under the load shall be measured using a suitable type of gauge and the deflection in millimetres per 10 mm of the total length of the rail shall be calculated.

Each hook shall have a load of 5.5 kg applied to it for one minute and any signs of failure shall be noted.

Flexibility test

Corner support of a cabinet

By corner support the base of the leg or the corner of the supporting base of the cabinet is meant. Domes shall be fitted to the corner supports of the cabinet to be tested. The domes shall be of such a size and shape that, when placed on a 12 mm wide hole in a metal plate, half of the height of the dome will be below surface of the plate.

Apparatus

An apparatus such as the one described in the appendix to the British Standard 1960: "Domestic furniture, part 2: 1953, Cabinet goods for storage purposes" is suitable for carrying out this test. The apparatus consists of three supports of equal height (A, B and C) and a fourth (D) of adjustable height, which are placed on a level surface.

Each of the supports A, B and C consists of a wooden block with a metal plate fixed to its upper surface. The plates on supports A and B have plain upper surfaces and the plate on support C has a hole in the centre of 12 mm diameter. The upper edge of the hole is bevelled. The adjustable support D also contains a metal bearing plate having a slot in the centre with the upper edge of the slot bevelled. The slot shall be approximately 12 mm x 25 mm. Support D is carried on a lever by which the support may be raised or lowered. A jack is placed under the lever, directly below the bearing plate. The upper end of the jack shall be positively located in the lower face of the lever. The jack is provided with a means of measuring the amount of vertical movement of the bearing plate and is so arranged that movement of the jack ram does not exert a force on the lever fulcrum. The measuring device should read to at least 0.02 mm. Means shall be provided to restrain the four supports from moving laterally.

By means of a low voltage electric circuit the two plain bearing plates (A and B) and the two domes, which will rest on them in the test, are connected in series with a low voltage power source and an electric light bulb, which indicates that either of the two domes has been raised off its bearing plate.

Loading weights in the form of metal plates, tiles or slabs of any convenient material shall be available.

Setting up for testing

The four domes shall be attached to the corner supports of the cabinet to be tested. The domes to be fitted to the two supports, which are the more lightly loaded of the four, shall be connected electrically by nipping the bared cable between them and the edge of the corner support. The four supports (A, B, C and D) are placed under the domes on the cabinet in such a way that the two more lightly loaded corner supports are resting on the centres of the plain supports A and B, the third is resting on the bevelled hole in the bearing plate of support C and the fourth on support D. The fourth support shall then be restrained from moving laterally.

Hinged doors and falls of the cabinet shall be opened to approximately 90° and fixed in this position with adhesive tape or by any other convenient method. Moveable mirrors shall be fixed to hang vertically.

Loading of cabinet

The horizontal surfaces of the cabinet shall be loaded to an extent depending on the unrestricted height above the surface in question. The load shall be the following:

(a) For drawer bottoms: $h \times 3.25 \text{ g/dm}$ (where "h" is the side or front of the drawer);

(b) For other horizontal surfaces for which the unrestricted height (H) above the surfaces is 600 mm or less: $\frac{1}{2} H \times 3.25 \text{ g/dm}$ and if the unrestricted height is above 600 mm: 970 g/dm .

Loads shall be applied to the fixed horizontal surface using convenient material to achieve the required intensity of loading over the area; however, an unloaded margin of not more than 75 mm may be left around the edges.

Drawers and trays shall be replaced by sheets of plywood of the same size as the drawer or tray bottom and the required loading shall be placed on them. On each hanging rail a load equivalent to 250 g for each 10 mm length of the rail shall be applied by evenly spacing concentrated units of 1.5 kg each along the rail. Show rails shall be loaded in the same way but with a load equivalent to 25 g for each 10 mm length of the rail.

A weight of 2 kg shall be hung on every hook.

Checking before testing

The jack shall be lowered sufficiently to allow the diagonally opposite corner support (B) of the article to rise free of its support. This will break the electric circuit and the light bulb will go out. If corner support B does not rise but corner support D hangs freely when the jack below it is lowered, this indicates that the two more lightly loaded legs have not been placed on supports A and B and therefore the cabinet will have to be turned around on the supports, facing in the opposite direction.

First racking

The jack shall be lowered sufficiently under the lever to allow the diagonally opposite corner support of the article to rise free of its support and the lever shall be raised until the indicating light comes on. The lever shall be raised further until the indicating light is extinguished and then lowered until the light is extinguished a second time. These movements shall be repeated five times. The raising and lowering shall be done at a rate not exceeding eight times per minute.

First flexibility measurement

Care shall be taken that the ram of the jack is positively located in the lever. The jack shall be raised until the dome on corner support B is just touching the metal plate of support B. This stage will be shown by the lighting up of the bulb. A reading of the position of the jack shall be taken. Raising of the jack shall be continued at a steady rate until the light goes out again indicating that the dome on corner support A has lifted off its support. The jack shall be held in this position for 15 seconds leaving the corner support A hanging freely. The jack shall then be lowered until the light comes on again. The position of the jack shall then be read. The first reading shall be subtracted from the second, and the difference, which gives the total movement of corner support D, shall be noted. This procedure shall be repeated twice and the mean of the final two noted readings shall be taken as the "first flexibility measurement".

Second racking

The jack shall be lowered until the light is extinguished. The lever shall be operated by hand to raise each of the corner supports A and B in turn from its support 50 times. The raising and lowering shall be done steadily at a rate not exceeding eight cycles per minute.

Second flexibility measurement

The flexibility shall be measured as described for the first flexibility measurement taking the mean of the final two measurements as the "second flexibility measurement".

Test for overbalancing and free action of components

Following the second flexibility measurement all the drawers and trays in the cabinet shall be replaced and the loads on the pieces of plywood transferred to the drawer and tray bottoms.

With all the doors still held open at 90°, all drawers and trays shall be opened to two thirds of their depth. Loaded hanging rails shall be fully extended. It shall be noted whether the article of furniture overbalances. The loaded cabinet shall then be examined for freedom of movement and proper functioning of drawers, trays, doors and falls.

Finally all loads shall be removed, drawers and trays opened to two thirds of their depth as before and all hanging rails fully extended. It shall be noted again whether the article of furniture overbalances and all drawers, trays, doors and falls shall again be checked for freedom of movement and proper functioning.

Tests on components

The article of furniture shall be free from all loads. Glass shelves shall be removed during these tests.

In testing drawers and trays, the article shall be arranged in such a way that the normal direction of motion of the drawer or tray front is vertically downwards. Each drawer or tray shall be opened to one third of its depth

and allowed to fall freely. This operation shall be repeated 10 times. Each drawer or tray and the drawer supports in the carcass shall then be examined and any flaws or defects which have developed as a result of the test shall be noted as well as any lack of freedom of movement.

In testing hinged or pivoted doors, the article shall be arranged in such a way that the doors, in the closed position, are horizontal. Doors made of glass and doors with glass panels shall not be subjected to this test. Each hinged or pivoted door shall be opened and be allowed to fall freely through 90° to the closed position. If the article has more than one door, each door shall be tested separately with the other door or doors held open, except that the underlapping door of a pair of doors which overlap one another shall be closed while the overlapping door is tested. This operation shall be performed 50 times for each door. The doors and their hinges shall be examined and any flaws or defects developed as a result of the test shall be noted.

In testing falls, the article of furniture shall be placed so that the plane of the fall when closed is horizontal. The fall shall then be opened to 90° and allowed to fall freely back to the closed position. This procedure shall be performed 50 times for each fall. The article of furniture shall then be placed in the normal position and the fall shall be allowed to fall freely through 90° to the open position. During this test all non-automatic stops shall be in the open position. This operation shall be performed 50 times for each fall. Each fall and its hinges and stops shall be examined and any flaws or defects developed during the tests shall be noted.

Freedom of movement of sliding doors shall be tested by means of a spring balance or other suitable means. The force required at the handle to move the door in the direction of travel shall be measured and expressed in newtons (N).

Each friction controlled mirror shall be examined to see if it will remain, within the limits imposed by its design, in a given position in which it is placed. The force, which if applied to a point at one of the extreme edges of the mirror furthest from the hinge line, will move the mirror in the direction of normal movement, shall be measured with a spring balance. For mirrors fitted with a clamping mechanism, the clamp shall be tightened and a force of 36 N shall be applied to various points at the edge of the mirror furthest from the hinge line. Should the mirror move under the action of the force this shall be noted.

Final inspection

The article of furniture shall be examined as in the initial inspection and any increase in the size of flaws or gaps, increased looseness of joints intended to be rigid or any other defects shall be noted as well as any deterioration of the appearance or of the functioning of the article of furniture or of its components.

Annex II

PERFORMANCE TESTS FOR TABLES AND TROLLEYS

Checking of moisture content

The procedure described in the section "Checking of moisture content" of annex I shall be followed.

Initial inspection

The tables shall be carefully inspected and any apparent defects noted. For extendable tables the leaves and flaps shall be examined for freedom of action and any lack of freedom shall be noted. The weight of the table shall be determined.

Static load test

A 150 mm x 150 mm piece of heavy plywood or blockboard shall be used to apply the load. If solid weights of the specified weight are not available heavy metal filings carried in a suitable container may be used as the test load. The table shall be placed in its normal position on a level surface with all its extensions in the fully open position. The 150 mm x 150 mm piece of wood shall be placed in the centre of the table and the specified load shall be applied to it and left in position for one minute. The same load shall be applied for one minute each to a sufficient number of other places on the surface to ensure that the table will withstand the load anywhere on the surface. The load shall not be applied to flaps or extensions or to any area of the table where its application causes the table to overturn.

Deflection

An apparatus such as the one described in British Standard 1960, part 3:1963, amendment No. 2 is suitable for carrying out this test. The table shall be placed on a level surface with all extensions in the fully open position. The width and length of the table top and of its flaps and extensions, if any, shall be measured separately to the nearest 10 mm. The table top and

each extension and flap shall be tested separately. A straight edge shall be placed across the edges of the table extension or flap and the maximum deflection caused by a weight of 10 kg placed at any part of the surface shall be measured. The test shall be repeated at a sufficient number of places to ensure that the maximum vertical deflection at any point relative to the table top, flap or extension has been measured. The result for the table top, extension or flap shall be compared with the value obtained by adding the length and breadth in millimetres and dividing it by 600.

Overbalancing

The overall height of the table top shall be measured to the nearest 10 mm. For tests on trolleys, the castors on the parts of the trolley nearest the point where the load is applied shall be turned inwards.

For tables having a height of 700 mm and more and an area of the top (excluding extensions or flaps) of 32 dm^2 or more, two wood blocks of 100 mm x 50 mm with centres 350 mm apart shall be placed as near as possible to the edge of the table or of any extension or flap. A 10 mm bearer shall be placed across these two blocks, at the midpoint of the bearer a weight of 12 kg shall be applied for one minute and the table observed to see if it will overbalance. This test shall be repeated at a number of positions along the edge of the table and of its extensions and flaps.

For tables having a height of less than 700 mm or an area of less than 32 dm^2 , a single load equal to half the weight of the table or 5.5 kg, whichever is the less, distributed over an area of 50 mm x 50 mm shall be applied for a period of one minute to any point along any edge of the table and along the edge of flaps and extensions. In each case the table shall be observed to see if it overbalances during application of the load at any position.

At each position of the load the amount by which the edge of the surface of the table top and the adjacent extension or flap rises or falls shall be observed to see if the rise or fall is more than 6 mm in relation to the adjacent edge of the surface.

Rigidity of construction

An apparatus such as the one described in British Standard 1960 "Domestic Furniture, Part 1:1951, tables and trolleys" is suitable for carrying out these tests. Castors on tables or trolleys shall be removed before carrying out this test.

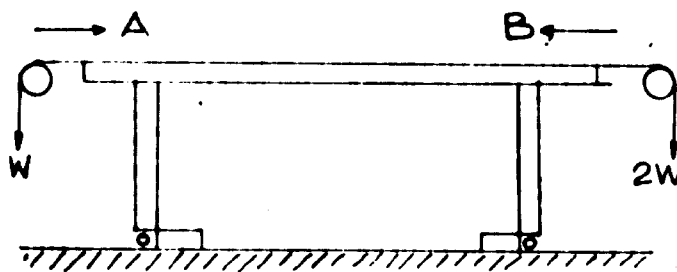


Figure I. Rigidity of construction test

Rigidity of tables supported by four fixed legs

For this test the table is placed as shown diagrammatically in figure I, so that a horizontal force may be applied at the centre in directions A or B, while the supporting members or legs are restrained from moving by stops placed at the base of the legs. If owing to the construction of the table stops cannot be applied in such a way, they shall be placed against the supporting members furthest from the edge. The table is put on rollers having their axes at right angles to the direction of the force. If the table tends to tip over when the force (W) is applied, a load equal to twice the weight of the table or 25 kg, whichever is the smaller, shall be placed at the centre of the table top. If the table still tends to tip over before the full force is applied, the value of the force at which tilting takes place shall be noted and this shall be the maximum value of the force (W) to be applied in the test. The force may be applied conveniently by an arrangement as shown in figure I, i.e. the force in direction A is obtained by applying a load of $2W$, and the force in direction B by removing the load $2W$.

During the first part of the test, a force, i.e. a load of 9 kg or the weight of the table, whichever is the less, shall be applied gradually once in the direction described above and then in the opposite direction. This cycle of loading shall be performed eight times and during the last three cycles the horizontal travel of the table top between its two extreme positions shall be measured with reference to a fixed point and recorded. The mean of these three measurements shall be taken as the first horizontal movement.

A second set of tests shall then be made with a load of 45 kg or the weight of the table, whichever is less. However, for tables having a

height of 700 mm or more and an area of the unextended top of 32 dm² or more, the load shall be not less than 22.5 kg. The load shall be applied and removed 25 times at a rate not exceeding 30 cycles per minute. During the last three cycles the horizontal travel of the table between its two extreme positions in each cycle shall be measured with reference to a fixed point and the mean of these three measurements shall be taken as the second horizontal movement.

The two sets of tests described above shall be repeated in the perpendicular direction. The result obtained in the first set-up shall be taken as the third horizontal movement and that in the second set-up as the fourth horizontal movement.

Rigidity of tables supported by three fixed legs

The test shall be carried out in a similar way as described above, the force being applied, in turn, in three different directions, i.e. the directions along the lines joining pairs of legs. Stops shall be provided to impede movement of the pair of legs concerned. For each pair the first horizontal movement shall be determined, and in determining the second horizontal movement the total number of cycles shall be 16 instead of 25.

Rigidity of tables supported by gate legs and similar supports

The table shall be placed in its normal extended position with the flaps raised and with one gate leg or similar support resting on a freely sliding platform having a rectangular upward projection of 6 mm to bear against the front of the leg. The remaining legs of the table shall be placed on blocks of the same height as the sliding platform. By means of the platform, a force of 9.5 kg or the weight of the table, whichever is the smaller, shall be applied to the foot of the gate leg, in the direction of motion, tending to open the gate leg further; the load shall then be removed. Should the force cause the gate leg or support to spring over the platform projection, the form of the projection shall be altered so as to restrain the leg. Weights may be placed on the main part of the table to hold it in position if necessary, but the flap which is supported by the gate leg or support under test shall be left unloaded. The force shall be applied and removed 10 times. Each gate leg, its fittings and means for attachment to the table shall be examined for compliance with the requirements of the specification.

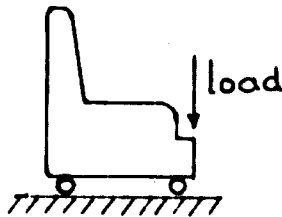
Annex III

PERFORMANCE TESTS FOR CHAIRS AND SETTEES

Stability tests

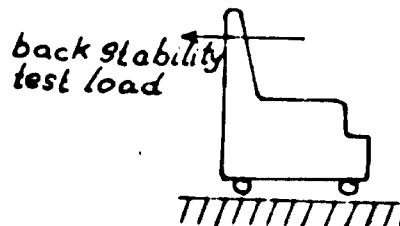
Forwards overbalancing

A vertical force of 1000 N shall be applied by means of a suitable loading pad of 200 mm diameter, placed with its centre on the back-to-front centre line of the seat at a point 100 mm behind the front edge. It shall be noted whether the article overbalances.



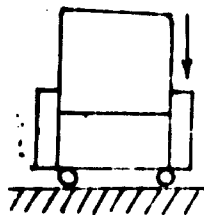
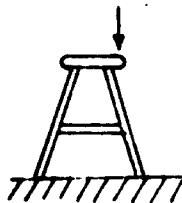
Rearwards overbalancing

Rearwards movement of the article shall be prevented by suitable supports placed behind its rear feet or castors. A horizontal rearwards force of 60 N shall be applied to the back 350 mm above the intersection point of the centre lines of the seat and back surfaces or 100 mm below the top of the back, whichever is the lower. It shall be noted whether the article overbalances.



Sideways overbalancing

A vertical downwards force of 200 N shall be applied at different points along the length of the arm by means of a 200 mm diameter pad. It shall be noted whether the chair overbalances. If the arms of the chair are not identical and the chair is therefore not symmetrical the test load shall be applied to each arm in turn.



Strength tests

Checking of moisture content

The procedure described in annex I, under the heading "Checking of moisture content" shall be followed.

Initial inspection

The chairs shall be thoroughly inspected, removing as much of the cover on the bottom as is necessary to perform a thorough inspection of the joints and the construction. Any apparent defects shall be noted.

Number of seating units for settees

If for settees and similar articles the number of "seating units" is not obvious from inspection, the article shall be regarded as consisting of a number of equal units, each of a maximum width of 560 mm at the front and a minimum width of 380 mm at the rear of the seat.

Order of tests

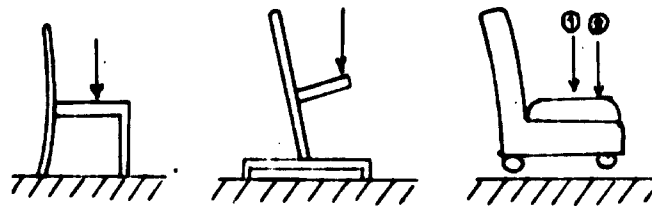
The article to be tested shall be submitted in turn to each of the tests described below.

Test 1 - Seat static load test

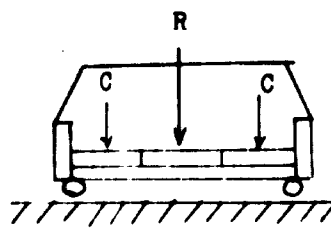
A downwards force shall be applied 150 times, at a rate of 40 times a minute, by means of a loading pad of 200 mm diameter, faced with a 25 mm thick

layer of hard, polyether foam, at right angles to the surface of the seam to any position along the fore and rear centre line of the seat most likely to cause failure. Such possible positions shall be loaded an equal proportion of the total number of applications. The applied load shall be 1,000 N for domestic chairs and 1,500 N for contract chairs.

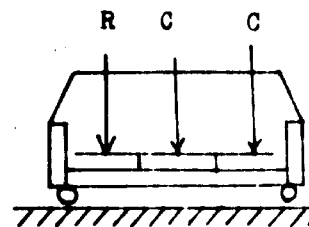
For settees the loading test shall be applied in turn to one end position and one central position, while each of the other seat units supports a constant weight of 75 kg.



Possible positions likely to cause failure



Seat static loading - central position



Seat static loading - end position

Key:

R = Repeated load

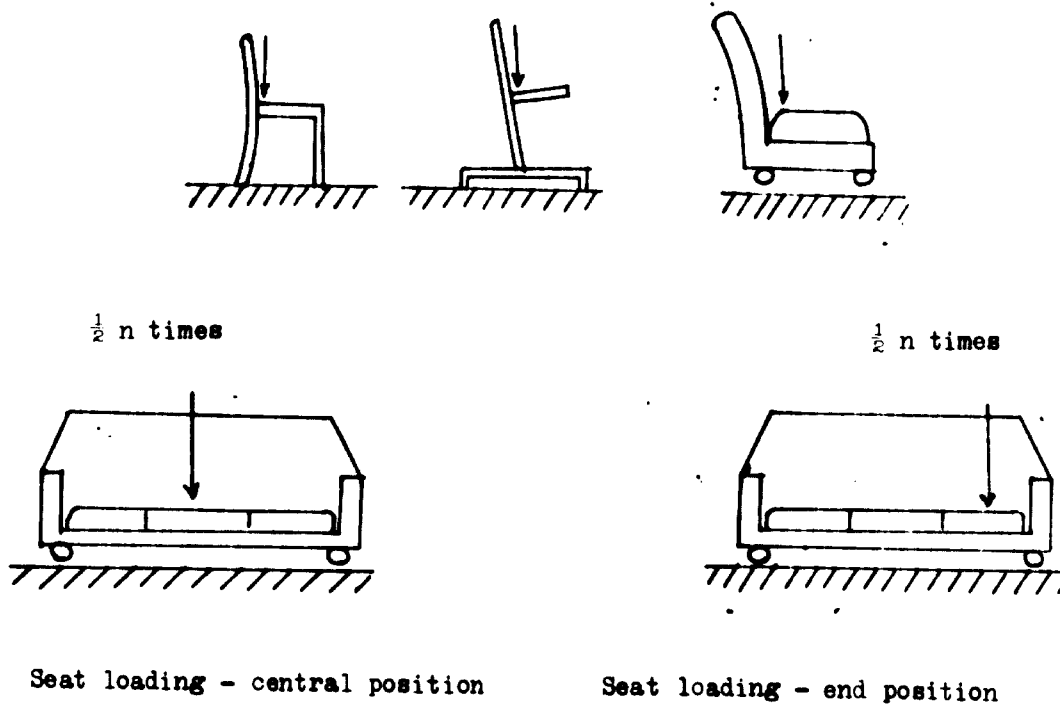
C = Constant load

Figure II. Seat static load test

Test 2 - Seat fatigue test

The test shall be carried out as test 1, except that the seat fatigue load shall be 950 N, the number of applications 25,000 for domestic and 100,000 for contract chairs and the centre of the seat loading pad applied 175 mm forward from the intersection point of the centre lines of the seat and back surfaces (see also test 5 regarding the application of the load).

For settees, half the specified number of applications shall be made first to a central position and then to an end position (see figure III).



Key: n = number of applications

Figure III. Seat fatigue test

Test 3 - Seat impact test

The seat impact load shall be applied by allowing a seat impact pad to fall freely 10 times from a height of 75 mm for domestic chairs and 200 mm for contract chairs (see figure IV). The pad shall have a leather striking

surface of 200 mm diameter and weigh 25 kg (fine, dried sand filling). The impact load shall be applied anywhere a person is likely to sit, at the position most likely to cause a failure.

For settees this test shall be applied to an end position only.

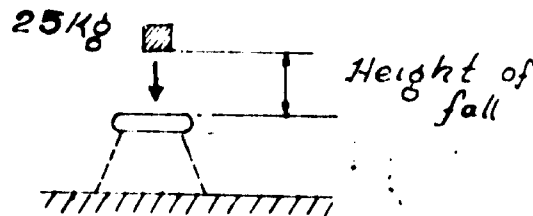


Figure IV. Seat impact test

Test 4 - Back static load test

The load, a rectangular pad of 200 mm height, 250 mm width and faced with a 25 mm thick layer of hard, polyether foam, shall be applied 150 times, at a rate of 40 times per minute, at right angles to the surface of the back, with its centre 350 mm above the intersection point of the centre lines of the seat and back surfaces, or 100 mm below the top of the back, whichever is the lower. The chair shall be prevented from rearwards movement by stops placed behind the rear feet or castors. During this test the seat shall be loaded by a constant force, a pad of 200 mm diameter applied at right angles to the seat surface at the most forward position possible, along the centre line of the seat. The seat load shall be 1,000 N for domestic chairs and 1,500 N for contract chairs and the back load shall not be so high as to cause overbalancing rearwards and, if the chair does not overbalance, shall not exceed 500 N for domestic chairs and 750 N for contract chairs.

For settees the load shall be applied in turn to one end position and one central position. In addition, a double loading shall be applied simultaneously to a central pair of seating units (see figure V).

When this test is applied to chairs fitted with spring rocking-action bases which have a tension adjustment, the adjustment shall be tightened so that the least possible rocking movement is obtained during the test.

When testing without back rest, the back load shall be applied horizontally to the front edge of the seat. The restrictions given above regarding the magnitude of the back load shall also apply to stools.

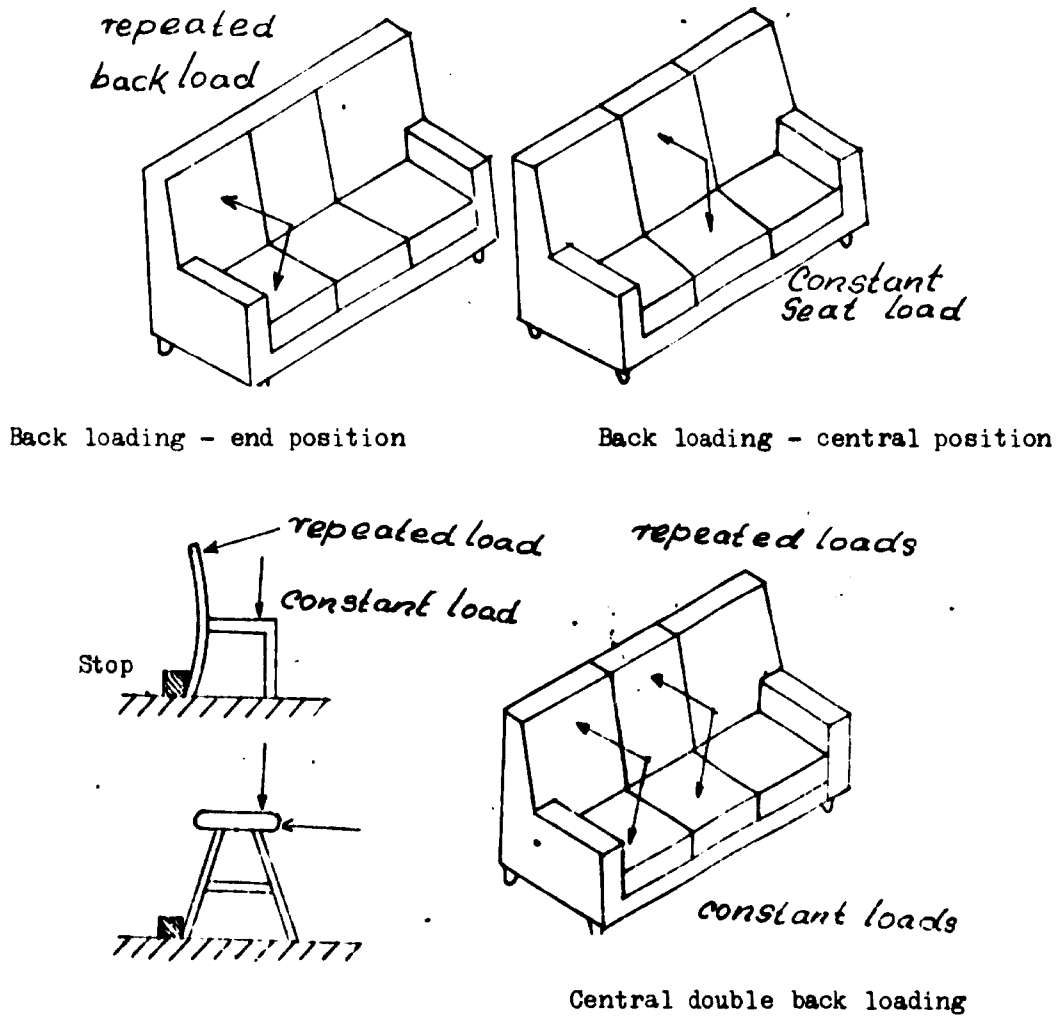


Figure V. Back static load test

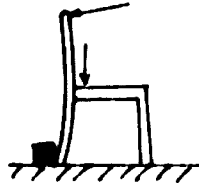
Test 5 - Back fatigue test

The test shall be carried out as test 4, with the following changes: 250 N shall be applied to the back 4,000 times for domestic chairs and 100,000 for contract chairs, and the centre of the seat loading pad shall be 175 mm forward of the intersection point of the centre lines of the seat and back surfaces (see figure VI).

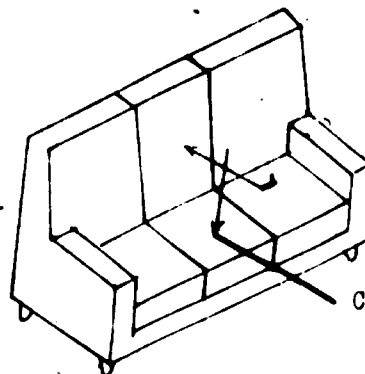
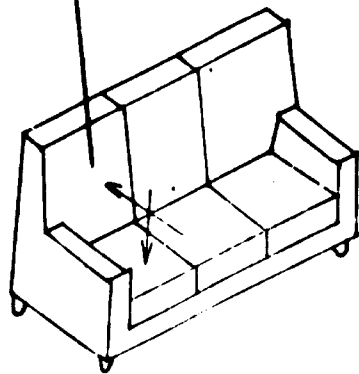
The seat and back fatigue load tests (tests 2 and 5) may be applied separately, using a constant seat load and a repeated on/off back load in test 5, or may be applied together in a representative cycle of seat load on, back load on, back load off and seat load off.

The restrictions given in test 4 regarding the magnitude of the back load shall apply in this test too, as shall the remarks regarding stools without back rests.

For settees half the specified number of applications shall be made to a central position and the other half to one end position.



Back load repeated
 $\frac{1}{2} n$ times



Constant seat
load

Back fatigue loading - end position

Back fatigue loading -
central position

Key: n = number of applications

Figure VI. Back fatigue test

Test 6 - Back impact test

The chair shall be placed in its normal position with its back feet secured to the floor by hinges, or prevented from moving rearwards by means of stops. A weight of 6 kg shall be allowed to strike the centre of the top of the inside of the back or, when there is no back, the centre of the front seat edge. The weight shall have a striking surface of 100 mm diameter, shall

be suitably padded so as not to damage the chair surface, and shall strike the chair horizontally at a speed of 0.75 m/sec for domestic chairs and of 3.0 m/sec for contract chairs.

The chair shall be allowed to swing freely backwards about the hinged, rear feet until the top of the bar hits a firm concrete block arranged at floor level and covered with a 3 mm thick rubber sheet of a hardness of 90 to 97 degrees as defined in British Standard 903 "Methods for testing vulcanized rubber, part A 26:1969, determination of hardness". The test shall be carried out 10 times at a rate of 10 times per minute.

For this test a device consisting of a 1 m long, light rigid bar with one end pivoted immediately above the article to be tested and the lower end carrying an object of a mass of 6 kg, may be used. The pivot shall be in such a position that, when the weight at the other end of the bar strikes the article, it is travelling horizontally and falls at the specified point on the concrete block. The severity of the impact depends upon the height of drop, i.e. the angle to which the lever is lifted from the vertical (see figure VII).

The height of drop shall be 30 mm for domestic and 500 mm for contract chairs; the angle (θ) from vertical position shall be 14° for domestic and 60° for contract chairs.

For settees this test shall be applied to an end position only.

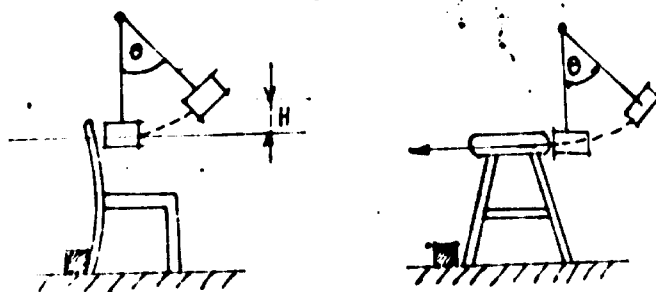


Figure VII. Back impact test

Test 7 - Disideways arm static load test

A pair of horizontal outward loads (see figure VIII) of 400 N for domestic and 600 N for contract chairs shall be applied, by means of load pads of 100 mm diameter, 50 times to any position along the inside of the uppermost part of the arms most likely to cause a failure. Such positions will depend on the construction of the chair and it may be that there are several such positions, in which case each position shall be loaded an equal proportion of the 50 applications.

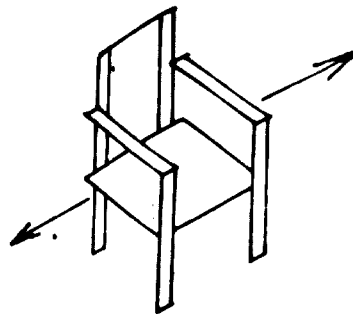


Figure VIII. Disideways arm static load test

Test 8 - Sideways arm fatigue test

The test shall be carried out as test 7, except that the magnitude of the load shall be 250 N, the number of applications 4,000 for domestic and 100,000 for contract chairs, and the point of application of the load shall be the most forward and uppermost possible on the arm.

Test 9 - Sideways arm impact test

The test shall be carried out in the same manner as test 6, with the following changes: the blow shall be applied in an inwards direction to the outside face of the arm, at any position most likely to cause a failure (see figure IX); a pair of side feet secured to the floor by hinges, or prevented from moving sideways by means of a stop; the height of drop shall be 29 mm for domestic and 463 mm for contract chairs and the angle θ from the vertical position 14° for domestic and 47° for contract chairs.

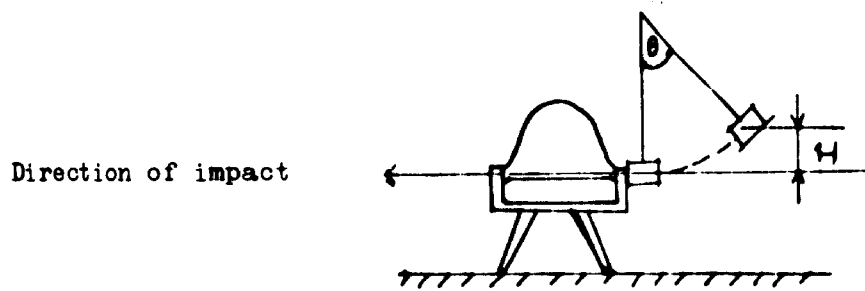


Figure IX. Sideways arm impact test

Test 10 - Downwards arm static load test

A vertical, downwards force of 500 N for domestic and 750 N for contract chairs shall be applied 50 times to the upper surface of each arm by means of a pad of 200 mm diameter to any point along the arm most likely to cause a failure.

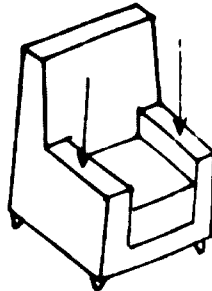


Figure X. Downwards arm static load test

Test 11 - Chair drop test

(a) Chairs other than easy chairs and castored chairs. The chair shall be supported e.g. by three lifting cords attached to suitable points on the chair, so that the impact is on one foot and the line joining the foot to the diagonally opposite foot is inclined at 10° to the horizontal, whilst the line joining the remaining feet is horizontal.

The chair shall be allowed to fall freely onto a 3 mm thick sheet of rubber placed on a concrete floor. The hardness of the rubber shall be 90 to 97 degrees, as defined in British Standard 903 "Methods for testing vulcanized rubber, part A 26:1969, determination of hardness". The height of fall shall be 300 mm for domestic and 600 mm for contract chairs. The chair shall be dropped in this way 10 times onto a front leg and 10 times onto a rear leg.

(b) Easy chairs and castored chairs. The test shall be carried out as described above, except that the heights of fall shall be 150 mm for domestic and 300 mm for contract chairs.

(c) Settees. The settee shall be lifted up at one end and allowed to fall freely so that the impacting feet or castors strike a 3 mm thick sheet of rubber of a hardness of 90 to 97 degrees, placed on a concrete floor, at the same level as the non-lifted feet or castors. The respective heights of fall shall be 150 mm for domestic and 300 mm for contract settees. The settee shall be dropped in this way 10 times (see figure XI).

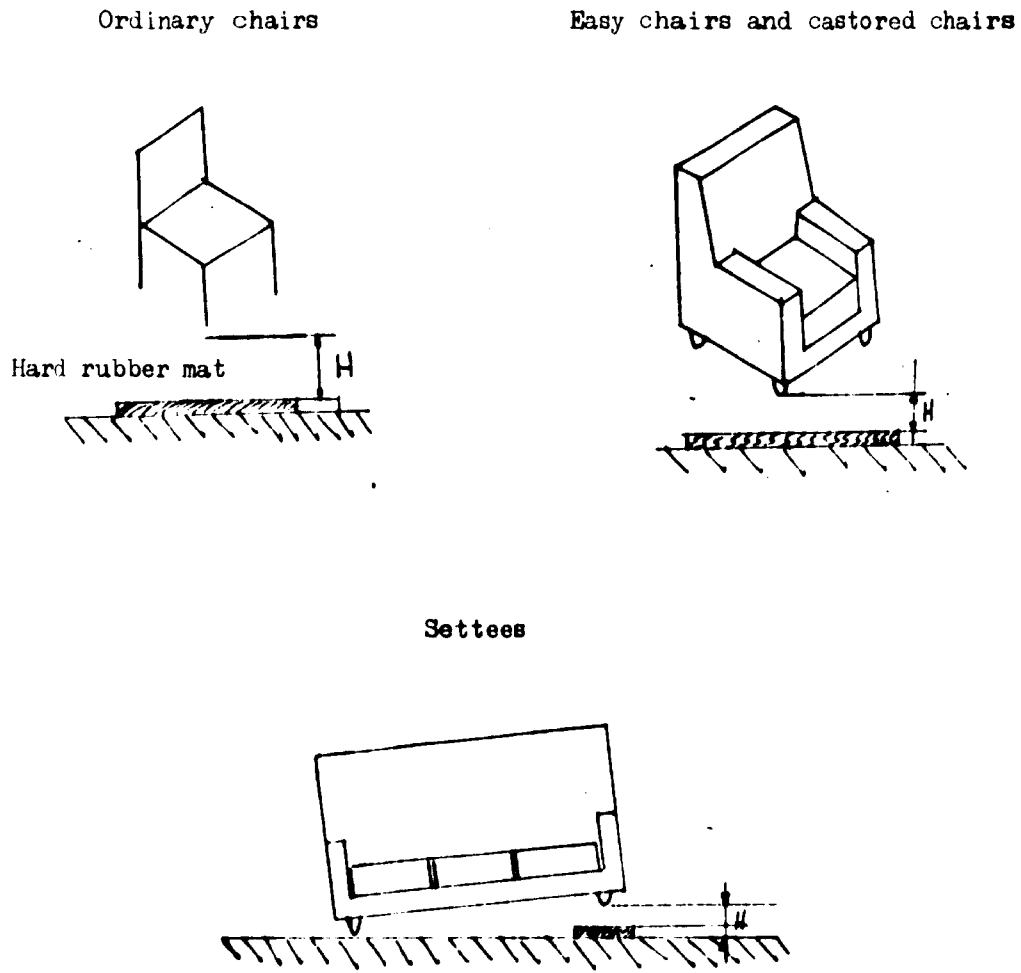


Figure XI. Chair drop test

Test 12 - Diagonal base load test for easy chairs and settees

Two opposing forces of 250 N for domestic and 500 N for contract articles shall be applied simultaneously to diagonally opposite legs or corners of the article, as near as possible to the lowest point. Application of these forces shall be made in an inwards direction 50 times at a rate of 20 times per minute (see figure XII).

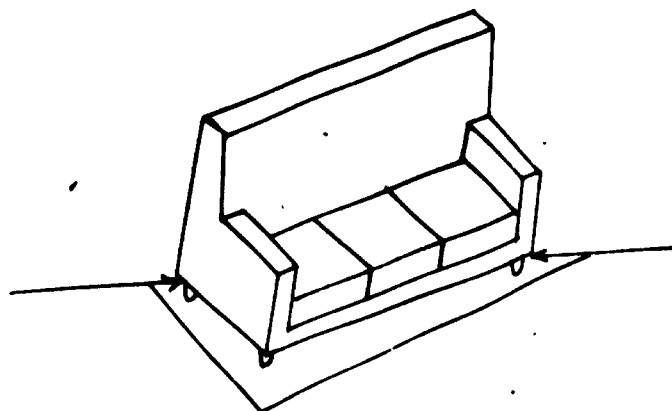


Figure XII. Diagonal base load test for easy chairs and settees

Test 13 - Chair racking test

The chair shall be subjected to a constant seat load of 1,000 N applied 250 mm forward of the intersection point of the centre lines of the seat and back surfaces. A single cycle of racking of the chair shall be achieved by applying a back load, on and off, first to the left hand part of the back, followed by a back load, on and off, to the right hand part of the back. The rear feet of the chair shall be restrained from front and back movements by suitable stops on the floor. These back loads shall be applied by means of two rectangular pads, 200 mm high by 125 mm wide, each faced with a 25 mm thick layer of hard polyether foam; their centre points shall be 350 mm above the back seat intersection point or 100 mm down from the top of the back, whichever is the lower, and 100 mm to either side of the centre line of the back.

The racking cycle shall be applied 150 times and the magnitudes of the back loads shall be 375 N for domestic and 550 N for contract chairs.

Back load - first half of cycle

Back load - second half of cycle



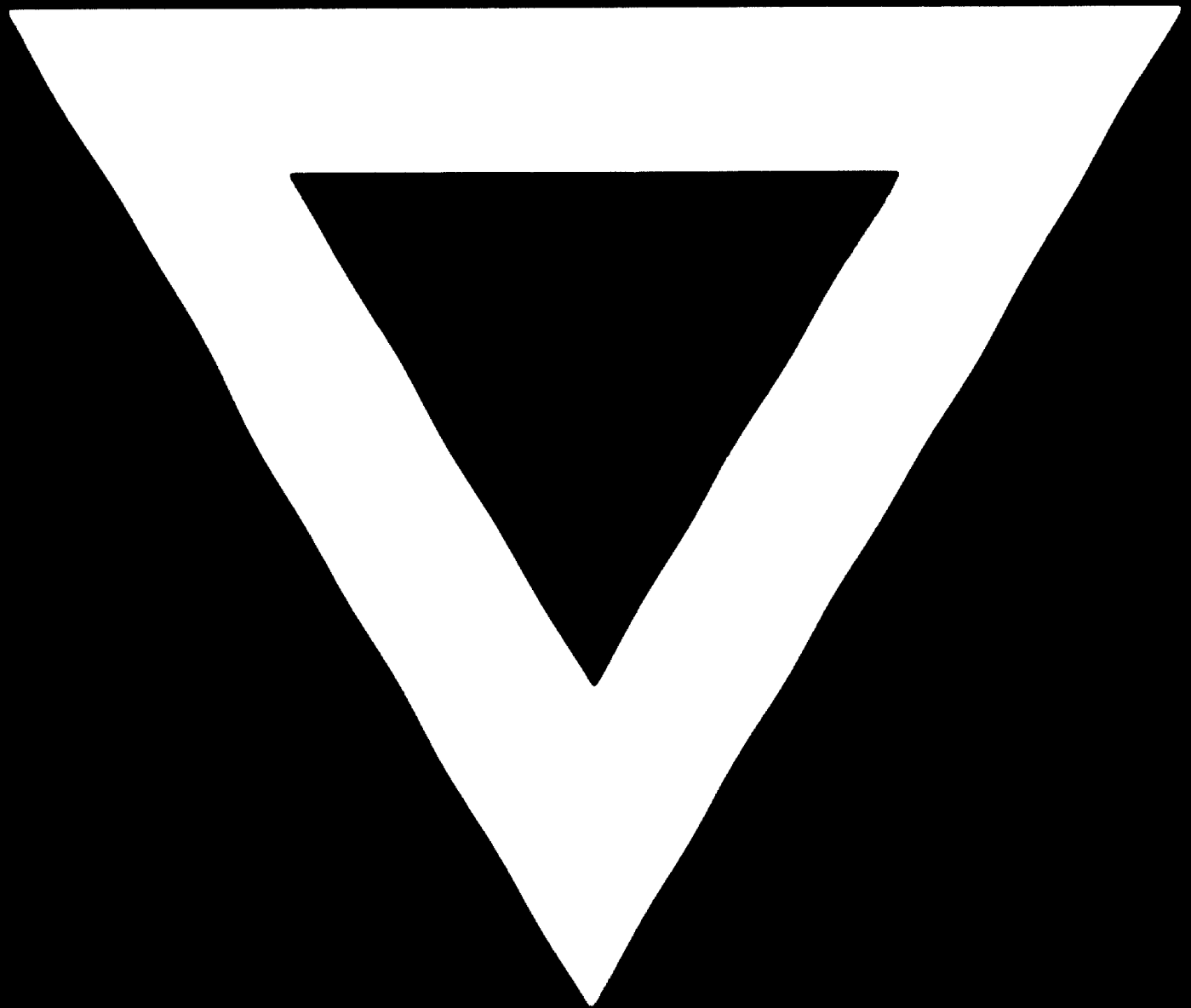
Figure XIII. Chair racking test

Final inspection

Immediately after the completion of the above tests the chair or settee shall again be thoroughly inspected; in the case of upholstered furniture, as much as possible of the covers shall be removed from the outside of the back, bottom and arms. Any apparent defect and any change that has taken place since the initial inspection shall be noted.



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