

Chapter 7

Wood Work

7.0 TERMINOLOGY

Ballies : Thin round poles usually without bark.

Beam : A structural timber generally long in proportion to its width and thickness and used for supporting load primarily by its internal resistance to bending.

Block Board : A Board having a core made up of strips of wood, each not exceeding 25 mm in width, laid separately or glued or otherwise joined to form a slab which is glued between two or more outer veneers with the direction of the grain of the core blocks running at right angles to that of the adjacent outer veneers.

Core : The inner layers of a composite wood product.

Cross Band : A general term indicating a transverse layer of veneer or veneers in composite wood products.

Decorative Veneers : Veneers having attractive appearance due to figure, colour, grain, lustre etc.

Hard Wood : A conventional term used to denote the wood obtained from broad-leaved trees. It has no relationship to the physical properties of hardness or strength. On account of the confusion this word might cause, its use is discouraged.

Freeze Rail : Horizontal member, mortised or otherwise secured to the stiles of a door, provided just below the free panel; usually provided for decorative purposes in the uppermost portion of the door.

Joint : A prepared connection for joining adjacent pieces of wood, veneer, etc.,

Dovetail Joint : A joint at the corner of two pieces in such a way that the notches made in one are fitted exactly into projections of corresponding size and shape made in the other. There are various kinds of dovetail joints for instance, lapped dovetail joint, wedge shaped dovetail joint, etc., joined in a way which will resist withdrawal except in the direction in which it was assembled (**FIGURE 7.1A**)

Mitred Joint : A joint between two members at an angle which bisects the joining angle; usually the joining faces are cut at 45°C to form a right angle (**FIGURE 7.1B**)

Mortise and Tenon Joint : A joint in which the reduced end (tenon) of one member fits

into the corresponding slot (mortise) in another member (**FIGURE 7.1C**).

Tongue and Groove Joint : A joint in which a tongue is provided on edge of one member to fit into a corresponding groove on the other (**FIGURE 7.1D**).

Knot : Base of a branch or limb embedded in the tree which becomes visible when it is cut.

Diameter of a Knot : The maximum distance between two points farthest apart on the periphery of a round knot, on the face where it becomes visible. In the case of a spike or splay knot, the maximum width of the knot visible on the face on which it appears shall be taken as its diameter.

Muntin : Small horizontal or vertical dividing bars within basic frame work of a window, or door subdividing and supporting the glass panes or panels of doors.

Particle Board : A board manufactured from particles of wood or other ligno-cellulose material, for example, flakes, granules, shavings, slivers, splinters agglomerated, formed and pressed together by use of an organic binder together with one or more of the agents, such as heat, pressure, moisture and a catalyst.

Particle : Distinct particle or fraction of wood, or other ligno-cellulose material produced mechanically for use as the aggregate for making a particle board. This may be in the form of flake, granule, shaving, splinter and sliver.

Plywood : A board formed of three or more layers of veneers cemented or glued together, usually with the grain of adjacent veneers running at right angles to each other.

Rebate : A recess along the edge of a piece of timber to receive another piece or a door, sash or a frame.

Sapwood : The outer layers of the log, which in the growing tree contain living cells and feed material. The sapwood is usually lighter in colour, and is readily attacked by insects and fungi.

Seasoning : A process involving the reduction of moisture content in timber under more or less controlled conditions towards or to an amount suitable for the purpose for which it is to be used.

Seasoned Timber : Timber whose moisture content has been reduced to the specified minimum, under more or less controlled processes of drying.

Structural Timber : Timber used in framing and load bearing structures or timber used or intended for use in buildings where strength is the primary consideration.

7.1 TIMBER

a) IS 4970 on "Key for identification of commercial Timbers" gives ready guidance to the purchasing organisations to determine whether the Timber supplied is actually of the species stipulated. IS 4970 contains diagnostic features of 60 species of Timber both Softwood and Hardwood. IS 4970 covers a simply operated Punched Card key for the field identification of the commercial Timber based on their general properties and anatomical characteristics visible under a hand lens.

b) IS 12806 on "Indian Timbers for Door and Windows Shutters and Frames – Classification" covers 109 species recommended for shutters and 69 for frames and gives guidance for selection of appropriate Timbers species for the purpose envisaged. The classification of species in IS 12806 is based on strength coefficient, appearance and texture, durability and treatability, weight, retention of shape, refractoriness to seasoning, ease of working etc of Timber. IS 12896 also lays down the general requirements of quality, seasoning, moisture content and preservative treatment for timber. It does not however cover the species suitable for flush doors.

c) Timber is classified as under :

- (i) Teak wood
- (ii) Deodar wood
- (iii) Non-coniferous timbers other than teak
- (iv) Coniferous timber other than deodar.

The timber shall be free from decay, fungal growth, boxed heart, pitch pockets or streaks on the exposed edges, splits and cracks. The timber shall be graded as first grade and second grade on the basis of the permissible defects in the timber as given in **ANNEXURE 7.1**. For both the grades, knots should be avoided over a specified limit.

7.1.1 Teak Wood (*Tectona granolis*)

It is of outstanding merit in retention of shape and durability. The heart wood is one of the most naturally durable woods of the world. It usually remains immune to white ant attack and insect attack for very long periods. It is,

however, not always immune from fungus attack (rot). Taken as a whole, good quality teak is very durable. It is relatively easy to saw and work. It can be finished to a fair surface and takes polish well. It is generally used for making furniture and all important timber constructions.

7.1.1.1. Superior Class Teak Wood such as Balharsha, Malabar and Dandeli

Individual hard and sound knot shall not be more than 12 mm in diameter and the aggregate area of all the knots shall not exceed half percent of the area of the piece. It shall be close grained.

7.1.1.2 First Class Teak Wood :

Individual hard and sound knot shall not be more than 25 mm in diameter and the aggregate area of all the knots shall not exceed one percent of the area of the piece.

7.1.1.3 Second Class Teak Wood :

Individual hard and sound knot shall not be more than 40 mm in diameter and the aggregate area of all the knots shall not exceed one and a half percent of the area of the piece. Wood shall be generally free from sapwood, but traces of sapwood may be allowed.

7.1.2 Sal Wood (*Shoera Robusta*)

Sal is about 30 percent heavier than teak, 50 percent harder, and about 20 to 30 percent stronger. In shock resistance it is about 45 percent above teak. Its heart wood is a naturally durable wood, and usually remains immune to attack by white ants and fungi for a long period, while its sapwood is very perishable and should not be used. Well dried sal is not a really easy wood to saw and work. It is a rough constructional wood than a carpentry timber. No individual hard and sound knot shall exceed 25 mm in diameter and the aggregate area of all the knots shall not exceed 1% of the area of the piece. It can be used for a variety of purposes, such as for frames of doors and windows, beams, rafters, flooring, piles, bridging, tool handles, tent pegs etc.

7.1.3 Kail Wood (*Pinus Wallichiana*)

Kail wood is not a very durable wood. But it is easy to saw and work and is usually very popular in workshops. It can be brought to a fine smooth surface, but is more suitable for paint and enamel finishes than for polish work. It is useful for joinery works, constructional work, light furniture and house fittings.

7.1.4.1 First Class Kail Wood

No individual hard and sound knot shall be more than 25 mm in diameter and the aggregate area of all the live knots shall not exceed 1.5 percent of the area of the piece. Wood shall be generally free from sapwood, but traces of sapwood may be allowed.

7.1.4.2 Second Class Kail wood

No individual hard and sound knot shall be more than 40 mm in diameter and the aggregate area of all the live knots shall not exceed 1.5 percent of the area of the piece. Wood shall be generally free from sapwood, but traces of sapwood may be allowed.

7.1.5 Other Species

The following species of timber can also be used for various activities of building construction. The information regarding their availability and use is given in **Table 7.1**. The chief characteristics of the species are given below: -

7.1.5.1 Khair (*Acacia Catechu* Wild)

The heart wood is very durable and is seldom attacked by white ants and fungi. It is an extremely strong and very hard and rough timber and a some what difficult timber to saw and machine, especially if the wood is old and dry. Stiff tools should be used in machining and turning. It finishes and polishes extremely well. It is used for posts in house construction, tool handles, tool bodies etc.

7.1.5.2 Babul (*Acacia Nilotica* SSP Indica)

Its functions and uses are similar to those described in 7.1.5.1.

7.1.5.3 Haldu (*Andina Cordifolia*)

Haldu is a fairly hard and strong wood. It is about 10 percent harder than teak but slightly weaker in transverse strain, elasticity and compression. It is a very easy wood to saw and machine. It also finishes very easily and takes polish remarkably well. It cannot be dovetailed because it breaks away. It is commonly used for door and window frames, floor boards, turning, carvings, furniture, panelling and house hold fitments.

7.1.5.4 Mango (*Mangifera Indica*)

It is a very sturdy wood when seasoned and it is as good as teak in this respect but is not a very durable wood in exposed positions. It is very liable to fungal staining and decay and is not immune to white ant attack. It receives preservative treatment well. It can be easily finished to smooth surface. Its chief uses are for cheap furniture, planking, floor and ceiling boards.

7.1.5.5 Chir (*Pinus Flexburghi*)

Chir is not a very durable wood unless treated with preservative. It is easy to saw and is usually popular in workshops. It can be brought to a fine smooth surface, but is more suitable for paint and enamel finishes than for polish work. It is used for construction work and house fitments.

7.1.5.6 Hollock (*Terminalia myriocarpa*)

Hollock is not a very durable wood unless properly treated. It can be readily treated with wood preservatives. It can be finished to fairly good surface, but needs careful filling before it is polished. It is used for house building in the form of scantlings, beams, rafters and planking. It also makes up into excellent furniture.

7.1.5.7 Benteak (*Largerstroemia Lanceolata*)

Benteak is very close to teak in strength. It is suitable for all constructional purposes and is not prone to fungus attack. It is finished to a fine smooth surface and takes a good polish. It is used for house building, furniture, carriage building and general carpentry.

7.1.5.8 Gamari (*Gmelina Arborea*)

Gamari is lighter and not so strong as teak. It is a durable wood but not immune to white ants attack for a very long period if placed in the ground. It is used for making furniture, panelling and other general utility and domestic purposes. It is a good wood for patterns.

7.1.5.9 Bahera (*Terminalia Bellirica* Roxb)

Seasoned wood is considerably immune to attack of fungus and insect. It can be treated fairly readily with wood preservatives. It is an easy wood to saw but difficult to bring to a smooth surface. It is used for rafters and boards. It is mainly used for ply wood work.

7.1.5.10 Bijasal (*Ptrocarpus Marsupium*)

It is a timber of natural durability above the average. It can be brought to a good finish and with ample filling, takes a good polish. Its chief use is for building purposes. It is also used for furniture.

7.1.6 Moisture Content

Control on moisture content of timber is necessary to ensure its proper utility in various climatic conditions. For specifying permissible limit of moisture content in the timber the country has been divided into four climatic zones as per **ANNEXURE 7.2**. In each of the zones, maximum permissible limit of moisture content of timber for different uses, when determined in

accordance with the procedure laid down in **ANNEXURE 7.3** shall be as per **Table 7.2**.

7.1.6.1 Tolerance on Moisture Content

Average Moisture content of all the samples from a lot shall be within + 3 percent and moisture content of individual samples within + 5 percent of maximum permissible

moisture content specified in **Table 7.2**. These tolerances are the absolute values over the percentage moisture content for Sl. Nos. 1 & 2 of **Table 7.2**. No tolerance on moisture content is permitted for Sl. Nos. 3 and 4 of **Table 7.2**.

TABLE 7.1 : SPECIES OF TIMBER

SL	Botanical Name	Trade Name	Average unit wt Kg/m ³	Availability				
				North Zone	East Zone	Central Zone	West Zone	South Zone
1.	Tectona granolis linnf	Teak	640	-	Y	X	X	X
2.	Acacia Catechiu Wild	Khair	1010	X	X	X	Y	Y
3.	Acacia Arabica Wild	Babul	785	X	X	X	Y	Z
4.	Andina Cordifolia Roxb HK.1.	Haldu	675	X	-	-	-	X
5.	Cedrus Deodars D Don	Deodar	545	X	-	-	-	-
6.	Magnifera Indica Linn	Mango	690	X	X	Y	Y	X
7.	Pinus Flexburgi	Chir	575	X	-	-	-	-
8.	Pinus Wallichiam Wall	Kail	515	X	-	-	-	-
9.	Shorea Robusta Gaertn.	Sal (U.P.)	881	X	X	X	-	-
10.	Terminalia Myrioecarpa Heurcket Muell Arg.	Hollock	610	-	X	-	-	-
11.	Lagerstroemia Lanceolata Wall	Benteak	675	-	-	-	Y	X
12.	Gamelinc Arborea Linn	Gamari	515	Y	Y	Y	Z	Y
13.	Terminalia Bellirica Roxb.	Bahera	801	X	X	X	Y	X
14.	Pterocarpus Marsupium Roxb	Bijasal	800	-	X	X	Y	Y

Note The average unit wt. is at 12 per cent moisture content.

AVAILABILITY : The territories comprising India, Sikkim and Bhutan have been divided into five zones, which cover roughly the following areas :

NORTH ZONE : Jammu and Kashmir, Punjab, Himachal Pradesh, Delhi, Uttar Pradesh and Rajasthan

EAST ZONE : Assam, Manipur, Tripura, West Bengal, Bihar, Orissa, Sikkim, Bhutan, Andamans, North East Frontier Agency and Nagaland.

CENTRAL ZONE : Madhya Pradesh, Vidharbha areas of Maharashtra State and the North East Part of Andhra Pradesh (Godavari delta area).

WEST ZONE : Maharashtra State (Except Vidharbha areas) Gujarat and North West Part of Karnataka.

SOUTH ZONE : Tamil Nadu, Andhra Pradesh (Except the Godavari delta area), Kerala and Karnataka (except North West Part)

The availability of timbers is categorized under three classes as indicated below :

X – Most common, 1415 m³ (1000 tonnes) and more per year.

Y – Common 355 m³ (250 tonnes) to 1415 m³ (1000 tonnes) per year and

Z – Less common, below 355 m³ (250 tonnes) per year.

TABLE 7.2 Maximum Permissible Moisture Content of Timber

SL	Use	Maximum Moisture Content Per cent			
		Zone I	Zone II	Zone III	Zone IV
1.	Beams, Rafters & Posts	12	14	17	20

2.	Doors and windows (a) 50 mm and above thickness (b) Thinner than 50 mm	10	12	14	16
3.	Flooring strips	8	10	10	12
4.	Furniture & cabinet making	10	12	14	15

7.1.7 Seasoning of Timber

The process of drying timber under controlled conditions is called seasoning of timber. Timber shall be either air seasoned or kiln – seasoned and in both cases moisture content of the seasoned timber shall be as specified in **Table 7.2**. Unless otherwise specified, air seasoned timber shall be used. Kiln seasoning of timber, where specified, shall be done as per IS : 1141 in a plant approved by the Engineer.

7.1.8 Preservation of Timber

Preservative treatment does not improve basic properties of timber but gives varying degree of protection against deterioration due to attacks by fungi, termites, borers and marine organisms. Preservative treatment, where specified, shall be done using Oil type, Organic solvent type or Water soluble type preservative. Oil type preservatives shall be used if the timber is not required to be polished or painted. Before preservative treatment, the timber shall be sawn and seasoned. All surfaces exposed after treatment, except due to planing, shall be thoroughly brushed with the preservation before jointing. Preservative treatment of timber shall be done as per IS: 401 in a plant approved by the Engineer.

7.1.9 Precautions against Decaying

- i) The contractor must in all cases obtain orders of the Engineer regarding the time at which he shall do painting, oiling, tarring, or otherwise treating wood work. The best time for painting wood work is when humidity is at its lowest.
- ii) When the end of a beam or any wood work is buried in masonry or brick work, an air space of 6mm shall be left at the end, sides and top.
- iii) Timber buried in the ground should be charred and well coated with tar. Also the ends of all beams, etc. which will be embedded in walls and the sides of timber which will abut against or rest on walls must be treated with boiling coal tar or any other protective mixture, approved by the Engineer.

7.2 PANELLING MATERIAL

7.2.1 Timber

Timber panels shall be preferably made of timber of large width. The minimum width and thickness of a panel shall be 150 mm and 15 mm respectively. When made from more than one piece, the pieces shall be joined with a continuous tongue and groove joint,, glued together and reinforced with metal dowels. The grains of timber panels shall run along the longer dimensions of the panels. The panels shall be designed such that no single panel exceeds 0.5 square metre in area.

7.2.2A Plywood for General Purposes (Refer IS 303)

7.2.2A.1 Definition Plywood boards are formed by gluing and pressing three or more layers of veneers with the grains of adjacent veneers running at right angles to each other.

7.2.2A.2 Materials Any species of timber may be used for plywood manufacture. The veneers shall be either rotary cut or sliced and shall be sufficiently smooth to permit an even spread of adhesive. Adhesive used for bonding the veneers in different grades of plywood shall be the corresponding type of adhesive as specified in IS 848. Extenders conforming to IS 1508 may be used with the synthetic resin adhesive subject to certain conditions.

7.2.2A.3 Grades and Types Plywood for general purposes shall be of the following two grades, depending on the bond strength developed by the adhesive used for bonding.

- a) Boiling water resistant or BWR Grade
- b) Moisture resistant or MR Grade

Plywood for general purposes of Grade BWR or MR shall be classified into three types AA, AB and BB depending on the quality of the surface. Quality requirements of Type A surface will be superior to those of Type B as stipulated in Table 1 of IS 303. Similarly permissible defects in Type A will be lesser than in Type B as given in Table 2 of IS 303. The better quality surface shall be called "face" and the opposite side called "back". Type AA means both face and back of Quality A. Type AB means face of quality

A and back of Quality B. Type BB means both face and back of Quality B.

7.2.2A.4 Dimensions, Thickness and Tolerances - Normal dimensions are of width 1200mm and length 2400mm,

2000mm and 1800mm; width 900mm and length 2100mm and 1800mm. Thickness of Plywood panes shall be as in **Table 7.3** below.

TABLE 7.3

No. of Ply	Thickness (mm)	No. of Ply	Thickness (mm)
3 Ply	3,4,5,6	9 Ply	12,15,16,19
5 Ply	5,6,8,9	11 Ply	19,22,25
7 Ply	9,12,15,16	Above 11 Ply	As ordered

Tolerances in Length + 6mm; - 0 mm
 Width + 3mm; - 0 mm
 Thickness Less than 6mm $\pm 10\%$
 6mm and above $\pm 5\%$

Thickness of all veneers shall be uniform within a tolerance of $\pm 5\%$. Corresponding veneers on either side of the central ply and those of face and back veneers shall be of species having similar physical and mechanical properties. Grain directions in the various plies shall conform to the requirements indicated in sub-clause 7.2.3 of IS 303. In all cases the grain on both faces of the assembly boards shall run in the same direction.

7.2.2A.5 Testing

Sampling shall be governed by Clause 10 of IS 303 and Testing by Clause 11. The requirements to be complied with are indicated in Sub clauses 11.2, 11.3 and 11.4. Retest if required shall be done as given in Subclause 11.5.

7.2.2B Veneered Decorative Plywood (Refer IS: 328)

7.2.2B.1 Definitions - Decorative Plywood is used in paneling work in buildings for furniture and for general interior decoration. The Plywood may be with ornamental veneers on one or both faces.

7.2.2B.2 Materials - Plywood when used in the manufacture of veneered decorative plywood of MR and BWR Grade shall be MR and BWR Type conforming to IS: 303. Adhesive for bonding veneers shall be MR and BWR type synthetic resin conforming to IS: 848 for MR and BWR Grade veneered decorative plywood. Decorative veneer shall be rotary cut or sliced and shall have a thickness of not less than 0.3 mm and not more than 1-0 mm

Veneers forming any one ply and the corresponding ply on the opposite side of the

central plane of plywood shall be of the same species of timber and of the same nominal thickness except in case of faces where they shall be of such thickness and strength as to balance each other.

7.2.2B.3 Grades and Types Decorative plywood shall be of the grade BWR (Boiling Water Resistant) and MR (Moisture Resistant). In each grade there shall be two types I and II with requirements as indicated in Clause 7 of IS 1328. Type I is of superior quality compared to type II.

7.2.2B.4 Dimensions and Tolerances

Normal supply shall be of size 2400 mm x 1200 mm; 2100 mm x 1200 mm; 1800 mm x 1200 mm; 2100 mm x 900 mm and 1800 x 900 mm. Thickness 3 mm, 4 mm, 6 mm, 9 mm, 12 mm, 19 mm, 25 mm.

Tolerance in length + 6 mm; - 0 mm

Width + 3 mm; - 0 mm

Thickness Less than 6 mm $\pm 10\%$

6 mm and above $\pm 5\%$

7.2.2B.5 Testing

Sampling and Criteria for conformity shall be as stipulated in Clause 10 of IS 1328. Tests and requirements to be complied with shall be as given in Clause 11 of IS 1328.

7.2.3A Particle Board for General purposes – Medium Density (Refer. IS 3087)

7.2.3A.1 Definition

Medium density Particle Boards are made of wood and/ or other lignocellulosic materials formed and pressed together under heat and pressure by use of an organic binder together with one or more additive like wax preservative etc. Board may be of Extruded type or Flat pressed type. In Extruded type, particles of wood and/or lignocellulosic materials are mixed with resin and the mix is pressed and forced through an extrusion hot plate press with the particle oriented

considerably in a direction at right angles to direction of extrusion. In flat press type, the mix is pressed in a parallel plate hot press or continuous band type of press. In Graded Particle Board there is gradual density gradient from the outer surface to the centre of the board across the thickness. Multilayer Particle Board is a board made of more than three layers of like material in which particles of different shapes and sizes may be used in different layers.

7.2.3A.2 Classes and Types

	<u>Class</u>	<u>Designation</u>
	<u>Grade</u>	
	Flat pressed single layer	
--	FPS	
	Flat pressed – three layer,	
	Multilayer and graded	I
	FPT-1	
--do--		
II	FPT-2	
	Extrusion pressed, solid	--
	XPS	
	Extrusion pressed, Tubular	
--	XPT	

7.2.3A.3 Materials

Timber : Any species of wood and/or other lignocellulosic material may be used.

Adhesive : Synthetic resin conforming to IS 848 shall be used. But for FPT-1 and FPT-2 only BWR or BWP type adhesive has to be used.

7.2.3A.4 Dimensions and Tolerances

The Standard sizes (length and widths) will be as stipulated in Clause 8.1 of IS 3087. Thickness shall be 6 mm, 9 mm, 12 mm, 15 mm, 20 mm, 25 mm, 30 mm, 35 mm, 40 mm and 45 mm.

7.2.3A.5 Tolerances

Tolerances in length & width will be as in Clause 8.3 of IS 3087. In thickness it will be $\pm 5\%$.

7.2.3A.6 Testing

Sampling and inspection will be as per Clause 10 of IS: 3087; Testing as per Clause 11 and Physical & Mechanical properties to be complied with by Flat pressed single layer, Flat pressed three layer. Multilayer and graded Extrusion pressed solid (XPS) and Extrusion pressed Tubular (XPT) shall be as in Table-1 of IS: 3087.

7.2.3B Veneered Particle Board (Refer IS: 3097)

7.2.3B.1 Grades and Types

Veneered Particle Boards are of two Grades I and II, with Grade-I being superior to Grade-II. Each of the Grades shall be of four types.

- Type-1 Solid core with general purpose type veneers on both faces.
- Type-2 Solid core with decorative veneer on one or both faces.
- Type-3 Tubular core with general purpose type veneers on both faces.
- Type-4 Tubular core with decorative veneer on one or both faces.

7.2.3B.2 Materials

i) **Particle Board** : Should conform to IS: 3087.

ii) **Veneer** : To be either sawn or rotary cut or sliced and of smooth surface. Face veneers of decorative type particle board should conform to Type-I of IS 1328. Face and cross band veneers of general purpose type should conform to Type A or B of IS: 303.

iii) **Adhesive** : For Grade-I Particle Board BWP or BWR type of IS: 848 should be used. For Grade-II MR type of IS: 848 shall be used.

7.2.3B.3 Manufacture

Veneered Particle Board shall be made by either glueing particle boards between the veneers or alternatively between two sheets of plywood. The total thickness of skin of either side shall not exceed 5 mm. Lipping, if provided shall be internal with a total depth not less than 22 mm and thickness same as that of Particle Board Core, made out of well seasoned Timber batten. Lipping may also be of suitable veneer glued to the edges.

7.2.3B.4 Dimensions and Tolerances

Length and width shall conform to clause 7.3 of IS: 3097. Thickness can be 6, 10, 12, 20, 25, 30, 35, 40, 45 and 50 mm. Tolerances shall be as specified in Clause 7.4 of IS: 3097 and for Thickness it is $\pm 5\%$.

7.2.3B.5 Testing

Sampling shall be as per Clause 8 of IS: 3097 and Tests and Accepting Criteria as per Clause-9.

7.2.3C Prelaminated Particle Board (Refer IS: 12823)

7.2.3C.1 Definition :

Prelaminated Particle Board to IS: 12823 is a Particle Board laminated on both surfaces by

Synthetic resin impregnated base papers under the influence of heat and pressure or with finished foils under the influence of pressure or pressure and heat depending upon the type of binder used.

7.2.3C.2 Materials

Particle Board used as the core shall be synthetic resin bonded flat pressed three layer or multi layer or graded Particle Board conforming to IS:3087. Impregnated Base paper shall be printed or plain coloured base paper impregnated in a suitable resin. Impregnated overlay is an absorbent Tissue paper. Finished foil shall be synthetic resin based surfacing film with one face fully finished. Adhesive will be any suitable synthetic resin.

7.2.3C.3 Grades and Types

Prelaminated Particle boards are available in two grades – Grade I and Grade II corresponding to the two Grades of Particle Board under IS: 3087. Each Grade consists of four types, Type-1, Type-II, Type-III and Type-IV depending upon the abrasion resistance of the prelaminated surface. Type-I is useful for flooring application, Type-II for horizontal application like cash counters and restaurant Table tops, Type-III for normal horizontal application like office Table tops and domestic furniture Tops and Type-IV for vertical application like panelling, partitioning and for false ceiling. Designation of different Types shall be PLB followed by two numbers, First number 1 stands for Grade-1 and 2 for Grade-2. Serial number 1,2,3,4 stands respectively for Types 1,2,3, & 4.

7.2.3C.4 Finish

The finish of the paper over laid board depends on the surface of the type used. Common surface finishes are glossy, matt textured (soft, swede, wood pore and leather) etc., The surface finish of the foil finished boards depends on the original finish of the foil used.

7.2.3C.5 Dimensions and Tolerance

They shall conform to Clause 8.1 (Amendment No.5) of IS: 12823. Prelaminated Particle Boards are available in Thickness ranging from 6 mm to 45 mm Tolerance in thickness ± 5 percent and in the dimensions as given in Clause 8.2 of IS: 12823.

7.2.3C.6 Testing

Sampling and inspection shall conform to Clause 9. Testing of samples shall be done as stipulated in Clause-10 of IS:12823. Physical and Mechanical properties should

conform to the figures in Table 1 of IS Code 12823.

7.2.4 Laminated Veneer Lumber (Refer IS: 14616)

7.2.4.1 Definition

Reconstituted ligno-cellulosic products like Plywood Particle Board, Fibre Board etc. are substitutes of wood for use as panels for partitions, shelves, toppings, decking etc. For load bearing applications as complete wood substitute, products like Laminated Veneer Lumber (LVL) have been developed and are reconstituted ligno-cellulosic products with the fibre oriented along a specific direction. LVL is a structural composite made by laminating veneers 1.5 mm to 4.2 mm thick, with suitable adhesive and with the grain of veneers in successive layers aligned along the longitudinal (length) dimension of the composite.

7.2.4.2. Materials

Veneers shall be obtained from logs grown in plantation such as rubber wood, eucalyptus, acacia etc. Adhesive will be of BWP Grade conforming to IS: 848. Preservatives shall be compatible with the adhesive.

7.2.4.3. Dimensions

Dimension of LVL will include margin for dressing and finishing not exceeding 3 mm in width and thickness, and 12 mm in length.

7.2.4.4. Testing

Sampling and Testing shall be done as stipulated in Clause 9 of IS: 14616. The physical and mechanical properties shall conform to the requirements stipulated in Table 1 of IS: 14616.

7.2.5 Hard Board (Refer IS 1658)

7.2.5.1. Hard boards are generally classified into the following three types according to their method of manufacture, density and other related mechanical and physical properties.

(a) Medium hard board: A homogenous fibre building board having a density exceeding 480 kg / m^3 but not exceeding 800 kg / m^3 .

(b) Normal hard board: A homogenous fibre building board having a density exceeding 800 kg / m^3 but not exceeding 1200 kg / m^3 .

(c) Tempered hard board: Hard board which has been further treated in the course of manufacture to increase its density, strength and water resistance.

7.2.5.2. The hard board used for paneling of door shutters, shall be of tempered quality. The thickness of hard board paneling used shall not be less than 12 mm in case of

single panels shutter and 10 mm in case of two or more panel shutter. The hard board shall be regular and, unless otherwise specified shall have square edges. The lengths of the two diagonals of the board shall not differ by more than ± 3 mm per metre length of the diagonal. The tolerance on length and width shall be ± 3 mm and on thickness ± 0.3 mm.

7.2.5.3 Workability

The hard boards shall not crack, split or chip when drilled, sawed or nailed perpendicular to the surface.

7.2.5.4 Finish

The boards shall be of uniform thickness subject to tolerance stated above. They shall be free from warp. The surface shall be flat, free from cracks and lumps and of natural colour. At least one face shall be smooth.

7.2.6 Block Board (Refer IS 1659)

7.2.6.1. Block Boards have a solid core made up of uniform strips of wood each not exceeding 25 mm in width, laid separately, or spot glued or otherwise joined to form a slab which is glued, between two or more outer veneers, with the direction of the grain of the core block running at right angles to that of adjacent veneers. In any one block board, the core strips shall be of one species of timber only. Face veneers may be decorative or commercial on both faces or decorative on one face and commercial on the other. Block boards shall be Grade 1 (Exterior Grade) as per IS : 1659. Both surfaces of the boards shall be sanded to a smooth finish.

7.2.6.2 Adhesives

The adhesives used for bonding shall be BWP type synthetic resin conforming to IS: 848 for Grade I block boards.

7.2.6.3 Thickness and Tolerance

Block boards are available in thickness ranging from 12 to 50 mm. Tolerance in thickness shall be $\pm 5\%$ for boards up to and including 25 mm thick and $\pm 2.5\%$ for boards above 25 mm thickness. Each board shall be of uniform thickness.

7.2.6.4 Testing

The samples tested shall meet the requirements of physical and mechanical properties of block boards specified in I.S. code 1659. No. of samples depending on the lot size shall conform to IS 1659.

7.2.6.5. Type of face veneers, thickness and grade of block boards shall be as specified. Unless otherwise stated, grade 1

(exterior grade) block boards bonded with BWP Type Synthetic resin shall be used.

7.2.7 Asbestos Cement Board (Refer IS 2096)

This should conform to IS : 2096. The material used in the manufacture of asbestos cement building boards shall be composed of an inert aggregate consisting of clean asbestos fibre cemented together by ordinary Portland cement, rapid hardening and low heat Portland cement, or blast furnace slag cement. No organic or inorganic materials shall be added to the composition. Pigments which are embodied in the asbestos cement for colouring purpose shall be of permanent colours and shall conform to the requirements. The thickness of the asbestos cement board used for paneling shall not generally be less than 6.5 mm in case of single panels shutters and 5 mm in case of two or more panel shutter. Asbestos cement building boards shall be of two classes, namely 'A' and class B. The thickness of class A shall be 6.5 mm and for class 'B' 5 mm. The tolerance on thickness shall be ± 0.5 mm.

7.2.8A Medium Density Fibre Board (MDF) (Refer IS 12406)

7.2.8A.1 Definition

Medium Density Fibre Board is a panel product manufactured from lignocellulosic fibres combined with synthetic resin or other suitable binder. The specific gravity of the product will be 0.6 to 0.9 by application of process of heat and pressure. Inter fibre bond is substantially created by binder.

7.2.8A.2 Types

MDF shall be of one type only that is flat pressed single layer. It may be of two Grades designated as under:

Solid Board Grade I SBG I

Solid Board Grade II SBG II

Grade I Boards may be used in "Hazard Class I" Environment with relative humidity less than or equal to 70% so that equilibrium moisture content of MDF will not be more than 15% as well as in "Hazard Class 2" Environment with relative humidity more than 70% so that the equilibrium moisture content of MDF will not be more than 20%. Grade II MDF can be used in "Hazard Class I" Environment only.

7.2.8A.3 Material

i) Wood - Any species of wood or other lignocellulosic material may be used.

ii) Adhesive - Any suitable type can be used so that MDF conforms to the requirements in Table 1 of IS 12406.

iii) Sizing material - Paraffin was dissolved in mineral spirit or emulsified with water.

7.2.8A.4 Manufacture

Should be carried out as described in Clause 6 of IS 12406.

7.2.8A.5 Dimensions and Tolerances

Standard Lengths and widths of MDF shall be as given in Clause 8.1 of IS 12406. Thickness will be 6, 9, 12, 15, 18, 22, 25, 30, 35 and 40mm. Tolerance shall be as given in Clause 8.2. In thickness it will be ± 0.3 mm.

7.2.8A.6 Testing

Sampling and Inspection will conform to Clause 10 and Testing of Samples to Clause 11 of IS 12406. The Physical and Mechanical requirements to be satisfied shall be as given in Table 1 of IS 12406.

7.2.8B Prelaminated Medium Density Fibre Board (Refer IS 14587)

7.2.8B.1 Definition

Prelaminated MDF Board to IS 14587 is a Fibre Board laminated on both surfaces by synthetic resin impregnated base papers with or without impregnated overlay under the influence of heat and pressure.

7.2.8B.2 Materials

Fibre Board shall conform to IS 12406. Impregnated base paper will be a printed or plain coloured paper impregnated in any suitable synthetic resin. Impregnated overlay paper will be a highly absorbent tissue paper impregnated in a suitable resin.

7.2.8B.3 Grades and Types

Prelaminated M.D.F. Board shall be of two Grads I and II corresponding to IS 12406. Grade I is generally preferred for use. Each of the Grades shall be of four Types I, II, III or IV classified by the surface abrasion characteristic defined in Table 1 of IS 14587. Type I will be useful for flooring application; Type II for horizontal application like

restaurant table tops; Type III for normal horizontal application like Office Table Top and domestic furniture and Type IV for vertical applications like panelling, partitioning and for false ceiling.

7.2.8B.4 Dimensions and Tolerances

They shall conform to IS 12406.

7.2.8B.5 Testing

Provisions in IS 14587 Clause 9 on "Sampling and Inspection" and Clause 10 on "Testing of Samples" will apply on Physical and Mechanical properties. The test results should conform to the figures stipulated in Table 1 of IS 14587.

7.2.9 Sheet Glass, Frosted Sheet Glass

7.2.9.1 Sheet glass shall be flat, transparent and clear as judged by the unaided eye. It may, however, possess a slight tint when viewed edgewise. Sheet glass shall be of Selected Quality (SQ) or Ordinary Quality (OQ) as per IS: 2835. Glass shall be free from cracks. Unless otherwise specified, ordinary quality sheet glass shall be used.

7.2.9.2 Dimensions

Nominal thickness and range of thickness of sheet glass shall be as per **Table No.7.4**. Tolerance on cut sizes (length and width) shall be ± 2.0 mm.

TABLE 7.4 : Thickness and Weight of Sheet Glass

Nominal Thickness (mm)	Range of Thickness (mm)	Weight (kg/sqm)
4.0	3.8 to 4.2	10.0
5.0	4.7 to 5.3	13.5

7.2.9.3 Sheet glass of 4 mm nominal thickness weighing not less than 10 kg/sqm shall be used for glass panel of area up to 0.5 sqm. For panel exceeding 0.5 sqm in area, the nominal thickness of the glass to be used shall be as specified.

7.2.9.4 Different Types of Glasses used for Doors, Windows and Ventilators are detailed below.

1. Clear Window glass	It is a thin transparent flat glass. Its thickness varies from 2.5 to 7.5mm.
2. Prism glass	It has prism shaped ribs which deflect light. These prisms are provided at different angles.
3. Plate glass	It is also a plain flat transparent glass, 3 to 6mm thick; fitted in the windows of luxurious buildings
4.Quartz glass	The glass transmits ultra-violet rays and is used in hospitals
5.Processed glass	The various types available in the market under this type of glass are ground glass, chipped one process and chipped two process. Some are used for providing privacy, they diffuse light. Others transmit maximum light.

6. Frosted glass	This glass is made by grinding off the polished surface by a sand blast. It is used to reduce heat and glare. It is also referred to as Ground glass/ Translucent glass and is used mainly in toilets and other places where vision is to be obstructed.
7. Wire glass	A mesh or wire is embedded in the glass for strengthening it.
8. Bullet proof glass	This is manufactured with laminated plate glass. The glass breaks under impact but does not turn into pieces.
9. Pinhead glass	This is also called perforated glass. Perforations are made in sheet or plate glass with the help of rollers or by providing a series of ribs to produce diffusion. It is used for the same purposes as frosted glass.

7.2.10 Wire Cloth (Wire Gauze)

7.2.10.1 Wire Cloth which shall generally conform to IS: 1568 shall be regularly woven with equally spaced galvanized mild steel wires in both warp and weft directions. The

wire cloth shall be properly selvaged by one or more wires in each edge.

7.2.10.2 Mesh - Average width of aperture and the nominal diameter of the wire shall be as under:

Average width of Aperture mm	Nominal dia of wire mm
1.40	0.63
1.18	0.56
1.00	0.50

7.2.10.3 Width of aperture and dia of wire of wire cloth shall be as specified. Unless otherwise stated, wire cloth of 1.40 mm average aperture width woven with 0.63 mm nominal dia galvanized mild steel wire shall be used.

7.2.10.4 Fly-proof wire cloth (aperture 1.40 mm) is generally provided in Kitchen and dining areas while wire cloth of smaller aperture is used in mosquito proof shutters.

7.2.11 Gypsum Board

Gypsum Board is formed by enclosing and bonding together a core gypsum plaster (a calcium sulphate mineral) with or without fibre between two sheets of highly durable paper. The gypsum boards shall be non-resonant, dimensionally stable and possess flame retardant qualities. The boards shall conform to IS : 2095 and gypsum plaster shall conform to IS : 2547. The surfaces of the board shall be true and free from imperfection that would render the board unfit for use with or without decoration.

7.2.11.1 Types - Gypsum plaster boards are classified according to their use.

7.2.11.2 Gypsum Wall Board with Reduced Water Absorption Rate

These boards have additives of the core and/or the paper liners to reduce the water absorption rate. They may be suitable for special applications in buildings where reduced absorption properties are required

to improve the performance of the board. Unless stated otherwise, decoration may be applied to the face.

7.2.11.3 Gypsum Wall Board with Improved Core Cohesion at High Temperatures

These boards have mineral fibres and/or other additives in the gypsum core to improve core cohesion at high temperatures. They have a face suitable for direct decoration.

7.2.11.4 Gypsum Plaster Base Board

These boards have a face suitable to receive gypsum plaster and may be perforated during primary manufacture.

7.2.11.5 Gypsum Plaster Base Board with Improved Core Cohesion at High Temperatures

These boards have mineral fibres and/or other additives in the gypsum core to improve core cohesion at high temperatures. They have a face suitable to receive gypsum plaster and may be perforated during primary manufacture.

Physical Requirements

7.2.11.6 Dimensions

The width, Length and thickness of the boards shall be as given in **Table 7.5**. The lengths of the two longitudinals of the boards shall not differ by more than ± 3 mm per metre length of the diagonal.

TABLE 7.5 Dimensions of Gypsum Plaster Boards

Type of Board	Width in mm	Length in mm	Thickness mm
Wall Board	600, 900 and 1200	1800 to 3600 in steps of 100 mm	9.5, 12.5 and 15
Base Board	400 and 900	1200, 1500 and 1800	9.5 and 12.5

7.2.11.7 Tolerance The tolerance on dimension shall be as given in **Table 7.6** below: -

**TABLE 7.6
TOLERANCES IN GYPSUM BOARDS**

Type	Tolerance in mm on		
	Width	Length	Thickness
Gypsum Wall Board	0 to – 5	0 to – 6	± 0.6
Gypsum Base Board			
(a) Non-perforated	0 to – 8	0 to – 6	± 0.6
(b) Perforated	0 to - 8	0 to - 10	± 0.6

7.2.11.8 Transverse Strength - Breaking load for gypsum plaster boards, shall be in accordance with **Table 7.7** given below:-

TABLE 7.7 Breaking Load of Gypsum Plaster Boards

Type of Board	Thickness (mm)	Breaking load, Transverse direction (N)	Min. Longitudinal Direction (N)
(1)	(2)	(3)	(4)
Plaster Board	9.5	140	360
	12.5	180	500
	15.0	220	650
Base Board	9.5	123	180
	12.5	165	235

7.2.12 Coir Veneer Board (Refer IS 14842)

7.2.12.1 Definition

Coir Veneer Board to IS 14842 is manufactured with a combination of coconut fibre needled felt, veneer and jute fibre with Kraft paper. Coconut fibre needled felt can be used as core / cross bands or as outer skins formed with jute fibres and kraft paper. The composite ply should be a balanced construction on either side of central ply. The blended mass of glued fibres is laid to form a mat which is pre-needled.

7.2.12.2 Materials

Coconut fibre, jute and kraft paper shall be as stipulated in Clause 5 of IS 14842. Adhesive shall conform to BWR/MR of IS:- 848 for BWR/MR Grade of Boards. Any species of Timber may be used for the manufacture of veneers which shall be either rotary cut or sliced. Alum, wax resin or other adhesive may be introduced in the agglomerate for coir veneer Board prior to forming primarily to increase water resistance.

7.2.12.3 Grades

Coir Veneer Board for general purposes shall be of Boiling Water Resistant (BWR) Grade or Moisture Resistant (MR) Grade.

7.2.12.4 Dimensions and Tolerance

Dimensions of Boards shall be as stipulated in Clause 8.2 of IS 14842. The thickness of Veneer Board shall be 3mm, 4mm, 5mm, 6mm, 9mm, 12mm, 16mm, 18mm, 20mm and 25mm. The thickness shall be uniform with a tolerance of 5 percent for 6mm and above and 10 percent for thickness less than 6mm. Tolerance for other dimensions shall conform to Clause 8.4 of IS 14842.

Testing
Sampling shall be done as per Clause 10 of IS 14842 and Tests as stipulated in Clause 11. The physical and Mechanical qualities shall conform to the requirements indicated in Sub clauses 11.1 to 11.4 of IS 14842. Retest if required shall be carried out as stipulated in Sub clause 11.5.

7.3 DOOR, WINDOW AND VENTILATOR FRAMES

Extracts from IS 4021-1995 on Timber, Door, Windows & Ventilator Frames are at **Annexure 7.4.**

7.3.1. Timber : Timber for door, window and ventilators frames shall be as specified.

Timber shall be sawn in the direction of the grains. All members of a frame shall be of the same species of timber and shall be straight without any warp or bow. Frames shall have smooth, well-planed (wrought) surfaces except the surfaces touching the walls, lintels, sill etc., which may be left clean sawn. Rebates rounding or moulding shall be done before the members are jointed into frames. The depth of the rebate for housing the shutters shall be 15 mm, and the width of the rebates shall be equal to the thickness of the shutters. Timber Sections shall be dressed and planed to within the permissible tolerance from the full dimensions as below.

(a) Width

(b) Thickness

7.3.2. Joints

The frames shall have dovetail joints **Figure 7.1A**. The jamb posts shall be through tenoned in to the mortise of the transoms to the full thickness of the transome and the thickness of the tenon shall be not less than 2.5 cm. The tenons shall closely fit into the mortise without any wedging or filling. The contact surface of tenon and mortise before putting together shall be glued with polyvinyl acetate dispersion based adhesive conforming to IS: 4835 or adhesive conforming the WBP or MR grade of IS : 851 and pinned with 10 mm dia hard wood dowels, or bamboo pins or star shaped metal pins. The joints shall be at right angles when checked from the inside surfaces of the respective members. The joints shall be pressed in position. Each assembled door frame shall be fitted with a temporary stretcher and a temporary diagonal brace on the rebated faces.

7.3.3. Fixing of Frames

The frames shall be got inspected and approved by the Engineer before being painted, oiled or otherwise treated and before fixing in position. The surface of the frames abutting masonry or concrete and the portions of the frames embedded in floors shall be given a coating of coal tar. Frames shall be fixed to the abutting masonry or concrete with holdfasts or metallic fasteners as specified. After fixing, the jamb posts of the frames shall be plugged suitably and finished neat. Vertical members of the door frames shall be embedded in the floor for the full thickness of the floor finish and shall be suitably struttred and wedged in order to prevent warping during fixing. A minimum of three hold fasts shall be fixed on each side of door and window frames one at center point and other two at 30 cm from the top

and bottom of the frames. In case of window and ventilator frames of less than 1 Metre in height two hold fasts shall be fixed on each side at quarter point of the frames. Hold fasts and metallic fasteners shall be measured and paid for separately.

7.3.4 Measurements

Wood work wrought, framed and fixed shall be measured for finished dimension without any allowance for the wastage or for dimensions beyond specified dimension. However, in case of members having mouldings, roundings or rebates and members of circular or varying sections, finished dimensions shall be taken as the sides of the smallest square or rectangle from which such a section can be cut. Length of each member shall be measured over all to the nearest cm so as to include projection for tenons. Width and thickness shall be measured to the nearest mm and the quantity shall be worked out in unit of cubic decimeter in whole numbers.

7.3.5 Rate

The rate shall include the cost of material and labour involved in all the operations described above except the hold fasts or metallic fasteners which will be paid for separately.

7.4 FALSE CEILING AND PARTITION FRAMES

This work shall be done as specified in 7.3 except that the scantlings need not be planed unless otherwise specified.

7.5 TRUSSES

7.5.1 General:- The work shall be carried out as per detailed drawings and as directed by the Engineer. Specified timber shall be used. Sawing shall be truly straight and square, and in the direction of the grains. The scantlings shall be accurately planed smooth to the full dimensions with rebate roundings and mouldings shown in the drawings, before the same are framed. Patching or plugging of any kind shall not be permitted. A tolerance of $-2/+3$ mm shall be allowed in the finished cross sectional dimension.

7.5.2 Joints

Joints shall be simple, neat and strong. All mortise and tenon joints, mitred joints, scarfs etc., shall fit in fully and accurately without wedging or fillings. The joints shall be as per detailed drawings. Holes of correct sizes shall be drilled before inserting screws/bolts. Driving in screws with hammer is prohibited. Holes for bolts shall be of uniform diameter. The screws, bolts and nails shall be dipped

in oil before using. The heads of nails and screws shall be sunk and puttied or dealt with as instructed by the Engineer. The gauge and length of nails, screws and bolts shall be approved by the Engineer before using on works.

7.5.3 Shaping Form and Cutting

The wood sections, as specified or required, shall be straightened, cut square and to correct lengths. A fine accuracy shall be ensured in the fabrication of various members so that these can be assembled without being unduly strained or forced into position and when built up, shall be true to shape and free from twist, kinks, buckles or open joints.

7.5.4 Fabrication

As per drawing, a full size truss diagram shall first be drawn on a levelled platform. From this full size diagram, templates of all joints as for tenons, mortises, scarves etc., shall be made for use in the fabrication. The template shall be made to correspond to each member and place for holes for screws and bolts shall be marked accurately on them and drilled. The templates shall be laid on wooden members and the holes for screwing and bolting marked on them. The ends of the wooden members shall also be marked for cutting. The base of columns and the position of anchor bolts shall be carefully set out. Before fabrication of the truss, individual members shall be assembled together to ensure close abutting or lapping of the surfaces of the different members and fitted close together as per drawing.

7.5.5 Hoisting and Placing in position

The trusses shall be hoisted and placed in position carefully, without any damage to itself and other building work and injury to workman. The trusses shall be secured to walls by means of holding down bolts or as directed by the Engineer. The necessary mechanical appliances such as fitting tackle, winch etc., for hoisting the truss shall be used. The trusses shall be stayed temporarily till they are permanently secured in position and connected with each other by means of purlins. Holding down bolts, cleats used for purlins and bottom plates used for tie and rafter member shall be paid for separately. All beams and guides shall be bedded in wall plates with atleast 25cm bearing. All joints shall bear not less than 12mm on wall plates. Every purlin or batten supported on a wall shall have a bearing in the direction of its length equal to its own depth, subject to a minimum of 10 cm.

When the end of a beam or any wood work is buried in masonry or brickwork, an air space of 6mm shall be left at the ends, sides and top.

7.5.6 Surface Treatment

Wood work shall not be painted, oiled or otherwise treated before it has been approved by the Engineer. All portions of timber built into or against or close to masonry or concrete or buried in ground shall be given two coats of boiling coal tar. It is desirable to add to Coal Tar quick lime powder in proportion of 1 kg. of lime to 5 litre of Coal Tar. In place of Coal Tar, use of red lead paint or other approved wood primer shall be permitted. All junctions of rafters, purlins, beams and wall plates shall be painted with approved wood primer.

7.5.7 Precautions

As a precaution against fire, no wood work shall be fixed within 60 cm of a fire place or flue.

7.5.8 Measurements

Wood work shall be measured for finished dimensions. No allowance shall be made for dimensions supplied beyond those specified. Length of each piece shall be measured over all nearest to a cm, so as to include projections for tenons, scarves or mitres. Width and thickness shall be measured to the nearest cm. Cubical contents can be worked out in units of cubic decimeter in whole number.

7.5.9 Rate

The rate includes the cost of materials and labour involved in all the operations described above. Unless otherwise specified, iron fixtures such as bolts and nuts, M.S. steel plates, holding down bolts and staining, priming, painting or polishing of the work shall be paid for separately.

7.6 PANELLED GLAZED OR PANELLED AND GLAZED SHUTTERS

Extracts from IS Code 1003 Pts. 1 & 2 on Shutters are at **Annexures 7.5A & 7.5B)**

7.6.1 General:- Panelled or glazed shutters for doors, windows, ventilators and cupboards shall be constructed in the form of timber frame work of stiles and rails with panel inserts of timber, plywood, block board, veneered particle board, Prelaminated Particle Board, fibre board, Prelaminated Fibre Board, wire gauze or sheet glass. The shutters may be single or multi-panelled, as shown in the drawings or as directed by the Engineer. Timber for frame work, material for panel inserts and

thickness of shutters shall be as specified. All members of the shutters shall be straight without any large warp or bow and shall have smooth well planed face at right angles to each other. Any warp or bow shall not exceed 1.5 mm. The right angle for the shutter shall be checked by measuring the diagonals and the difference between the two diagonals should not be more than ± 3 mm.

7.6.2 Frame work

Figure 7.2 may be seen for the Terminology for various components.

7.6.2.1 Timber for stiles and rails shall be of the same species and shall be sawn in the directions of grains. Sawing shall be truly straight and square. The timber shall be planed smooth and accurate to the required dimensions. The stiles and rails shall be joined to each other by plain or haunched mortise and tenon joints and the rails shall be inserted 25 mm short of the width of the stiles. The bottom rails shall have double tenon joints and for other rails single tenon joints shall be provided. The lock rails of door shutter shall have its center line at a height of 800 mm from the bottom of the shutters unless otherwise specified. The thickness of each tenon shall be approximately one-third the finished thickness of the members and the width of each tenon shall not exceed three times its thickness.

7.6.2.2 Gluing of Joints

The contact surfaces of tenon and mortise shall be treated, before putting together, with

bulk type synthetic resin adhesive conforming to IS : 851 suitable for construction in wood or synthetic resin adhesive (Phenolic and aminoplastic) conforming to IS : 848 or polyvinyl acetate dispersion based adhesive conforming to IS : 4835 and pinned with 10 mm dia hardwood dowels or bamboo pins or star shaped metal pins; after the frames are put together and pressed in position by means of press.

7.6.2.3 Stiles and bottom rail shall be made out of one piece of timber only. Intermediate rail exceeding 200 mm in width may be out of one or more pieces of timber. The width of each piece shall be not less than 75 mm. Where more than one piece of timber is used for rails, they shall be joined with a continuous tongued and grooved joint glued together and reinforced with metal dowels at regular intervals not exceeding 200 mm.

7.6.3 Muntin & Glazing Bars:- Muntin and glazing bars where required shall be sub-tenoned to the maximum depth which the size of the member would permit or to a depth of 25 mm whichever is less. Unless otherwise specified the finished dimensions of the components of frame work of shutters shall be as given in **Table 7.8**. The tolerance on width of styles and rail shall be ± 3 mm. The tolerance in thickness will be ± 1 mm. The thickness of all components of frame work shall be the same as the thickness of the shutter. Tolerance on over all dimensions of the shutter shall be ± 3 mm.

TABLE 7.8 Dimensions of components of Frame Work

SL	Description	Width (mm)	Thickness (mm)
A. DOOR SHUTTERS			
(a)	Stile, top and freeze rail	100	35 or 40
(b)	Lock rail	150	35 or 40
(c)	Bottom rail	200	35 or 40
(d)	Muntin	100	35 or 40
(e)	Glazing bar	40	35 or 40
B. WINDOW, VENTILATOR CUPBOARD SHUTTES			
(a)	Stile, top and freeze rail	80	20, 25 or 30
(b)	Bottom rail	80	20, 25 or 30
(c)	Muntin	60	20, 25 or 30
(d)	Glazing bar	40	20, 25 or 30

7.6.4 Rebating

The shutters shall be single-leaf or double leaved as shown in the drawings or as directed by the Engineer. In case of double leaved shutters, the meeting of the stiles

shall be rebated by one-third the thickness of the shutter. The rebating shall be either splayed or square type as shown in **Figure 7.2**.

7.6.5 Panelling

The panel inserts shall be either framed into the grooves or housed in the rebate of stiles and rails. Timber, plywood, hard board and particle board panels shall be fixed only into grooves. The depth of the groove shall be 12 mm and its width shall accommodate the panel inserts such that the faces are closely fitted to the sides of the groove. Panel inserts shall be framed into the grooves of stiles and rails to the full depth of the groove leaving on space of 1.5 mm. Width and depth of the rebate shall be equal to half the thickness of stiles and rails. Glass panels, asbestos panels wire gauze panels and panel inserts of cupboard shutters shall be housed in the rebates of stiles and rails.

7.6.5.1 Timber Panels

Timber panels shall be preferably made of timber of large width; the minimum width and thickness of the panel shall be 150 mm. and 15 mm respectively. When made from more than one piece, the pieces shall be jointed with a continuous tongued and grooved joint glued together and reinforced with headless nails at regular intervals not exceeding 100 mm. Depth and thickness of such joint shall be equal to one-third of thickness of panel. The panels shall be designed such that no single panel exceeds 0.5 square metre in area. The grains of timber panels shall run along the longer dimensions of the panels. All panels shall be of the same species of timber unless otherwise specified. Tolerance permissible in thickness of Panel is $\pm 1.00\text{mm}$

7.6.5.2 Plywood Panels

Plywood boards used for paneling of shutters shall be BWR type or grade as specified in Para 7.2.2A & 7.2.2B. Each panel shall be a single piece of thickness, 9 mm for two or more panel construction and 12 mm for single panel construction unless otherwise specified.

7.6.5.3 Block Board Panels

Block board used for paneling of shutters shall be Grade I (Exterior Grade) bonded with BWR type synthetic resin adhesives as specified in 7.2.6. Each panel shall be a single piece of thickness 12 mm unless otherwise specified.

7.6.5.4 Veneered Particle, Board Panels / Prelaminated Particle Board Panels

Veneered Particle Board / Prelaminated Particle Board used for paneling of shutters shall be Exterior Grade I bonded with BWR type synthetic resin adhesives as specified in Paras 7.2.3B and 7.2.3C. Each panel shall

be a single piece of thickness 12 mm unless otherwise specified.

7.6.5.5 Fibre Board Panels / Prelaminated Fibre Board Panels

Fibre Board / Prelaminated Fibre Board used for paneling of shutters shall be Exterior Grade I bonded with BWP type synthetic resin adhesives as specified in Paras 7.2.8A & 7.2.8B. Each panel shall be a single piece of thickness 10 mm unless otherwise specified.

7.6.5.6 Wire Gauze Panels

Wire Gauze used for paneling of shutters shall be woven with 0.63 mm dia galvanized mild steel wire to form average aperture size of 1.40 mm as specified in 7.2.10. Wire gauze shall be securely housed into the rebates of stiles and rails by giving right angle bend turned back and fixed by means of suitable staples at intervals of 75 mm and over this wooden beading shall be fixed., The space between the rebate and the beading shall be fixed with putty to give a neat finish. Each wire gauze panel shall be a single piece, and the panels shall be so designed that no single panel exceeds 0.5 sqm. in area. However, care shall be taken to prevent sagging of wire gauge of panel by providing and fixing 20 x 20 mm square or equivalent beading to the external face in the required patterns as directed by the Engineer.

7.6.5.7 Glass Panels

Glass paneling (Glazing) shall be done with sheet/float glass of ordinary quality as specified in 7.2.9. Glazing in the shutters of doors, windows and ventilators of bath, WC and Lavatories shall be provided with frosted glass the weight of which shall be not less than 10 kg/sqm. Frosted glass panels shall be fixed with frosted face on the inside. Glass panels shall be fixed by providing a thin layer of putty conforming to IS : 419 applied between glass pane and all along the length of the rebate and also between glass panes and wooden beading. Putty can be prepared by mixing one part of white lead with three parts of finely powdered chalk and then adding boiled oil to the mixture to form a stiff paste and adding varnish to the paste at the rate of 1 litre of varnish to 18 kg. of paste. Fixing of glass panes without beading shall not be permitted. Glazing shall be done after the shutters have been primed and prepared for painting, so that wood may not draw oil out of putty. Typical arrangement of glazing is at **Figure 7.3**. For external glazed doors and windows, the beadings should be fixed on the outside. No

glazing is to be considered complete until all stains have been removed from the surface of the glass and wood work. No glass is to be inserted in frames until the frames have been primed and prepared for painting etc, so that the putty may adhere properly.

7.6.5.8 Finish

Panels of shutters shall be flat and well sanded to a smooth and level surface.

7.6.6 Beading

Beadings in panelled shutter shall be provided where specified in architectural drawings or directed by the Engineer. Each length of beading shall be of single piece. Joints at the corners shall be mitred and exposed edges shall be rounded. Beading shall be fixed with headless nails at 75 mm intervals. For external shutters, the beading shall be fixed on the outside face.

7.6.7 Machine/Factory made Shutters

Machine made shutters, where specified, shall be procured from an approved factory. For machine made shutters, operations like sawing, planing, making tongue and tenons, cutting grooves, mortises and rebates, drilling holes and pressing of joints shall be done by suitable machines. Machine made shutters shall be brought to the site fully assembled but without any priming coat. Panel inserts of sheet glass and wire gauge, may, however, be fixed at site.

7.6.8 Fixing of Shutters

For side hung shutters of height upto 1.2 m each leaf shall be hung on two hinges at quarter points and for shutters of height more than 1.2 m each leaf shall be hung on the hinges one at the center and the other two at 200 mm from the top and bottom of the shutters. Top hung and bottom hung shutters shall be hung on two hinges fixed at quarter points of top rail or bottom rail. Centre hung shutter shall be suspended on a suitable pivot in the center of the frame. Size and type of hinges and pivots should be as specified. Flap of hinges shall be neatly counter sunk into the recesses cut to the exact dimensions of flap. Screws for fixing the hinges shall be screwed in with screw driver and not hammered in. Unless otherwise specified, shutters of height more than 1.2 Metres shall be hung on butt hinges of size 100 mm and for all other shutters of lesser height butt hinges of size 75 mm shall be used. For shutters of more than 40 mm thickness butt hinges of size 125 x 80 x 4 mm shall be used. Continuous (piano) hinges shall be used for fixing cup-board shutters where specified.

7.6.9 Fittings

Fittings shall be provided as per schedule of fittings decided by the Engineer. **Annexure 7.6** gives for guidance the schedule of fittings and screws usually provided. Cost of providing and fixing shutter shall include cost of hinges and necessary screws for fixing the same. All other fittings shall be paid for separately. The fittings shall conform to specifications laid down in 7.21.

7.6.10 Wooden Cleats and Blocks

Wooden cleats and blocks shall be fixed to doors and windows as directed by the Engineer, as per size and shape approved by him. These are included in the cost of providing and fixing the shutters.

7.6.11 Measurements

Frame work and panelling shall be measured separately.

7.6.11.1 Frame Work of Shutters

The overall length and width of the frame work of the shutters shall be measured nearest to a cm in fixed position (overlaps not to be measured in case of double leaved shutters) and the area calculated in square metres correct to two places of decimal. No deduction shall be made to form panel openings or louvers. No extra payments shall be made for shape, joints and labour involved in all operations described above.

7.6.11.2 For panelling of each type or for glazed panel, length and width of opening for panels inserts or glazed panels shall be measured correct to a cm before fixing the beading and the area shall be calculated to the nearest 0.01 sqm. The portions of the panel inserts or glazed panel inside the grooves or rebates shall not be measured for payment.

7.6.12 Rate

Rate includes the cost of materials and labour involved in all the operations described above. The frame work and paneling of each type or glazed panels shall be paid separately. The rate for frame work includes the cost of butt hinges and necessary screws as specified in 7.6.9. However, extra payment shall be made for providing moulded beading where specified. Nothing extra shall be paid for plain beading as stated in 7.6.6 when specified in drawing.

7.7A Wooden Flush Door Shutters (Cellular and Hollow Core Type) (Plywood Face Panels) (Refer IS 2191 Pt.1)

7.7A.1 Types and Designation

Cellular or Hollow Core flush door shutters may be of the decorative type or non-decorative (paintable) type. Abbreviations to be used are Cellular Decorative CD; Cellular Non Decorative CN; Hollow Decorative HD and Hollow Non decorative HN.

7.7A.2 Sizes, Thickness and Tolerances

Extracts from Clause 4 on "Sizes" from IS 2191 Pt. 1 are enclosed as **Annexure 7.7**. Sketch representing the dimensions is at **Figure 7.4A**.

7.7A.3 Materials

7.7A.3.1 Timber

Timber (Species, quality, preservative treatment) shall conform to stipulations in Clause 5.1 of IS 2191 Pt.1. For Stiles, rails and lipping only hard wood species shall be used. Moisture content in timber shall be not more than 12% when tested as per IS 1708.

7.7A.3.2 Plywood

Commercial Plywood used in Flush door shutters shall be BWR Grade of Type AB conforming to IS 303. Decorative Plywood should conform to BWR Grade Type II to IS 1328.

7.7A.3.3 Cross Band - Should conform to BWR Grade Plywood to IS 303.

7.7A.3.4 Face Veneers

Commercial face veneer should conform to BWP Grade Plywood to IS 303. Decorative face veneer should conform to BWR Grade I to IS 1328.

7.7A.3.5 Adhesive - Adhesive used shall be phenol formaldehyde synthetic resin conforming to BWR Type of IS 848.

7.7A.3.6 Particle Board

Particle Board used for the core of the Flush Shutters shall be either Flat pressed or extrusion pressed type conforming to IS 3087 using Phenol Formaldehyde adhesive.

7.7A.4 Construction

7.7A.4.1 Cellular Core (Refer Figure No.7.4B)

Timber frames for holding the core shall be constructed from stiles and top and bottom rails, each not less than 75mm wide including internal lippings where provided. The cellular core shall be of Type A or Type B described in sub clause 6.1 of IS 2197 (Pt.1). For Type A, Particle Board to IS 3087 or Hard Board to IS 1658 or Wooden battens or Plywood battens etc of not less than 25mm width will be used to provide voids of area not exceeding 25 cm^2 and total voids contents not exceeding 50% of Core Volume. For Type B Rolls, strips, Coils or

corrugations of veneer not less than 1mm thick and 100mm length will be used. Voids will be uniformly distributed throughout the core.

7.7A.4.2 Hollow Core (Refer Fig. No. 7.4C)

Timber frames for holding the core shall be constructed from stiles and top, bottom and minimum two intermediate rails each not less than 75mm wide including internal lipping where provided. In each segment, battens not less than 25mm wide shall be fixed in such a way that voids are distributed equally and the void area in any segment is less than 500 cm^2 . Battens may be replaced by suitable rolls or strips of veneers.

7.7A.4.3 Face Panels

The plywood forming the face panel shall be not less than 3mm in thickness in the case of cellular core shutters and not less than 6mm in thickness in the case of hollow core shutters except for 25mm thick shutters in which case 4mm thickness may be permitted. The thickness of face veneers in the plywood shall be between 0.5mm and 1.5mm for commercial veneers and 0.5mm and 1.0mm for decorative veneers.

7.7A.4.4 Lipping

Lipping where provided shall be internal (designated as edge band) or external as specified by the Purchaser. Joints shall not be permitted in the lipping. Edge band shall have a total depth of not less than 25mm. External lipping shall be solid and measure atleast 6mm on the face of the door.

7.7A.4.5 Rebating

In the case of double leaved shutters, the meeting of stils shall be rebated by one third thickness of shutter. Where lipping is provided, the depth of lipping at the meeting of stiles shall be not less than 35mm.

7.7A.4.6 Opening for Glazing

When required by the purchaser, opening provided shall be 25cm in height and 20cm in width. Bottom of opening shall be at a height of 140cm from the bottom of the shutter, Opening shall be lipped internally with solid timber.

7.7A.4.7 Venetian

This shall be provided where desired. Height of opening shall be 30 cm from the top of bottom rail. Width of opening shall provide for a clear space of atleast 75mm between the edge of the door and the venetian opening.

7.7A.5 Fittings -Shutters shall be shop prepared for taking mortice locks or latches as ordered.

7.7A.6 Testing

The tests to be carried out and the requirements to be complied with are as given in Clause 9 of IS 2191 Pt.1. Sampling and Criteria for conformity shall be as laid down in Clause 10 of IS 2191 Pt.1.

7.7A.7 Fixing - This shall be as specified in Para 7.6.8.

7.7A.8 Measurements

Length and width of the shutters shall be measured to the nearest cm in closed position covering the rebate of the frames but excluding the gap between the shutters and the frame. Overlap of two shutters shall be measured.

All work shall be measured net as fixed and area calculated in square metres to nearest

two places of decimal. No deduction shall be made for providing venetion opening and opening for glazing.

7.7A.9 Rate

The Rate shall include the cost of materials and labour involved in all the operations described above. Extra shall be payable for providing rebate in double leaved shutters.

7.7B Wooden Flush Door Shutters (Cellular and Hollow Core Types (Particle Board and Hard Board Face Panels) – (Refer Is 2191 Pt.2)**7.7B.1 Types and Designations**

Types and Designations shall be as under for Particle Board Face Panels.

CORE	TYPE		DESIGNATION
	Decorative or Non Decorative	Skin	
Cellular	D	Decorative Veneered Particle Board	CDPV
	ND	Unveneered Particle Board	CNP
	ND	Commerical Veneered Particle Board	CNPV
Hollow	D	Decorative Veneered Particle Board	HDPV
	ND	Unveneered Particle Board	HNP
	ND	Commerical Veneered Particle Board	HNPV

7.7B.2 Sizes, Thickness and Tolerances

Same as in Para 7.7A.2. Core shall conform to provisions in IS 2191 Pt.1.

7.7B.3 Materials

7.7B.3.1 Timber: Same as in Para 7.7A.3.1.

7.7B.3.2 Particle Board

Unveneered Particle Board for use with CNP and HNP should conform to IS 3087 using BWR Type Resin. Veneered Particle Board for use with Decorative type CDPV and HDPV as well as for Nondecorative type CNPV and HNPV should conform to the corresponding appropriate provisions in IS 3097.

7.7B.3.3 Fibre Board

For shutters with Fibre Hard Board face only tempered hard board conforming to IS 1658 shall be used.

7.7B.3.4 Adhesive

Phenol Formaldehyde of BWP Type conforming to IS 848 should be used.

7.7B.4 Construction

The relevant provisions in IS 2191 (Pt.2) will apply. For Face Panel, if unveneered Particle Board or Veneered Particle Board is used, the face panel shall not be less than 6mm thick in the case of cellular core flush doors and not less than 9mm thick in case of hollow core flush doors. If hard board is used the corresponding figures will be 4mm and 6mm. The Panel shall be glued under pressure on both faces of the core by the hot press process.

7.7B.5 Fittings -Para 7.7A.5 will apply.

7.7B.6 Testing - Para 7.7A.6 will apply.

7.7B.7 Fixing - Para 7.7A.7 will apply.

7.7B.8 Measurements - Para 7.7A.8 will apply.

7.7B.9 Rate - Para 7.7A.9 will apply.

7.7C WOODEN FLUSH DOOR SHUTTERS (Solid Core Type) (Plywood Face Panels) (Refer IS 2202 Pt.1)**7.7C.1 Types and Designations**

Solid Core flush door shutters may be of the decorative type or non decorative (paintable)

type as under depending on the type of Core.

SL	Core	Type	Designation
i)	Block Board	Decorative	BD
		Non Decorative	BN
ii)	Particle Board with or without Block Board	Decorative	PD
		Non Decorative	PN
iii)	Medium density Fibre Board with or without Block	Decorative	MD
		Non Decorative	MN

Board

7.7C.2 Size and Thickness - Same as in Para 7.7A.2

7.7C.3 Material - 7.7C.3.1 Timber Same as in Para 7.7A.3.1.

7.7C.3.2 Plywood

Commercial Plywood should conform to IS 710 for adhesive and grading with surface requirements to suit type AB of IS 303 for veneers. Decorative Plywood should conform to Type I of IS 1328.

7.7C.3.3 Cross band / Face Veneer

Cross band and commercial face veneer should conform to Marine Grade Plywood IS 710 for quality and IS 303 for veneers. Decorative face veneer should conform to Type I of IS 1328.

7.7C.3.4 Adhesive - It shall be Phenol Formaldehyde BWP Grade synthetic resin to conform to IS 848.

7.7C.3.5 Particle Board

Particle Board used for the core shall be either FPT-1 or XPS designation of IS 3087.

7.7C.3.6 Medium Density Fibre Board

MDF Board used for the core shall conform to Type EGSB of IS 12406.

7.7C.4 Construction

7.7C.4.1 Block Board Core (See **Figure 7.4D**)

A frame constructed of stiles and rails shall be provided for holding the core. Width of frame including lipping shall be 45mm to 75mm. Wooden strips to form to core shall not exceed 30mm in width. The strips of wood may be laid separately or spot glued or otherwise jointed to form a core which is glued between two or more outer veneers.

7.7C.4.2 Particle Board or Medium Density Fibre Board Core (See **Figure 7.4E**)

Frame shall be as mentioned in 7.7C.4.1 Particle Board / M.D.F.Board should be as given in Para 7.7C.3.5 and 7.7C.3.6 respectively.

7.7C.4.3 Particle Board or Medium Density Fibre Board with Block Board Core (Reg. **Figure 7.4F**)

Frame, Particle Board and M.D.F. Board shall be as indicated in Para 7.7C.4.2, Block Board shall conform to Para 7.7C.4.1 and should extend atleast 150mm from inner edge of the stiles on either side and the rest shall be particle board or MDF Board.

7.7C.4.4 Stiles and rails - They shall be one piece, without any joint.

7.7C.4.5 Face Panel - The Face Panel shall be formed by gluing on both faces of the core either plywood or cross board and face veneers by the hot press process. The thickness of the cross band as such or in the plywood shall be between 1mm and 3mm. The thickness of face veneer as such or in the plywood shall be between 0.4mm to 1.5mm for commercial veneers and 0.35mm to 1.0mm for decorative veneers, provided combined thickness of both is not less than 2.2mm.

7.7C.4.6 Lipping

Internal lipping shall have a total depth of not less than 25mm. External lipping shall be solid and shall measure atleast 4mm on the face of the door.

7.7C.4.7 Rebating

In the case of double leaved shutters, the meeting of stiles shall be rebated by 8mm to 10mm. Where lipping is provided, the depth of lipping at the meeting of stiles shall be not less than 30mm.

7.7C.4.8 Opening for glazing - Same as in 7.7A 9 except that the width may be 15cm or 20cm.

7.7C.4.9 Venetian

This shall be provided if ordered. The height of opening shall be 35cm from bottom of shutter. A clear space of atleast 7.5cm should be left between the edge of door and venetian opening.

7.7C.5 Fittings

Shutters shall be shop prepared for taking mortice locks or latches. Suitable blocks of wood may be provided for fixing the locks.

7.7C.6 Testing - The following Clauses of IS 2202 (Pt.1) will apply.

Clause 10 Tests

Clause 11 Requirements

Clause 12 Sampling and criteria for conformity

7.7C.7 Fixing - Para 7.7A.7 will apply.

7.7C.8 Measurements - Para 7.7A.8 will apply.

7.7C.9 Rate - Para 7.7A.9 will apply.

7.7D Wooden Flush Door Shutters (Solid Core Type) – (Particle Board and Hard Board Face Panel) (Refer IS 2202 Pt.2)

7.7D.1 Type and Designations

Solid Core flush door shutters with Particle Board face panels may be of decorative or non decorative (Paintable) type. The Designations based on the type of Core and type of face panel will be as under:

Core	Type		Designation
	Decorative or Non Decorative	Veneered or Unveneered Particle Board	
Block Board	Decorative Nondecorative Nondecorative	Veneered Unveneered Veneered (commercial)	BDPV BNP BNPV
Particle Board with or without Block Board	Decorative Nondecorative Nondecorative	Veneered Unveneered Veneered (Commercial)	PDPV PNP PNPV

7.7D.2 Sizes Thickness and Tolerance - Same as in Para 7.7A.2.

7.7D.3 Materials -

7.7D.3.1 Timber Same as in Para 7.7A.3.1.

7.7D.3.2 Particle Board for Face Panel

Unveneered To conform to IS 3087 and of appropriate Type

Veneered To conform to IS 3097 and of appropriate Type

7.7D.3.3 Fibre Hard Board for Face Panel

Tempered hard board should conform to IS 1658.

7.7D.3.4 Adhesive - Should be Phenol formaldehyde synthetic resin and should conform to BWP Type to IS 848.

7.7D.4 Construction

7.7D.4.1 Core - Paras 7.7C.4.1 to 7.7C.4.4 will apply.

7.7D.4.2 Face Panel

Face Panel shall be formed by gluing by the hot press process on both faces of the core. Particle Boards or veneered particles boards or Hardboard. The thickness of each face Panel of Particle Board shall be not less than 4mm and of hardboard not less than 3mm.

7.7D.5 Fittings - Para 7.7A.5 will apply.

7.7D.6 Testing - Provisions in Para 7.7C.6 will apply.

7.7D.7 Fixing - Para 7.7A.7 will apply.

7.7D.8 Measurements - Para 7.7A.8 will apply.

7.7D.9 Rate - Para 7.7A.9 will apply.

7.8. Battened and Framed Door and Window Shutters (Figure 7.5A)

7.8.1 General:- Specified timber shall be used, and it shall be sawn in the direction of the grains. Sawing shall be truly straight and square. The timber shall be planed smooth and accurate to the full dimensions; rebates, roundings and mouldings as shown in the drawings made before assembly. Patching or plugging of any kind shall not be permitted except as provided.

7.8.2 Dimensions:- Planks for battens shall be 20 mm thick unless otherwise specified and of uniform width of 75 mm to 100mm. These shall be planed and made smooth, and provided with minimum 12 mm rebated joints. The finished work with a tolerance of ± 1 mm in thickness and $\pm 1 \frac{1}{2}$ mm in width of battens etc., shall be accepted. The ends of battens shall be feather tongued into stiles and rails, which shall be provided with 12 mm groove to fit in the battens.

7.8.3 Fixing etc:- The specification for fixing wooden cleats and blocks, fittings and measurements shall be as described under 7.6.

7.8.4 Rate - It includes the cost of materials and labour involved in all the operations described above.

7.9 LEDGED AND BATTENED, OR LEDGED BRACED AND BATTENED DOOR AND WINDOW SHUTTER (FIGURE 7.5B & 7.5C)

7.9.1 General:- Provisions in Para 7.8.1 shall apply.

7.9.2 Dimensions:- Planks for battens shall be 20mm thick unless otherwise specified and of uniform width of 75 mm to 100 mm. These shall be planed and made smooth and provided with minimum 12 mm rebated

joints. The finished work with a tolerance of ± 1 mm in thickness and $\pm 1 \frac{1}{2}$ mm in width of battens, ledges etc., shall be accepted. The ends of battens shall be feather tongued into style and rails, which shall be provided with 12 mm groove to fit in the battens.

7.9.3 Ledges and Braces

The battens shall be fixed together by 25 mm thick ledges and braces fixed to the inside face of door shutters with screws. The ledge shall be 175 mm wide and brace 125 mm wide unless otherwise specified. The braces shall incline downwards towards the side on which the door is hung as shown in **Figure 7.5C**. Edges and ends of ledges and braces shall be chamfered. Tee hinges shall be provided in ledges only. The finished work with a tolerance of ± 1 mm in thickness and $\pm 1 \frac{1}{2}$ mm in width of battens, ledges etc., shall be accepted.

7.9.4 Fixing etc.:- The specifications for fixing wooden cleats, blocks, fittings and measurements shall be as described under 7.6.

7.9.5 Rate - It includes the cost of materials and labour involved in all the operations described above.

7.10 LEDGED BRACED AND BATTENED GARAGE DOOR SHUTTERS (FIGURE 7.5C & 7.5D)

7.10.1 General:- Para 7.8.1 will apply.

7.10.2 Battens:- Planks for battens shall be 20mm thick unless otherwise specified and of uniform width of 125 to 175 mm. These shall be planed and made smooth, and provided with minimum 12 mm rebated joints. The joint lines shall be chamfered. The finished work with a tolerance of ± 1 mm in thickness and $\pm 1 \frac{1}{2}$ mm in width of battens etc., shall be accepted. Thickness of doors shall be the thickness of battens only and not the combined thickness of battens and braces.

7.10.3 Ledges and Braces

The battens shall be fixed together by 30 mm thick (unless otherwise specified), ledges and braces on the inside face of door shutter with minimum two numbers of 50 mm long wood screws per batten. The ledges shall be 225 mm and braces 175 mm wide, unless otherwise specified. The braces shall incline downwards towards the side on which the door is hung. Edges and ends of ledges and braces shall be chamfered.

7.10.4 Fittings and Fixing

Garage door shutter shall be fixed to the wall masonry with six pintle sets. Each set shall consist of a pin clamp of 50 x 6 mm flat iron 45 cm long, bent and forked at one end and provided with 20 mm dia. M.S. pin on the other end and 50 x 6 mm double strap 60 cm long. The pin shall be firmly riveted or welded to the pin clamps, the other end of which shall be embedded in masonry by means of cement concrete block 40 x 20 x 20 cm 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size). These shall be so placed that the bottom pin shall face upwards and the top pin downwards, in order that the gate may not be removed by lifting over pins. The fixing shall be so done that the door shutter can open on the outside by 180° .

The double strap shall fit in the pin on one side and shall be fixed to the shutter at ledge on the other side with 4 bolts and nuts of 12 mm diameter. One hook and eye 450 mm size of mild steel shall be provided for each shutter to keep fixed in open position. A cement concrete block 15 x 10 x 20 cm in 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) mix shall be embedded in the floor at junction of two shutters so that the door shutters open only on the outside and not on the inside. An iron sliding bolt (aldrop) 450 x 16 mm in diameter shall be provided and fixed. Tolerance of ± 0.5 mm in diameter may be allowed.

7.10.5 Measurements

The over all length and width of the shutter shall be measured nearest to a cm in fixed position (overlaps not to be measured in case of double leaved shutters) and area calculated in square metres correct to two places of decimal. Rate of 450X16mm dia aldrop is included in the rate of shutters .

7.10.6 Rate - It includes the cost of materials and labour required for the operations described above. Nothing extra shall be paid for cement concrete blocks, nor anything deducted from the measurement of masonry of wall on account of cement concrete blocks etc.,

7.11 LOUVERED SHUTTERS

7.11.1 General:- Para 7.8.1 will apply.

7.11.2 Frames

Where the shutters have to be provided in the same frames as for the ordinary door or window, the thickness of the frame shall be increased by the specified thickness of the

shutters, which shall be paid for separately under the relevant items of work.

7.11.3 Stiles and Rails - It shall be as specified in 7.6.

7.11.4 Venetians

The panel space shall be fitted with Venetians which shall be 12 mm thick, unless otherwise specified. The venetian blades shall slope down towards the outside at angle as shown in the drawings and shall be fixed in stiles. These shall overlap each other by about half of their widths. The Venetians may be of fixed or movable type as specified. The finished work with a tolerance of ± 1 mm in thickness and $\pm 3/2$ mm in width of battens etc., shall be accepted.

7.11.5 Fittings etc:- The specification for fittings, wooden cleats and blocks and measurements shall be as specified under 7.6.

7.11.6 Rate

It includes the cost of materials and labour involved in all the operations described above. The rate for frame work includes the cost of butt hinges and necessary screws as specified in 7.6.8. The rate for venetian/louvers shall include the cost of beading if specified.

7.12 LOUVERS FIXED TO FRAMES

7.12.1 General:- The louvers shall be of wood, glass, AC sheet or any other material as specified.

7.12.2 Fixing -

These shall be fixed in grooves of minimum of 1.25 mm depth, made in the frame. The venetian blades shall slope down towards the outside at an angle of 45° or as shown in the drawings. These shall overlap each other by about half of their widths.

7.12.3 Measurements

The width and height of the clear opening shall be measured to the nearest cm and area calculated in square metre correct to two places of decimal for the purpose of payment.

7.12.4 Rate - The rate is inclusive of the cost of materials and labour required for all the operations described above.

7.13 WIRE GAUZE FLY PROOF SHUTTERS

7.13.1 General:- Para 7.8.1 will apply.

7.13.2 Stile and Rails

The specifications shall be as described under 7.6.2.3. The stiles and rails shall be

given a rebate to receive the wire gauze which shall form the panels.

7.13.3 Wire Gauze

This shall unless specified otherwise conform to para 7.2.10 and 7.6.5.6. The wire gauze shall be bent at right angles in the rebates of stiles and rails, turned back and fixed tight with blue tacks at about 75 mm centres, fixed alternately in the two faces of the rebates. Over this, wooden beading shall be fixed with beads or small screws at about 75 mm centers.

The space between the beading and rebates, where the wire gauze is bent, shall be neatly finished with putty, so that the end of the wire gauge may not be visible.

7.13.4 Fixing etc:- Fixing Fittings, Wooden cleats, blocks and Measurement shall be as specified under 7.6.

7.13.5 Rate - This includes the cost of materials and labour involved in all the operations described above, and as specified under 7.6.

7.14 PANELLED PARTITIONS

7.14.1 Frames:- Wooden frames shall be made as per detailed drawings or as directed by the Engineer and paid for separately, unless otherwise specified.

7.14.2 Partitions:- The space between the frame work shall be filled in with panelled or glazed partitions of wood, asbestos sheet, masonite or as specified. The specifications under Para 7.6 shall apply to wooden partitions except that those shall be fixed in the rebates of the frame with screws. Asbestos, hard board, plywood or other specified sheets shall be similarly fixed in the rebates of the frame with screws and wooden beading.

7.14.3 Measurements:- The partitions shall be measured in Sqm. within the rebates of the frames. The width and height of partitions shall be measured correct to a cm.

7.15 SHELVES

7.15.1 General:- Shelves and vertical partitions of cupboards shall be of timber planks fibre board, particle board, block board or veneered / prelaminate particle board as specified. Thickness and type of planks or boards shall be as specified. Each shelf shall be a single piece and vertical partitions between two consecutive shelves shall be without any joint. Exposed edge of boards having particle board core shall be sealed with 3 mm thick single piece teak wood strips of width equal to the thickness of board with headless pins. The arrangement

of shelves and vertical partitions shall be as per drawings or as directed by the Engineer.

7.15.2 Fixing

Planks for shelves shall be planed on all faces and edges. In case of boards they shall be sawn to the required size truly straight and square. Timber battens 25 x 40 mm unless otherwise specified shall be planed smooth and fixed inside the cupboard with wooden plugs and screws. Shelves shall be fixed to the battens and vertical portions shall be held in position by fixing them to the battens and shelves using screws. Teakwood strips for edge sealing of the boards shall be planed smooth and fixed with headless nails. Tolerance in width shall be ± 1.5 mm and in thickness 1 mm.

7.15.3 Measurements

Length and width of shelves and vertical partitions shall be measured correct to a cm separately for each type of board stating its thickness. Area shall be calculated correct to 0.01 sqm.

7.15.4 Rate

It includes the cost of materials and labour required for all the operations described above.

7.16 TRELLIS (JAFFRI) WORK

7.16.1 General:- Para 7.8.1 will apply.

7.16.2 Plain Trellis (Jaffri)

This shall consist of wooden strips or laths 35 x 10 mm section unless otherwise specified planed and nailed together at every alternate crossing. The strips shall cross each other at right angle and shall be spaced 35 mm apart, so as to form 35 x 35 mm square opening or as shown in the drawing. These shall be fixed with nails to the frame. To cover the ends of strips, 50 x 12 mm beading shall be fixed to the frame with screws. The finished work with a tolerance of ± 1 mm may be accepted).

7.16.3 Trellis (Jaffri) Doors and Windows Shutters

Shutter frame of specified timber shall consist of two stiles and top, lock and bottom rails, each of section 75 x 35 mm unless otherwise specified. The stiles and rails shall be properly mortised and tenoned. The tenons shall pass through the stiles for at least $\frac{3}{4}$ th of the width of the stile. Shutter frame shall be assembled and passed by the Engineer before jointing. The joints shall be pressed and secured by bamboo pins of about 6 mm diameter. To this frame, plain trellis (Jaffri) work as described in 7.12.2 shall be fixed as shown in the drawings or as

directed by the Engineer, Fixing, fittings, wooden cleats and blocks shall be provided as specified under 7.6.

7.16.4 Measurements

Width and height of plain trellis work and trellis shutters shall be measured overall correct to a cm. The area shall be calculated in square metres nearest to two places of decimal. In case of shutters, the measurement shall be as specified in 7.6.

7.16.5 Rate - It includes the cost of materials and labour required in all the operations described above.

7.17 PELMETS

7.17.1 General:- Para 7.8.1 will apply.

7.17.2 Components:- Sides, front and top of the pelmets shall be of 12 mm planks or boards of specified quality and width unless otherwise stated. These shall project from the wall face by 15 cm or as specified and shall be securely fixed to walls with wood screws by means of wooden plugs and 10 cm long 25 x 3 mm M.S. flat bent in the form of angle or by any other device approved by the Engineer. The pelmets shall be provided with curtain rods and brackets or curtain rails with rollers., stop ends and brackets wooden, brass or chromium plated brass as specified. Intermediate wooden brackets shall be provided, if the front length of pelmet exceeds 1.5 metres.

7.17.3 Measurements

The pelmets box shall be measured along the sides and front planking correct to a centimeter.

7.17.4 Rate - The rate includes the cost of sides, front and top planking, curtain rods with brackets or curtain rails with rollers, labour and materials required for all the operations described above.

7.18 HOLD FASTS

7.18.1 General:- These shall be made from mild steel flat 40 x 5 mm size conforming to IS : 7196 without any burns or dents. 5 cm length of M.S. flat at one end shall be bent at right angle and one hole 11 mm dia shall be made in it for fixing to wooden frame with 10 mm dia nut and bolt. The bolt head shall be sunk into the wooden frame, 10 mm deep and plugged with wooden plug. At the other end 10 cm length of the hold fast flat shall be forked and bent at a right angle in opposite direction and embedded in cement concrete block of size 30 x 10 x 15 cm of mix 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate, 20 mm nominal size) or as specified (Refer **Figure 7.6**).

7.18.2 Measurements - Measurements for the hold fasts shall be in number/Kgs.

7.18.3 Rate - It includes the cost of labour and material involved in all the operations described above including fixing bolt and cement concrete blocks.

7.19 EXPANDED METAL, HARD DRAWN STEEL WIRE FABRIC, WIRE GAUZE, MS BARS AND MS GRILLS IN WOODEN FRAMES

7.19.1 General:- (a) Expanded metal, hard drawn steel wire fabric or wire gauge or weld mesh as described in the item of work shall be fixed to the window frames on the outside or inside as per detailed drawings or as directed by the Engineer. These shall be free from rust and other defects.

I. Expanded Metal

This shall be in the form of rhombus with its opening diagonals 20 x 60 mm and strands 3.25 mm wide and 1.6 mm thick weighing 3.633 kg/m² unless otherwise specified.

II. Welded Steel Drawn Wire Fabric

This shall conform to IS : 4948 and shall have rectangular mesh of 75 x 25 mm size with wires of diameter not less than 5 mm longitudinally and 3.15 mm transversely. Its weight shall be not less than 7.5 kg/m² unless otherwise specified.

III. Wire Gauze

This shall conform to 7.2.10. MS Bars and Grills shall be fixed as per detailed drawings or as directed by the Engineer.

7.19.2 Fixing

(a) Expanded metal, hard drawn steel wire fabric and wire gauze shall be cut in one piece to the size of the frame (out to out). Expanded metal and hard drawn steel wire fabric shall be fixed on to the frame with staples, over which wooden beading 50 x 20 mm shall be fixed with wood screws.

(b) For MS Bars to be fixed in wooden frames of windows etc. through holes shall

be drilled in one frame and in the other frame, holes shall be drilled 5cm deep. The bars shall be passed into the frame from one side and these shall be of the correct length to fit in at one end and be flush with the outside of the frame at the other end. Where there are MS flats provided along with the bars, these shall be fixed to the wooden frame with screws. Holes for passing MS bars shall be drilled or punched in the flats at the proper positions. Grills shall be fabricated as per design and fixed to the frame by round headed bolts and nuts in the new work, and by screws for old work.

7.19.3 Measurements

(a) The length and breadth shall be measured correct to a cm, the area from outside to outside of beading shall be calculated in square metre nearest to two places of decimal.

(b) For MS bars and flats as well as for grills, the length of MS bars and flats shall be measured separately correct to a cm and their weight calculated from Standard Tables.

7.19.4 Rate

It includes the cost of labour and materials required for all the operations described above.

7.20 SAL BALLI WORK / CASURINA POSTS

7.20.1 General:- Ballies/posts shall be free from large and dead knots, cracks and wooden borer infection. The sal ballies/casurina posts shall be of the variety popularly known as gollas in Northern India. These shall be as far as possible straight and of uniform section. The diameter specified shall be the mean diameter being the average of two diameters at ends. The tolerance shall be permitted as per **Table 7.10**.

TABLE 7.10

Length	Mean diameter or diameter at the center	Tolerance in diameter at the thinner end
Ballies/posts not exceeding 3 metre length	Not less than the specified diameter	The diameter at the thinner end shall not be less than specified diameter by more than 10 mm.
Ballies / posts exceeding 3 metre length	Not less than the specified diameter	The diameter at the thinner end shall not be less than specified diameter by more than 20 mm.

7.20.2 Surface Treatment - It shall be as specified in 7.5.6.

7.20.3 Fixing - The fixing of the ballies for posts, purlins and rafters shall be done by

clamps, bolts and nuts and spikes (country nails) as specified or as directed by the Engineer. In case of the last alternative, the large nail with a cap shall be driven through about 40 mm beyond the ballies to be fixed together and the end of the nail turned back so as to ensure proper fastening. Where so required, holes of slightly smaller size may be drilled before hammering the spike.

7.20.4 Trusses

The ballies in truss work shall be as far as possible of full lengths. Where making up is considered necessary it may be done by half lap joints secured together with 50 x 6 mm M.S. clamps of suitable length and shape fixed with bolts and nuts.

7.20.5 Measurements

The sal ballies/casurina posts shall be measured in running metres correct to a cm. Each piece shall be measured overall so as to include half lap joints etc.,

7.20.6 Rate

The rate will include the cost of materials and labour required for all the operations described above. The cost of bolts, nuts, flat iron clamps and other iron work except nails and spikes shall be paid for separately under relevant item of steel work.

7.21 FITTINGS

Fittings shall be of mild steel, brass, aluminium or as specified. Some mild steel fittings may have components of cast iron. These shall be well made, reasonably smooth and free from sharp edges and corners, flaws and other defects. Screw holes shall be counter sunk to suit the head of specified wood screws. These shall be of the following types according to the material used.

(a) Mild Steel Fittings

These shall be bright satin finish black stone enameled or copper oxidised (black finish), nickel chromium plated or as specified.

(b) Brass Fittings

These shall be finished bright satin finish or nickel chromium plated or copper oxidized or as specified.

(c) Aluminium Fittings

These shall be anodized to natural matt finish or given dyed anodic coating not less than grade AC 10 of IS : 1868.

The fittings generally used for different type of doors and windows are indicated in **Annexure 7.6**. The fittings to be actually provided in a particular work shall, however, be decided by the Engineer.

Screws used for fittings shall be of the same metal, and finish as the fittings. However, chromium plated brass screws or stainless steel screws shall be used for fixing aluminium fittings. These shall be of the size as indicated in respective figures.

Fittings shall be fixed in proper position as shown in the drawings or as directed by the Engineer. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with screw driver and not hammered in. Recesses shall be cut to the exact size and depth for the counter sinking of hinges.

7.21.1 Butt Hinges (Figure 7.7A)

These shall be of the following types according to the material used.

- (a) Mild steel butt hinges (Medium)
- (b) Cast brass butt hinges light/ordinary or heavy.
- (c) Extruded aluminium alloy butt hinges.
- (d) Stainless steel butt hinges

7.21.1.1 Mild Steel (Medium) : These shall be medium type manufactured from M.S. sheet. These shall be well made and shall be free from flaws and defects of all kinds. All hinges shall be cut clean and square and all sharp edges and corners shall be removed. These shall generally conform to IS : 1341.

Hinge Pin: Hinge pin shall be made of mild steel wire. It shall fit inside the knuckles firmly and riveted head shall be well formed so as not to allow any play or shake, and shall allow easy movement of the hinge, but shall not cause looseness.

Knuckles: The number of knuckles in the hinges of different sizes shall be as per IS : 1341. The sides of knuckles shall be straight and at right angle to the flap. The movement of the hinges shall be free and easy and working shall not have any play or shake.

Screw Holes: The screw holes shall be clean and counter sunk. These shall be suitable for counter sunk head wood screws and of the specified size for different types, and sizes of hinges. The size of the holes shall be able to accommodate the full depth of counter sunk head of the wood screws.

7.21.1.2 Cast Brass: These shall be light/ordinary or heavy as specified. These shall be well made and shall be free from flaws and defects of all kinds. These shall be finished bright or chromium plated or oxidized or as specified. These shall generally conform to IS : 205.

Hinge Pin: Hinge pin shall be made of brass or of phosphor bronze. The hinge pins shall be firmly riveted and shall be properly finished. The movement of the hinge shall be free easy and square and shall not have any play or shake.

Knuckles: The number of knuckles in each hinge shall not ordinarily be less than five. The number of knuckles in case of sizes less than 40 mm shall be three. The sides of the knuckles shall be straight and at right angle to the flap. The movement of the hinge pin shall be free and easy and working shall not have any play or shake.

Screw Holes: The screw holes shall be clean and counter sunk and of the specified size for different types and sizes of hinges. The size of the holes shall be such that when it is counter sunk it shall be able to accommodate the full depth of counter sunk head of wood screw specified.

7.21.1.3 Extruded Aluminium alloy: These shall be manufactured from extruded sections. These shall be well made and free from flaws and defects of all kinds. These shall generally conform to IS : 205.

Hinge Pin: Hinge pin shall be made of mild steel (galvanized or aluminium alloy). The aluminium alloy hinge pin shall be anodized. The hinge pin shall be finally riveted and shall be properly finished. The movement of hinges shall be free easy and square and shall not have any play or shake.

Knuckles: Number of knuckles in each hinge pin shall ordinarily not be less than 5. The sides of knuckles shall be straight and at right angle to the flap. The movement of the hinge pin shall be free and easy and working shall not have any play or shake.

Screw Holes: The screw holes shall be suitable for counter sunk head wood screws, and of specified sizes for different type of hinges. The size of the holes shall be such that when it is counter sunk it shall be able to accommodate the full depth of counter sunk head of wood screw specified.

7.21.1.4 Stainless Steel Hinges

These shall generally conform to IS 12817 and fall under four Types Light weight, Medium weight, Heavy weight and Unequal flap with dimensions and tolerances as given in Tables 1 to 4 of IS 12817. Screw holes shall be suitable for taking counter sunk head of wood screws. Unless otherwise specified, hinges shall be naturally finished bright with smooth surface without chemical coating. Scale of sampling and Criteria for conformity shall be as given in Table 5 of IS 12817.

7.21.1.5. Sampling and Criteria for Conformity: The number of butt hinges to be selected from a lot shall depend on the size of lot and shall be in accordance with **Tables 7.11A & 7.11B**. Butt hinges for testing shall be taken at random from at least 10 per cent of the package subject to a minimum of three, equal number of hinges being selected from each package. All butt hinges selected from the lot shall be checked for dimensional and tolerance requirements. Defects in manufacture and finish shall also be checked. A lot shall be considered conforming to the requirements of this specification if the number of defective hinges among those tested does not exceed the corresponding number given in **Tables 7.11A & 7.11B**.

TABLE 7.11A

SCALE OF SAMPLING AND CRITERION FOR CONFORMITY (FOR MILD STEEL HINGES)

Lot Size	Sample Size	Permissible No. of defective hinges
Up to 150	5	0
151 to 300	20	1
301 to 500	32	2
501 to 1000	50	2
1001 and above	80	3

TABLE 7.11B

(FOR NONFERROUS HINGES)

Lot Size	Sample Size	Permissible No. of defective hinges
Up to 200	15	0
201 to 300	20	1
301 to 500	30	2
501 to 800	40	2

801 and above	55	3
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Note : Any hinge which fails to satisfy the requirements of any one or more of the characteristics shall be considered as defective hinge.

7.21.2 Parliament Hinges (Figure 7.7B)

7.21.2.1. These shall be of mild steel, cast brass or as specified, and shall generally conform to IS: 362. The size of Parliament hinges shall be taken as the width between open flanges. Mild steel parliamentary hinges shall be copper oxidized (thick finish) or as specified. The brass parliament hinges shall be finished bright, chromium plated or oxidized or as specified.

7.21.2.2. The hinge pin shall be made of mild steel or Phosphor Bronze in the case of brass hinges. The hinge pin shall be mild steel (galvanized) or aluminium alloy in the case of aluminium alloy hinges. The hinge pin shall be firmly riveted and shall be properly finished. The movement of the hinges shall be free, easy and square, and shall not have any play or shake. All screw holes shall be clean and counter sunk to suit the counter sunk head of wood screws specified.

7.21.2.3. Sampling and Criteria for and Conformity:- It shall be as specified in Para 7.21.1.5 except that in Table 7.11A .Sample size upto 150 shall be 13 in place of 5.

7.21.3 Spring Hinges (Single or double acting)

7.21.3.1. These shall be single acting when the shutter is open on one side only or double acting when the shutter opens on both sides. These shall be made of M.S. or brass as specified, and shall generally conform to IS : 453 in case of Double acting spring hinges.

Hinges shall work smoothly and shall hold the door shutter truly vertical in closed

position. Each double-acting spring hinge shall withstand the following tests which shall be carried out after fixing it to a swing door in the normal manner.

(a) When the door is pushed through 90° and released 2000 times on each side in quick succession the hinge shall show no sign of damage or any appreciable deterioration of the components during or on completion of the test.

(b) The door shall require a force of 2.0 ± 0.5 kg for 100mm hinges and 3.0 ± 0.5 kg for 125 mm and 150 mm hinges, at a distance of 45 cm from the hinge pin to move the door through 90°.

The Size of spring hinge shall be taken as the length of the plate.

7.21.3.2 These shall be of the following type:

(a) Mild Steel: The cylindrical casing shall be made either from M.S. sheet of 1.60 mm thickness, lap jointed and brazed, welded or riveted, or from solid drawn tube of thickness, not less than 1.60mm or from mild steel sheet of 1.60mm thickness pressed to form the two casings and the distance piece.. It shall be stove enameled black or copper oxidized or as specified.

(b) Cast Brass: The cylindrical casing shall be made either from brass sheet of 1.60 mm thickness, lap jointed and brazed or from solid drawn brass tube of not less than 1.60 mm thickness. It shall be satin bright nickel plated or copper oxidized or as specified.

7.21.3.3 Sampling: The number of spring hinges shall be selected from the lot and this number shall depend on the size of the lot and shall be in accordance with **Table 7.12** based on IS 453.

TABLE 7.12
SCALE OF SAMPLING AND CRITERION FOR CONFORMITY

Lot size	Sample Size	Permissible No. of defective spring hinges
Upto 100	13	0
101 to 300	20	1
301 to 500	32	2
501 to 1000	50	3
1001 and above	80	5

7.21.4 Rising Hinges

These shall be made of brass, finished bright or chromium plated or oxidized or as specified. Its shape and pattern shall be

approved by the Engineer. The size of the rising hinge shall be taken as the length of its plate.

7.21.5 Continuous Piano Hinges (Figure 7.8A)

7.21.5.1 These shall be made from mild steel or aluminium alloy sheet, and shall generally conform to IS : 3818. All screw holes shall be clean and counter sunk. Piano hinges shall be fixed in the entire length of the cup board shutters. Its size will be the width of the two flaps when open.

7.21.5.2 M.S. Piano Hinges: These shall be made from 1 mm or 0.80 mm thick M.S. sheets and shall be protected with anti-corrosive treatment, such as bright polished, chromium plated or oxidized finish.

Hinge pin shall be of galvanized mild steel. It shall fit in the knuckle firmly so as not to allow any play or shake and shall allow easy movement of hinge, but shall not cause looseness.

The sides of the knuckles shall be straight and at right angle to the flap. The movement of the hinge shall be free and easy and working shall not have any play and shake.

7.21.5.3 Aluminium Piano Hinges: These shall be made from aluminium alloy sheet, and shall be anodized. The anodic coating shall not be less than the grade AC 15 of IS : 1868.

Hinge pin shall be made of aluminium alloy with anodic coating not less than the grade AC 15 of IS 1868. The Hinge pin shall fit in the knuckle firmly so as not to allow any play or shake and shall allow easy movement of hinge, but shall not cause looseness.

The sides of the knuckles shall be straight and at right angle to the flap. The movement of the hinge shall be free and easy and working shall not have any play and shake.

7.21.5.4.1 Sampling and Criteria for Conformity. It shall be same as specified in **Table 7.11A**.

7.21.6 Tee Hinges (Figure 7.8B)

These shall be made from M.S. sheets and shall be either bright finished or stove enameled black or as specified. These shall generally conform to IS : 206 Tee hinges shall be well made, free from burrs, flaws and defects of any kind. The movement shall be square, and the working shall be free and easy without any play or shake. The hole for the hinge shall be central to the bore and shall be square.

The hinge pin shall be firm and riveted over, so that the heads are well formed. All screw

holes shall be clear and counter sunk and shall be suitable for the counter sunk head of wood screws.

7.21.6.1 Sampling and Criteria for conformity:

It shall be same as specified in 7.21.1.5 **Table 7.11A**.

7.21.7 Sliding Door Bolts (Aldrops) (Figure 7.9)

7.21.7.1 These shall be mild steel, cast brass, aluminium or as specified, and shall be capable of smooth sliding action.

7.21.7.2 Mild Steel Sliding Door Bolts:- These shall be made of M.S. sheets and M.S. rods and shall generally conform to IS : 281. M.S. sliding door bolts shall be copper oxidized (black finish) or as specified.

7.21.7.3 Cast Brass Sliding Door Bolts

These shall be made from rolled brass and shall generally conform to IS : 2681. The hasp shall be of cast brass and secured to the bolt as shown in **Figure 7.9**. Alternatively, the hasp and the bolt may be cast in one piece. The fixing and staple bolts shall be cast with 6 mm studs. Bolts shall be finished to shape and have threaded ends and provided with round washers and nuts of square or hexagon type. All components shall be finished smooth and polished before assembly. Cast brass sliding bolts shall be finished bright or chromium plated or oxidized or as specified.

7.21.7.4 Aluminium Sliding Door Bolts

These shall be made of aluminium alloy and shall generally conform to IS : 2681. Aluminium sliding door bolts shall be anodized. All screw holes shall be counter sunk to suit the counter sunk head of screws of specified sizes. All edges and corners shall be finished smooth. In case of single leaf door, when iron socket plate or a brass or aluminium fixing bolt (or sliding door bolt) cannot be fixed, hole of suitable size shall be drilled in the door frame and an iron or brass plate cut to shape shall be fixed at the face of the hole.

7.21.7.5 Sampling and Criteria for Conformity

It shall be as specified in 7.21.1.5 **Table 7.11B**.

7.21.8 Tower Bolts (Figure 7.10)

7.21.8.1. These shall generally conform to IS : 204 (Part I) and IS 204 (Part II). Tower bolts shall be well made and shall be free from defects. The bolts shall be finished to the correct shape and shall have a smooth action. All tower bolts made with sheet of 1.2

mm thickness and above shall have counter sunk screw holes to suit counter sunk head wood screws. All sharp edges and corners shall be removed and finished smooth.

The height of knob of tower bolt when the door, window etc., is in closed position shall be not more than 1.9 meter from the floor level.

7.21.8.2 Tower bolts shall be of the following types:

(a) Aluminium barrel tower bolts with barrel and bolt of extruded sections of aluminium alloy.

(b) Brass tower bolts with cast brass barrel and rolled or cast brass bolt

or

Brass tower bolts with barrel and bolt of extruded sections of brass and rolled or drawn brass bolt.

Note: Tower bolts, where possible, shall have the knob integral with the bolt. If not possible, the knob may be fitted to the bolt with a pin or alternatively screwed and riveted to the bolt. Nonferrous metal tower bolts shall each be provided with a small spring and a ball on the inside of barrel to enable smooth working.

(c) Mild steel barrel tower bolts with mild steel barrel and mild steel bolt. Or Mild steel tower bolts with mild steel barrel and cast iron bolts.

The plates and straps after assembly shall be firmly riveted or spot welded. The rivet head shall be properly formed and the rivet back shall be flush with the plate. These shall be made in one piece.

7.21.8.3 Unless otherwise specified bolt shall have finish as given below:

(a) Mild steel tower bolts (Types 1A and 1B) Bolts bright finished or Nickel chromium plated as specified and barrel and socket stove enameled black.

(b) Brass tower bolts (Types 1 to 3 as per IS 204 Pt.2) Bolt and barrel polished or plated as specified.

(c) Aluminium alloy tower bolts (Type 4 as per OS 204 Pt.2) Bolt and barrel anodized. The anodic film may be either transparent or dyed as specified. The quality of anodized finish shall not be less than grade AC – 10 of IS : 1868.

7.21.8.4 Sampling and Criteria for Conformity

It shall be same as specified in 7.21.1.5 Table 7.11.B.

7.21.9 Door Latch

7.21.9.1 This shall be of mild steel, cast brass, or as specified and shall be capable of smooth sliding action. In case of mild steel latch, it shall be copper oxidized (black finish) or as specified and in case of brass, it shall be finished bright, chromium plated or oxidized or as specified. The size of door latch shall be taken as the length of the latch.

7.21.10 Mortice Lock and Latch (Figure 7.13)

7.21.10.1 This should generally conform to IS : 2209. The size of the mortice lock shall be denoted by the length of the body, measured from the outside face of fore end to the rear end. It shall be 65 mm, 75 mm and 100 mm as specified. The measured length shall not vary by more than 3 mm from the length specified.

7.21.10.2 Non-interchangeable Keys

Testing of non-interchangeable keys shall be as per IS : 2209.

7.21.10.3 The clear depth of the body shall not be more than 15 mm. The fore end shall be firmly fitted to the body suitably by counter sunk head screw. The latch bolt shall be of specified material and of section not less than 12 x 16 mm for all sizes of locks. If made of two piece construction both parts shall be riveted. Ordinary lever mechanism with not less than two levers shall be provided. False levers shall not be used. Lever shall be fitted with one spring of phosphor bronze or steel wire and shall withstand the tests as provided in IS : 2209.

7.21.10.4 Locking bolts, spring and strike plate shall conform to IS : 2209.

7.21.10.5 Handles : These shall conform to IS : 4992.

7.21.10.6 Keys : Each lock shall be provided with two keys.

7.21.10.7 Sampling, Criteria for conformity: It shall be the same as specified in 7.21.1.5 Table 7.11B.

7.21.10.8 Tests

The finally assembled locks shall be tested as prescribed in Clause 9 of IS 2209.

7.21.11 Mortice Latch (with locking bolt)

7.21.11.1 These are generally used in doors of bath rooms. WC's and private rooms.

7.21.11.2 Mortice latch shall, in respect of shape, design and mechanism of the latch and its components parts, generally conform to IS : 5930. The material used for the different component parts of the latch shall comply with Tables 1 and 2 of IS : 5930 , unless otherwise specified.

7.21.11.3 The size of the latch shall be denoted by the length of the body measured from the outside face of the fore end to the rear end and shall be 65 mm, 75 mm or 100 mm as specified. The depth of the body shall not be more than 15 mm.

7.21.11.4 The latch shall be of size (10 x 18 mm) of shape as shown in Fig. 1 of IS : 5930. The locking bolt shall be of section not less than 8 x 25 mm for all size of locks. The mechanism of the latch bolt, its spring, striking plate etc., shall be described in IS : 5930.

7.21.11.5 The handles provided shall conform to IS : 4992.

7.21.11.6 Sampling, criteria for conformity shall be as per 7.21.1.5 Table 7.11B.

7.21.12 Mortice Lock and Latch (Rebated)

7.21.12.1 These are slightly different from mortice lock described in 7.21.14 and are designed for use in double leaved doors. These should generally conform to IS : 6607.

7.21.12.2 Handles, Keys, Sampling, Criteria for Conformity and Test.

These shall be as specified in 7.21.1.5 Table 7.11B.

7.21.13 Mortice Night Latch (Fig. 7.14)

7.21.13.1 This is a mortice lock having a single spring bolt withdrawn from the outside by using the key and from inside by turning the knob and with an arrangement whereby the lock can be prevented from being opened by its key from outside while the night latch is used from inside the room.

7.21.13.2 This should generally conform to IS : 3847.

7.21.13.3 It shall be of cast or sheet brass, cast or sheet aluminium alloy or Mild steel as specified and of best quality of approved make. These shall be bright finished or copper oxidized (black) finish as specified. Nominal size of the latch shall be denoted by the length of the face over the body in millimeters. These shall have not less than two levers. False (Dummy) levers shall not be allowed.

7.21.13.4 Keys

Each latch shall be provided with two keys which should work smoothly and without any appreciable friction in the lock.

7.21.14 Cupboard or Wardrobe Lock

This should generally conform to IS:729. The size of the cupboard lock shall be 40,50,65 & 75 mm, This shall be made of cast brass and shall be of the best make of approved quality. These shall be finished

bright or chromium plated or oxidized or as specified. The size of the lock shall be denoted by the length of the face across the body in mm.

These locks shall be fitted with four, five or six levers as specified. False (dummy) levers shall not be used.

7.21.15 Ball Catches for Wooden Almirah

7.21.15.1 This should generally conform to IS : 8756. These may be of brass sheets or cast brass with steel balls of sizes, 6, 7.5, 9 or 12 mm dia as specified. The size shall be denoted by the external diameter of the cylinder holding the steel ball with spring. When the almirah is in the closed position it shall be retained in that position by the spring action of the ball catch and shall be so in continuous usage. The door shall open only when it is pulled open.

7.21.15.2 Sampling, criteria for conformity and test shall be as specified in 7.21.1.5.

7.21.16 Finger Plate

7.21.16.1 This shall be of brass (finished bright, chromium plated, oxidized), or anodized aluminium or transparent plastic or as specified. This shall be made from brass or aluminium plate of 1.6 mm thickness with beveled or square edge as specified.

7.21.16.2 The size of the plate shall be 300 x 65 mm unless otherwise specified. The shape and pattern shall be approved by the Engineer.

7.21.17 Kicking Plates

7.21.17.1 This shall be of brass (finished bright or chromium plated or oxidized), bronze, stainless steel, aluminium or as specified. Aluminium kicking plates shall be anodized and the anodic coating shall not be less than grade AC-10 of IS : 1868. It shall be made from a plate of minimum thickness 3.0 mm and 1.5 mm in case of stainless steel. This shall have beveled or straight edges and shall be fixed by means of counter sunk or rounded screws of the same material and finish as that of the plate. The shape and pattern shall be according to the drawings or as specified and as approved by the Engineer.

7.21.18 Handles (Doors and Windows) (Figure 7.15)

7.21.18.1 These should generally conform to IS:208. The door handles shall be well made and free from defects. These shall be finished correct to shape and dimensions. All sharp edges and corners shall be removed and finished smooth so as to facilitate easy handling. Cast handle shall be

free from casting defects. Where the grip portion of the handle is joined with the piece by mechanical means, the arrangement shall be such that the assembled handle shall have adequate strength comparable to that of integrally cast type handles.

7.21.18.2 Door handles shall be of the following types according to the material used.

(a) Cast or Sheet Aluminium Alloy Handles: These shall be of aluminium of specified size, and of shape and pattern as approved by the Engineer. The size of the handle shall be determined by the inside grip of the handle. Door handles shall be of 100 mm size and window handles of 75 mm size unless, otherwise specified. These shall be fixed with 25 mm long wood screws of designation No.6. Aluminium handles, shall be anodized and the anodic coating shall not be less than grade AC 10 of IS :1868 or as specified. The finish can be bright natural, matt or satin or dyed as specified.

(b) Cast Brass Handles. These shall be of cast brass of specified size, and of shape and pattern as approved by the Engineer. The size of the handle shall be determined by the inside grip of the handle. Door handles shall be of 100 mm size and window handles of 75 mm size unless, otherwise specified. These shall be fixed with 25 mm long wood screws of designation No.6. Brass handles shall be finished bright satin or nickel chromium plated or copper oxidized or as specified.

(c) Mild Steel Handles: These shall be of mild steel sheet, pressed into oval section. The size of the handles will be determined by the inside grip of the handle. Door handles shall be of 100 mm size and window handles of 75 mm size unless otherwise specified.

These shall be fixed with 25 mm long wood screws of designation No.6. Iron handles shall be copper oxidized (black finish) or stove enameled black or as specified.

7.21.18.3 Sampling and Criteria for Conformity: It shall be as specified in Annexure B of IS 208.

7.21.19 Hanging Rubber Door Stopper

7.21.19.1 These shall be of cast brass, finished bright, chromium plated or as specified. Aluminium stopper shall be anodized and the anodic coating shall not be less than grade AC – 10 of IS : 1868. The size and pattern of the door stopper shall be approved by the Engineer. The size shall be determined by its length.

7.21.20 Universal Hydraulic Door Closer (Exposed Type) (Figure 7.17)

7.21.20.1 These shall be made of cast iron/aluminium alloy/zinc alloy and of shape and pattern as approved by the Engineer.

7.21.20.2 These shall generally conform to IS : Specifications for door closers (Hydraulically regulated) IS 3564.

7.21.20.3 The door closers may be polished or painted and finished with lacquer to desired colour. Aluminium alloy door closer shall be anodized and the anodic coating shall not be less than grade AC 15 of IS : 1868. All dents, burrs and sharp edges shall be removed from various components and they shall be pickled, scrubbed and rinsed to remove grease, rust, scale or any other foreign elements. After pickling, all the M.S. parts shall be given phosphating treatment in accordance with IS : 3618.

7.21.20.4 The nominal size of door closers in relation to the weight and the width of the door size to which it is intended to be fitted shall be as given in **Table 7.14**.

TABLE 7.14 : Type and Designation of door Closers

Designation of closers	Weight of door (kg)	Size of door (mm)	Remarks
1.	Up to 35	700	For light doors such as double leaved and toilet doors.
2.	36 to 60	850	Interior doors, such as bed rooms, kitchen and store
3	61 to 80	1000	Main doors in a building, such as entrance doors

7.21.20.5 Sampling and Criteria for Conformity: All the door closers of the same nominal size and shape and from the same batch of manufacture in one consignment shall constitute a lot. The number of door

closers to be taken at random from a lot shall depend upon the size of the lot. (**Table 7.15**). The sample shall be tested for construction, finish, dimensions, interchangeability of parts and performance.

TABLE 7.15
SCALE OF SAMPLING AND CRITERION FOR CONFORMITY

No. of door closers in the lot	Sample	Sample size	Cumulative Sample Size	Acceptance Number	Rejection Number
Up to 100	First	8	8	0	2
	Second	8	16	1	2
101 to 300	First	13	13	0	2
	Second	13	26	1	2
301 to 500	First	20	20	0	2
	Second	20	40	1	2
501 to 1000	First	32	32	0	3
	Second	32	64	3	4
1001 and above	First	50	50	1	4
	Second	50	100	4	5

7.21.20.6 Performance Requirements:

After being fitted in position when the door is opened through 90° the same should swing back to angle of $20^{\circ} \pm 5^{\circ}$ with nominal speed but thereafter, the speed should get automatically retarded and in case of doors with latches, it should be so regulated that in its final position the door smoothly negotiates with the latch.

7.21.21 Hooks and Eyes (Figure 7.18)

7.21.21.1 These shall be of mild steel or hard drawn brass or as specified. Mild steel hooks and eyes shall be copper oxidized (black finish) or as specified. Cast brass hooks & eyes shall be finished bright or chromium plated. These shall be well made and free from defects. They shall be finished to the correct shape and dimensions so as to function properly when they are in use. Cast hooks, eyes and plate shall be free from casting and other defects. All these shall generally conform to IS : 207. All sizes of hooks and eyes shall be determined by the length of the hooks measured "out to out". Unless otherwise specified the articles shall be finished bright.

7.21.22 Casement Window Fastners

7.21.22.1 These shall be made of cast brass, finished bright, chromium plated or oxidized or of Nylon or as specified. Casement fastners for single window shutter shall be left or right handed as specified. These shall not weigh less than 0.20 kg. per fastener. Nylon window fastners shall conform to IS : 6318.

7.21.23 Casement Brass Stays (Straight Peg Type) (Figure 7.19)

7.21.23.1 These shall be made of mild steel, cast brass, aluminium (extruded section) or plastic (polypropylene) or as specified. Mild steel casement stays shall be copper oxidized (black finish) or as specified. Cast

brass stays shall be finished bright or chromium plated or as specified. Aluminium stays shall be anodized and the anodic coating shall not be less than grade AC-10 of IS : 1868. Aluminium and M.S. stays shall be made from channel section. The stays shall not weigh less than that indicated below:-

200 mm	0.24 kg. each
250 mm	0.28 kg. each
300 mm	0.33 kg. each

7.21.23.2 The shape and pattern of the stays shall be as approved by the Engineer. The size of stays shall be determined by its length as shown in **Figure 7.19**. The plastic (Polypropylene) stays shall conform to IS : 6318.

7.21.24 Quadrant Stays 300 mm

These shall be made of cast brass and finished bright or chromium plated or as specified. The shape and pattern shall be approved by the Engineer. It shall not weigh less than 0.20 kg. each.

7.21.25 Hasp and Staple Safety Type (Figure 7.21)

7.21.25.1 This shall be made of mild steel, cast brass or aluminium as specified. This shall generally conform to IS : 363. M.S. Hasp and staples shall be finished black enameled, or copper oxidized (black finish) or as specified. Brass hasp and staples shall be finished bright chromium plated or oxidized or as specified. Aluminium hasp and staples shall be anodized and the anodic coating shall not be less than grade AC-15 of IS : 1868.

7.21.25.2 M.S. hasp and staples shall be manufactured from M.S. sheet and brass hasp and staples by casting and Aluminium hasp and staples shall be made from dye section. The hinge pin which in all cases

shall be of mild steel, shall be firm and its riveted heads well formed. The movement of hasp shall be free, easy and square, and shall not have any play or shake

The hasp shall fit in the staple correctly. The size shall be determined by the length of the bigger half of the hasp.

7.21.25.3 The staple except in the case of cast one, shall be riveted properly to its plate. The ends of the hinge pin for the safety type hasp shall be riveted and properly finished. All screw holes shall be clean and counter-sunk to suit counter wood screws. All edges and corners shall be rounded,

7.22 Bamboo Products

7.22.1 PRODUCT: BAMBOO MAT BOARD (BMB) : ISI : 13958-1994 certified product with CM/L No.: 5280865

PRODUCT APPLICATIONS: Walling & Wall Paneling

PRODUCT SIZES AVAILABLE: 6' x 3' OR 1.83m X 0.92m, 6' x 4' OR 1.83m X 1.22m & 8' x 4' OR 2.44m X 1.22m

PRODUCT THICKNESS AVAILABLE: 9 MM

TECHNICAL DETAILS :

SL	Properties	9 MM
1.	Density	800 kg/m ³
2.	Moisture Content	8 %
3.	Internal Bond Strength	
	a) Dry State :	
	(i) Average	0.96 N/mm ²
	(ii) Minimum Individual	0.96 N/mm ²
	a) Wet State :	
	(i) Average	1.11 N/mm ²
	(ii) Minimum Individual	0.79N/mm ²
4.	Modulus of Rupture (Avg.)	79 N/mm ²
5.	Screw Withdrawal Strength	4300 N
6.	Tensile Strength	30 N/mm ²
7.	Thermal Conductivity	0.194 k.cal/m-°c

7.22.2 PRODUCT : BAMBOO MAT BOARD (BMB) : ISI : 13958-1994 certified product with CM/L No.: 5280865

PRODUCT APPLICATIONS: Walling & Wall Paneling

PRODUCT SIZES AVAILABLE: 6' x 3' OR 1.83m X 0.92m, 6' x 4' OR 1.83m X 1.22m & 8' x 4' OR 2.44m X 1.22m

PRODUCT THICKNESS AVAILABLE: 12 MM

TECHNICAL DETAILS :

SL	Properties	12 MM
1.	Density	850 kg/m ³
2.	Moisture Content	9 %
3.	Internal Bond Strength	
	a) Dry State :	
	(i) Average	0.98 N/mm ²
	(ii) Minimum Individual	0.99 N/mm ²
	a) Wet State :	
	(i) Average	1.15 N/mm ²
	(ii) Minimum Individual	0.82N/mm ²

4.	Modulus of Rupture (Avg.)	86 N/mm ²
5.	Screw Withdrawal Strength	4800 N
6.	Tensile Strength	34 N/mm ²
7.	Thermal Conductivity	0.198 k.cal/m-°c

7.22.3 PRODUCT : VENEERED BAMBOO PARTICLE BOARD – Both Side Commercial Veneer SOGP GRADE II (Interior) : ISI : 3097 – 1980 certified product

PRODUCT APPLICATIONS : Cupboards, Partitions, Paneling, Modular Furniture & Kitchen Cabinets, Conference tables, office

tables, computer tables, Heavy Duty Racks & Cabinets

PRODUCT SIZES : 8' x 4' OR 2.44m X 1.22m

PRODUCT THICKNESS : 9MM / 12 MM / 18 MM / 25 MM

TECHNICAL DETAILS :

SL	Properties	Interior Grade Type (Grade II)
1.	Moisture Content	9 %
2.	Water Absorption	
	a) 2 Hr. Soaking	4 %
	b) 24 Hr. Soaking	30 %
3.	Swelling due to Surface Absorption (2 Hrs. immersion)	5.0 %
4.	Modulus of Rupture	32 N/mm ²
5.	Modulus of Elasticity (Avg. Value)	3000 N/mm ²

7.23 FRP DOORS, SHUTTERS & FRAMES :

7.23.1 SCOPE

This specification lays down requirements regarding types, sizes, material, construction, workmanship, finish, performance evaluation, sampling and testing of Fibre Glass reinforced Plastic Door Shutters for use in domestic buildings, schools, hospitals etc.

7.23.2 CONSTRUCTION / FABRICATION

The FRP Shutter shall be paneled door shutter with hollow rails and stiles monolithically cast with panels.

The shutters shall be contact moulded i.e. by hand lay up process in two pieces as shown in Figure 1. The process shall consist of laying gelcoat at 1,000 gms/m² and laid over with three layers of FRP mat (one layer of 300 CSM mat and two layers of 450 CSM mat) for each of the web (panel) portion and four layers of FRP mat for the flange (rails and stiles) portion (one layer of 300 CSM mat and three layers of 450 CSM mat). While closing the two pieces, additional layer of 450 CSM mat shall be provided in the web portion. The CSM mat shall be bonded with Isophthalic resin in the ratio not less than 1:2

(one part of mat to two parts of isophthalic resin and fillers and additives) by weight. The edges shall be sealed with gelcoat and FRP mat to obtain smooth finish sufficient 4021 rovings shall be laid in the corners to have smooth curve while laying the CSM mat.

Blocks of exterior grade MDF or seasoned and treated rubber wood for eucalyptus wood of sufficient thickness and length shall be provided inside the shutter at suitable place to hold fittings and fixtures such as aldrop, tower bolt, handle, sliding door bolt, mortice locks etc. Blocks for hinges shall be provided at three locations, unless otherwise specified by the purchaser, one at the centre and other two at 200 mm from the top and the bottom of the shutter.

Suitable depression shall be made in the profile of shutter at edges where blocks are provided for hinges and concealed mortice locks.

The finished surface shall be buffed and polished with wax.

7.23.3 DIMENSIONS, SIZES AND TOLERANCES :

Dimensions of Components & Tolerances –

The finished dimensions and tolerances of the different components of door shutter

shall be given in Table -1.

Table – 1 : Dimensions and Tolerances of Components of Door Shutters			
SL	Description	Width (mm)	Thickness (mm)
1.	Vertical stile, top and freeze rail	90 $\pm$ 3	30 $\pm$ 1 or 35 $\pm$ 1
2.	Lock rail	120 $\pm$ 3	30 $\pm$ 1 or 35 $\pm$ 1
3.	Bottom rail	150 $\pm$ 3	30 $\pm$ 1 or 35 $\pm$ 1

Thickness of FRP laminate of hollow rails and stiles shall be 3 mm.

Thickness of FRP laminate used for panel in the shutter shall be 5 mm.

Sizes and Types.

7.23.4 LOCATIONS OF FITTINGS AND ACCESSORIES

The lock rail of door shutters shall be so placed that its centre line is at a height 950 mm from the bottom of the shutter.

Each door shutter shall be fixed to the frame with three hinges, unless otherwise specified by the purchaser, of the type specified. These location shall be, one at the centre and other two at 200 mm from the top and the bottom of the shutter, where blocks have already been provided and suitable indication, by depressing the profile has been made.

Other fixtures shall also be provided at locations where blocks have already been provided.

Hinges and other fixtures shall be fixed with full threaded steel screws after coating the screws with adhesive such as fevicol etc. For fixing of hinges, holes of 3.5 mm

diameter and 52 mm length shall be bored and No.10 full threaded parallel shank steel screws coated with adhesives shall be screwed. In on circumstances screws shall be hammered into board.

For re-screwing, a plastic sleeve of appropriate diameter shall be inserted into the hole and then fixing with full threaded steel screws shall be done.

7.23.5 TESTS

Tests on Material :

Tests as per Table-2 shall be conducted on FRP laminate (without removing gel coat cut from door shutter. The method of carrying out the test shall be as per the reference code mentioned against each test. Acceptable criteria shall be as mentioned against each test.

Tests on Shutter :

The tests as given in Table-3 shall be carried out by the manufacturer on paneled FRP door shutters with panels of FRP. The method of carrying out the test and acceptability criteria shall be as per IS:4020-1994.

Table -2 : Tests on FRP Laminate			
SL	Test	Test Method as per	Acceptable Value
1.	Fibre Glass Content	ISO:1172-1975	Not less than 25%
2.	Barcol Hardness	ASTM:D2583-1987	Not less than 26 BIU when tested on the face of laminate finished with gelcoat
3.	Ultimate Tensile Unit Strength	BS:4994-1973	Not less than 150 N/mm Per Kg/m ² of glass.
4.	Tensile Unit Modulus	ISO:3268-1978	Not less than 6500N/mm per Kg/m ² of glass
5.	Flexural Strength	ISO:178-1975	Not less than 110 N/mm ²
6.	Flexural Modulus	ISO:178-1975	Not less than 7000 N/mm ²
7.	Izod Impact	ISO:180-1982	Not less than 10 J/cm
8.	Water Absorption	ISO:62-1980	Not more than 0.5% by weight

Table – 3 : Tests on Door Shutter	
SL	Test
1.	Slamming Test
2.	Impact Indentation Test
3.	Shock Resistance Test

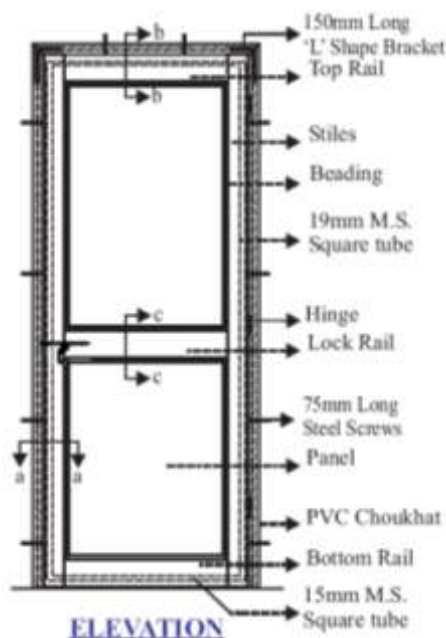
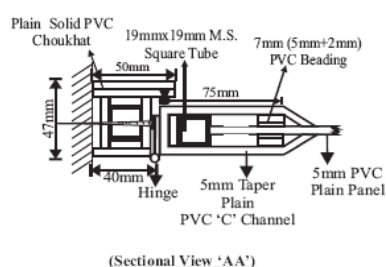
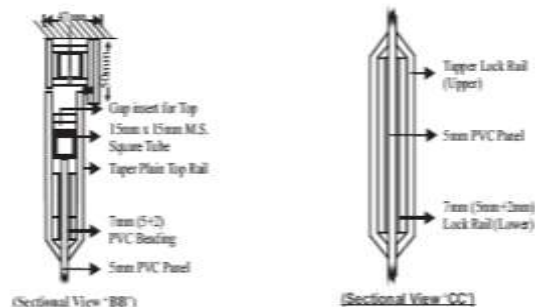
4.	Edge Loading Test
5.	Misuse Test
6.	Buckling Test
7.	Dimensions and Defects of Squareness Test
8.	General Flatness Test
9.	Local Plainness Test*

* Local Plainness test shall be carried out on rails, stiles and panels separately.

7.24 SOLID PANEL / WIRE MESH / GLASS PANEL PVC SHUTTER :

The Solid Panel PVC Door shall be fabricated from 5mm PVC Sheet. The sheets used may be in plain color, printed design or pre-laminated veneer shade as specified before hand of as approved by the Engineer-in-Charge.

The nominal thickness width and height of the shutter shall be as shown in the drawings or as indicated by the Engineer-in-Charge. All form edges of the shutters shall be square. The shutter shall be free from twist of warp in its plane. The 5mm Sheet used in the fabrication of the door shall be of minimum density of 600 kgs/cbm and the doors shall weigh a minimum of 8 kg/sqm.



7.24.1 TESTS

Samples of PVC Solid Panel Doors shall be subjected to the following tests:

- Edge loading test as per IS 1998 4042.
- Slamming test as per IS 1998 4042.
- Shock Resistant test for soft body and heavy body as per IS 1998 4042.

No permanent damage or delaminating / dismembering of the stiles and nails should be observed on the sample door.

These tests may be conducted at the door-testing laboratory at the factory of the principal company provided the principal company stands warranty for the doors supplied.

One door may be tested when the sample size is more than 100 doors and less than 300 doors. In sample size of higher than 300 doors two doors may be tested.

7.24.2 FIXING OF SHUTTERS

PVC Solid Panel Door Shutter shall be side hung on three bolt hinges of size 100mm, one at the centre and the other two at 200mm from the top and bottom of the shutter. The flap of the hinges shall be neatly counter sunk in to the recesses out to the exact dimensions of the hinge flap. The door shall be drilled on the thickness to fit hinges. Screws for fixing the hinges shall be screwed in with screwdrivers and not hammered. The length of the screws should be 8mm/30mm and it should be ensured that the screws pass through the two opposite surfaces of the M.S. reinforcement. The hinges used should be of stainless steel or aluminum.

Under no circumstance MS hinges should be used stainless steel screws should be used.

in the doorframe if required. A tolerance of ± 3 mm shall be permitted in the specified dimension of PVC section in the doorframes.

7.24.3 PVC DOOR FRAME

The Solid PVC Door Frames shall be fabricated from 5mm PVC Sheet having density of 600 kg/cum. The Sheet used may be in plain color, printed design or prelin veneer shade as specified before hand or as approved by the Engineer-in-Charge.

A 19mm x 19mm square tube of 19 gauge thickness is to be inserted in the door frame section for reinforcement. Weight per running metre of door including reinforcement should be a minimum of 1.5kg/sqm.

Depth of rebate of door frame shall be 20mm frames shall have smooth surface, without any warping or bending in any member of the doorframe. All the parts of the doorframe are to be joined to each other using solvent cement adhesive confirming to IS 14182. Provision of rubber gasket is to be provided



ANNEXURE 7.1

TABLE FOR PERMISSIBLE DEFECTS FOR VARIOUS GRADES OF TIMBERS

SL	Defects	First Grade	Second Grade
(1)	(2)	(3)	(4)
(i)	Cross-grain	Not steeper than 1 in 15	Not steeper than 1 in 10
(ii)	Sound knots and live knots	(i) Stiles and rails (a) Short Exposed Face: Not more than 15 mm size and not more than 1 knot/metre. (b) Long Exposed Face: Not more than 15 mm size and not more than 1 knot/m. No knot shall occur within 20 mm of the edges. (ii) Panels – Not more than 20 mm size and not more than 2 knots/m ² . No knot shall occur on edge of any component of a panel.	(i) Stiles and rails (a) Short Exposed Face: Not more than 15 mm size and not more than 3 knots per stile and 1 knot per rail. (b) Long Exposed Face: Not more than 20 mm size and not more than 3 knots per stile and 1 knot per rail. (ii) Panels – Not more than 20 mm size and not more than 4 knots/m ² . No knot shall occur on edge of any component of a panel.
(iii)	Dead and loose knots (Plugged)	(i) Stiles and Rails – Not more than 10 mm size, centrally located and not more than 1 knot/m. (ii) Panels: Not more than 15 mm size and not more than 2 knots/m ² . No knot shall occur on edge of any component of a panel.	(i) Stiles and Rails – Not more than 10 mm size, centrally located and not more than 3 knots per stile and 1 knot per rail. (ii) Panels: Not more than 15 mm size and not more than 4 knots/m ² . No knot shall occur on edge of any component of a panel.
(iv)	Pitch pockets or streaks	None	Permissible except on exposed edges provided that they are clean and filled up with suitable putty or filler. When

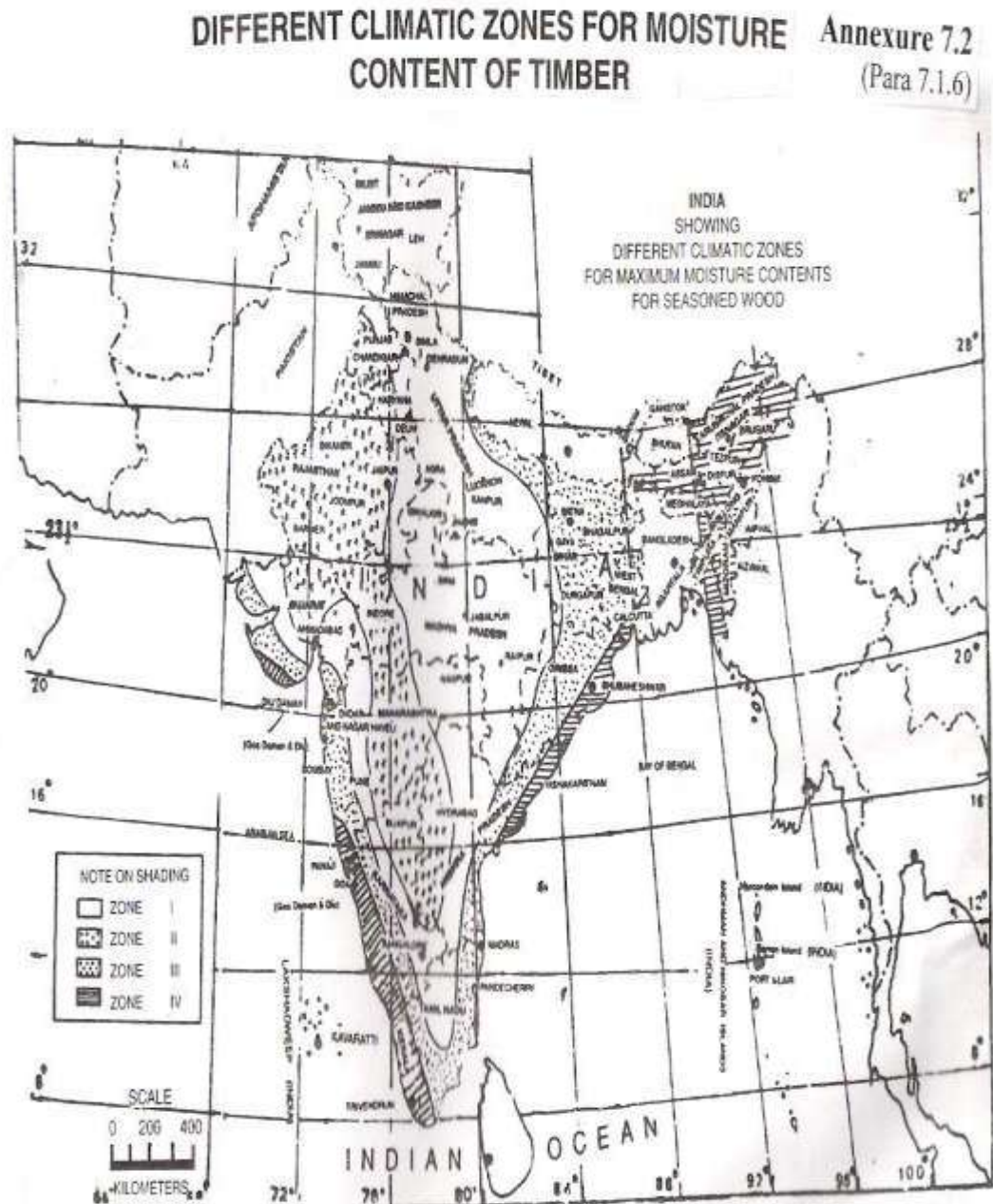
			pitch pockets or streaks are located on the exposed edges of the core, they shall be cut out and filled with piece of wood of similar species with grain running in the same direction. The piece shall be well glued.
(v)	Sapwood	Total not exceeding 5 mm wide and 150 mm long per metre.(This restriction applies only to super group species)	Total not exceeding 10 mm wide and 300 mm long per metre.(This restriction applies only to super group species)
(vi)	Pin holes	Permitted provided they are not in cluster	Permitted.
(vii)	Worm holes	None	Permitted provided they are not more than 10 mm in diameter and not more than one per metre and provided such worm holes are plugged with similar timber in such a manner that the plugging merges with the surrounding area both as to colour and grain.

Notes :

- (i) Dead and loose knots are permitted only if they are suitably plugged.
- (ii) Knot shall not occur where hinges or locks are to be fixed.

ANNEXURE 7.2

DIFFERENT CLIMATIC ZONES FOR MOISTURE CONTENT OF TIMBER

**DRAWINGS NOT TO SCALE**

- Note 1: Based upon Survey of India map with the permission of the Surveyor General of India.
- Note 2: The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
- Note 3: The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified.
- Note 4: The administrative headquarters of Chandigarh, Haryana and Punjab are at Chandigarh.

ANNEXURE 7.3**MOISTURE CONTENT OF TIMBER**

1 Moisture content of timber shall be checked for every 1 cum or part thereof by electrical moisture meters as per IS : 287.

2 Electrical moisture meters are of resistance type and shall be used when the moisture content is within a range of 8 to 35 percent. When checking moisture content with electrical moisture meter, it shall be ensured that:-

(a) Timber is not hot or surface wet and the moisture gradient is not large due to wet cores.

(b) Electrode probes are of adequate depth (not less than one-fifth the thickness of the timber).

3 Sufficient number of readings at different positions are taken on each piece of timber to eliminate localized variations in surface moisture and species corrections are applied for the make of electrical resistances and type of moisture meter.

4 If for any reason, whatsoever, the results of electrical moisture meter are not to be relied upon, the moisture content shall be checked by the oven drying method.

5 For checking for moisture content by oven drying method, a complete test cross section, 12 to 19 mm long in the direction of timber grain, free from all defects shall be cut from each piece of timber selected for test as follows:-

(a) If weighing can be done immediately, the test section shall be cut from a point at least 45 cm from one end of the piece or from its center.

(b) If weighing cannot be made immediately, a sample of 30 cm long shall be cut from a point at least 45 cm from one end of the piece or from its centre. Subsequently (within 24 hours) the test section shall be cut from the centre of this sample.

(c) In case cutting of test section from the piece is not permissible, the moisture content in the whole section can also be determined by collecting a boring to a depth of half of the thickness of the piece by means of an auger, in a pre-weighed weighing bottle which should then be securely stoppered.

6 The test sections obtained above shall be weighed, immediately after cutting, on a balance the sensitivity of which is not less than 10 mg. They shall be dried in a ventilated and preferably thermostatically controlled oven at a temperature of 100°C to 105°C until the weight is constant. The weight of the test section shall be deemed to have become constant if successive weighings at intervals of 2 to 5 hours do not differ from one another by more than 50 mg. The test weight shall be taken to be the oven dry weight of the test section.

7 The percentage moisture content in the test section shall be calculated as follows:

$$\text{Moisture content (Per cent)} = \frac{W_1 - W_0}{W_0} \times 100$$

Where :

W_1 – initial weight of test section and

W_0 – oven dry weight of test section

8 When moisture content of timber is checked by oven drying method, results of electrical moisture meter shall be ignored.

ANNEXURE 7.4

EXTRACTS FROM IS - 4021-1995 ON TIMBER DOOR, WINDOW & VENTILATOR FRAMES- SPECIFICATIONS

5 Dimensions, Sizes and Tolerances
5.1 Dimensions of Frames and Tolerances
The finished dimensions of timber sections in frames for doors, windows and ventilators shall be as given in Table 2 (see fig.5,6,7 and 8) subject to a general tolerance of +3/-0 mm/for width and +2/-3 mm for thickness.

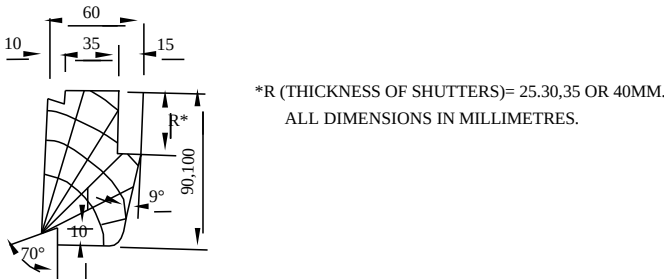


Fig. 5 Typical Cross Section of Frame for Doors and Large Windows carrying one set of shutters

6.2 Size and Types
Sizes and types of the door shutters shall generally conform to the modular size as shown in Fig. 9 Size other than modular sizes, as agreed to between the manufacturer and the purchaser, may also be permitted.
Note: - The size shown in Fig 9 is overall height and width on the outside of frames. This size is derived after allowing a margin of 5 mm all round for fitting and fixing to fit up to modular openings based on 10 cm module . The sizes marked with asterisk in Fig. 9 will be given preference.

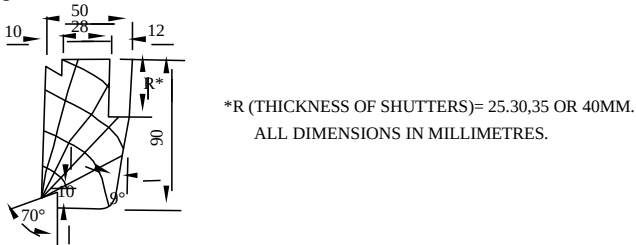


Fig. 6 Typical Cross Section of Frame for small Window and Ventilator carrying one set of shutters

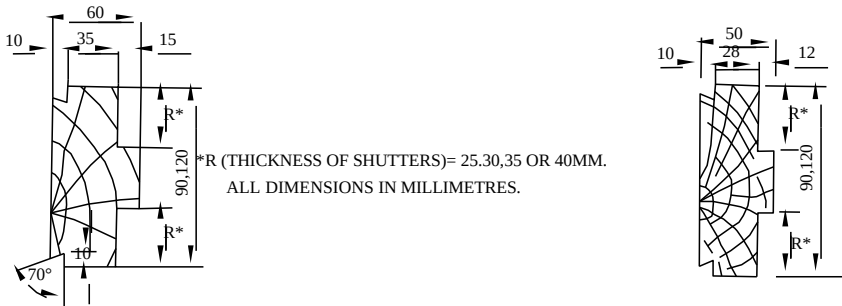


Fig. 7 Typical Cross Section of Frame for Doors and Large Windows carrying two set of shutters

Fig. 8 Typical Cross Section of Frame for small Windows and Ventilators carrying two set of shutters

6.3 Designation

Frames of doors, Windows and ventilators shall be designated by symbols denoting their width, type and height in succession in the following manner:

(a) Width - It shall be indicated by the number of modules in the width of opening.

(b) Type - It shall be indicated by the following letters of alphabet:

D for door

W for Window

V for Ventilator

S for single shutter

T for double shutter

Note :- Where a frame is intended to carry two setsof shutters. The frame shall be designated as DD. WW and VV.

(c) Height - It shall be indicated by the number of modules in height of opening.

Example: 12 DT 20' would mean a frame of double shutter door with a width of 12 modules (119 cm) and height of 20 modules(199 cm).

Table 2 Dimensions of Doors, Windows and Ventilators

Requirements	(Clause 6.1)			
	Door	Dimensions mm		Ventilator
		Window size > 120 cm	Window size < 120 cm	
(1)	(2)	(3)	(4)	(5)
(a) Width of frame carrying one swt of shutters:				
(1) for 35,40 mm shutter	100	100	90	90
(2) for 25,30 mm shutter	90	90	90	90
(b) Width of frame carrying two sets of shutters:				
(1) for 30,35 and 40 mm shutter	120	120	120	120
(2) for 25 mm shutter	90	90	90	90
(c) Thickness	60	60	50	50

6.3.1 Combination of Frames of Doors, Windows and ventilators

When frames of doors and windows are combined with those of windows and ventilators, they shall be designated as illustrated below. However size of frame for such combination shall be uniform for doors, windows and ventilators, by choosing the highest recommended dimension vide 6.1.

Example 1 : 6 WS 12/12 DT 20/6 WS. 12' means 12 modules wide and 20 modules high double shutter door frame combined in its two sides with two windows, 6 modules wide and 12 modules high.

Example 2 : $\begin{matrix} 6V6 & 6V6 \\ 6WS12 & 6WS12 \end{matrix}$ means frames of two single. windows of 6 modules wide and 12 modules high combined side by side and with two ventilators at top 6 modules wide and 6 modules high.

7 Location of Holdfasts

A minimum of three holdfasts shall be fixed on each side of the door frame, one at the centre point and other two at 30 cm from the top and bottom of frame excepting in case of horned head when two equally spaced holdfasts shall be provided. in case of windows and ventilators one holdfast on each side centrally placed shall be fixed up to a height of 60 cm. in case of height more than 60 cm, with or without harms two holdfasts shall be suitably fixed at each side.

8 Finish

8.1 Defective knots, when permitted on surfaces exposed to view, shall be completely bored or cut out and tightly plugged with same timber species and properly glued in. The grain of the plug shall run in the direction of the piece.

8.2 the unexposed surfaces in contact with either wall or lintel shall be properly painted with coal tar pitch (conforming to IS 216: (1961) before delivery.

8.3 All surfaces of door, window and ventilator frames which are required to be painted ultimately shall be covered evenly by brush painting with a priming coat of a wood primer as specified in IS 3536 : 1966.

8.3.1 In the case of frames to be polished or varnished, a priming coat of suitable polish or varnish shall be given before

Notes : - (1) Priming alone does not provide full protection against weather and, therefore, all work should receive coats of paint, polish or varnish, as the case may be, within a reasonable period. Any cut surface, particularly that exposing end grain should be primed before the joinery is set in position.

(2) When aluminium primer is used, the user should assure himself it is of a type especially prepared for this purpose. Unless suitable aluminium primers are used, it is not possible to obtain satisfactory finish.

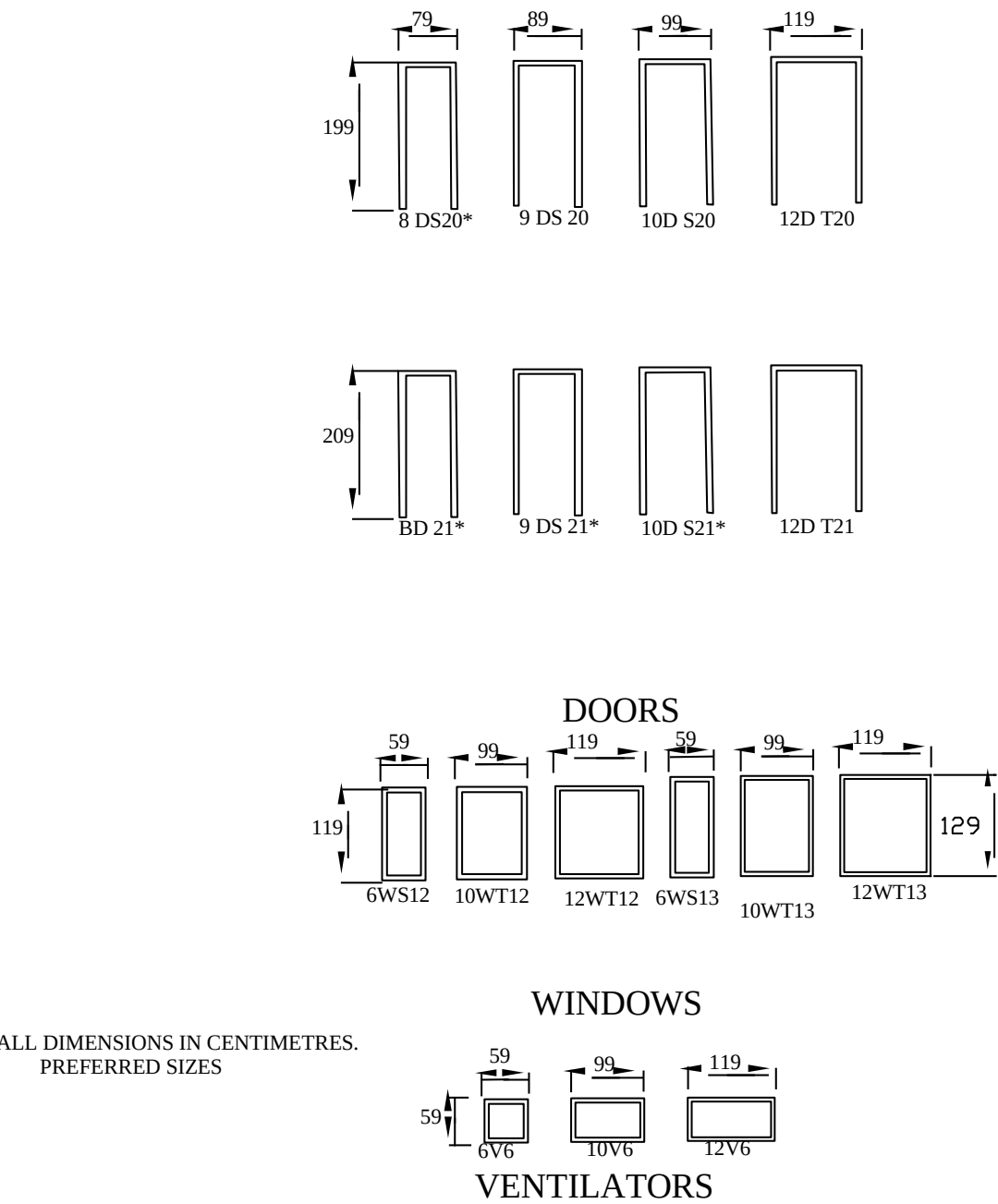


Fig. 9 Type and size of Frame of timber Doors, Windows and Ventilators

ANNEXURE 7.5 A

EXTRACTS FROM IS - 1003 pt. 1-1991 ON TIMBER PANELLED & GLAZED SHUTTERS (DOOR SHUTTERS)

7 Dimensions, size and Tolerances

7.1 Dimensions of components and Tolerances

The finished dimensions and tolerances of the different components of door shutters shall be as given in Table 2.

Table 2: Dimensions and Tolerances of Components of Door shutters

Sl. NO.	Description	Width mm	Thickness mm
(1)	(2)	(3)	(4)
(1)	Vertical stile top and freeze rail	100+3	35+1 or 40+1
(2)	Lock rail	150+3	35+1 or 40+1
(3)	Bottom rail	200+3	35+1 or 40+1
(4)	Munting	100+3	35+1 or 40+1
(5)	Glazing bar	40+3	35+1 or 40+1

7.2 Sizes and Types

Sizes and types of the timber panelled and glazed shutters shall generally conform to the modular sizes specified in Table 3 (see also Fig. 6). Sizes other than modular sizes as agreed to between the manufacturer and the purchaser, may also be permitted.

Table 3 : Dimension of Door shutters

Designation of Doors	Width mm	Height mm
(1)	(2)	(3)
8 DS 20	700	1 905 (1 945)
8 DS 21	700	2 005 (2 045)
9 DS 20	800	1 905 (1 945)
9 DS 21	800	2 005 (2 045)
10 DS 20	900	1 905 (1 945)
10 DS 21	900	2 005 (2 045)
12 DT 20	1100 *	1 905 (1 945)
12 DT 21	1100 *	2 005 (2 045)

- Notes (1) The designation refers to modular sizes of door openings. First number stands for width and the last for height in module (M=100mm). Alphabet 'D' refer to doors, 'S' to single shutter and 'T' to double leaf shutter.
 (2) Standard size of door frames are covered in IS : 4021 - 1983 and IS : 4351 - 1976.
 (3) The standard widths and heights for panel doors are arrived at as shown in Fig. 6. In case the modular height is taken from the finished floor level, the height of the door shall be the one given in bracket. In the case of double leaf shutters, the rebate in the shutters shall be as given in 6.12.

Combined width of double leaf shutters.

Illustration of components of Door

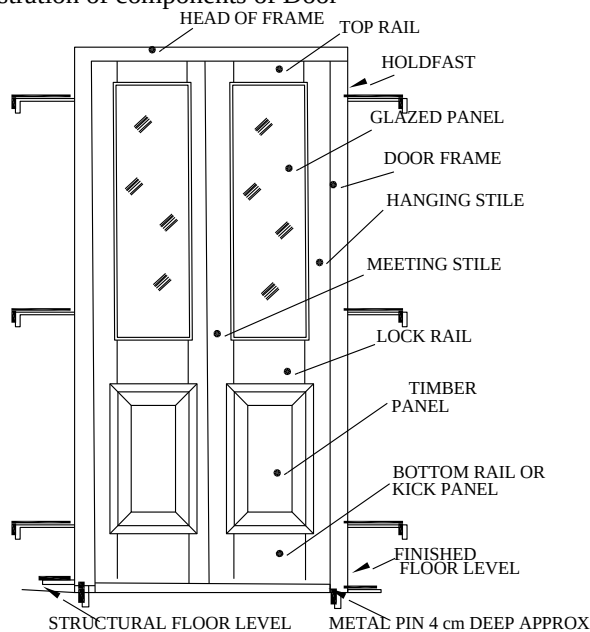


Fig. 1 : Typical Illustration of Double Panelled Door with Timber and Glazed panels

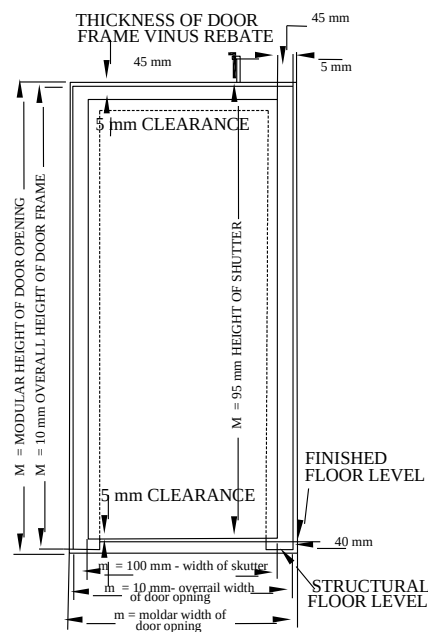


Fig.6 : Sketch Illustrating Dimensions of Shutter

7.3 Tolerances

Tolerances on the sizes of door shutters shall be ± 3 mm.

8. Location of fittings and Accessories

8.1 The lock rail of door shutters, where provided, shall be so placed that its centre line is at a height of 850 ± 5 mm from the bottom of the shutter.

8.2 Each door shutter shall be fixed to the frame with three hinges of the type specified by the purchaser one at the centre and the other two at 200 mm from the top and the bottom of the shutter.

8.3 Timber panelled shutter may be provided with louvers or vision panels as specified by the purchaser. Where such a provision is made, the position, size and shape of louver or vision panel opening shall be as specified by the purchaser.

9 . Finish

9.1 All door shutters shall be sanded and finished smooth.

9.2 Panels of shutters shall be flat and well sanded to a smooth and level surface.

9.3 Defective knots, when permitted on surfaces exposed to view shall be completely bored or cut out and tightly plugged with the same timber species and properly glued in. The grains of the plug shall run in direction of the grains of the piece.

9.4 All the surfaces of door shutters which are required to be painted or polished or varnished ultimately shall be covered initially before delivery by protective coat of primer polish or varnish as specified in IS : 2338 (part 1)-1967 and IS : (part 2)-2338

10. Glazing

10.1 The glass used for panels shall be of good and durable quality, weighing not less than 10 kg/m² and the thickness shall not be less than 4 mm. The particular type, quality and shade shall be as agreed between the purchaser and the supplier.

10.2 In specifying size of openings or panels of glass, the first dimension shall be the width.

10.3 The glass shall be embedded in putty and secured to the rebate by wooden beads of suitable size and shape.

10.4 Wash leather, ribbon velvet, rubber flanner felt, asbestos or other similar material may be used in place of putty for internal Glazing. The material shall be fitted lighter as a beading on one side or in such a manner that it covers all parts of the glass which will be covered by the beading

ANNEXURE 7.5B
(Para 7.6)

EXTRACTS FROM IS 1003 PT.II – 1994 ON TIMBER PANELLED AND GLAZED SHUTTERS (WINDOW AND VENTILATOR SHUTTERS)

7. Dimensions, Sizes and Tolerances

7.1 Dimensions of Components and Tolerances

The finished dimensions and tolerances of different components of window / ventilator shutters shall be as given in Table 2.

Table 2: Dimensions and Tolerances of Components of Window and Ventilator Shutters (Clause 7.1)

Description of Component	Window Shutters		Ventilators Shutters	
	Width mm	Thickness mm	Width mm	Thickness mm
Stiles and rails	80 ± 3	25 ± 1	80 ± 3	20 ± 1
		30 ± 1		22.5 ± 1
				25 ± 1
				27.5 ± 1
Munting	60 ± 3	25 ± 1	60 ± 3	-do-
		30 ± 1		
Glazing Bars	40 ± 1	25 ± 1	40 ± 1	-do-
		30 ± 1		

7.2 Designation (Window and Ventilator Shutters)

Window and ventilator shutters shall be designated by symbols denoting the width type and height of window and ventilators in succession in the following manner:

a) Width: It shall be indicated by the number of modules in the width of opening.

b) Type: It shall be indicated by the following letters of alphabet:

W= Window

V= Ventilator

S= Single Shutter

T = Double Shutter

c) Height : It shall be indicated by the number of modules in the height of opening.

Example:

10 WT 12 would mean a window shutter suitable for a double shutter window of 10 modules width and 12 modules height.

12 V6 would mean ventilator shutter suitable for a ventilator of 12 modules width and 6 modules height.

7.3 Sizes

7.3.1 Sizes of the window and ventilator shutters shall generally conform to the modular sizes specified in Tables 3 and 4 respectively. These sizes are derived after allowing the thickness of the frame and a margin of 5mm all round for fitting and fixing into a modular opening based on 100mm module. Sizes other than modular sizes, as agreed to between the manufacturer and the purchaser, may also be permitted.

7.3.2 Tolerances on the overall dimensions of window and ventilator shutters shall be ± 3 mm.

Table 3: Dimensions of Timber Window Shutters

(Clause 7.3.1)

Designation	Width mm	Height mm
(1)	(2)	(3)
6WS 12	500	1 100
10 WT 12	460	1 100
12 WT 12	560	1 100
6 WS 13	500	1 200
10 WT 13	460	1 200
12 WT 13	560	1 200

Table 4: Dimensions of Timber Ventilator Shutters
(Clause 7.3.1)

Designation	Width mm	Height mm
(1)	(2)	(3)
6 V 6	500	500
10 V 6	900	500
12 V6	1100	500

8. Location of Fitting and Accessories

8.1 Each window shutter shall be fixed to the frame with two hinges of the suitable type generally at quarter points. Prefer locating hinges so that the bottom hinge is at a larger distance (say 15 cm) from the lower end of shutter than the distance for the upper hinge (say 10 cm) from the upper end of shutter. Each ventilator shutter shall be either fixed to its frame with two hinges of suitable type at quarter points of top rail or bottom rail or suspended on a suitable peg stay in the centre of the frame according as it is to be hung; top hung, bottom hung or centre hung ventilator.

8.2 Timber panelled shutters may be provided with louvers or vision panels as specified by the purchaser. Where such a provision is made, the position, size and shape of louver or vision-panel opening shall be specified by the purchaser.

9. Finish

9.1 Same as in IS 1003 (Part 1)

9.2 Same as in IS 1003 (Part 1)

9.3 Same as in IS 1003 (Part 1)

9.4 Same as in IS 1003 (Part 1)

10.0 Glazing

10.1 Same as in IS 1003 (Part 1)

10.2 Same as in IS 1003 (Part 1)

10.3 Same as in IS 1003 (Part 1)

10.4 Same as in IS 1003 (Part 1)

Notes

A: Door Shutters

1. Door of room adjoining the verandah, corridor, lobby or hall, shall be considered as external door.
2. Where the height of the door leaf exceeds 2.15 metres above the floor level, one extra hinge shall be provided for every additional height of 0.50 metre, or part thereof and the length of top bolts shall be increased by the height of the leaf above 2.15 metres from floor level.
3. Single leaf door shutters of more than 0.80 m in width shall be provided with one extra hinge.
4. Fan light shutters of more than 0.80 metre width shall be provided with one extra hinge and extra quadrant stay.
5. In double leaf shutters of doors, two door bolts shall be fixed to the first shutter and one on the closing shutter at the top.
6. In case of single leaf inter communicating, panelled, glazed or panelled door shutter for bath and w.c. one tower bolt will be replaced by a bathroom latch.
7. For shutter exceeding 40 mm thickness heavy type M.S. butt hinges of 125 x 90 x 4 mm shall be used.
8. In case of external door shutters, instead of sliding door ball mortice lock can be provided where specified.
9. Cupboard and wardrobe shutters will have ball catches where specified.
10. Finger plates shall be provided in case of bath and W.C. shutters in office buildings.

B. Window Shutters

11. In case of windows with double shutters, two lower bolts shall be fixed to the closing shutters and one tower bolt to the first shutter at the top.
12. In case of window shutters, hooks and eyes may be provided in lieu of casement stays where specified.
13. Where the height of window shutter exceeds 1.20 metres one extra hinge shall be provided and length of top bolts shall be increased by height of the leaf above 2.15 metres from the floor level.
14. Window shutter with steel frames shall be provided with six hinges in case of double leaf shutters and three hinges in case of single leaf shutters, irrespective of height and width of shutters.

C. Fanlight and Clerestory Window or Ventilator

15. Centrally hung and bottom hung CS windows and fan lights, will be provided with chain and hook bamboo pole with hook for opening ventilators shall be provided for each residence or for set of 4 rooms in case of office building.
16. Centrally hung clerestory windows or fanlights will have fan light pivots in lieu of hinges.

ANNEXURE 7.6

SCHEDULE OF FITTINGS FOR TEAK WOOD JOINERY AND FLUSH DOORS

S.No	Name of fittings	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Remarks
1	Butt hinges 100mm																						Single leaf wire gauze window shutter of height upto 1.20 metres
2	Butt hinges 75 mm																						Double leaf wire gauze window shutter of height upto 1.20 metres
3	Single action spring hinges																						Single leaf wire gauze door shutters
4	Mortice lock																						Double leaf wire gauze door shutters
5	Sliding door bolt (Aldrop) 300mm																						Double leaf wire gauze door shutters upto 80 cm width
6	Sliding door bolt (Aldrop) 250mm																						Double leaf wire gauze door shutters upto 80 cm width
7	Flush bolts 250mm																						Double leaf wire gauze door shutters upto 80 cm width
8	Flush bolts 100mm																						Double leaf wire gauze door shutters upto 80 cm width
9	Barrel bolts 250mm																						Double leaf wire gauze door shutters upto 80 cm width
10	Barrel bolts 150mm																						Double leaf wire gauze door shutters upto 80 cm width
11	Barrel bolts 100mm																						Double leaf wire gauze door shutters upto 80 cm width
12	Furniture handles																						Double leaf wire gauze door shutters upto 80 cm width
13	Door handle with plate 100mm																						Double leaf wire gauze door shutters upto 80 cm width
14	Door handle with plate 75mm																						Double leaf wire gauze door shutters upto 80 cm width
15	Helical door springs (Superior quality)																						Double leaf wire gauze door shutters upto 80 cm width
16	Ball catchers 10mm dia																						Double leaf wire gauze door shutters upto 80 cm width
17	Cup-board or ward-robe lock 65mm. (6 lever (Godrej) or equivalent)																						Double leaf wire gauze door shutters upto 80 cm width
18	Fan light pivot set																						Double leaf wire gauze door shutters upto 80 cm width
19	Fan light catch																						Double leaf wire gauze door shutters upto 80 cm width
20	Chain and hooks 300mm																						Double leaf wire gauze door shutters upto 80 cm width
21	Hooks and eyes 150mm																						Double leaf wire gauze door shutters upto 80 cm width

Annexure 7.6 (ii)

SCHEDULE OF FITTINGS FOR JOINERY WORK OF WOOD OTHER THAN TEAK WOOD

S.No.	Name of fittings	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	Remarks
1	Butt hinges 100mm	6																Single leaf wire gauzed door shutters width upto 80 cm.
2	Butt hinges 75 mm																	Double leaf wire gauze door shutters
3	Tee hinges 115mm (arm length 300mm)																	Clerestory window and fan light shutters bottom hung upto 80 cm width
4	Sliding door bolt (Aldrop) 300mm																	
5	Sliding door bolt (Aldrop) 250mm	1	1															
6	Door bolts 250mm	2	1															
7	Door bolts 150mm	1																
8	Door bolts 100mm																	
9	Door handles 100mm	2																
10	Door handles 75mm	1																
11	Cupboard or wardrobe knob (Brass)																	
12	Helical door spring 150mm																	
13	Ball catchers 10mm dia																	
14	Hooks and eyes 100mm																	
15	Chain and hooks 300mm long																	
16	Safety hasp and stable 115 mm																	
17	Fan light pivot (set)																	
18	Fan light catch																	

ANNEXURE 7.7**(Para 7.7A.2)**

SIZES OF FLUSH DOOR SHUTTERS
(Extracted from Clause 4 of IS 2191 Pt.1)

4 SIZES

Sizes of the door shutters shall generally conform to the modular sizes specified in Table 1. Sizes other than modular sizes as agreed to between the manufacturer and the purchaser, may also be permitted; however, the thickness of shutters in such cases shall not be less than that specified against the nearest higher modular size given in 4.2.

TABLE 1 DIMENSIONS OF FLUSH DOOR SHUTTERS

DESIGNATION OF DOORS	WIDTH	HEIGHT MM
8 DS 20	700	1 905 (1 945)
8 DS 21	700	2 005 (2 045)
9 DS 20	800	1 905 (1 945)
9 DS 21	800	2 005 (2 045)
10 DS 20	900	1 905 (1 945)
10 DS 21	900	2 005 (2 045)
12 DT 20	1100*	1 905 (1 945)
12 DT 21	1100*	2 005 (2 045)

NOTE 1 D = Door, S = Single shutter and T = Double shutter.

NOTE 2 The designation indicates the size of door openings, the first number denoting width in modules of 100mm and the last number, the height in modules.

NOTE 3 Standard sizes of door frames are covered in IS:4021-1983+ and IS:4351-1976++.

NOTE 4 In arriving at the standard widths and heights for flush doors, an allowance of 60mm has been made for door frames, 40mm for floor finish and 5mm for clearance all round (see also Fig.7.4A) between door opening and door frame and 15mm for rebate all round for the shutter into the frame. In case the modular height is taken from the finished floor level, the height of the door shall be the one given in bracket. In the case of double shutters, the rebate and clearance between the shutters shall be as given in Para 6.7 of IS 2191 (Part 1)- 1983.

“6.7 Rebating: In the case of double leaved shutters, the meeting of the stiles shall be rebated by one-third the thickness of shutter. The rebating shall be either splayed or square type as shown in Fig. 4 of IS 2191 Pt.1. Where lipping is provided, the depth of lipping at the meeting of stiles shall not be less than 35mm”.

*Combined width of two shutters in closed position.

+ Specification for timber door, window and ventilator frames (second revision)

++ Specification for steel door frames (first revision)

1.2 Nominal thickness of shutters shall be 25, 30 or 35mm.

NOTE – It is recommended that as far as possible the thickness adopted for flush doors should be as given below :

Door Designation	Thickness of Shutter (mm)
8 DS 20 and 8 DS 21	25
9 DS 20 and 9 DS 21	30 or 35
10 DS 20 and 10 DS 21	35
12 DT 20 and 12 DT 21	35

4.3 Tolerances – Tolerance on nominal width and height shall be +3mm / -0mm; tolerance on nominal thickness shall be ± 1.2 mm. The thickness of the door shutter shall be uniform throughout with a permissible variation of not more than 0.8mm when measured at any two points.

ANNEXURE 7.8

SCHEDULE OF FITTINGS FOR TEAK WOOD JOINERY AND FLUSH DOORS

S.No	Name of fittings	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	Remarks
1	Butt hinges 100mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
2	Butt hinges 75 mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
3	Single action spring hinges	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
4	Mortice lock	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
5	Sliding door bolt (Aldrop) 300mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
6	Sliding door bolt (Aldrop) 250mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
7	Flush bolts 250mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
8	Flush bolts 100mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
9	Barrel bolts 250mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
10	Barrel bolts 150mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
11	Barrel bolts 100mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
12	Furniture handles	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
13	Door handle with plate 100mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
14	Door handle with plate 75mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
15	Helical door springs (Superior quality)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
16	Ball catchers 10mm dia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
17	Cup-board or ward-robe lock 65mm, 6 lever (Godrej or equivalent)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
18	Fan light pivot set	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
19	Fan light catch	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
20	Chain and hooks 300mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres
21	Hooks and eyes 150mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Shutter of height upto 1.20 metres

SCHEDULE OF FITTINGS FOR JOINERY WORK OF WOOD OTHER THAN TEAK WOOD

S. No.	Name of fittings	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	Remarks
1	Butt hinges 100mm	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf wire gauzed shutters width upto 80 cm.
2	Butt hinges 75 mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Double leaf wire gauze door shutters
3	Tee hinges 115mm (arm length 300mm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Clerestory window and fan light shutters central hung
4	Sliding door bolt (Aldrop) 300mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Clerestory window and fan light shutters bottom hung upto 80 cm width
5	Sliding door bolt (Aldrop) 250mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf window shutters, of heights upto 1.20 metres glazed, battened and braced, veneerlaid or wire gauzed
6	Door bolts 250mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Double leaf window shutters of heights upto 1.20 metres glazed, battened and braced, veneerlaid or wire gauzed
7	Door bolts 150mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf cup-board or wardrobe shutters, panelled, glazed or and glazed
8	Door bolts 100mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Double leaf cup-board or ward-robe shutter panelled, glazed, or panelled and glazed
9	Door handles 100mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf, door shutter battened and braced with top and bottom clearance fro WC's and bath rooms
10	Door handles 75mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf battened and braced door shutter width upto 80 cm.
11	Cupboard or wardrobe knob (Brass)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf inter communicating door shutterpanelled width upto 80 cm
12	Helical door spring 150mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf external door shutters glazed, framed and battened or jaffri width upto 80 cm
13	Ball catchers 10mm dia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Double leaf door shutters, panelled, glazed, panelled and glazed, framed
14	Hooks and eyes 100mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf external door shutters glazed, framed and battened or jaffri width upto 80 cm
15	Chain and hooks 300mm long	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Single leaf external door shutters glazed, framed and battened or jaffri width upto 80 cm
16	Safety hasp and stable 115 mm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Double leaf door shutters, panelled, glazed, panelled and glazed, framed
17	Fan light pivot (set)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Double leaf door shutters, panelled, glazed, panelled and glazed, framed
18	Fan light catch	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Double leaf door shutters, panelled, glazed, panelled and glazed, framed

JOINTS IN TIMBER

FIGURE 7.1 A to D

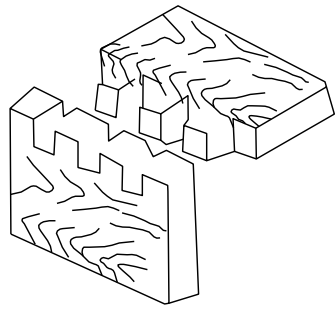


Fig. 7.1 A DOVETAIL JOINT

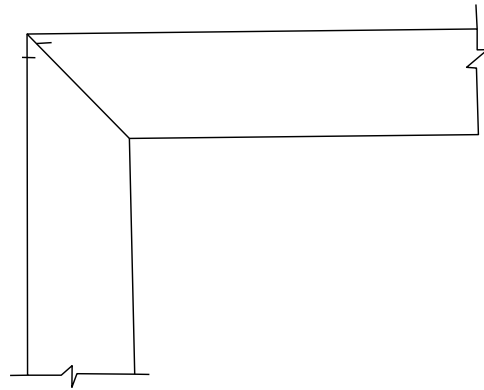


Fig. 7.1 B MITRED JOINT

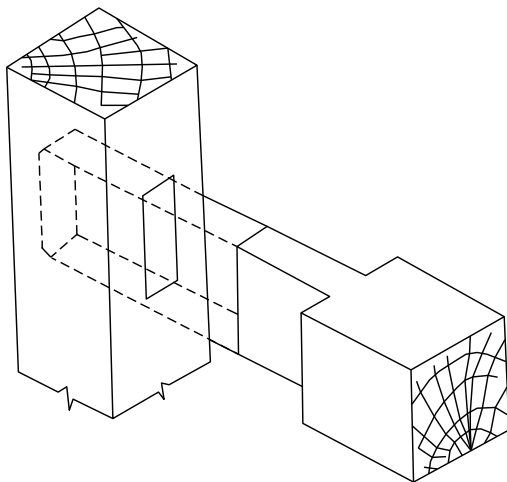


Fig. 7.1 C MORTISE & TENON JOINT

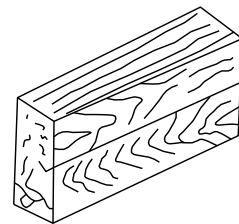
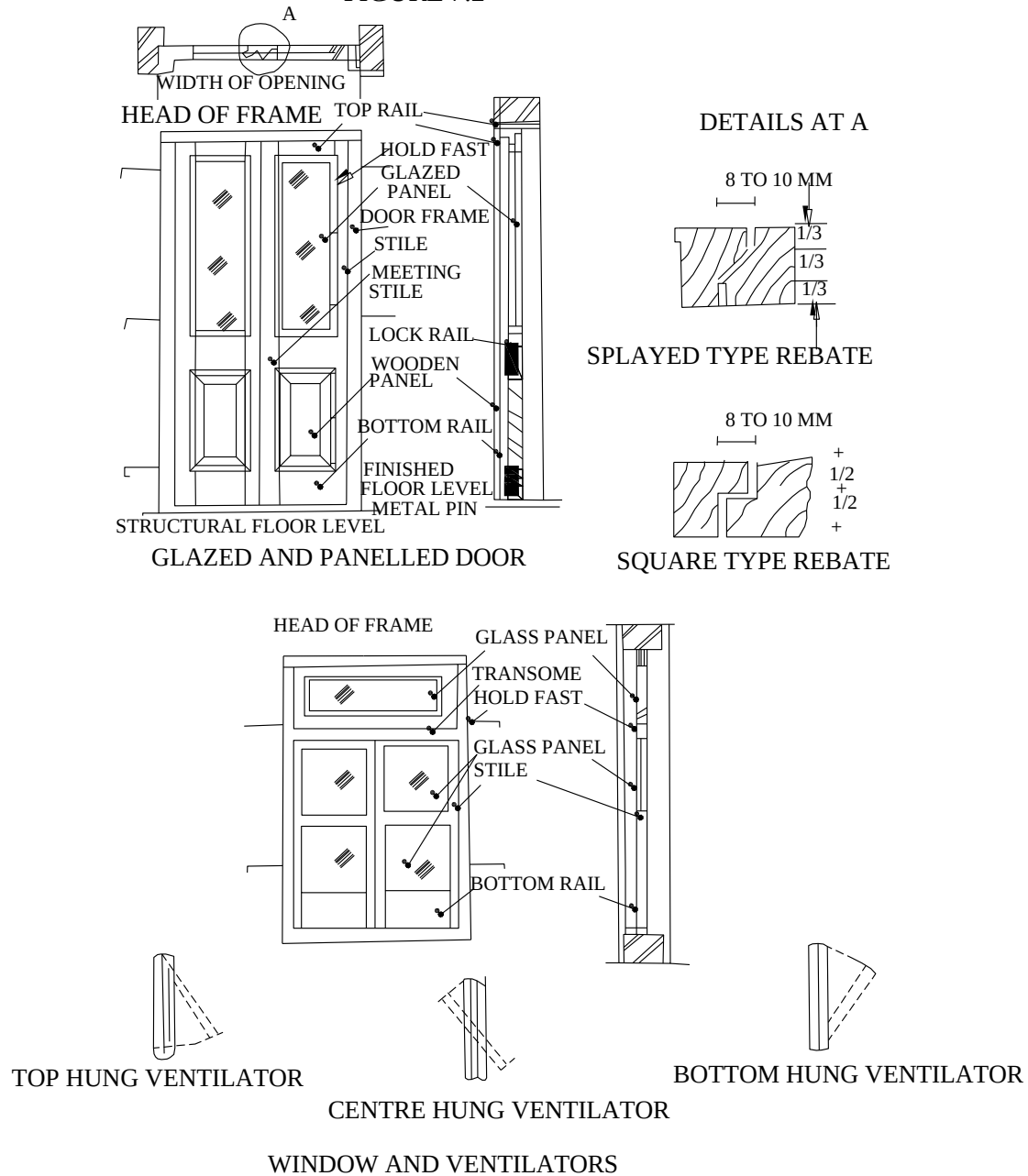


Fig. 7.1 D TONGUE & GROOVE JOINT

All dimensions are in mm
Drawings Not to Scale

TERMINOLOGY - TIMBER DOOR, WINDOW &
VENTILATOR COMPONENTS

FIGURE 7.2

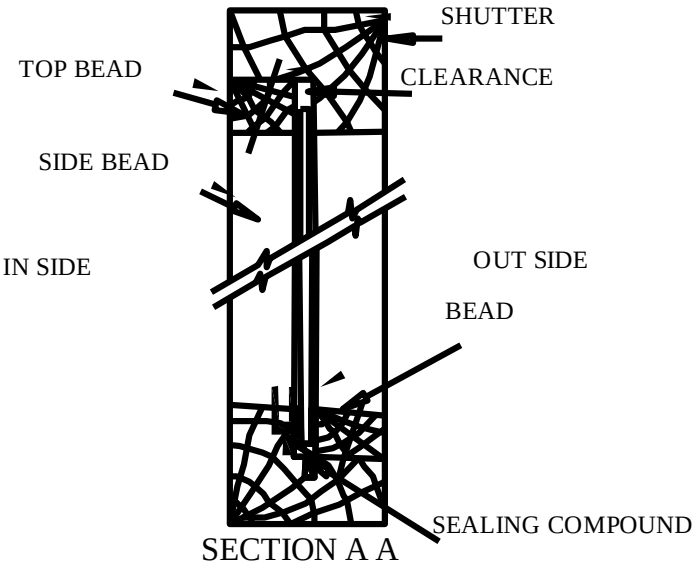
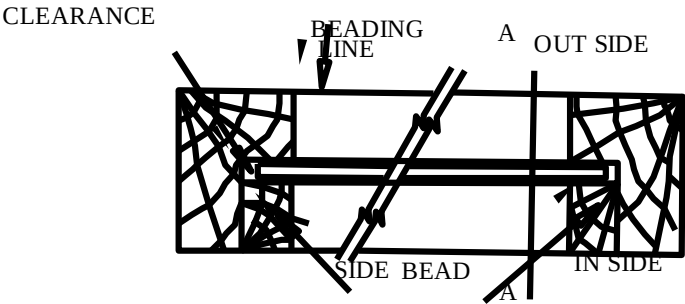


All dimensions are in mm

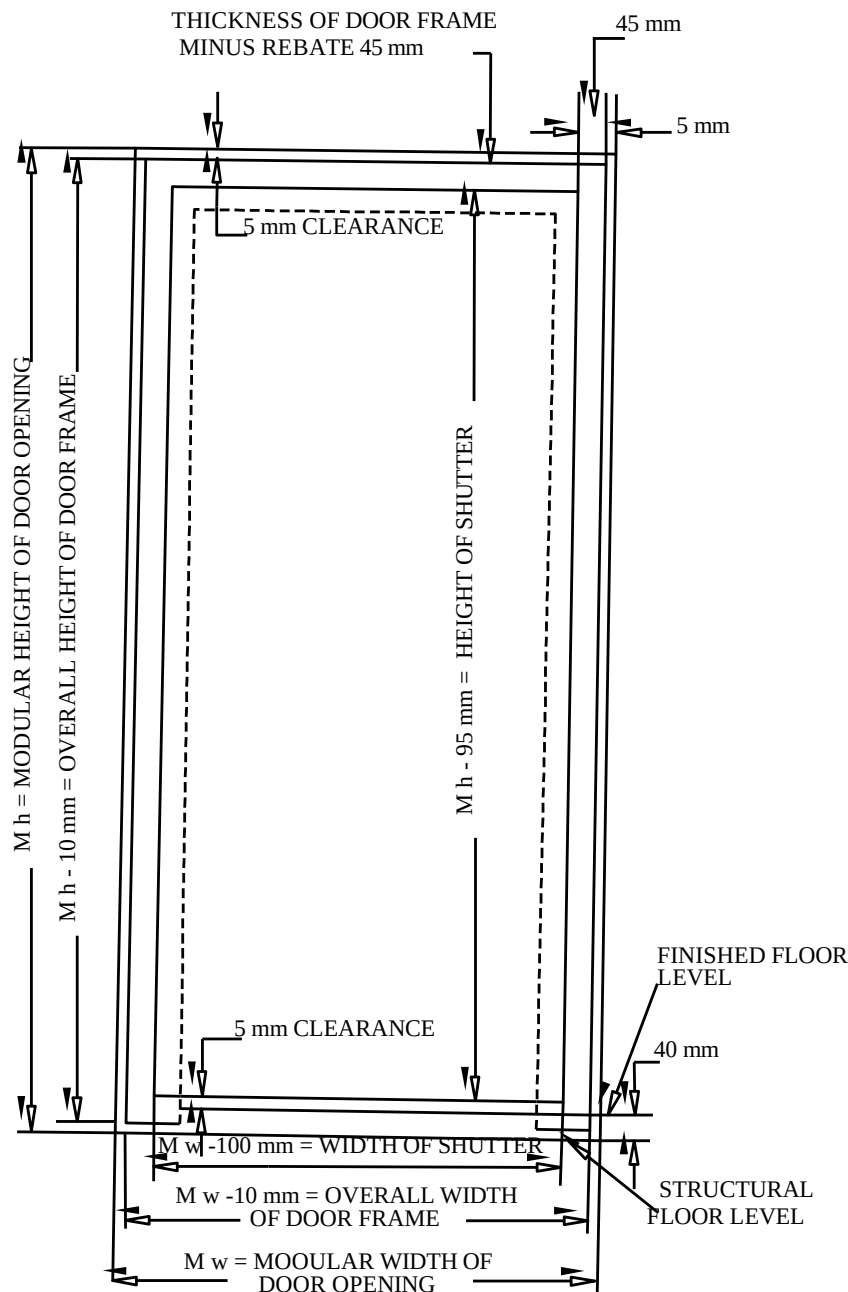
Drawings Not to Scale

GLAZING

FIGURE 7.3



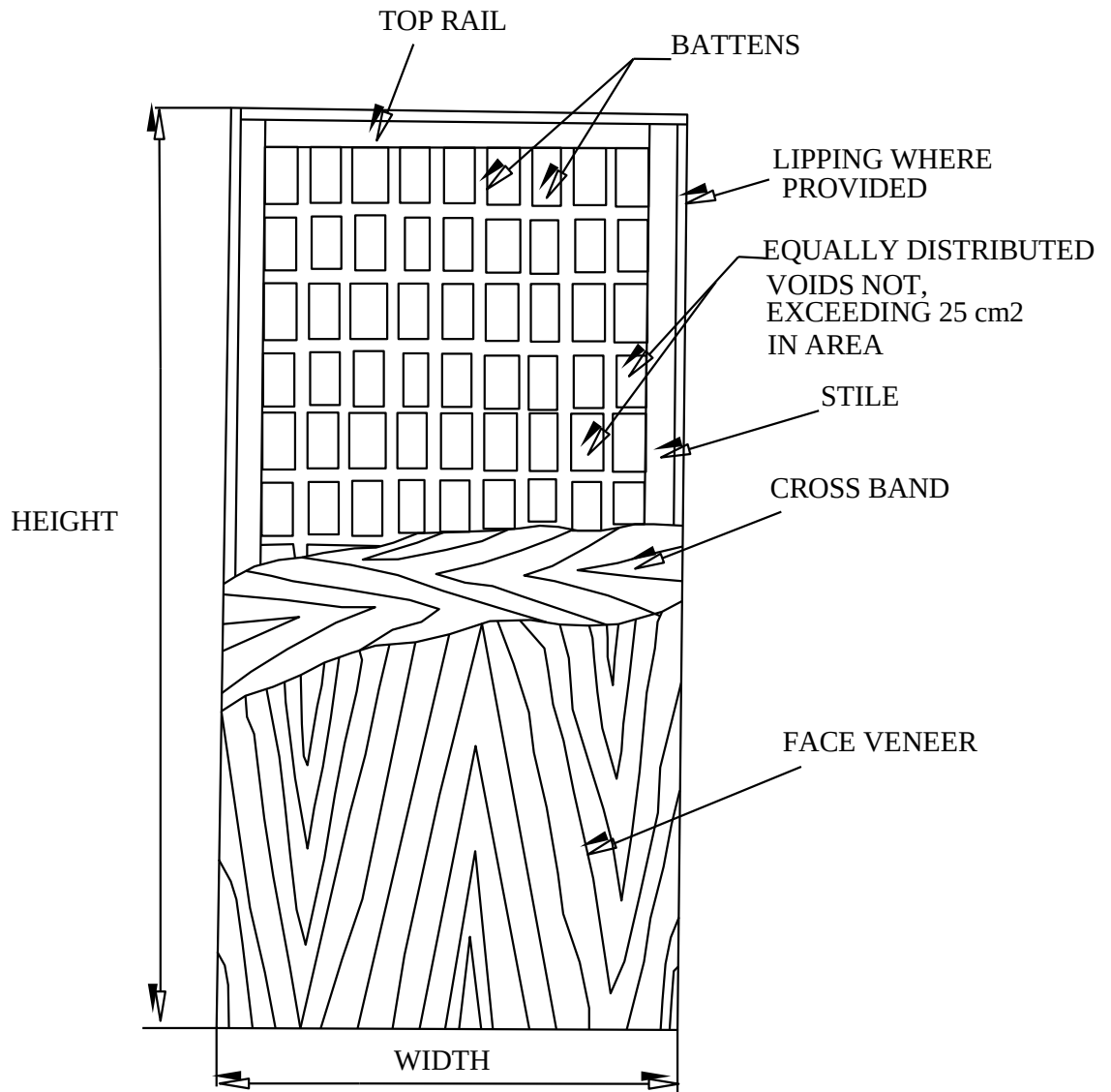
SKETCH ILLUSTRATING DIMENSIONS OF SHUTTER
FIGURE 7.4 A



SKETCH ILLUSTRATING DIMENSIONS OF SHUTTER

CELLULAR CORE FLUSH DOOR SHUTTER

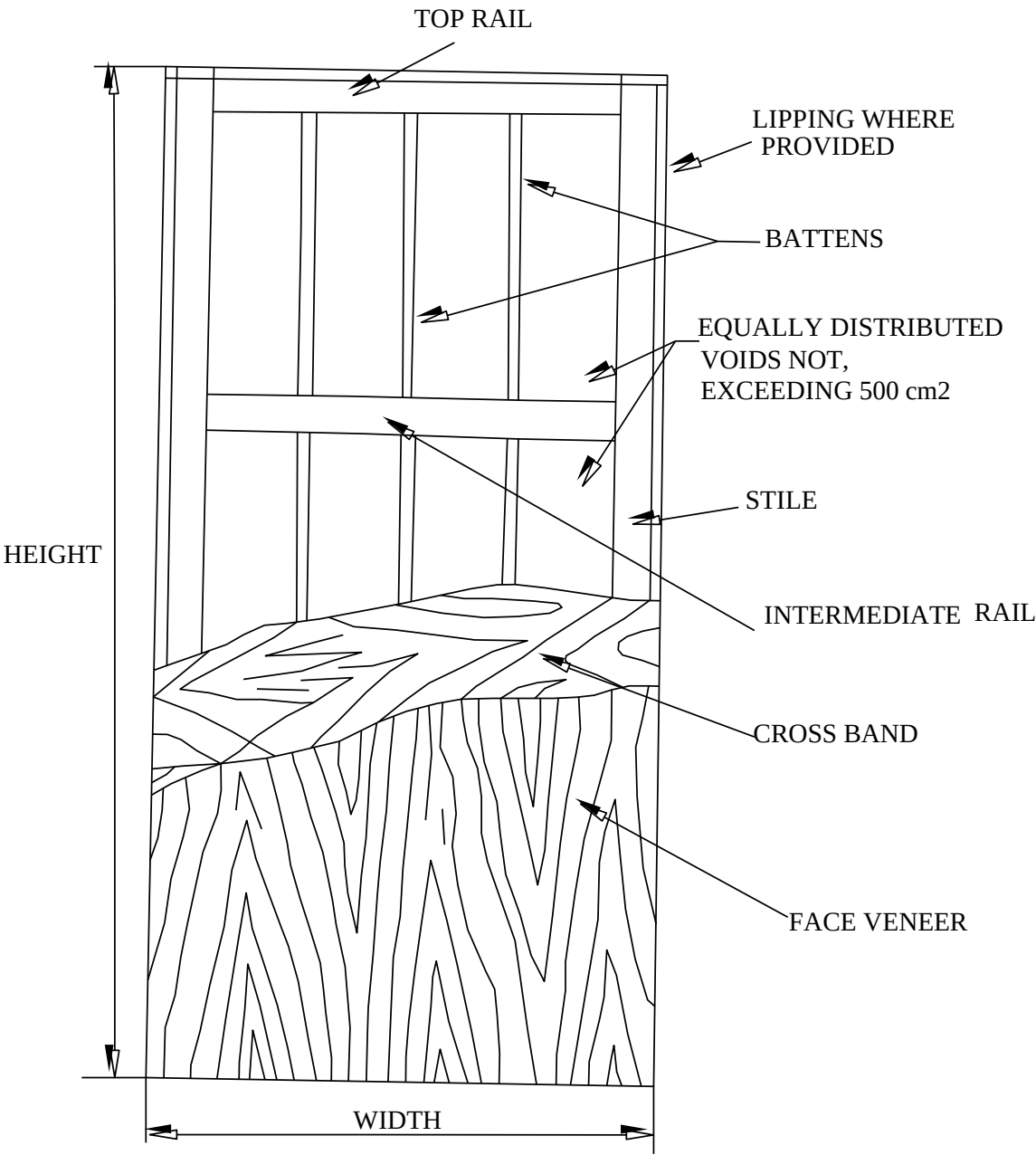
FIGURE 7.4 B



CELLULAR CORE FLUSH DOOR SHUTTER

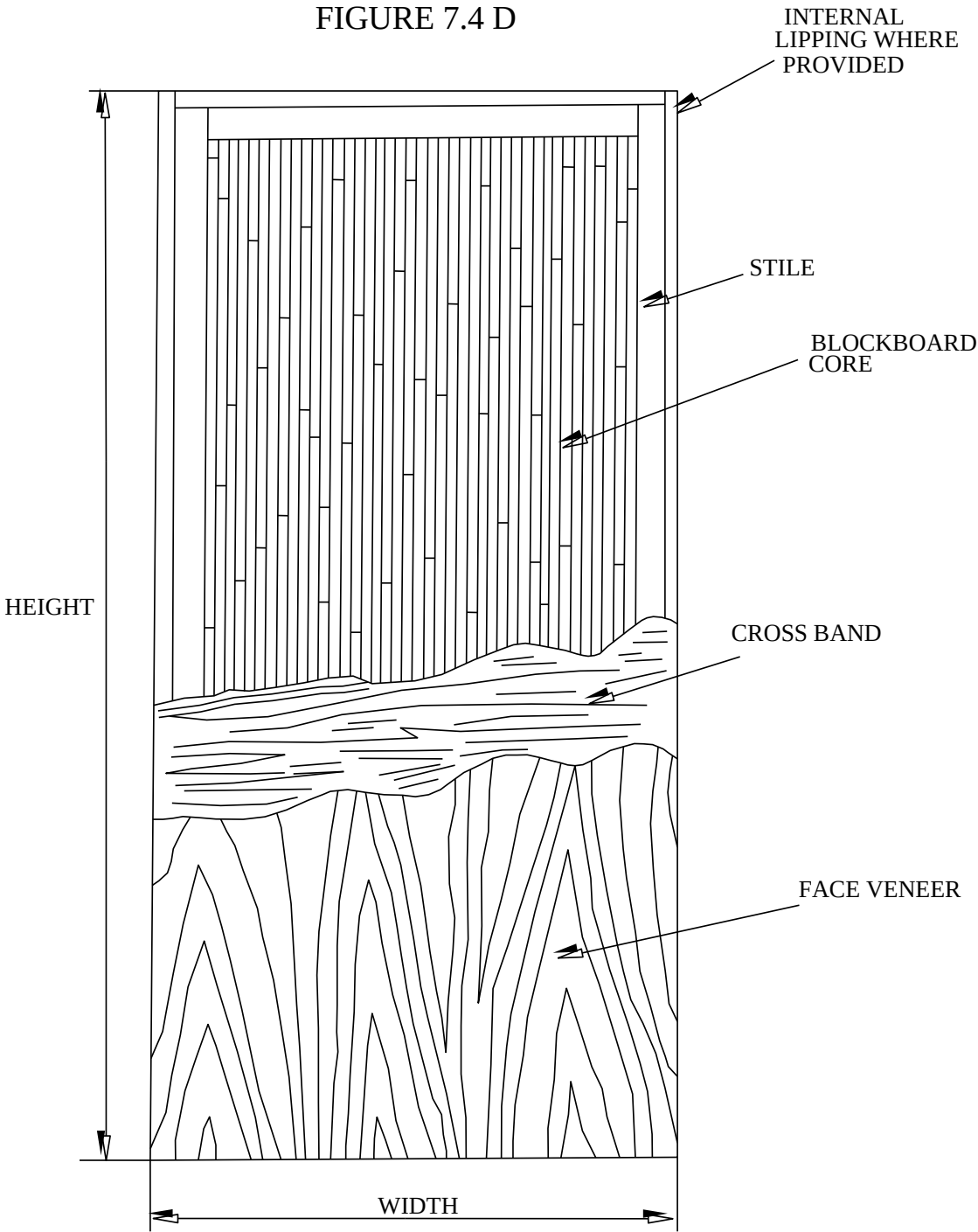
HOLLOW CORE FLUSH DOOR SHUTTER

FIGURE 7.4 C



HOLLOW CORE FLUSH DOOR SHUTTER

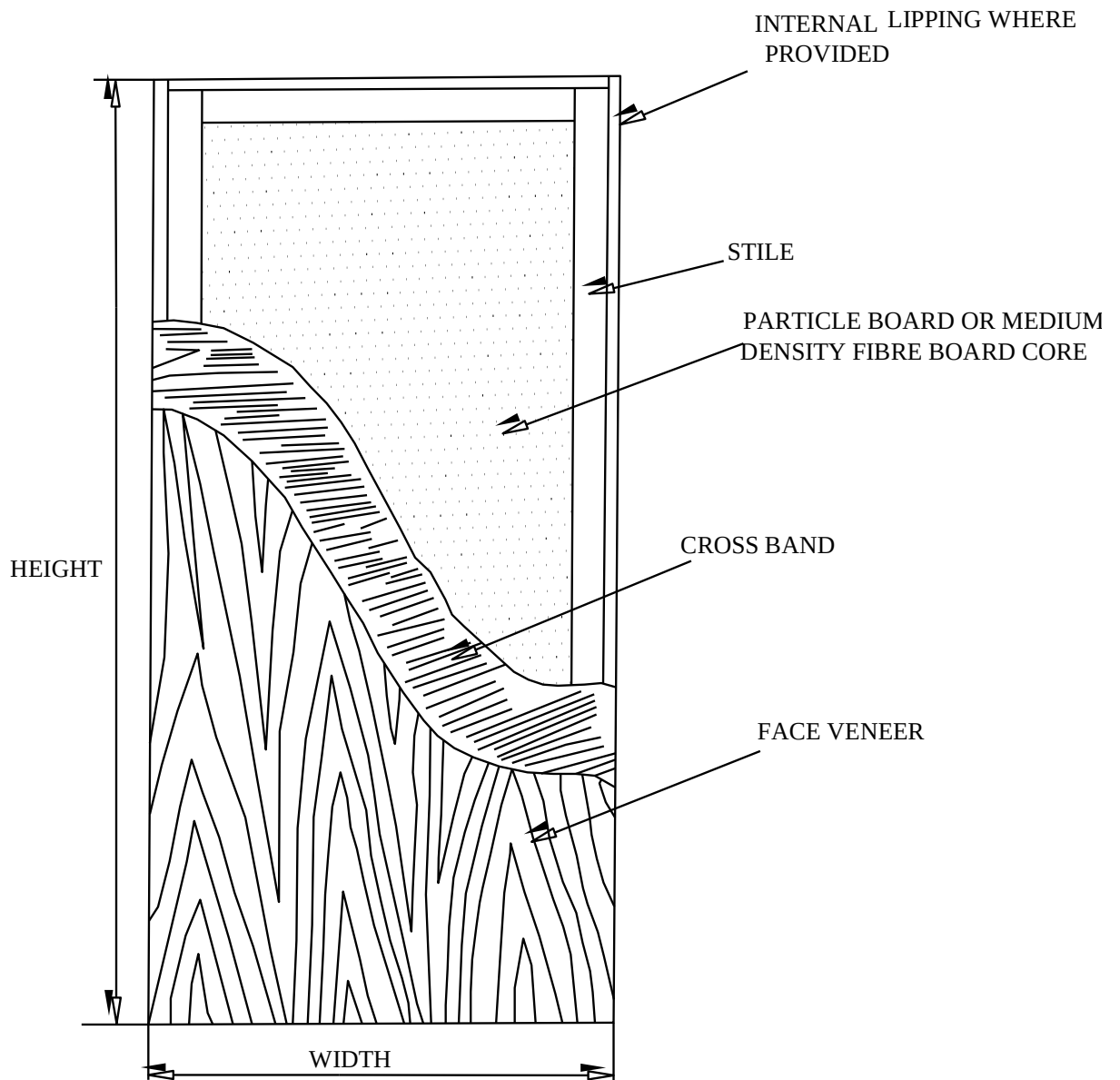
BLOCKBOARD CORE FLUSH DOOR SHUTTER



BLOCKBOARD CORE FLUSH DOOR SHUTTER

PARTICLE BOARD/MEDIUM DENSITY FIBRE BOARD CORE FLUSH DOOR SHUTTER

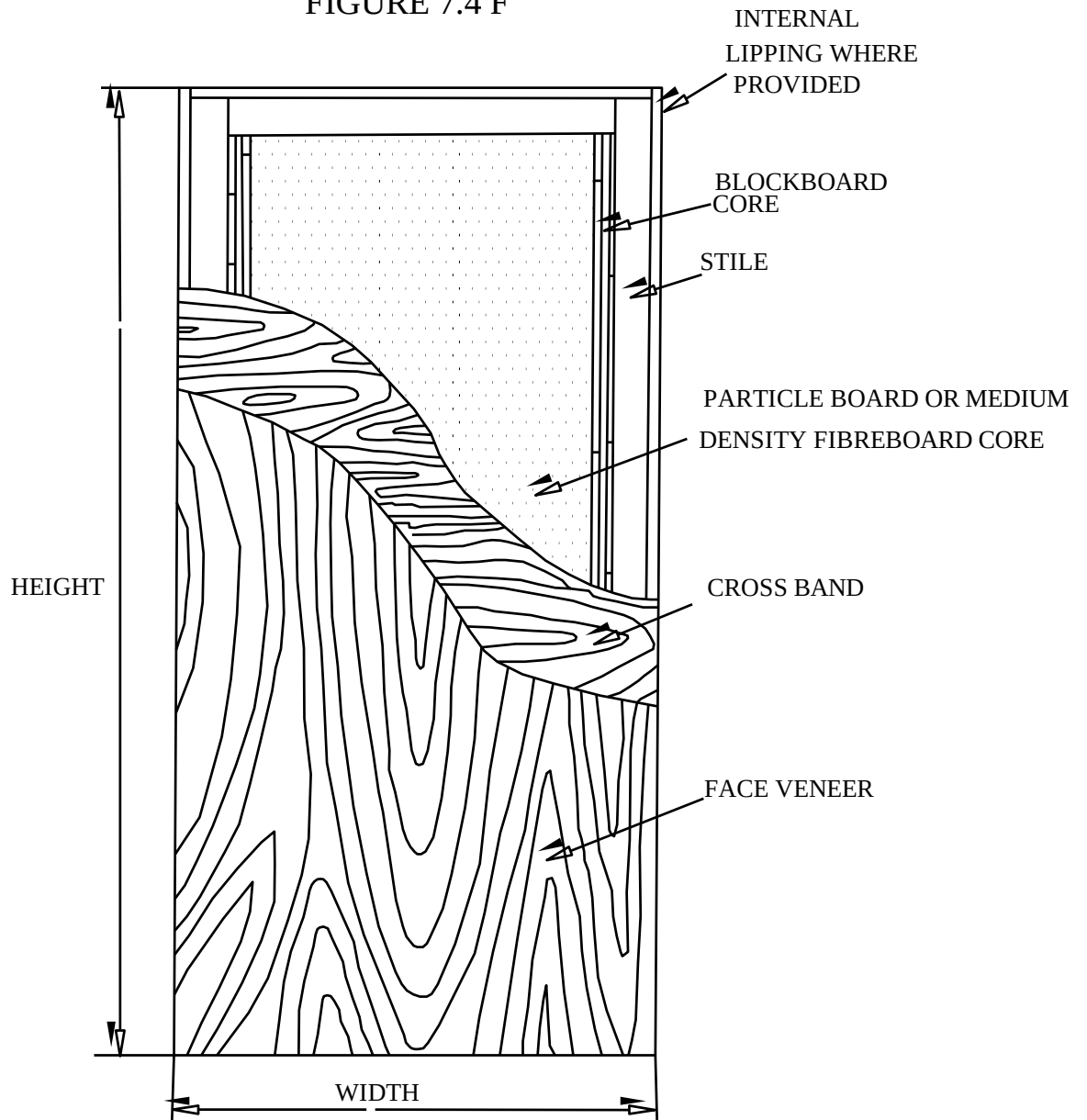
FIGURE 7.4 E



PARTICLE BOARD/MEDIUM DENSITY FIBRE BOARD CORE FLUSH DOOR SHUTTER

PARTICLE BOARD/MEDIUM DENSITY FIBRE BOARD AND BLOCKBOARD CORE FLUSH DOOR SHUTTER

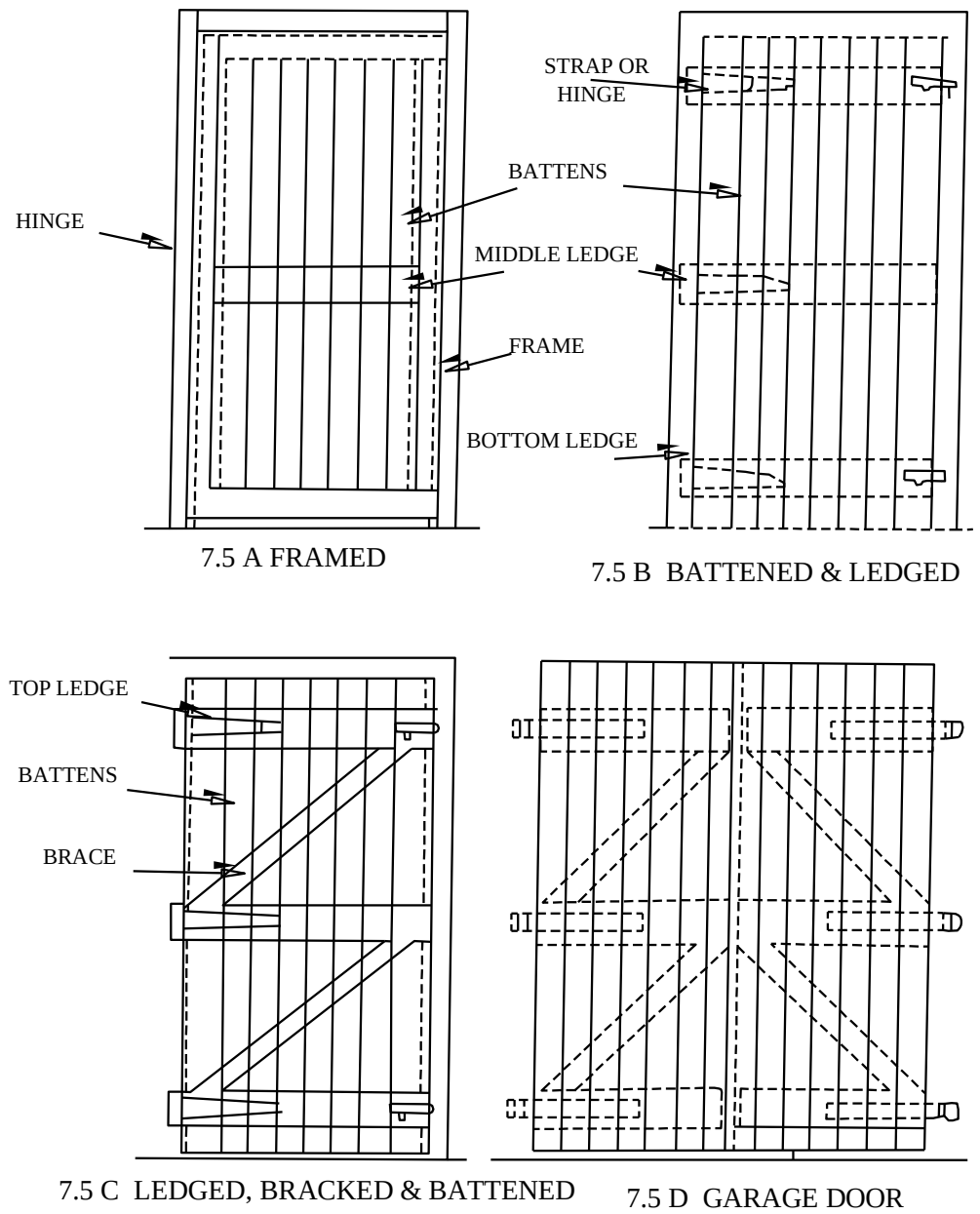
FIGURE 7.4 F



PARTICLE BOARD/MEDIUM DENSITY FIBRE BOARD AND BLOCKBOARD CORE FLUSH DOOR SHUTTER

FRAMED, LEDGED, BRACED, BATTENED DOORS

FIGURE 7.5A toD

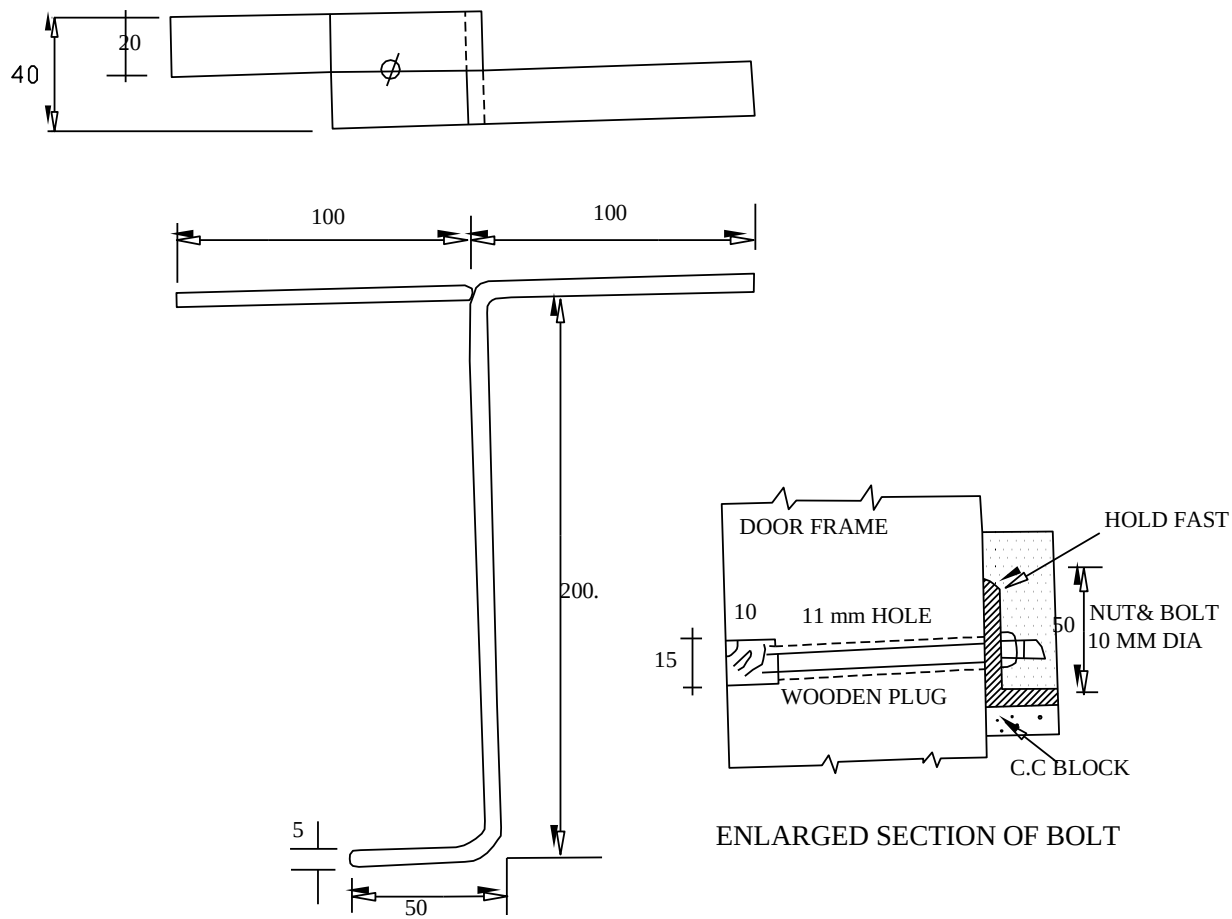


All dimensions are in mm

Drawings not to Scale

HOLD FAST

FIGURE 7.6

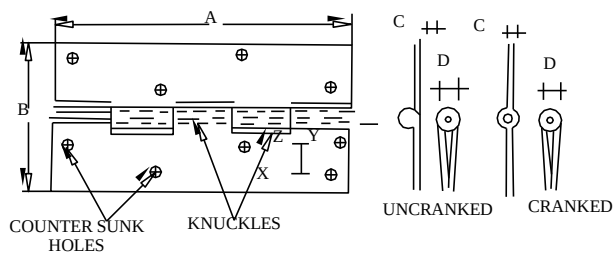


All dimensions are in mm

Drawings not to Scale

HINGES (BUTT & PARLIAMENT)

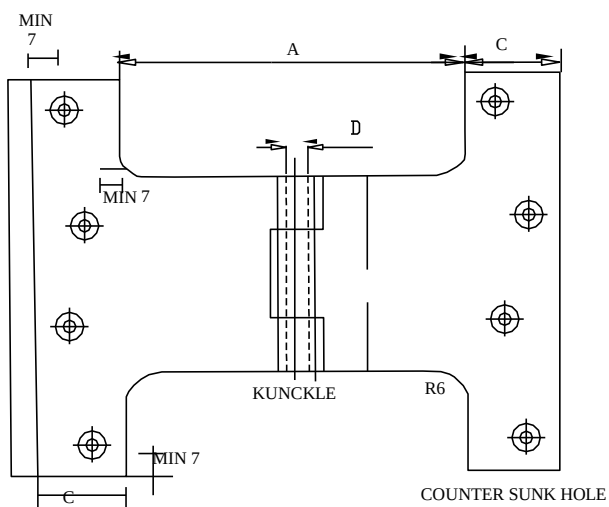
FIGURE 7.7 A - BUTT HINGES



7.7 A DIMENSION OF MEDIUM WT. MILD STEEL BUTT HINGES

Size of Hinge	Length (A)	Breadth (B)	Thickness of Flap (C)	Dia of Hinge Pin (D)	No. of Knuckles	No. of screw Holes	Holes for Screw No
1	2	3	4	5	6	7	8
50	50 $\pm$ 0.5	37 $\pm$ 1	1.50 $\pm$ 0.06	3.15 $\pm$ 0.08	3	4	6
75	75 $\pm$ 0.5	47 $\pm$ 1	1.70 $\pm$ 0.06	4.00 $\pm$ 0.08	5	6	8
100	100 $\pm$ 0.5	58 $\pm$ 1	1.90 $\pm$ 0.06	5.60 $\pm$ 0.08	5	8	10

7.7 B PARLIAMENT HINGES



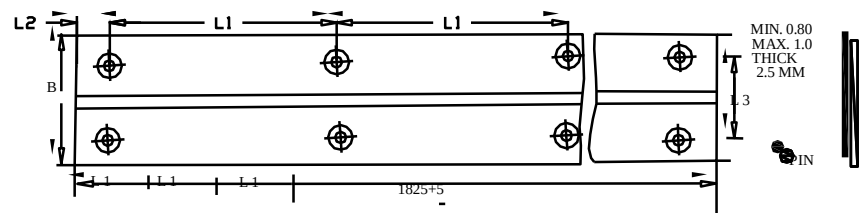
Size of Hinge	Flanges		Diameter of hinge pin D		Diameter of butt for cast brass hinges	Length of joint	Thickness of flanges		No. of screw holed	Screw Designation	Length of wood screw	
	Width between flanges	Length	Width	Mild steel			cast brass					
A	B	C	E									
75	75+2	100+1	20+1	6.30+0.10	4.50+0.10	8.0+0.5	48+1	2.24+0.10	3.2+0.5	6	8	30
100	100+3	125+1	27+1	7.10+0.10	6.30+0.10	12.5+0.5	63+1	2.50+0.10	5.0+0.5	8	10	40
125	125+3	125+1	27+1	7.10+0.10	6.30+0.10	12.5+0.5	63+1	2.50+0.10	5.0+0.5	8	10	40
150	150+3	125+1	27+1	7.10+0.10	6.30+0.10	12.5+0.5	63+1	2.80+0.10	5.0+0.5	8	10	45

All dimensions are in mm

Drawings not to Scale

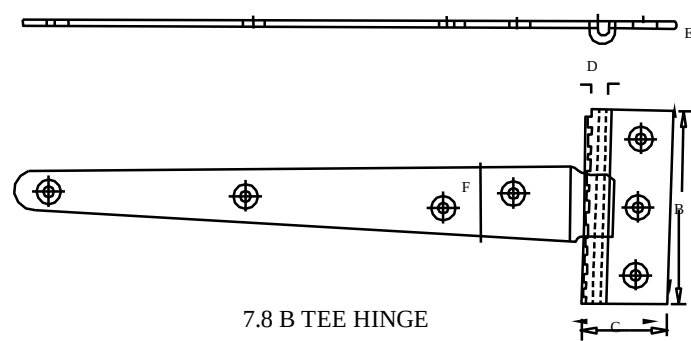
HINGES (TEE & PIANO)
TEE HINGE
PIANO HINGE

FIGURE 7.8



DIMENSIONS				
Nominal Size	B	L ₁	L ₂	L ₃
40	40+1	25+2	25+1	20+1
30	30+1	75+2	25+1	15+1

7.8 A PIANO HINGE



7.8 B TEE HINGE

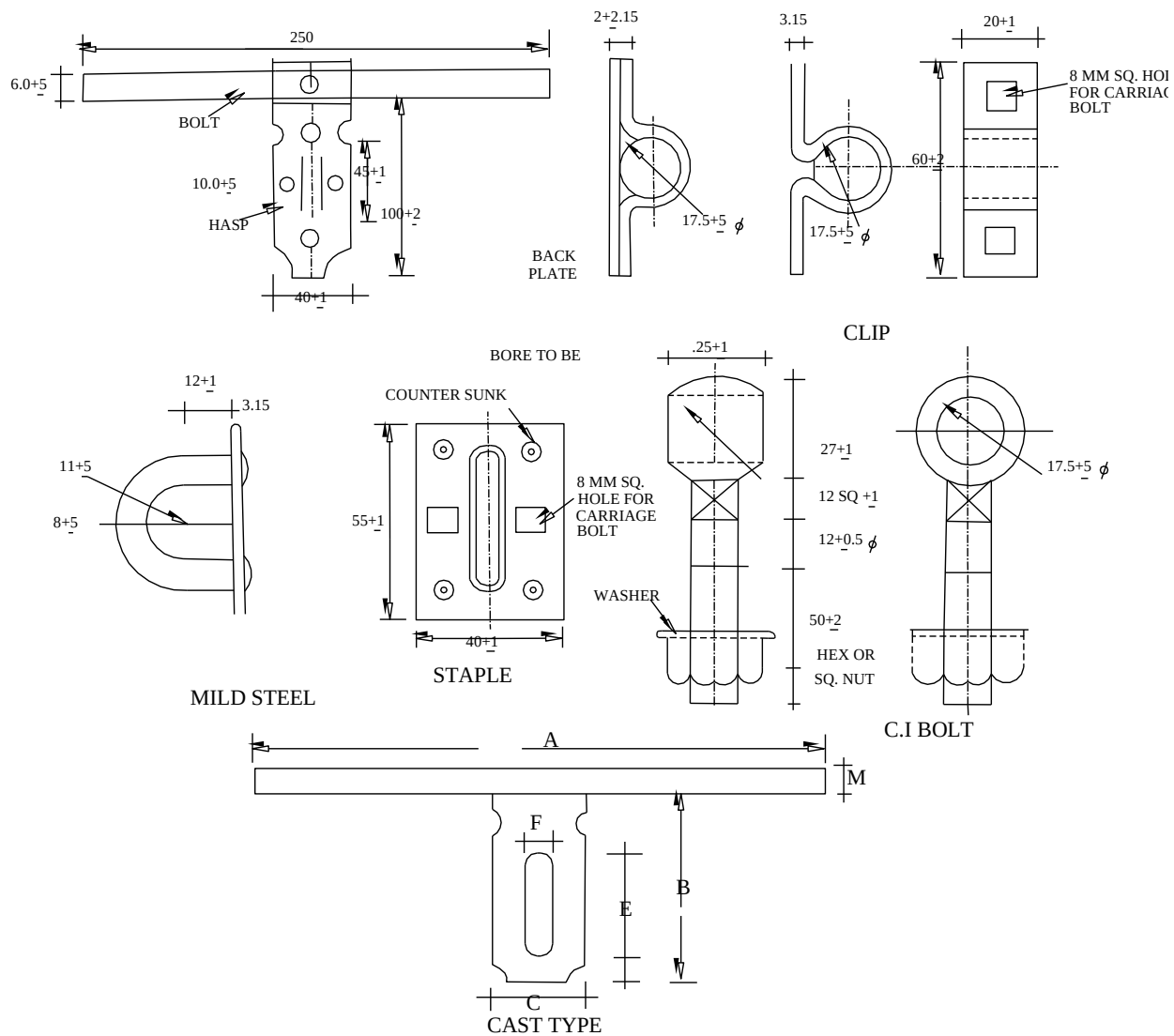
DIMENSIONS									Screw Designation No.	No. of Holes in Strap	No. of Holes in Tee
Size	A	B	C	D	E	F	G	R			
250	250+03	100+2	30+1.5	5.6+0.10	2.24+0.10	45+2	40+1	8+1	9	5	3
300	300+03	115+2	30+1.5	6.30+0.10	2.26+0.10	50+2	50+1	8+1	9	5	3

All dimensions are in mm

Drawings not to Scale

SLIDING DOOR BOLTS (ALDROPS)

FIGURE 7.9



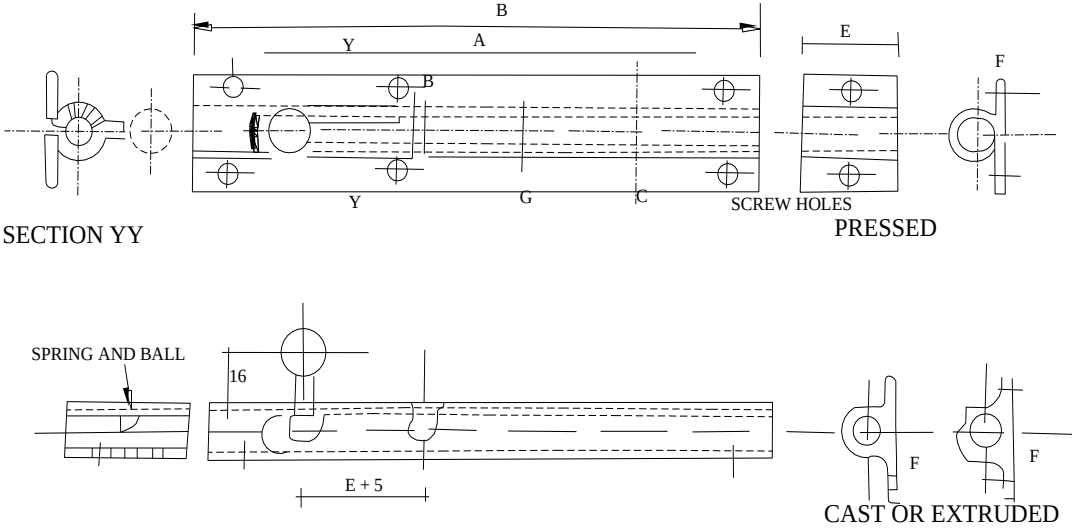
Size	DIMENSIONS						Screw Designation No.
	A	B	C	E	F	M	
250	250 $\pm$ 2	100 $\pm$ 2	45 $\pm$ 1	55 $\pm$ 1	15 $\pm$ 1	16.0 $\pm$ 0.5	9
300	300 $\pm$ 2	100 $\pm$ 2	45 $\pm$ 1	55 $\pm$ 1	15 $\pm$ 1	16.0 $\pm$ 0.5	9

All dimensions are in mm

Drawings not to Scale

BARREL TOWER BOLTS

FIGURE 7.10



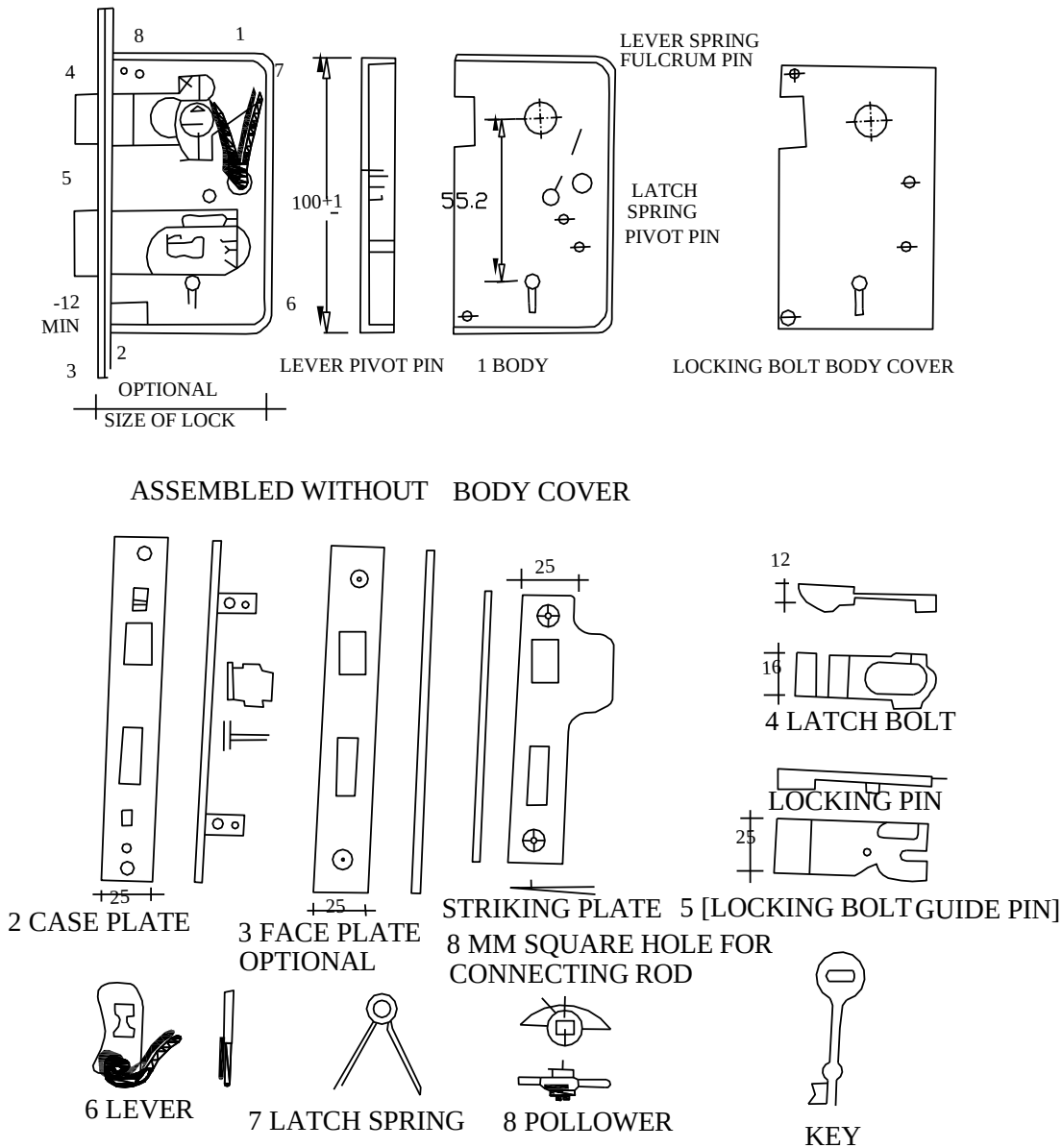
Size	DIMENSIONS										Screw Designation No.	
	A	B	Width of Barrel		D	E	Thickness of Metal of Barrel Sheet					G
			C	D			Brass or Zinc Alloy	Aluminium Alloy	Mild Steel	Brass		
When D = 10.0	When D = 12.0											
150	150 + 3	170 + 3	32 + 3	38 + 310 or 12 + 0.5	25 + 1	2.0 + 0.5 - 0.2	1.60 + 0.33	2.40 + 0.36	[1.25 + + 0.15]	1 to 1.25 + 0.15]	1 to 1.5 more than Dia of Bolt	8
200	200 + 3	220 + 3	32 + 3	38 + 310 or 12 + 0.5	25 + 1	2.0 + 0.5 - 0.2	1.60 + 0.33	2.40 + 0.36	[1.25 + + 0.15]	1 to 1.25 + 0.15]		8
250	250 + 3	270 + 3	32 + 3	38 + 310 or 12 + 0.5	25 + 1	2.0 + 0.5 - 0.12	1.60 + 0.33	2.40 + 0.36	[1.25 + + 0.15]	1 to 1.25 + 0.15]		10

All dimensions are in mm

Drawings not to Scale

MORTICE LOCK & LATCH

FIGURE 7.13

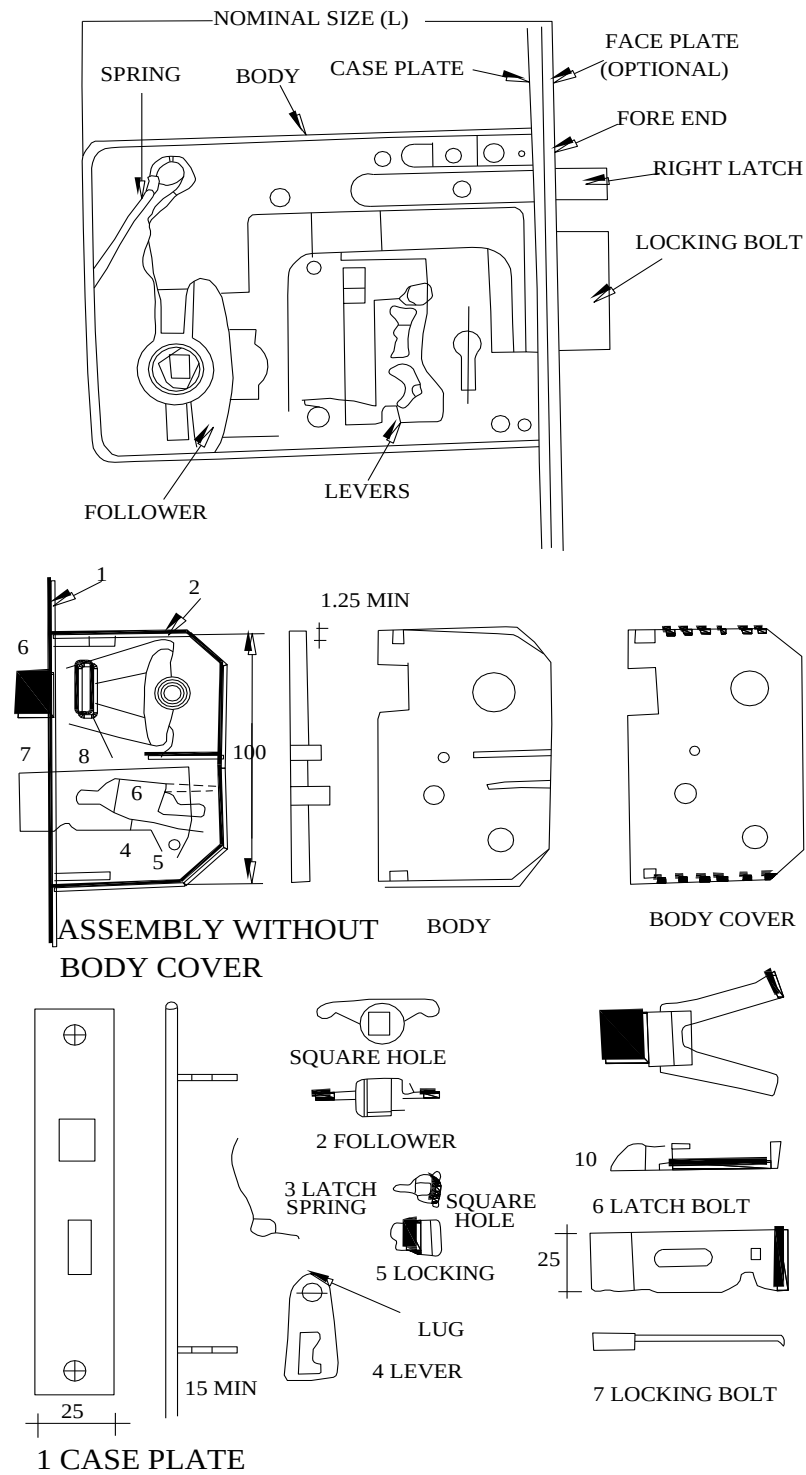


All dimensions are in mm

Drawings not to Scale

MORTICE NIGHT LATCH

FIGURE 7.14



All dimensions are in mm

Drawings not to Scale

DOOR HANDLES

FIGURE 7.15

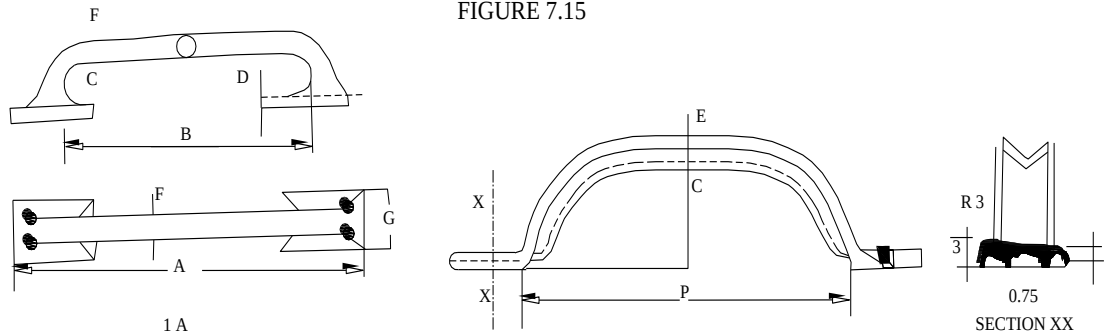


FIG.1: TYPICAL DOOR HANDLE (TYPE1)

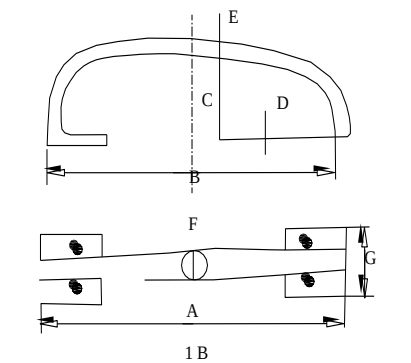


FIG.2: TYPICAL DOOR HANDLE (TYPE2)

All dimensions are in mm

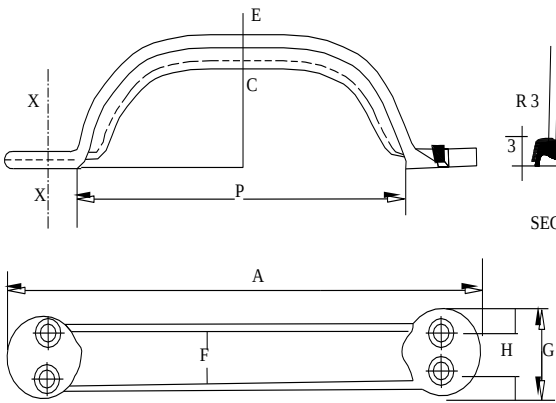
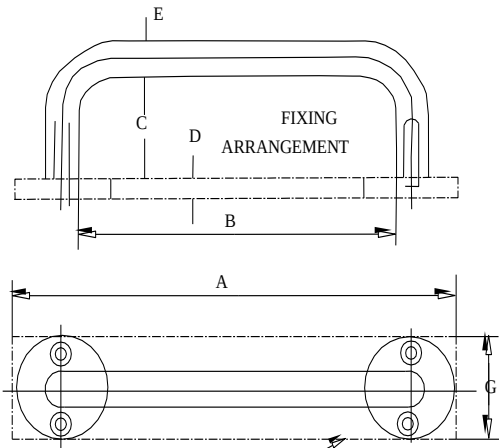


FIG.3: TYPICAL DOOR HANDLE (TYPE3)



CONTINUOUS PLATE MAY BE PROVIDED WHERE DESIRED

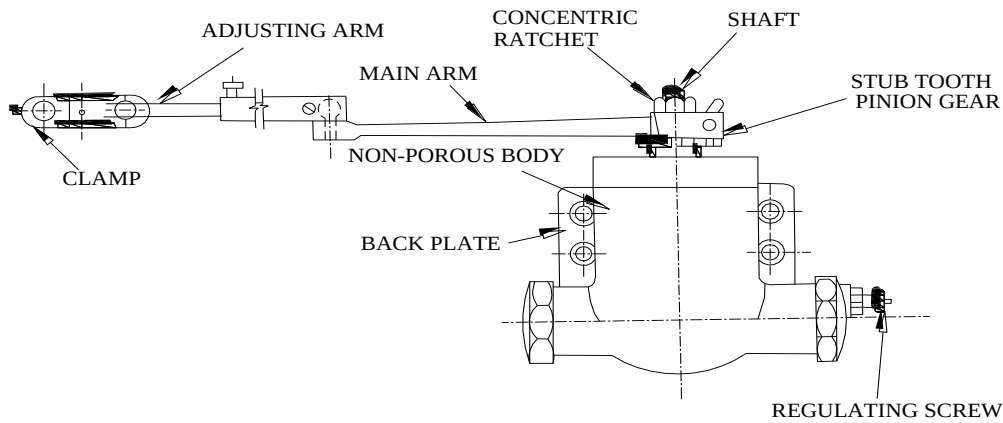
Note : M5 x 20 mm GI countersunk machine screw or any other suitable fixing arrangement may be used

FIG.4: TYPICAL DOOR HANDLE (TYPE4)

Drawings not to Scale

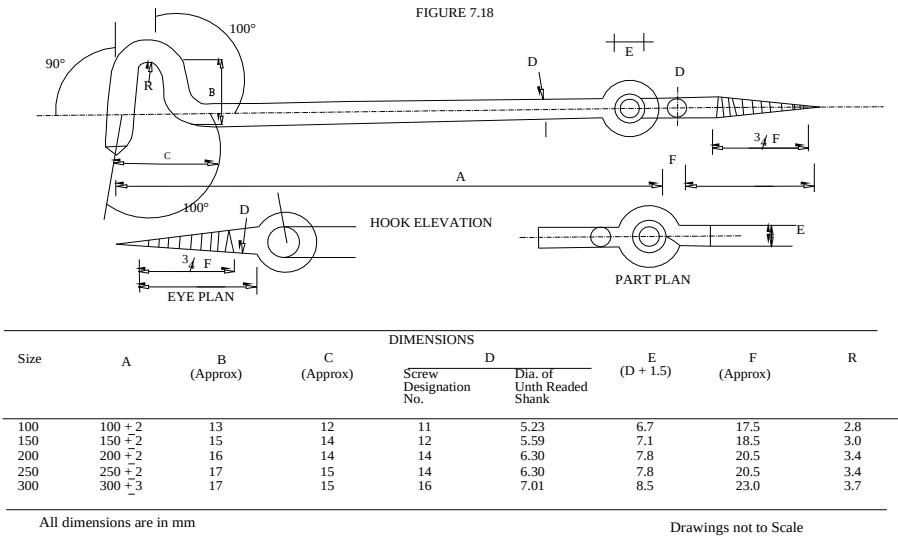
HYDRAULIC DOOR CLOSER

FIGURE 7.17



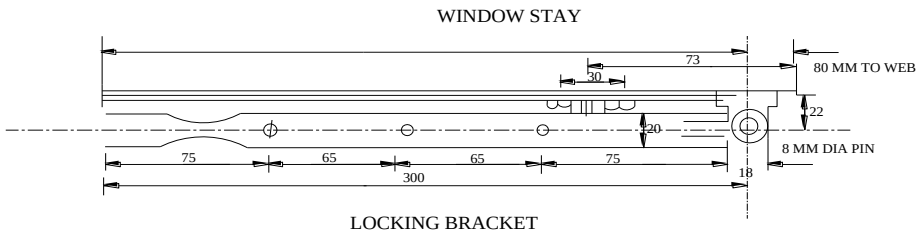
HOOKS & EYES - MILD STEEL & BRASS

FIGURE 7.18



WINDOW STAY

FIGURE 7.19

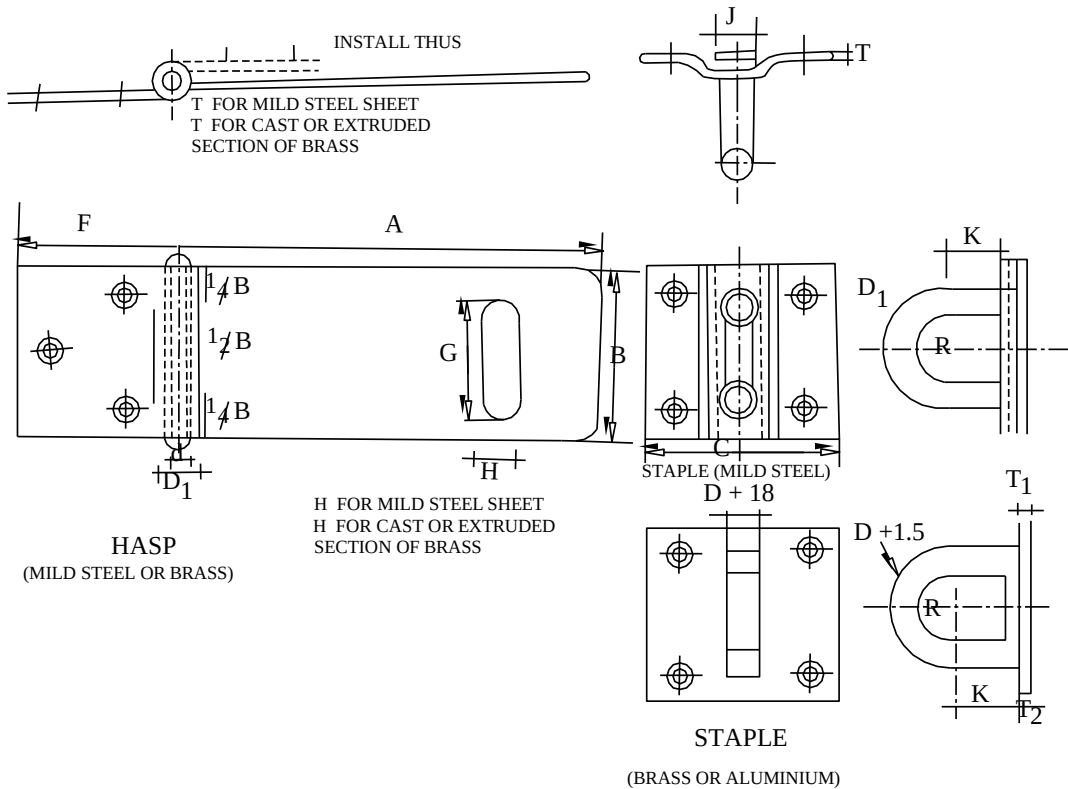


All dimensions are in mm

Drawings not to Scale

HASP & STAPLE

FIGURE 7.21



MILD STEEL

Size	A	B	C	D	E	F	G	H	J	K	R	T	Thickness of sheet	Dia of hinge Pin D	Screw Holes		
															No. on HASP	No. on Staple	Screw Designation No.
90	90+2	38+1.5	46+2	5.0+1.0	5.0+0.5	35+1.5	28+1.5	8+5	12+1	8+1	8+5	2+1.0	4+1.0	4+1.0	3	4	8
115	115+2	38+1.5	46+2	5.0+1.0	5.0+0.5	55+1.5	28+1.5	8+5	12+1	8+1	8+5	2+1.0	4+1.0	4+1.0	3	4	8
150	150+2	45+1.5	60+2	6.30+1.0	6.0+0.5	65+1.5	33+1.5	10+5	15+1	14+1	9+5	2.24+1.0	5+1.0	5+1.0	4	4	10

BRASS CAST OR EXTRUDED

Size	A	B	C	D	E	F	G	H	K	R	T ₁	T ₂	Thickness	Dia of hinge Pin D	Dia of Butt D,	Screw Holes		
																No. on HASP	No. on Staple	Screw Designation No.
90	90+2	40+1.5	42+1.5	5+2.5	6+5	35+1	28+5	10+5	8+1	6.5+5	2+2.5	3+2.5	3.15+1.0	6+2	6+2	3	4	5
115	115+2	40+1.5	42+1.5	5+2.5	6+5	45+1	28+5	10+5	11+1	6.5+5	2+2.5	3+2.5	3.15+1.0	6+2	6+2	3	4	8
150	150+2	46+1.5	48+1.5	6+2.5	7+5	65+1	32+5	11+5	14+1	7.5+5	3+2.5	4+2.5	4+1.0	8+2	8+2	4	4	0

All dimensions are in mm

Drawings not to Scale

ANNEXURE 7.6**(Para 7.6.9 & 7.21)****SCHEDULE OF FITTINGS FOR TEAK WOOD JOINERY AND FLUSH DOORS**

SL	Name of fittings	Double leaf flush door shutters	Single leaf external flush door shutters width upto 80 cm	Single leaf inter communicating flush door shutters width upto 80 cm.	Single leaf flush door shutters for lavatory opening in corridor width upto 80 cm.	Double leaf door shutters panelled, glazed, or panelled and glazed	Single leaf external door shutters, panelled, glazed, or panelled and glazed width upto 80 cm.	Single leaf inter communicating door shutter, panelled, glazed or panelled and glazed width upto 80 cm.	Double leaf cupboard or wardrobe shutters, panelled, glazed, panelled and glazed or flush	Single leaf cupboard or wardrobe shutters, panelled, glazed, panelled and glazed or flush	Double leaf window shutters of heights upto 1.20 metres, panelled, glazed or venetian	Single leaf window shutters of heights upto 1.20 metres, panelled, glazed or venetian	Fan light shutter, bottom hung upto 80 cm width	Clerestory window or fan light shutter, central hung	Clerestory window shutter bottom hung upto 80 cm width	Double leaf wire gauze door shutters	Single leaf wire gauze door shutters width upto 80 cm.	Double leaf wire gauze window shutter of height upto 1.20 metres	Single leaf wire gauze window shutter of height upto 1.20 metres
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
1	Butt hinges 100mm	6	3	3	--	6	3	3	6	3	--	--	--	--	--	6	3	--	--
2	Butt hinges 75 mm	--	--	--	--	--	--	--	--	--	4	2	2	--	2	--	--	4	2
3	Single action spring hinges	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	y
4	Mortice lock	1	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5	Sliding door bolt (Aldrop) 300mm	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
6	Sliding door bolt (Aldrop) 250mm	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	y
7	Flush bolts 250mm	3	1	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8	Flush bolts 100mm	--	--	--	--	--	--	--	2	1	--	--	--	--	--	--	--	--	--

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
9	Barrel bolts 250mm	--	--	--	--	3	2	4	--	--	--	--	--	--	--	3	2	--	--
10	Barrel bolts 150mm	--	--	--	--	--	--	--	--	--	2	1	--	--	--	--	--	2	1
11	Barrel bolts 100mm	--	--	--	--	--	--	--	--	--	1	1	--	--	--	--	--	1	1
12	Furniture handles	--	--	--	--	--	--	--	2	1	--	--	--	--	--	--	--	--	--
13	Door handle with plate 100mm	--	--	--	--	2	2	2	--	--	--	--	--	--	--	2	1	--	--
14	Door handle with plate 75mm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	1
15	Helical door springs (Superior quality)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	1	--	--
16	Ball catchers 10mm dia	--	--	--	--	--	--	--	2	1	--	--	--	--	--	--	--	--	--
17	Cup-board or ward-robe lock 65mm. 6 lever (Godrej or equivalent)	--	--	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--	--
18	Fan light pivot set	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--
19	Fan light catch	--	--	--	--	--	--	--	--	--	--	--	1	1	1	--	--	--	--
20	Chain and hooks 300mm	--	--	--	--	--	--	--	--	--	--	--	1	--	1	--	--	--	--
21	Hooks and eyes 150mm	--	--	--	--	--	--	--	--	--	2	1	--	--	--	--	--	2	1

TABLE A : DIMENSIONS OF DOOR HANDLES

Fig. 1 to 3
All dimensions are in mm

Type	Ref to. FIG.	Sizes	A Min.	B	C Min.	D Min.	E Min.	F Min.	G Min.	H Min.	I Min.	No. in Each Lug	Screw Holes * Size Designation of Counter - sunk Head Wood Screw (see IS : 6760-1972 \$)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	1 A	75	125	75	20	2.5	5	8	15	-	-	2	6
		100	150	100	25	3.0	8	10	20	-	-	2	6
		125	190	125	25	4.0	10	12	22	-	-	2	6
		150	215	150	30	1.5	12	15	25	-	-	2	8
	1 B	75	85	75	20	2.5	5	8	15	-	-	2	6
		100	110	100	25	3.0	5	10	20	-	-	2	6
		125	140	125	25	3.0	7.5	12	22	-	-	2	6
		150	165	150	30	4.0	7.5	15	25	-	-	2	8
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2.	2	75	125	75	20	-	10	16	32	20	1.0	2	6
		100	150	100	25	-	11	19	38	20	1.0	2	6
		115	175	115	28	-	13	22	45	25	1.0	3	8
		135	200	135	30	-	14	25	50	32	1.25	3	8
3.	3	75	100	75	20		5	14	16	8	1.25	1	6
		90	125	90	25		6	16	20	10	1.25	2	6
		100	150	100	28		7	18	25	12	1.60	2	6

* More evenly spaced screw holes may be provided, if so required, by the purchaser.
 \$ Specification for slotted countersunk head wood screws.

TABLE B : DIMENSIONS OF DOOR HANDLES

Fig. 4
All dimensions are in mm

Type	Ref to. FIG.	Sizes	A Min.	B	C Min.	D	E#	G Dia	No. in Each Lug	Screw Holes ** No. in a plate when a continuous plate is used	Size Designation of Counter - sunk Head Wood Screw (see IS : 6760-1972\$)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
4.	4	75	115	75	25	5 + - 0.5	10 + - 0.5	30	+ 0 - 1	2	4
		100	140	100	30	5 + - 0.5	10 + - 0.5	30	+ 0 - 1	2	4
		125	175	125	35	5 + - 0.5	12 + - 0.5	38	+ 0 - 1	3	6
		150	200	150	35	5 + - 0.5	12 + - 0.5	38	+ 0 - 1	3	6

In case a continuous base plate is used, the thickness may be reduced to 3 mm.
 Hexagonal or round.
 ** * More evenly placed screw holes may be provided, if so required by the purchaser.
 \$ Specification for slotted countersunk head wood screws.