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रेल मंत्रालय - Ministry of Railways
GOVERNMENT OF INDIA – भारत सरकार

Doors and Their Testing Requirements

दरवाजे एवं उनकी परीक्षण आवश्यकताएं



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Doors and Their Testing Requirements

Foreword

Indian railway holds the major chunk of civil engineering assets in the country. It is looked at as a premier organization in respect of quality and workmanship. It has been observed that various types of doors are used in building and the Testing requirements of such doors are available in staggered form.

CAMTECH has made a nice attempt to provide all the information about the Doors and their testing requirements which are used in any building at a glance for the field engineers. Efforts have been made to cover the codal requirements of such doors.

I hope this handbook will certainly prove to be a valuable source of technical knowledge and will be quite helpful for civil engineering personnel of Indian Railway

CAMTECH/Gwalior ***(Jitendra Singh)***
26 February 2024 *Principal Executive Director*

Preface

Indian Railway having a lot of stations, buildings, offices and residential accommodations is vast network spread all over India. Various types of doors are used in any building. The requirements of such doors are available in various Indian Standards in staggered form.

Objective of this handbook is to provide all codal information about the doors used in the building at a glance for the field engineers of Indian Railways. Every effort has been made to make this handbook useful to civil engineering personnel of Indian Railways.

This hand book does not supersede any existing information from Railway Board, RDSO, IRWM and Indian standards available on the subject. This book is not statutory & contents are for the purpose of guidance only. Most of the data, sketch and information mentioned here is available in some form or the other in various books or printed matter.

This handbook is the result of sincere efforts of Shri D. K. Shrivastava, SSE/CAMTECH, who collected and compiled information, data, etc. from different sources, and went through the complete text.

We welcome valuable suggestions from our readers for further improvements.

CAMTECH/Gwalior ***(Deepak Mehra)***
26 February 2024 *Director/Civil*

CONTENT

Chapter No.	Description	Page No.
	Foreword	**i**
	Preface	**ii**
	Content	**iii**
	Correction slip	**iv**
Chapter 1	**DIFFERENT TYPES OF DOOR AND THEIR TESTING REQUIREMENTS**	
1.0	INTRODUCTION	1-1
1.1	TYPES OF DOOR	1-8
2	TIMBER PANELLED AND GLAZED	9
3	WOODEN FLUSH DOOR SHUTTERS (SOLID CORE TYPE) PLYWOOD FACE PANELS	14
4	ROLLING SHUTTER	19
5	COLLAPSIBLE STEEL GATES	24
6	MILD STEEL SLIDING DOOR (TOP HUNG TYPE)	27
7	STEEL DOOR	30
8	MOULDED HIGH DENSITY FIBER (HDF) PANELED DOOR SHUTTERS	33
9	SOLID PANEL FOAM UPVC DOOR SHUTTERS	37
10	GLASS FIBER REINFORCED PLASTICS DOORS (GRP)	41
11	BAMBOO-JUTE COMPOSITE HOLLOW CORE DOOR SHUTTER	44
12	OTHER	47
12.1	PVC DOORS	47
12.2	CUPBOARD SHUTTER	48
12.3	WIRE GAUGE SHUTTER	49
12.4	12 MM THICK FRAMELESS TOUGHENED GLASS DOOR	49
12.5	ALUMINIUM DOOR	50
	Reference	*51*

संशोधन पर्चियों का प्रकाशन
ISSUE OF CORRECTION SLIPS

इस हस्तपुस्तिका के लिए भविष्य में प्रकाशित होने वाली संशोधन पर्चियों को निम्नानुसार संख्यांकित किया जाएगा :

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Chapter 1

DIFFERENT TYPES OF DOOR AND THEIR TESTING REQUIREMENTS

1.0 INTRODUCTION

Door is a solid barrier that is fixed in an opening in a wall, it can be opened for access to and from buildings and between the rooms or closed to privacy. Similarly doors are provided in the cup boards also.

There are large varieties of doors which can either be manufactured or are available in the market for ready fixing. Based on the material of manufacture, some of their types along with their main feature, advantages and disadvantages are given here to facilitate easy selection. The selection of suitable material based on their varying characteristics especially in case of timber is itself a vast subject, the same has not been considered in this handbook. Similarly doors have certain testing requirements and their testing methods has been detailed in IS 4020:1998. Methods of tests are not in the scope of present document.

The scope of present handbook is limited to brief discussion of various types of doors and discussion on codal requirements of dimension & acceptance criterion of the doors which are mentioned in the IRUSSOR & CPWD DSR.

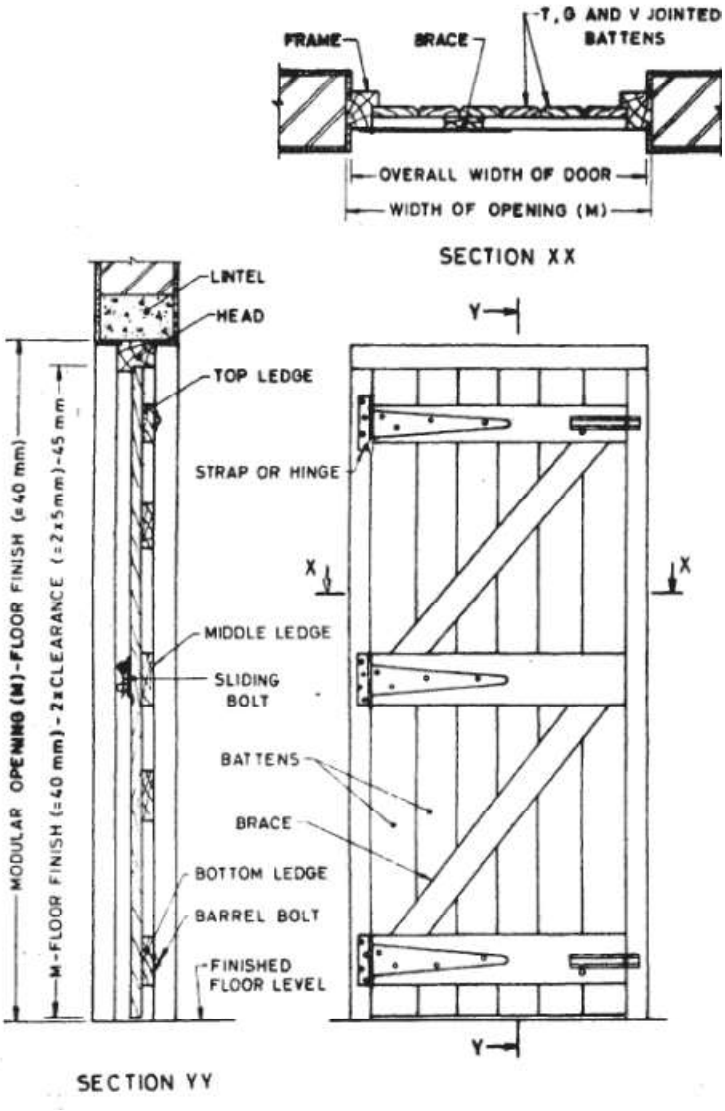
1.1 TYPES OF DOOR

Various types of doors and reference Indian standards are shown below.

SN	Types of Door	Reference IS for Door Shutter
1.	Ledged, braced and battened timber doors	IS 6198:1992
2.	Wooden/Timber panelled doors	IS 1003 part 1:2003 (2018)
3.	Flush Doors	IS 2202 part 1and 2 for solid core type. IS 2191 Part 1and 2 for cellular, hollow and tubular core type
4.	Rolling Shutters	IS 6248:1979
5.	Collapsible steel gate	IS 10521:1983(2022)
6	Mild steel sliding door	IS10451: 1983 (2022)
7	Steel door	IS 1038:1983 (2022)
8	Moulded High Density Fiber (HDF) Paneled Door	IS 15380
9	Solid panel foam UPVC door Shutters	IS 15931
10	Glass Fiber reinforced plastic door	IS 14856
11	Bamboo jute composite door	IS 16096:2013
12	PVC door	-
13	Frameless toughened glass door shutter	-
14	Aluminium doors	-
15	Wire gauge shutters	-
16	Cup boards shutter	-

1.1.1 Ledged, Braced and Battened Timber Doors

It is the simplest form of doors and is relatively cheap. It is used for narrow opening and in position where aesthetically appearance is not considered such as temporary shed, garages etc. The door consists of vertical boards or battens, which are secured to horizontal pieces called ledges.



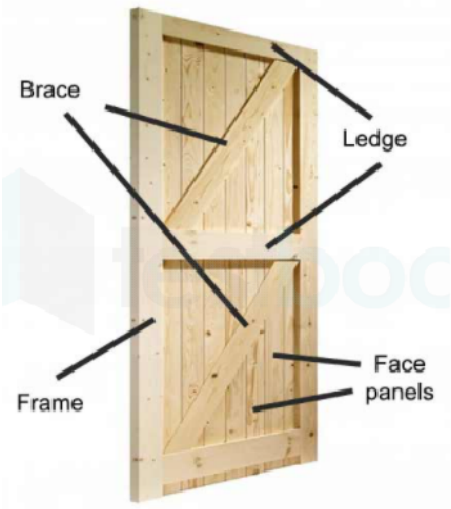


Fig. 1 Ledged, Braced and Battened Timber Door Shutter

Since this door is not part of IRUSSOR & CPWD DSR, it has not been discussed further.

1.1.2 Paneled and Glazed Door

Traditionally, timber or wood as it is popularly known has been the main stay for the manufacture of doors/windows. Its main advantage has been local availability of material and the ease with which it can be made by the local carpenters.

Presently large varieties of wood are available in the market and its selection should be made based on the properties of longevity and the budget of the house owner. Although they can be used for all locations in the house, they are best placed for exterior locations.



Fig. 1.2 Timber Paneled Door

Paneled door consist of a framing or rim, which is grooved on the inside edges to receive one or more panels. The Horizontal members are called rail i.e. top rail, bottom rail, and middle rail etc and vertical members are called stile. Timber paneled and glazed shutters are governed by the Indian Standard 1003 part 1:2003 (2018). This door is further discussed in *Chapter 2*.

1.1.3 Flush Door

Flush doors have becomes very popular these days particularly for interior work because of their pleasing appearance, simplicity of construction, less cost and better strength than paneled doors.

Flush doors shutters either a solid core or Cellular, hollow, tubular core set in a frame work of stiles and rails, which is covered on both sides with either plywood or a combination of cross bands and face veneer giving a perfectly flush and joint less surface. Further flush doors may be classified as Decorative type and Non decorative type.



Fig. 1.3 Flush Door

Flush door shutters shall be classified in two grades as follows:

a) **BWP (Boiling Water Proof) Grade:** Such flush door shutters recommended for use at humid and dry locations.
b) **MR (Moisture Resistance) Grade:** Such flush door shutters recommended for use at dry locations only.

Cellular, hollow, tubular core type flush door is governed by IS 2191:2022 (Part 1 and 2). Since this door is not part of IRUSSOR & CPWD DSR, it has not been discussed further.

Flush Doors solid core type is governed by the Indian Standard 2202 (Part 1 and Part 2).

A flush door is a completely smooth door, having plywood or Medium Density Fiberboard fixed over timber frame which is comparatively light. The hollow core so obtained is often filled with

a card board core material. Flush doors are most commonly used in the interior of a dwelling, although with some variations they are also used as exterior doors in houses.

The doors are usually hinged along one side to allow the door to open in one direction only. Flush doors are commonly provided in houses these days due to the reasons of economy, pleasing appearance, durability etc and are commonly available in the market.

Flush doors (Solid Core Type) may be classified into two categories viz.

i) Wooden Flush Door Shutters (Solid Core Type) Plywood Face Panels: Governed with IS 2202 Part-1:2023
ii) Wooden Flush Door Shutters (Solid Core Type) Particle Board, High Density Fiber Board, Medium Density Fiber Board and Fiber Hardboard Face Panels Governed with IS 2202 Part-2:2022

Flush door (Solid Core Type) is further discussed in *Chapter 3*.

1.1.4 Rolling Shutters

Rolling shutters are being largely provided at the entrances of shops, garages, godowns and even in workshops, power houses, mills and factories for affording protection and safety, Rolling grills, which operate on the same principle as rolling shutters, are being provided for showrooms and display windows for exhibiting any goods while ensuring safety. These may also be used in conjunction with rolling shutters where it is desired to have certain amount of ventilation combined with safety.



Fig. 1.4 Rolling Shutter

The rolling shutters are available in the self closing type, Gear operated type and electrically operated type.

Rolling Shutter is governed by the Indian Standard 6248:1979(2022) Rolling shutter is further discussed in *Chapter 4*.

1.1.5 Collapsible Steel Gate

Collapsible gates are provided at opening where visibility and maneuverability in width are required along with security. These are installed at the locations where prevention of entry is more important than concealing what is within.

Collapsible steel gate is governed by the Indian Standard 10521:1983(2022). Collapsible steel gate is further discussed in *Chapter 5*.



Fig. 1.5 Collapsible Door

1.1.6 Mild Steel Sliding Door

Mild steel sliding doors are generally provided in the goods shed, godowns etc. where security is of major concern and where sliding of shutters to the sides does not obstruct the adjacent opening. Shutters are commonly in use are top hung type.



Fig. 1.6 Mild Steel Sliding Door

Steel sliding shutters, top hung type, find extensive application in godowns, warehouses, etc, where the sliding of the shutters to the sides does not obstruct the adjacent openings. These are fixed on the outside only. Two types of shutters arc generally in use, namely, top hung and bottom resting.

Top hung type mild steel sliding shutter goverened by IS10451: 1983 (2022). Mild steel sliding gate is further discussed in *Chapter 6*.

1.1.7 Steel Door

Doors made of steel are being increasingly used in buildings, due to scarcity and high cost of timber. It is not suffering any dimensional changes on account of variation in humidity and are unaffected by termites. Steel doors are more durable and economical than those of timber.



Fig. 1.7 Steel Door

Steel door is governed by the Indian Standard IS 1038:1983(2022). Steel door is further discussed in *Chapter 7*.

1.1.8 Moulded High Density Fiber (HDF) Paneled Door

HDF moulded doors close the look of wooden panel doors.HDF panel are pre primed, high density fiber board, with deep moulded designs on the panel. The number of panels on the face and design may be selected as per choice.



Fig. 1.8 Moulded High Density Fiber (HDF) Paneled Door

Door shutters shall be of the following two types.

a) **Heavy Duty:** Having void area less than and equal to 35 percent, and
b) **Light Duty:** Having void area more than 35 percent but not exceeding 65 percent.

Each type of door shutter shall be further classified in two grades as follows:

a) **BWP (Boiling Water Proof) Grade:** Such door shutters recommended for use at humid as well as dry locations.

b) **MR (Moisture Resistance) Grade:** Such door shutters recommended for use in dry locations only.

Moulded high density fiber (HDF) paneled door Shutters are governed by IS 15380:2023.

Moulded high density fiber (HDF) panelled door is further discussed in *Chapter 8*.

1.1.9 Solid Panel Foam UPVC Door Shutters

Solid panel foam UPVC door shutters made from foam UPVC sheet is one of the latest developments in the plastic industry and a substitute of timber door shutters. Solid panel foam UPVC door shutters are used in residential buildings, offices, schools, hospitals, community hall and similar applications.



Fig. 1.9 Solid Panel Foam UPVC Door

It is governed by IS 15931:2012(2022).

Solid panel foam UPVC door is further discussed in *Chapter 9*.

1.1.10 Glass Fiber Reinforced Plastic Door

Glass Fiber Reinforced Plastics popularly known as GRP is a general term relating to the reinforcement of plastic with fibrous glass. Normally it is used internally and governed by 14856:2000(2022).



Fig. 1.10 Glass Fiber Reinforced Plastic Door

Glass Fiber reinforced plastic door is further discussed in *Chapter 10*.

1.1.11 Bamboo Jute Composite Door

Bamboo is one of the fastest renewable plants with a maturity cycle of 3-4 years, making it a good natural resource compared to forest hard woods. Bamboo offers good potential for processing it into composites as a wood substitute. Bamboo laminates could replace timber in many applications including for doors & windows and their frames etc.



Fig. 1.11 Bamboo Jute Composite Door

One of the alternatives to wood product is the jute-coir composite board which can be utilized for the manufacture of doors. Natural hard fibers such as coir and jute impregnated with phenolic resins can be used for manufacturing these boards. Bamboo-jute composite doors have the advantage of

being water resistant, corrosion resistant, termite resistant, eco-friendly, bio-degradable and cost effective. Such doors are being manufactured by a number of entrepreneurs and can be easily adopted as a substitute for wooden or other type of doors in the house.

Bamboo jute composite door is governed with IS 16096:2013 and further discussed in *Chapter 11*.

1.1.12 PVC Door

Panel PVC Shutters are factory made shutter and shall be brought to site fully assembled. The Solid Panel PVC Door shall be fabricated from 5 mm PVC sheet. The sheets used may be in plain colour, printed design or pre laminate veneer shade. Shutter shall be made of PVC material conforming to IS 10151.

PVC door is further discussed in *Chapter 12*.



Fig. 1.12 PVC Door

1.1.13 Frameless Toughened Glass Door Shutter

This is a clear 12 mm toughened safety glass frameless shutter having a consulate top and bottom self closer mechanism with a pivot connecting to a discrete metal patch fitting at the top and bottom corners to the door.

Frameless toughened glass door shutter is further discussed in *Chapter 12*.



Fig. 1.13 Frameless Toughened Glass Door

1.1.14 Aluminium Doors

Material, fabrication and dimensions of aluminium doors, windows and ventilators manufactured from extruded aluminium alloy sections of standard sizes and designs complete with fittings, ready for being fixed into the building shall be as per IS 1948.

Aluminium door is further discussed in *Chapter 12.*



Fig. 1.14 Aluminium Door

1.1.15 Wire Gauge Shutter

Wire gauge shutters (Fly proof) shutters prevent entry of mosquitoes, flies insects etc. into a building. At the same time they also allow free circulation of air.

Wire gauge shutter is further discussed in *Chapter 12*.



Fig. 1.15 Wire Gauge Shutter

1.1.16 Cupboard Shutters

Cupboard shutters are provided at cup boards, it may be panelled, flush or glazed. Cupboard shutter is further discussed in *Chapter 12.*



Fig. 1.16 Cupboard shutter

Note: The scope of present handbook is limited to discussion on various types of doors and their dimensional and testing requirements having Indian Standards only for finished doors that are mentioned in the IRUSSOR & CPWD DSR. The requirement for material of door is not in the scope of this handbook.

The requirements are discussed in detail in the respective chapters ahead.

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Chapter 2

TIMBER PANELED AND GLAZED SHUTTERS



2.0 TIMBER PANELED AND GLAZED SHUTTERS ARE GOVERNED BY THE INDIAN STANDARD 1003 PART 1:2003 (2018).

As discussed earlier, the requirements of timber for door is not in the scope of this handbook. However, the timber suitable for manufacture of door shutters should be in accordance with IS 12896. In the present handbook the codal requirements of finished door has been discussed only.

2.1 COMPONENT OF TIMBER PANELED AND GLAZED DOOR SHUTTERS

- Timber panelled shutters shall be constructed in the form of timber framework of stiles and rails with panel inserts of timber.
- All members of the door shutters shall be straight, smooth and well planed faces at right angles to each other. Any warp or bow shall not exceed 1.5 mm.
- Stiles, top rails, bottom rails and lock rails of shutters shall be made out of one piece of timber only.
- Intermediate rails, lock rails and bottom rails exceeding 150 mm in width may be made out of one or more pieces of timber, but the width of each piece shall be not less than 75 mm.
- All door shutters shall be sanded and finished smooth.
- Panels of shutters shall be flat and well-sanded to a smooth and level surface.

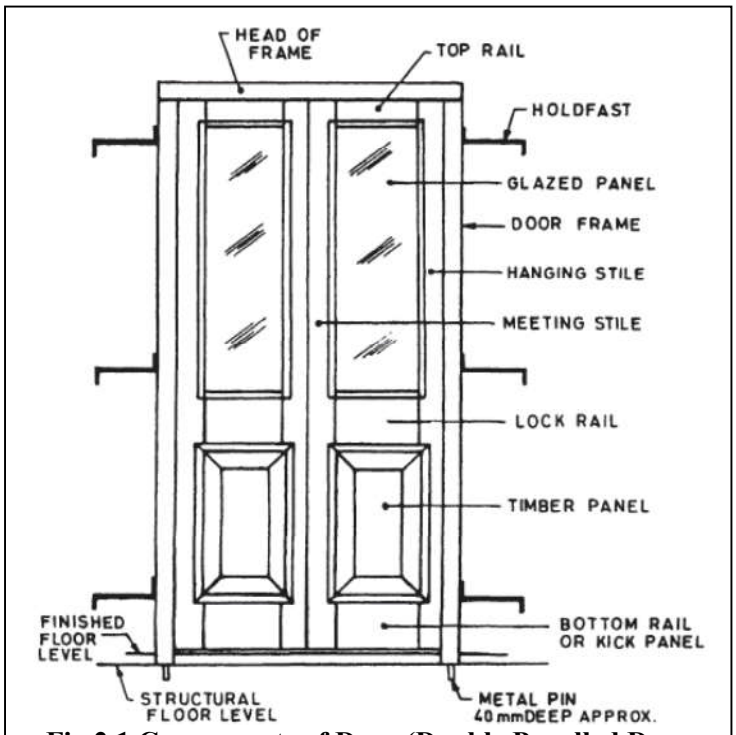


Fig.2.1 Components of Door (Double Panelled Door with Timber and Glazed Panels)

2.2 DIMENSIONS AND TOLERANCE FOR COMPONENTS OF TIMBER PANELED AND GLAZED DOOR SHUTTERS

The finished dimensions and tolerances of the different components of door shutters shall be as given in Table 2.1.

Table 2.1 Dimensions and Tolerances for Components of Door Shutters (Ref: Table 2 of IS 1003 Part 1)

SN	Description	Width in mm	Thickness in mm
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± 1	35 ± 1 or 40 ± 1

2.3 SIZES AND TYPES OF TIMBER PANELLED AND GLAZED DOOR SHUTTERS

Sizes and types of the timber panelled and glazed shutters shall generally conform to the modular sizes specified in Table 2.2

Table 2.2 Dimension of Timber panelled and glazed door shutters (Ref: Table 3 of IS 1003 Part 1)

SN	Designation of Door	Width in mm	Height in mm
1	8DS20	700	1905 (1945)
2	8DS21	700	2005 (2045)
3	9DS20	800	1905 (1945)
4	9DS21	800	2005 (2045)
5	10DS20	900	1905 (1945)
6	10DS21	900	2005 (2045)
7	12DT20	1100	1905 (1945)
8	12DT21	1100	2005 (2045)
Tolerances: *Tolerances on the sizes of door shutters shall be ± 3 mm*			

Note:

- The designation refers to modular sizes of door openings. First number stands for width and the last for height in module *(M* = 100 mm).
- Alphabet *'D'* refers to doors, *'S'* to single shutter and *'T'* to double leaf shutter.

The standard widths and heights for panel doors are arrived at as shown in Fig 2.2 given below. In case the modular height is taken from the finished floor level, the height of the door shall be the one given in bracket.

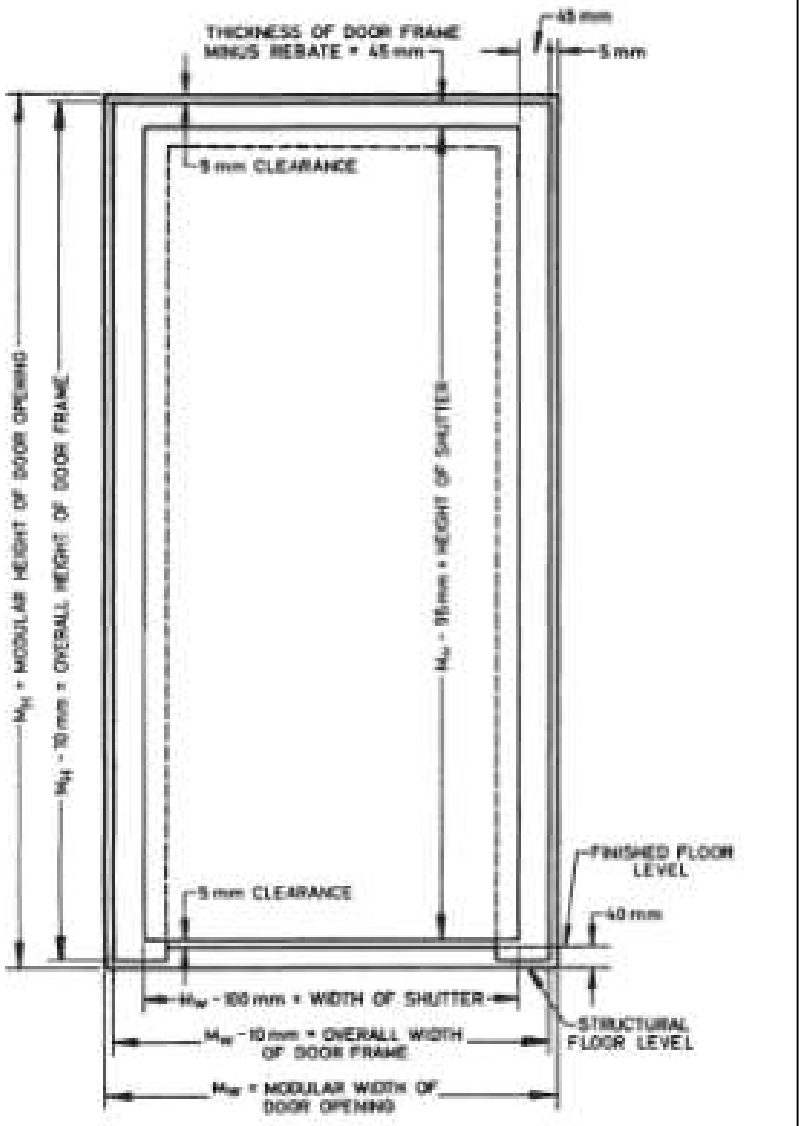


Fig- 2.2 Sketch Illustrating Dimensions of Shutter

2.4 LOCATION OF FITTINGS AND ACCESSORIES

- 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.
- Each door shutter shall be fixed to the door frame with hinges of the type specified by the purchaser, as follows:

Width of Door Shutter	Numbers of Fittings
Door shutter of width 900 mm and below	Three hinges for single leaf door
Door shutter of width more than 900 mm	Six hinges for double leaved doors, three on each side and four hinges for single leaf door

2.5 MARKING

All door shutters shall be hammer-marked or indelibly marked on the exposed edge of a rail with the following information:

a) Name of the manufacturer or trade-mark, if any;
b) Whether the size of the shutter is Modular' or 'Non-modular
c) Designation (showing width and height in modules) for modular sizes as specified in Table 2.2, of the actual size (width and height in case of non-modular sizes) along with appropriate symbols for shutters as given in Note 1 of Table 2.2
d) Group and Grade of timber used for rails and stiles
e) Species of timber, in case of ECO-Mark; and
f) The criteria for which the product has been labelled as ECO-Mark.

2.6 TEST REQUIREMENTS

Test requirements is as per IS 1003 Part 1 and Test method is as per IS 4020.

SN	Test	Requirement
1	Dimensions and Squareness Test	The dimensions of width and height shall be within a limit of ± 5 mm. The door shutter shall not deviate by more than 1 mm on a length of 500 mm. The thickness of the door shutter shall be uniform throughout with the permissible variation of not more than 0.8 mm between any two points. The thickness of the shutter shall be within a limit of ± 1 mm.
2	General flatness test	The twist, cupping and warping shall not exceed 6 mm.
3	Local Planeness Test	The depth of deviation measured at any point shall not be more than 0.5 mm.
4	Slamming test	By method mentioned in 2.1 of IS 4020 (Part 10) - Shall not have any visible damage in any part of the door at the end of 50 successive impacts. Or By method mentioned in 3.1 of IS 4020 (Part 10) - Shall not have any visible damage in any part of the door at the end of 100 successive impacts.
5	Impact Indentation Test	Shall have no defects such as cracking, tearing or delamination and the depth of indentation shall not be more than 0.2 mm.
6	Flexure Test	There shall not be any residual deflection of more than one-tenth of the maximum deflection. The residual deflection shall not be more than one-tenth of the maximum deflection. The deflection at the maximum load shall not be more than one-thirtieth of the length and one-fifteenth of the width, whichever is less.
7	Edge Loading Test	The deflection of the edge at the maximum load shall not be more than 5 mm. On removal of the loads, the residual deflection shall not be more than 0.5 mm, failing which the

		test may be repeated on the other edge in the reverse direction. Also there shall be no lateral buckling by more than 2 mm during loaded condition and no residual lateral buckling after removal of the load.
8	Shock Resistance Test	There shall be no visible damage in any part of the door after twenty five blows on each end. Door shutters, when tested in accordance with 3.1 of IS 4020 (Part 8), the normally hung shutter, with hangings, fixings and fastenings should withstand without any significant permanent deformation and without deterioration the five impacts on both sides of the shutter.
9	Buckling Test	Shall not show any deterioration and any residual deformation more than 5 mm after 15 min of unloading and the initial deflection also shall not be more than 50 mm.
10	Misuse Test	There shall not be any permanent deformation of the fixing or any other part of the door set in hindering its normal working after the test.
11	Screw Withdrawal Resistance Test	The required load to withdraw the screw completely shall not be less than I 000 N. On withdrawal, there shall be no visible damage to the surface either by delamination or extra chipping off at the points of withdrawal.

***

Chapter 3

WOODEN FLUSH DOOR SHUTTER (SOLID CORE TYPE)

3.0 FLUSH DOOR SHUTTER (SOLID CORE TYPE)

As mentioned earlier the material for Flush door (Solid Core Type) is not in the scope of this handbook. This handbook covered the requirements for finished door only.



3.1 CLASSIFICATION OF FLUSH DOOR SHUTTER (SOLID CORE TYPE)

Flush door shutters shall be classified in two grades as follows:

a) **BWP (Boiling Water Proof) Grade:** Such flush door shutters recommended for use at humid and dry locations.
b) **MR (Moisture Resistance) Grade:** Such flush door shutters recommended for use at dry locations only.

Each of the grades specified above shall be further classified into two types that are decorative type and non-decorative type for different core construction as given in Table 3.1 A.

Table3.1-A Nature of Construction of Wooden Flush Door Shutters (Solid Core Type) (Ref: Table 1 of IS 2202 Part-1)

SN	Core	Type	Abbreviation
(1)	(2)	(3)	(4)
i)	Block board	Decorative	BD
		Non-decorative	BN
ii)	Particle board	Decorative	PD
		Non-decorative	PN

iii)	Medium density fiber board	Decorative	MD
		Non-decorative	MN

Table 3.1B Designation of Wooden Flush Door Shutters, Solid Core Type with Particle Board, HDF, MDF and Fiber Hardboard Face Panels
(Ref: Table 1 of IS 2202 Part-2)

SN	Core	Type	Abbreviation
(1)	(2)	(3)	(4)
i)	Block board	Decorative with skins of decorative veneered/pre laminated particle board/HDF/MDF	B D P V
		Non-decorative with skins of particle board/MDF/HDF un veneered	B N P
		Non-decorative with skins of particle board/HDF/MDF veneered with commercial veneers	B N P V
ii)	Particle board	Decorative with skins of decorative veneered/pre laminated particle board/HDF/MDF	P D P V
		Non-decorative with skins of particle board/HDF/MDF un veneered	P N P
		Non-decorative with skins of particle board/HDF/MDF veneered with commercial veneers	P N P V
iii)	Medium density fibre board	Decorative with skins of decorative veneered/pre laminated particle board/HDF/MDF	M D P V
		Non-decorative with skins of particle board/HDF/MDF un veneered	M N P
		Non-decorative with skins of particle board/HDF/MDF veneered with commercial veneers	M N P V

3.2 SIZES OF FLUSH DOOR SHUTTER (SOLID CORE TYPE)

Sizes and thickness of the door shutters shall conform to the modular sizes specified in Table 3.2 (*see* Fig. 3.1). However, for sizes greater than 12 DT 21, the thickness of such shutters shall be greater than 35 mm.

Table 3.2 Dimensions of Flush Door shutter (Solid Core Type)
(Ref: Table 2 of IS 2202 Part-1)

SN	Designation of Door Shutters	Width mm	Height mm	Thickness mm
(1)	(2)	(3)	(4)	(5)
i)	8 DS 20	700	1 905 (1 945)	25 or 30
ii)	8 DS 21	700	2 005 (2 045)	
iii)	9 DS 20	800	1 905 (1 945)	30

iv)	9 DS 21	800	2 005 (2 045)	
v)	10 DS 20	900	1 905 (1 945)	35
vi)	10 DS 21	900	2 005 (2 045)	
vii)	12 DT 20	1 100*	1 905 (1 945)	35
viii)	12 DT 21	1 100*	2 005 (2 045)	

Note:
1. D = Door, S = Single Shutter, and T = Double Leaf Shutter.
2. The designation indicates the size of door opening, the first number referring to width in modules of 100 mm and the last number the height in modules of 100 mm.

In arriving at the standard widths and heights of flush door shutters, allowances have been made as given in Fig.3.1. In case, the modular height of door opening is taken from finished floor level, the height of the flush door shall be the one given in the bracket.
*Combined width of two shutters in closed position.

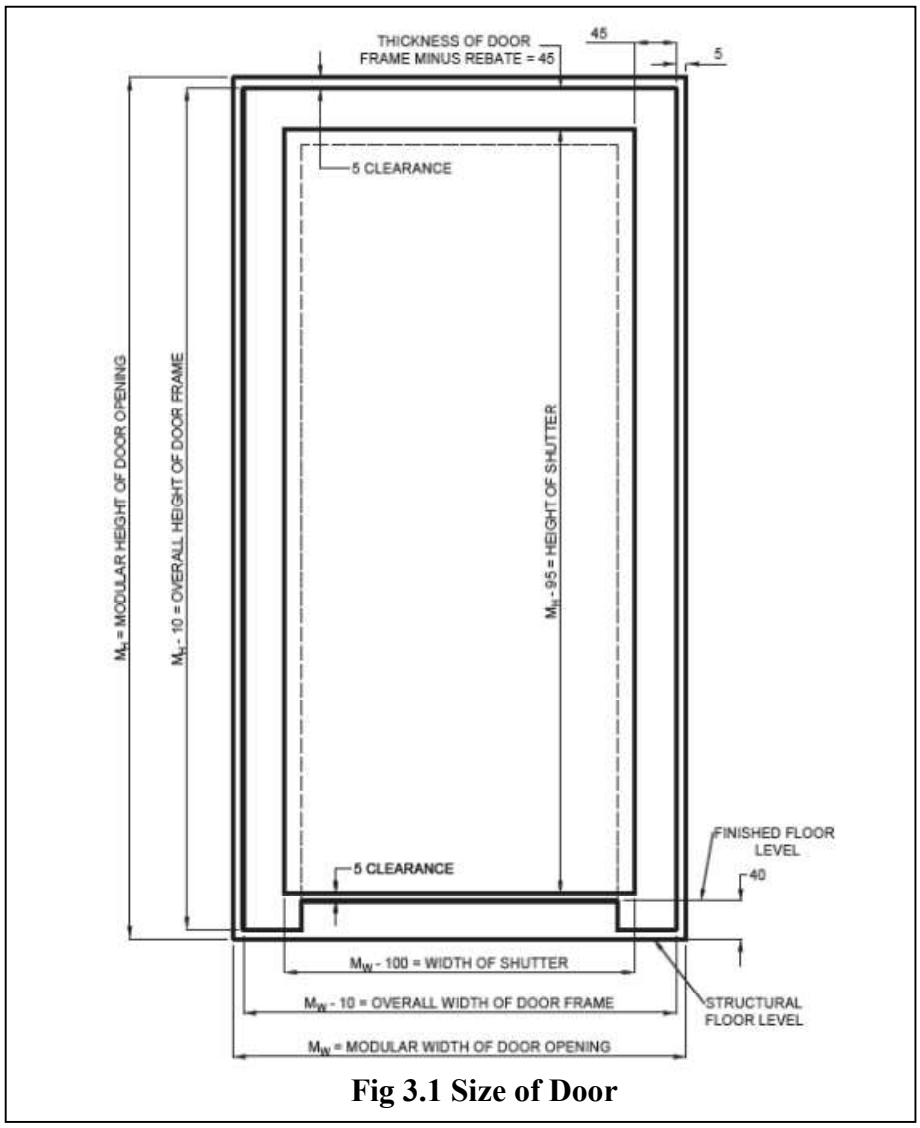


Fig 3.1 Size of Door

3.3 GENERAL REQUIREMENTS FOR FLUSH DOOR SHUTTER (SOLID CORE TYPE)

- All the four edges of the door shutter shall be square.
- Both faces of door shutter shall be sanded to a smooth even texture.

3.4 MARKING

Each shutter shall be legibly and indelibly marked on any of its edges with the following information:

a) Name of the manufacturer or trade-mark, if any;
b) Grade of door shutter;
c) Abbreviation indicating the nature of construction of the shutter.
d) Whether the size of the shutter is 'Modular' or 'Non-Modular';
e) Designation as specified in Table 3.2 of the standard for modular sizes; or the actual size (width and height) for non-modular sizes along with appropriate designation for door shutters as given in 'Table 3.2;
f) Thickness of door shutter.
g) Species of timber, in case of ECO Mark; and
h) The criteria for which the shutter has been labeled as ECO Mark (in case the flush door shutter has been marked with ECO Mark).

3.5 REQUIREMENT OF TEST FOR FLUSH DOOR SHUTTER (SOLID CORE TYPE)

The testing requirements are as per IS 2202 Part 1 are as under. Test method is as per IS 4020.

SN	Test	Requirement
1	Dimensions and Squareness Test	The dimensions of width and height shall be within a limit of ± 5 mm. The door shutter shall not deviate by more than 1 mm on a length of 500 mm. The thickness of the door shutter shall be uniform throughout with the permissible variation of not more than 0.8 mm between any two points. The thickness of the shutter shall be within a limit of ± 1 mm.
2	General Flatness Test	The twist, cupping and warping shall not exceed 6 mm.
3	Local Planeness Test	The depth of deviation measured at any point shall not be more than 0.5 mm.
4	Slamming Test	Shall not have any visible damage in any part of the door at the end of 50 successive impacts. or Shall not have any visible damage in any part of the door at the end of 100 successive impacts.
5	End Immersion Test	There shall be no delamination at the end of the test. Glue lines in all the exposed edges of the plywood on both faces of the specimen, between the plywood faces and the stile and rail shall be examined for delamination. The immersion cycles for MR grade door shutter shall however be three.
6	Knife Test	The adhesion is excellent when it is difficult to find the glue line and impossible to keep the tool within it for more than 6 mm without

		cutting into adjacent wood. On pressing upwards, the veneer/facing sheet usually breaks off over a width only slightly greater than that of the tool.
7	Glue Adhesion Test	Shall be considered to have passed the test if no delamination has occurred in the glue lines in the plywood or if no single delamination or more than 50 mm in length and more than 3 mm in depth has occurred in the assembly glue lines only between the plywood faces and stile and rail. Delamination at a knot, knot hole, a pitch pocket and wormhole or other permissible wood defects shall not be considered in assessing the sample. A door shutter shall be deemed to have passed the test if both the specimen tested passed the test. However, in the test for MR grade door shutter, the water with submerged specimens shall be bought to (60 ± 2) °C in the place of boiling water.
8	Impact Indentation Test	Shall have no defects, such as cracking, tearing or delamination and the depth of indentation shall not be more than 0.2 mm.
9	Flexure Test	The deflection at the maximum load shall not be more than one thirtieth of the length and one fifteenth of the width, whichever is less. On removal of the loads, the residual deflection shall not be more than one tenth of the allowable maximum deflection.
10	Edge Loading Test	The deflection of the edge at the maximum load shall not be more than 5 mm. On removal of the loads, the residual deflection shall not be more than 0.5 mm, failing which the test may be repeated on the other edge in the reverse direction. Also, there shall be no lateral buckling by more than 2 mm during loaded condition and no residual lateral buckling after removal of the load.
11	Shock Resistance Test	By any one method mentioned in IS4020. There shall be no visible damage in any part of the door after twenty-five blows on each end. or The normally hung shutter, with hangings, fixings and fastenings shall with stand without any significant permanent deformation and without deterioration the five impacts on both sides of the shutter.
12	Buckling Resistance Test	Shall not show any deterioration and any residual deformation of more than 5 mm after 15 min of unloading and the initial deflection also shall not be more than 50 mm.
13	Misuse Test	There shall not be any permanent deformation of the fixing or any other part of the door set in hindering its normal working after the test.
14	Varying Humidity Test	There shall not be any visible warping, twisting or delamination and where precision is required the maximum departure from the general planeness shall not be more than 1.0 mm. The recovery of the original size after subjecting the door to high and low humidity shall be at least 90 percent of the change in dimensions.
15	Screw Withdrawal Resistance Test	The required load to withdraw the screw completely shall not be less than 1 000 N. On withdrawal, there shall be no visible damage to the surface either by delamination or extra chipping off at the points of withdrawal.

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Chapter 4

ROLLING SHUTTER

4.0 ROLLING SHUTTERS

Rolling shutters shall conform to IS 6248:1979(2022). These shall include necessary locking arrangement and handles etc. These shall be suitable for fixing in the position as specified i.e. outside or inside on or below lintel or between jambs of the opening. The door shall be either push and pull type or operated with mechanical device supplied by the firm. Shutters up to 10 square metre shall be of push and pull type and shutters with an area of over 10 square metre shall generally be provided with reduction gear operated by mechanical device with chain or handle, if bearings are specified for each of operation, these shall be paid for separately.

4.1 COMPONENT OF ROLLING SHUTTER

Component of rolling shutter are shown in fig 4.1 given below.

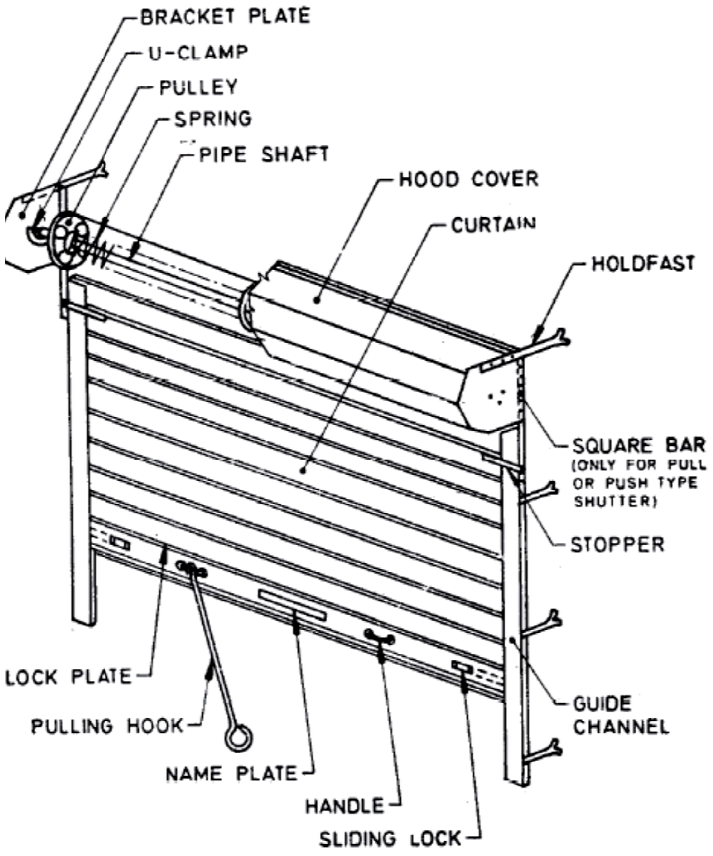


Fig- 4.1 Component Parts of Self-Closing Rolling Shutter

- **Bottom Lock Plate:** The fabricated bar inserted at the bottom of rolling shutter curtain, so as to lie against the sill, including the slide bolts, pulling handles, etc.
- **Bracket Plates:** The supporting plates at either end on the top, together with the U-shaped clamps supporting the entire moving mechanism of the rolling shutter.
- **Crank Handle: The** winding handle used for raising and lowering mechanical gear-operated rolling shutters through a bevel gear box.
- **Curtain:**-The main apron of the rolling shutter consisting of the assembly of lath sections end-locking clips and the connecting pieces at the top.
- **Guide Channels:** The channels on either side in which the shutter moves up and down.
- **Hood Cover:** A sheet metal cover bent into a suitable shape for covering the roller.
- **Lath Sections:** The individual rolled interlocking laths or slats with which the rolling shutter curtain is assembled.
- **Overall Height:-** The distance between the sill and the top of the bracket plate of the rolling shutter plus an allowance of not more than 150 mm.
  Note-The allowance is meant for taking care of the extra curtain height required for partly covering the roller in the closed position.
- **Overall Width:** The outer distance between the backs of the two guide channels of the roiling shutter.
- **Pulling Hook:** The steel rod shaped into a hook at one end and into a ring at the other, used for raising and lowering self-coiling type rolling shutters.
- **Roller:** The entire rolling portion at the top of the shutter including the suspension shaft, the pulleys, the springs and ball bearing, if any.
- **Stopper Height:** The stopper height of a rolling shutter shall be the height as measured from the sill to the bottom of the lock plate, when the rolling shutter is in the full open position.

4.2 SIZE OF ROLLING SHUTTER

The size of a rolling shutter shall be denoted by specifying the clear width (W) and the clear height (H) of the opening for which the rolling shutter is required, in the following manner, care shall be taken to mention the width first always.

2500 (W) x3500 (H) mm

The clear size of rolling shutters shall be defined and identified as given as under**:**

4.2.1 Clear Size: The clear size of a rolling shutter, to suit any opening, shall be arrived at by measuring the opening as follows:

a) **Clear width:** The clear distance between the two jambs of the opening.
b) **Clear height:** The clear distance between the sill and the soffit (Bottom of lintel) of the opening.

4.2.2 Stopper Height: The maximum available stopper height shall be 10 cm less than the clear height of the rolling shutter, although special arrangements may be made for the stopper height to be equal to the clear height, in exceptional cases.

4.3 TYPE OF ROLLING SHUTTER

The different types of rolling shutters based on standard positions of fixing and the standard designations applicable to them shall be as given in Table 4.1 (see also Fig. 4.2).

Table 4.1 Types of shutters based on standard position of fixing
(Ref: Table 1 of IS 6248)

Designation	Representing	Description
Type I A	Inside and above soffit	With guide channels overlapping the jambs on the inside face of the wall on either side and with the roll bon the face of the lintel inside.
Type IB	Inside and below soffit	With guide channels as in Type IA, but with the roll below soffit level inside.
Type OA	Outside and above soffit	With guide channels overlapping the jambs on the outside face of the wall on either side and with the roll on the face of the lintel outside.
Type OB	Outside and below soffit	With guide channels as in Type OA, but with the roll below soffit level outside (where sunshades, *CHAJJAS,* etc, project from the soffit level).
Type JPB	Jamb, projecting and below soffit	With guide channels projecting into the opening in front of the jambs and with the roll mounted in between the jambs just below soffit level. (For example, when a large opening is surrounded by concrete columns on either side and a concrete beam on top).
Type JEB	Jamb, embedded and below soffit	With guide channels embedded inside the jambs in grooves and with the roll mounted in between the jambs (slightly recessed at the top) just below soffit level. The exact position where the guide channel is to be embedded in the thickness of the wall is left to the preference of the user, as it will not affect the fabrication.

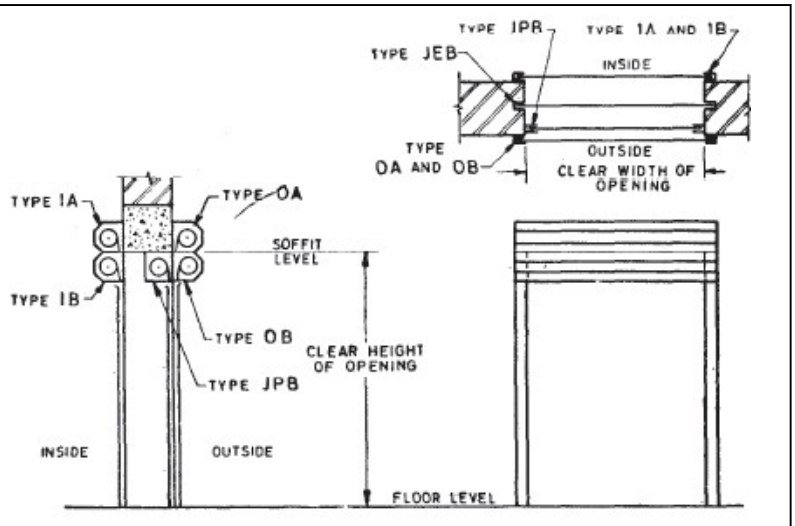


Fig. 4.2 Fixing of Rolling Shutters

4.3.1 Types of Rolling Shutters and Applicable Sizes: Rolling shutters shall be supplied in the following alternative types based on different methods of operation .The size range applicable to each type shall be as follows:

a) **Self-Closing Type (Push-Pull Type or Manual Type):** It shall be used up to a maximum of about 8 m^2 clear area without ball bearings and up to a clear area of about 12 ms with ball bearings.
b) **Gear-Operated Type (Mechanical Type):** It shall be fitted with ball bearings. It shall be used up to a maximum of about 25 m^2 clear area, if the rolling shutter is operated by a bevel gear-box and crank handle and up to a maximum of about 35 m^2 clear area, if the rolling shutter is operated by chain wheel and hand chain, mounted directly on the-worm shaft.
c) **Electrically Operated Type**: It shall be used up to a maximum of about 50 m^2 clear area.

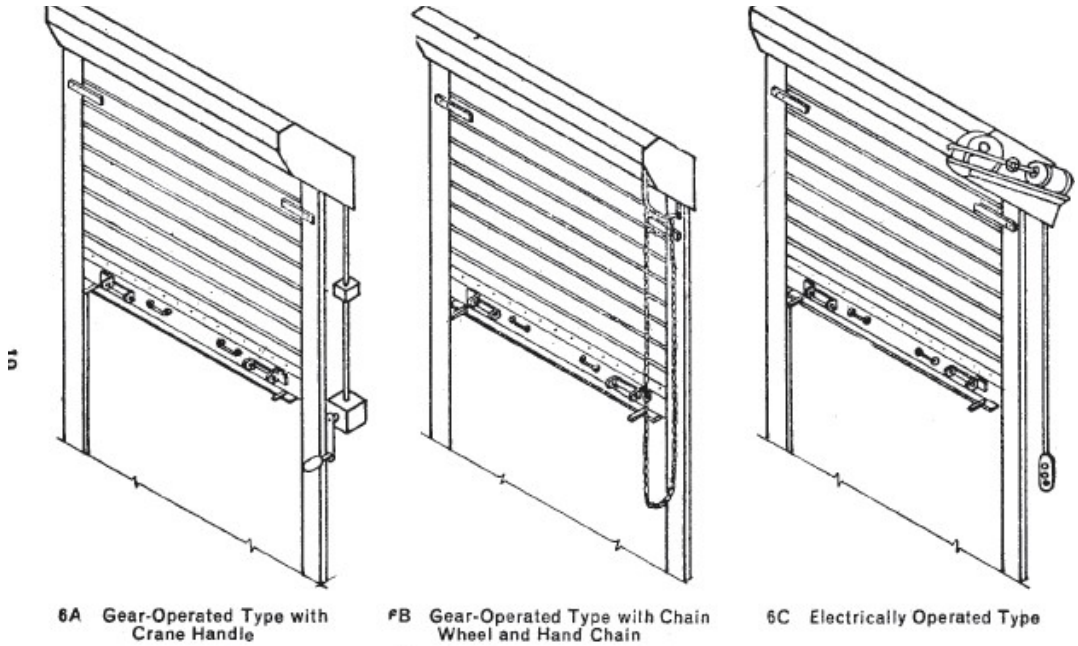


FIG. 6 OPERATION OF SHUTTER

Fig.4.3 Types of Rolling Shutter

4.4 ROLLING GRILLS

Rolling grills are similar in design, construction and operation to rolling shutters and consequently all the provisions applicable to rolling shutter apply equally to rolling grills, except in respect of the curtains. Rolling grill curtains may be built of aluminium alloy or cold-rolled steel sheet links of 0.90 mm thickness assembled on tubes or rods. Grills may also be manufactured out of 8 mm diameter mild steel or aluminium alloy round bars.



Fig 4.4 Rolling Grill

The function of a rolling grill is to provide visibility and/or ventilation, where necessary. At the same time, it provides less protection and less safety as compared to a rolling shutter. This factor shall be borne in mind when specifying rolling grills.

Rolling Shutter-cum-Grill-In situations where a certain amount of ventilations combined with safety is called for, for example, in transformer rooms, sub-stations, etc, the rolling shutter may have a small rolling grill portion either at the top or at the bottom or at both places. The height of the grill portion shall be a maximum of 0.5 m.



Fig 4.5 Rolling Shutter cum Grill

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Chapter 5

COLLAPSIBLE STEEL GATES

5.0 COLLAPSIBLE GATES

Collapsible gates are governed with IS 10521:1983(2022) and provided at opening where visibility and maneuverability in width are required along with security.

5.1 COMPONENTS OF COLLAPSIBLE GATE

Components are shown in figure below. Brief descriptions of components are as under:

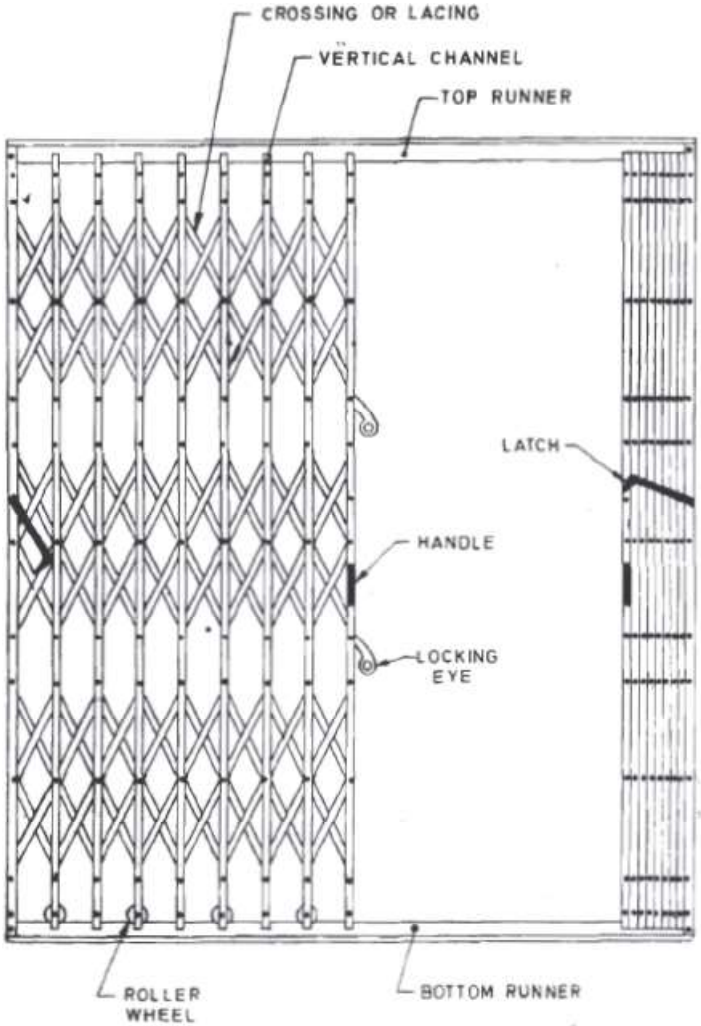


Fig- 5.1 Components of Collapsible Gate

- **Top Runner: T**he flat section provided at the top of the gate which acts as the guide for running of the gate at the top or runner for the wheels to roll when they are fixed at the top. 'T' section also can be used as top runner when the wheels are fixed at bottom.
- **Bottom Runner:** The 'T' or 'E' section suitably fixed on the ground over which the wheels, attached to the gate, roll and act as the guide for running of the gate at the bottom.
- **Vertical Channels:** Channels held in pair by means of spacers, rivets and running for the full height of the opening.
- **Crossings or Lacings:** Flats connecting three adjacent vertical channels as shown in the Fig. 1 above.
- **Spacers or Sockets:** Tubes used to keep the distance between a pair of vertical channel uniform. This is an important component, since, if the spacing between the channels is not kept uniform, the collapsing and stretching of the gate would become difficult.
- **Roller Wheels:** Wheels which carry the entire weight of the gate and roll on the bottom or top runner.

5.2 TYPES OF COLLAPSIBLE GATE

Collapsible gates may be classified into the following types:

a) Gates fixed under the lintel,
b) Gates fixed outside the opening,
c) Gates fixed inside the opening, and
d) Gates fixed on movable top and bottom channels with swinging arrangement on either side.

The above types may be with single panel collapsible at the right end or left end or with double panels collapsible at respective ends with wheels attached to the gates rolling on bottom or top runners.

5.3 SIZES OF COLLAPSIBLE GATE

Collapsible gates are recommended for a maximum height of 3 m. There is no restriction in width.

When the gate is fitted under the lintel, the width and height of the gate shall be the same as that of the opening. But when the gate is fixed inside or outside the opening, the width of the gate shall be the clear width of opening plus the width of the gate in the collapsed position and the height shall be 150 mm more than the clear height to enable usage of the full opening.

5.4 GENERAL REQUIREMENT FOR COLLAPSIBLE GATE

- Collapsible gates shall be fabricated from rolled steel channels, T or E sections and flats as shown in Fig. 5.1. These shall be provided with roller wheels at bottom to roll on 'T' or 'E' bottom runners or with wheels at top to roll on flat top runner.
- The channels shall have a maximum spacing of 100 mm when the gate is in closed position. The vertical channels shall be first riveted in pairs with toes face to face and with the spacers in position. The crossings shall be introduced at appropriate positions and

riveted. One set of crossings shall extend from 450 to 600 mm in height and the clear space between two sets of crossings shall be within 150 mm. The edges shall then be trimmed, locking eyes and handles welded or riveted and the roller wheels fitted in the respective channels.

- The number and size of roller wheels shall be dependent on the width of the gate and shall be as given in Table 5.1. The roller wheels shall be capable of taking the weight of the gate. For gates of width more than 1.5 m and up to 2.0 m, the wheels may be fitted with ball bearings; and for gates of width above 2.0 m, the wheels shall be fitted with ball bearings. Single row ball bearings, self lubricating type shall be used.
- The bottom and top runners shall be fabricated separately with necessary holding fixtures for burying in the ground or fixing in the lintel or to the walls, as the case may be.
- Suitable holding fixtures shall be provided for fixing the end channels at the face of the openings.
- The fabricated parts shall be finished with a coat of red oxide primer, conforming to IS:102:1962.

5.5 MARKING

Each gate shall be clearly and legibly marked with the following information:

a) Name of the manufacturer or trade-mark, if any;
b) Height, width and type; and
c) Year of manufacture.

Table 5.1 Requirements of Roller Wheels
(Ref: Table 1 of IS 10521)

Width and panel in (metre)	Size of the roller wheel in mm	Quantity required	Whether ball bearing to be fitted
Up to 1.0 single panel	40	2	No
Above 1.0 and up to 1.5 single panel	40	3	No
Above 1.5 and up to 2.0 single panel	50	3	Optional
Up to 2.0 double panel	50	4	Optional
Above 2.0 and up to 2.5 double panel	65	6	Yes
Above 2.5 and up to 3.0 double panel	65	6	Yes
Above 3.0 and up to 3.5 double panel	5	8	Yes
Above 3.5 and up to 4.0 double panel	65	8	Yes

Note: For every additional width of 1.0 m or part thereof, two additional wheels shall be provided.

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Chapter 6

MILD STEEL SLIDING DOOR (TOP HUNG TYPE)

6.0 TOP HUNG TYPE SLIDING SHUTTER

Top hung type sliding shutter (Top Hung Type) is goverened by IS 10451: 1983 (2022).

6.1 COMPONENTS FOR MILD STEEL SLIDING DOOR

Various components of the sliding shutters are as under. (Fig -.6.1)

- **Shutter Leaf:** A structural frame of angles or tees covered on one side or both sides with mild steel sheets, GI sheets, plain or corrugated; or rolling shutter laths.
- **Top Runner (or Track):** A mechanism on which the shutter leaf hangs and is slided over. This is made up of mild steel flats or angles or cold rolled mild steel special track sections.
- **Bottom Guide:** An arrangement to guide the movement of the shutter at the bottom.
- **Gear Mechanism:** An arrangement consisting of a pulley or a group of pulleys with or without ball bearings called 'trolley' which rolls over or within the track/top runner.

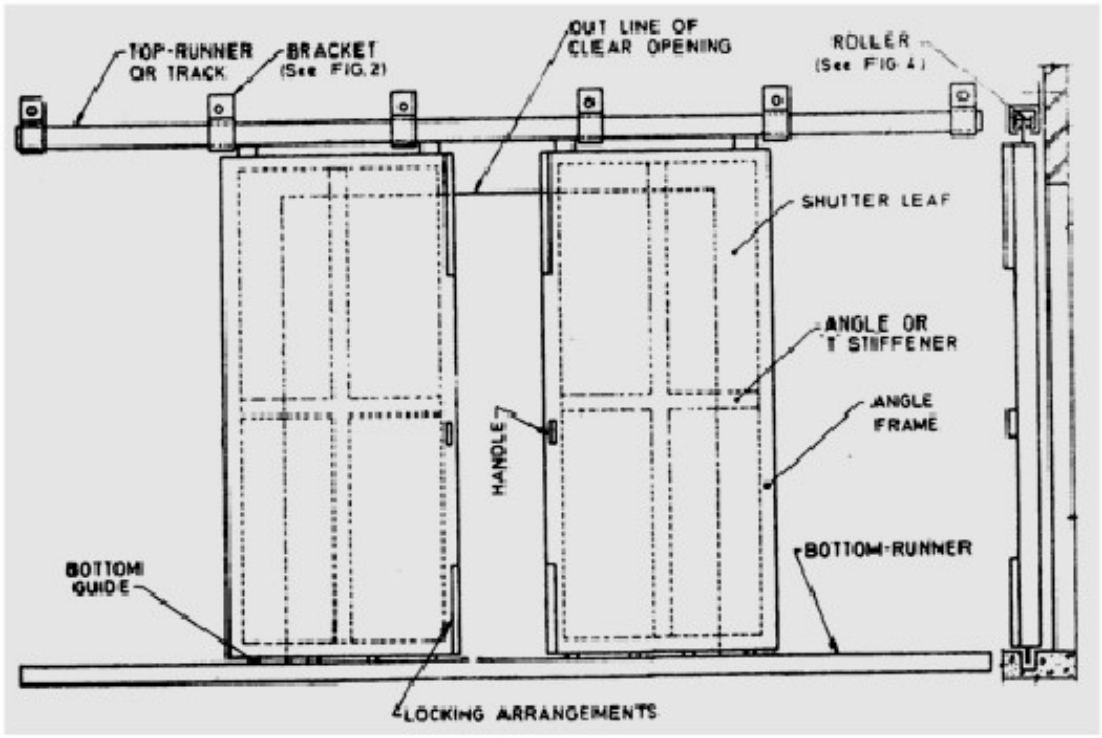


Fig- 6.1 Components of Sliding Shutter

6.2 SIZE OF SLIDING SHUTTER

The size of the shutter shall be greater than the actual opening for weather protection. The height of the shutter shall be at least 150 mm more and width at least by 300 mm more than the size of the opening.

6.3 GENERAL REQUIREMENT FOR SLIDING SHUTTER

- Sliding shutters may be with single leaf or two leaves. The shutter leaves shall be fabricated from mild steel angle frames using angles of size not less than 50 x 50 *X 5* mm for shutters up to 2 m width and 2.5 m height and 65 *X* 65 *X* 6 mm for bigger sizes.
- Stiffeners shall be provided with mild steel angle or mild steel tees at intervals not exceeding 1 m and covered on one or both sides with mild steel sheets of thickness not less than 3.15 mm or galvanized steel sheets of thickness not less than 2 mm or rolling shutter laths of thickness not less than 1.20 mm.
- The framing pieces shall be suitably notched and welded with due particular attention to sequence of welding so as to avoid distortion.
- The stiffening tees or angles shall he equally spaced vertically to suit the available width of sheets. Similarly, the horizontal stiffeners shall also be spaced depending on the length of the sheet.
- In cases where rolling shutter laths are used for the covering, there shall be no restriction in the spacing of the stiffeners.
- The vertical stiffeners shall be taken for the full height and only the horizontal stiffeners shall be out at the crossings.
- The mild steel black sheet shall be tack welded to the inside of the frame, with 25 mm run of weld spaced 200 mm apart, paying due attention of welding sequence, to avoid distortion.
- When sheet covering is done on both sides, the inner side shall be covered first by tacking and the outer side sheet shall be plug welded and ground so that the frame work within is not seen outside.
- Welding of two or more sheets to get the desired width or length shall not be permitted.
- When rolling shutter laths are used for covering, the lath shall be interlinked first and placed over the frame work of angle and tees and tack welded to the inside of the frame. If laths are to be provided on both sides, the second covering shall be plug welded in a similar manner as done in case of mild steel sheets .
- Locking and bolting arrangements shall be welded to the frames.
- Separate brackets shall be provided for holding the sliding gears so that access is available for repairs at any time.

6.4 MARKING

Each shutter shall be marked with labels containing following information:

a) Name of the manufacturer or the trade-mark, if any;
b) Height and width of the shutter;
c) Type of roller mechanism; and
d) Date of manufacture.

6.5 MS SHEET SLIDING SHUTTER

These shall be manufactured as per drawings and specification. These shall be fabricated from mild steel sheets.

The shutters shall be double or single leaf shutter as specified. The shutters shall be fabricated of specified size of M.S. angle iron frame diagonally braced with the same size of M.S. angle riveted /welded together with 3mm gusset plate at junction to form a rigid frame. M.S. sheet of 1 mm thickness or as specified shall be fixed to the frame with rivets/welds as approved by the Engineer- in-charge.

These shall also be provided with top and bottom guide rails of specified size angles or T- irons and 25 mm diameter pulley or with 25 mm diameter ball bearing at the bottom and guide block with steel pulleys at the top. The shutters shall also be provided with locking arrangement, handles, stoppers, and holdfasts, other fittings as specified in the description of the item.

The guide rails shall be sufficiently long and continued along the wall on both ends so that the sliding shutters can rest against the walls, giving full opening when so required.



Fig 6.2 MS Sheet Sliding Shutter

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Chapter 7

STEEL DOOR

7.0 STEEL DOOR

Steel doors are commonly used and are governed by IS 1038:1983(2022).

7.1 COMPONENTS OF STEEL DOORS

Components of steel door and windows are shown in fig given below.

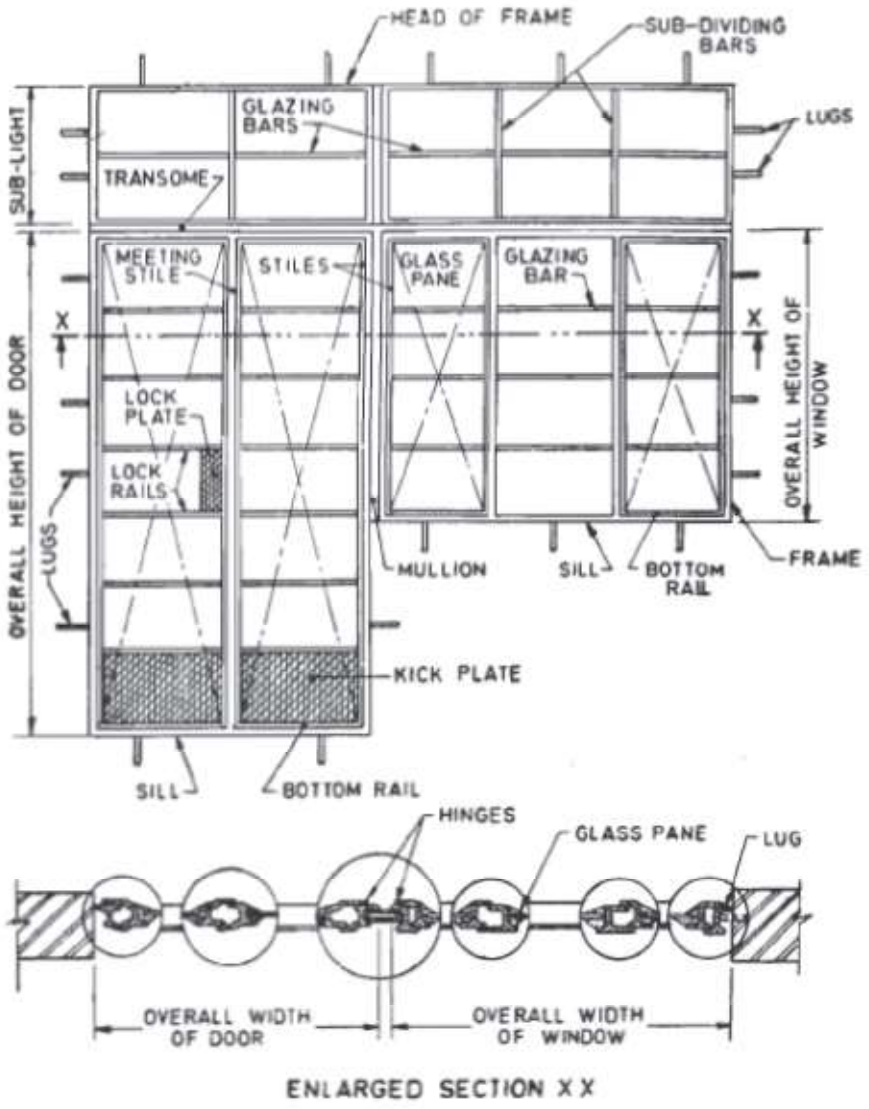


Fig. 7.1 Components of Steel Doors

7.2 STANDARD SIZES, TOLERANCES AND DESIGNATIONS OF STEEL DOOR

Standard sizes of steel doors are shown in Fig.7.2 given below.

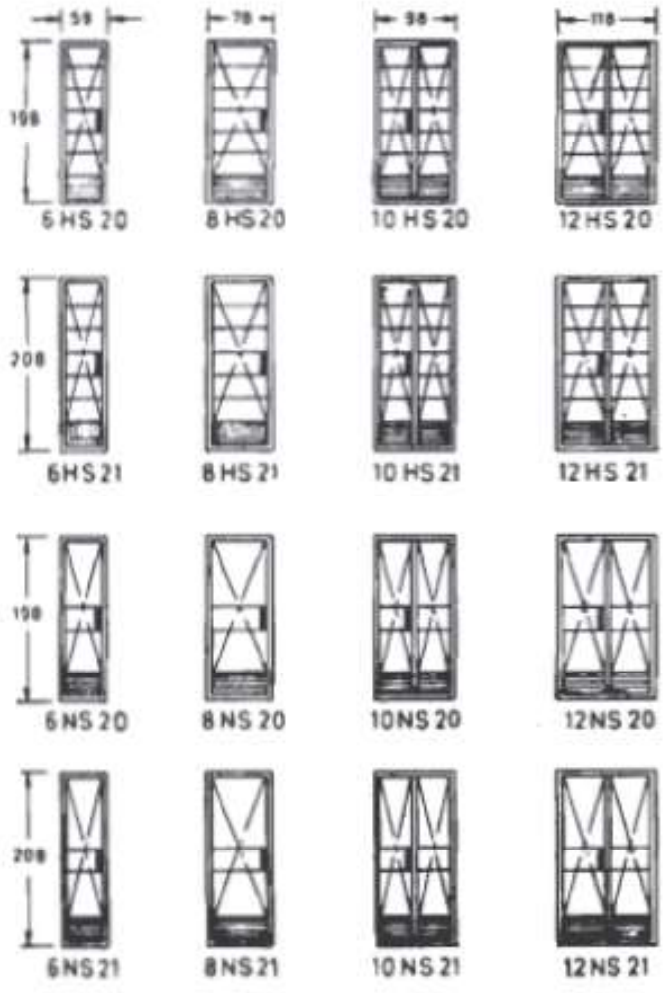


Fig- 7.2 Standard Size of Steel Doors

7.2.1 Tolerance: The sizes indicated in Fig. 2, for door shall not vary by more than ± 1.5 mm.

7.2.2 Designation: Doors, windows, ventilators and fixed-lights 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:

C = Centre hung shutter,
F = Fixed glass panes,

H = With horizontal glazing bars,
N = Without horizontal glazing bars,
S = Side hung shutters, and
T = Top hung shutters.

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

Example: A window of a width of 10 modules and height 12 modules having horizontal glazing bars and side hung shutters is designated by 10 HS 12.

7.3 GENERAL REQUIREMENTS FOR STEEL DOOR

All the steel surfaces shall be thoroughly cleaned free of rust, mill scale, dirt, oil, etc, either by mechanical means, for example, stand or shot blasting or by chemical means, for example, pickling and then finished either with painting only or phosphating and painting or by hot dip galvanizing as may be agreed to between the purchaser and the manufacturer.

7.4 MARKING

All doors, windows, ventilators and fixed-lights shall carry an identification of the manufacturer or trade-mark, if any and the process of welding adopted.

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Chapter 8

MOULDED HIGH DENSITY FIBER (HDF) PANELED DOOR SHUTTERS

8.0 MOULDED HIGH DENSITY FIBER (HDF) PANELED DOOR SHUTTERS

Moulded high density fiber (HDF) paneled door Shutters governed by IS 15380:2023 is pre-primed, high density fiberboard, with deep moulded designs on the panel. Typical moulded HDF paneled door shutter is shown in Fig 8.1 given below for information.

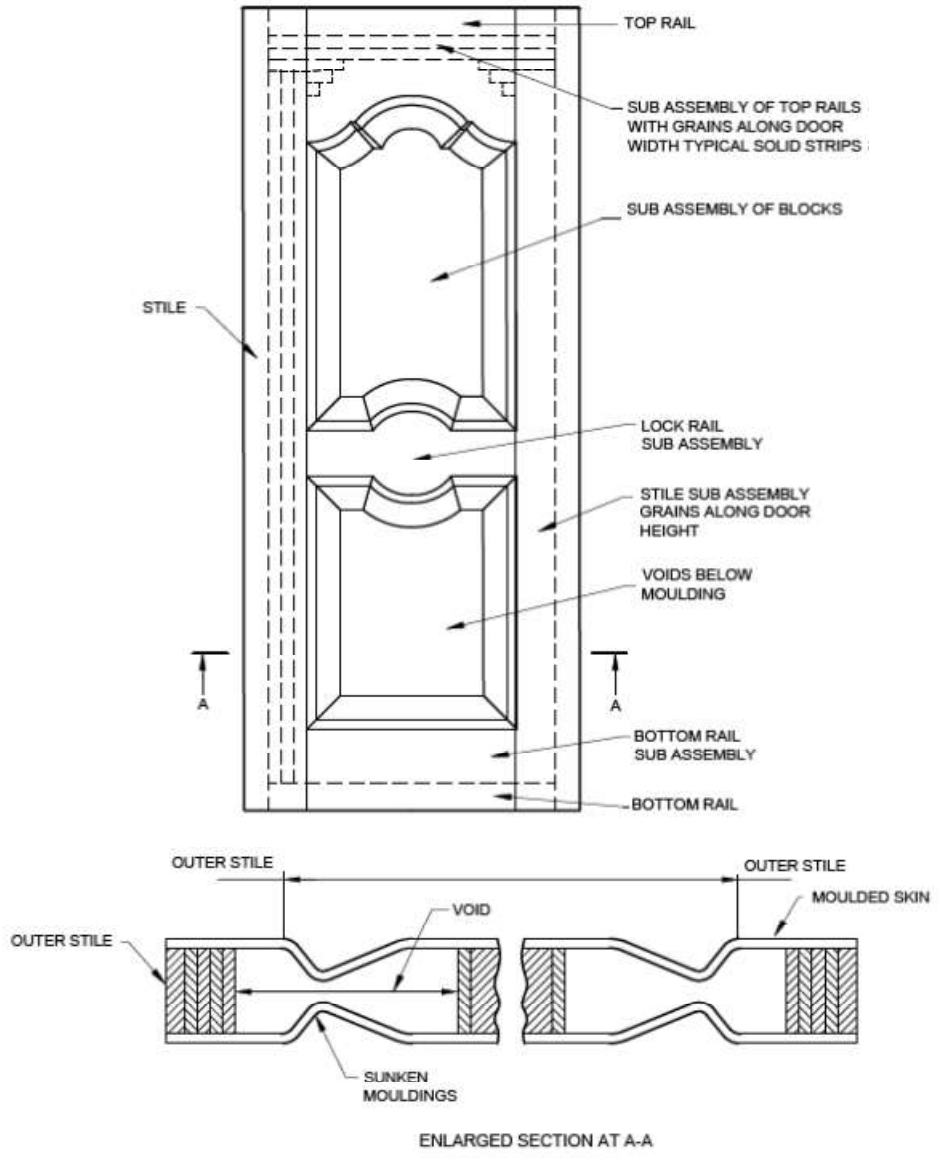


Fig- 8.1 Typical Moulded HDF Panel Door Shutter

8.1 SIZES OF MOULDED HDF PANELED DOOR SHUTTERS

Sizes of the door shutters shall conform to the modular sizes specified in Table 8.1

Table 8.1 Dimensions of Moulded HDF Paneled Door Shutters (Ref: Table 1 of IS 15380)

SN	Designation of Door Shutters	Nominal Width	Nominal Height	Thickness
		mm	mm	mm
(1)	(2)	(3)	(4)	(5)
i)	8 DS 20	700	1905	25 or 30
ii)	8 DS 21	700	2005	25 or 30
iii)	9 DS 20	800	1905	30
iv)	9 DS 21	800	2005	30
v)	10 DS 20	900	1905	35
vi)	10 DS 21	900	2005	35
vii)	12 DT 20	1100	1905	35
viii)	12 DT 21	1100	2005	35

8.2 GENERAL REQUIREMENT FOR MOULDED HDF PANELED DOOR SHUTTERS

- All the four edges of the door shutter shall be square.
- The surfaces of the shutter shall be pre-primed. The shutter may be supplied either in textured or smooth surface finish.

8.3 MARKING

Each shutter shall be legibly and indelibly marked on any of its edges with the following information:

a) Name of the manufacturer or trademark, if any
b) Type and Grade of door shutter
c) Designation of door
d) Thickness of door shutters

8.4 TESTING REQUIREMENTS FOR MOULDED HDF PANELED DOOR SHUTTERS

Testing requirements are as per IS 15380 and test methods are as per IS 4020. Testing requirements are as under.

SN	Test	Description
1	Dimensions and Squareness Test	Door shutters when tested in accordance with IS 4020 (Part 2), the dimensions of the nominal width and height shall be within a limit of +5 mm. The door shutter shall not deviate by more than 1 mm on a length of 500 mm. The thickness of the door shutter shall be uniform throughout with the permissible variation of not more than 0.8 mm between any 2 points. The nominal thickness of the shutter shall be within a limit of ±1 mm.

2	General Flatness Test	Door shutters when tested in accordance with IS 4020 (Part 3), the twist, cupping and warping shall not exceed 6 mm.
3	Local Planeness Test	Door shutters when tested in accordance with IS 4020 (Part 4), the depth of deviation measured at any point shall not be more than 0.5 mm. Measurement should be taken in a way to avoid the areas etched for simulated grain effect.
4	End Immersion Test	Door shutters when tested in accordance with IS 4020 (Part 13), shall be no de lamination at the end of the test. Glue lines between the HDF panel faces and the stile and rail shall be examined for de lamination in the immersed portion of the shutter. The immersion cycles for MR grade door shutter shall however be three.
5	Glue Adhesion Test	Door shutters, when tested in accordance with IS 4020 (Part 15), shall be considered to have passed the test if no delamination has occurred in the glue lines between the HDF panel faces and stile and rail. De lamination at a knot, knot hole, a pitch pocket and wormhole or other permissible wood defects shall not be considered in assessing the sample. A door shutter shall be deemed to have passed the test if both the specimen tested passed the test. However, in the test for MR grade. The water with submerged specimen shall be bought to (60 ± 2) °C in the place of boiling water.
6	Slamming Test	Door shutters when tested in accordance with IS 4020 (Part 10), shall not have any visible damage in any part of the door shutter at the end of 50 successive impacts in the horizontal position.
7	Impact Indentation Test	On the flat part of the empanelment shall have no defects cracking, tearing and delamination and the depth of indentation shall not be more than 0.2 mm.
8	Flexure Test	The deflection at the maximum load shall not be more than one thirtieth of the length and one fifteenth of the width, whichever is less. On removal of the loads, the residual deflection shall not be more than one tenth of the allowable maximum deflection.
9	Edge Loading Test	The deflection of the edge at the maximum load shall not be more than 5 mm. On removal of the loads, the residual deflection shall not be more than 0.5 mm, failing which the test may be repeated on the other edge in the reverse direction. Also, there shall be no lateral buckling by more than 2 mm during loaded condition and no residual lateral buckling after removal of the load.
10	Shock Resistance Test	For soft and light body impact, there shall be no visible damage in any part of the door shutter after fifteen blows. When tested for soft and heavy body impact, the normally hung door shutter with hangings, fixings and fastenings shall withstand without any significant permanent deformation and without deterioration the five impacts on both sides of the shutter.
11	Buckling Resistance Test	Shall not show any deterioration and any residual deformation more than 5 mm after 15 min of unloading and initial deflection also shall not be more than 50 mm.
12	Misuse Test	There shall not be any permanent deformation of the fixing or any other part of the door set in hindering its normal working after the test.
13	Varying Humidity Test	There shall not be any visible warping, twisting or delamination and where precision is required the maximum departure from the general planeness shall not be more than 1.0 mm. The maximum the recovery of the original size after subjecting the door shutter to high and low humidity shall be at least 90 percent of the change in dimensions.
14	Screw Withdrawal Resistance Test	The required load to withdraw the screw completely shall not be less than 1000 N. On withdrawal, there shall be no visible damage to the surface either by delamination or extra chipping off at the points of withdrawal. In case, if it

		is not possible to take specimens of size as given in IS 4020 (Part 16), the test shall be carried out on specimens of size 150 mm x actual width of longitudinal edge of the door shutter.

***

Chapter 9

SOLID PANEL FOAM UPVC DOOR SHUTTERS

9.0 SOLID PANEL FOAM UPVC DOOR SHUTTER

Solid panel Foam UPVC door shutter is governed by IS 15931:2012(2022).

9.1 DIMENSIONS, SIZES AND TOLERANCES FOR SOLID PANEL FOAM UPVC DOOR SHUTTERS

The finished dimensions and tolerances of door shutters and its components shall generally conform to the modular sizes specified in Table 9.1 (*see* Fig.1).

The nominal thickness of door shutters shall be of 30 mm for each of the sizes indicated in Table 9.1.

9.1.1 Tolerance

- The tolerance on size of door shutters shall be +3 mm and - 0 mm.
- The tolerance on thickness of door shutters shall be +2 mm and - 0 mm.
- The tolerance on joinery of the components shall be +5 mm and - 0 mm.

Table 9.1 Dimension & Tolerance of Solid Panel Foam UPVC Door Shutters and Components (Ref: Table 1 of IS 15931)

SN	Width in mm	Height in mm	Stile in mm	Rail in mm
1	2	3	4	5
i)	700	2005 (2045)	50	75
ii)	800	2005 (2045)	75	100
iii)	900	2005 (2045)	100	125

Note:
1. Standard sizes of door frame are covered in IS 4021.
2. The standard widths and heights for doors have been arrived at as shown in Fig. 9.2. In case the modular height is taken from the finished floor level, the height of the door shall be the one given in bracket.
3. Gap inserts of 15 mm shall be provided between stiles and rails and panels.
4. For door shutters larger than 1.6 m^2, an additional mild steel tube of 15mm × 15 mm shall be provided at a distance of 75 mm from the tube under the top rail.

9.2 GENERAL REQUIREMENTS FOR SOLID PANEL FOAM UPVC DOOR SHUTTERS

- The surface of the shutters shall be free from any visible defects such as pin holes, small pores, crazing, blistering, wrinkling, impurities, colour blotches, etc.
- The panels of the door shutters shall be flat and shall have smooth and level surface.
- All the four edges of the door shutter shall be square.
- The shutter shall be free from twist or warp.
- The colour of the door shutters shall be as agreed to between the purchaser and the manufacturer.

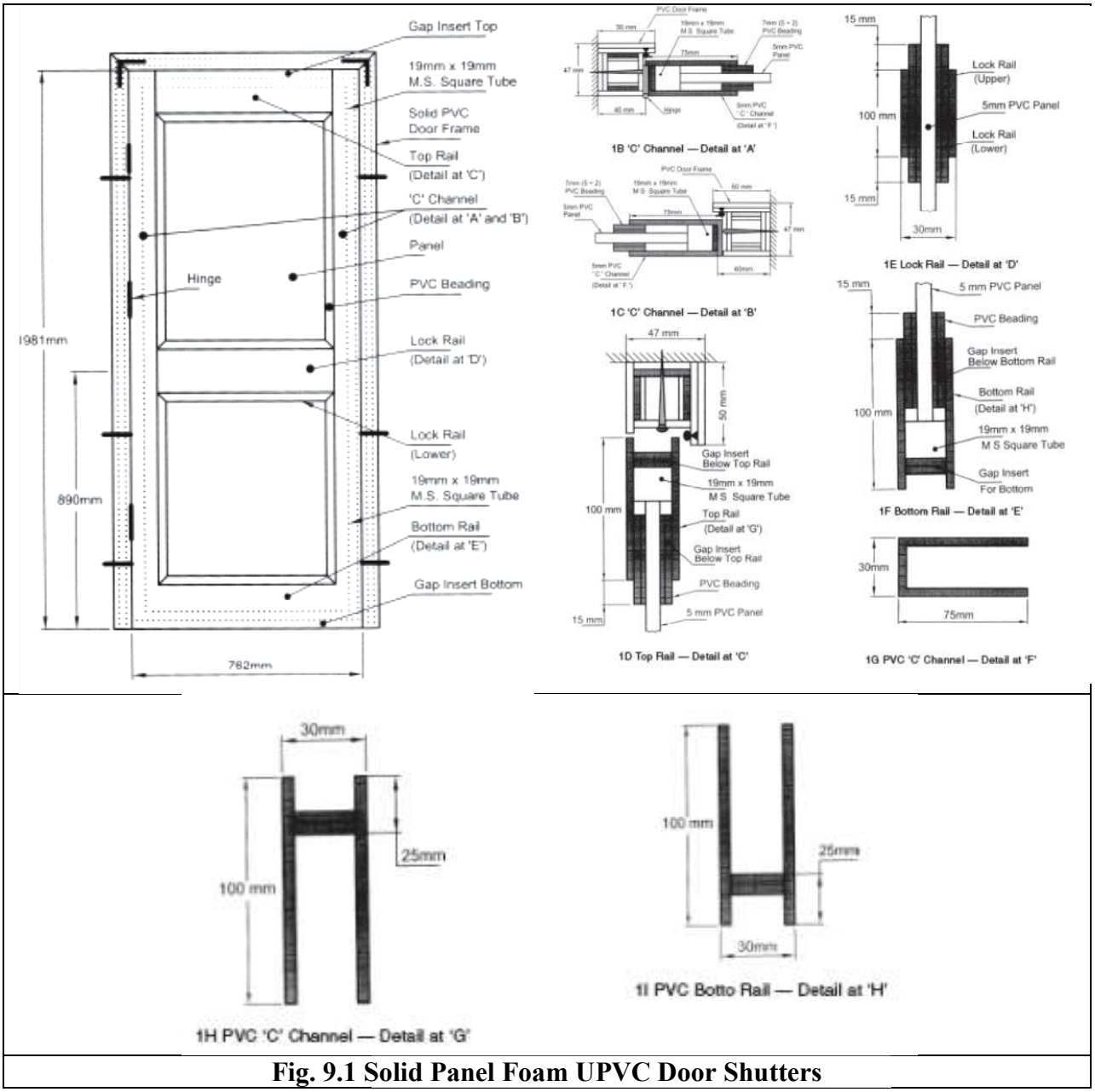


Fig. 9.1 Solid Panel Foam UPVC Door Shutters



Fig- 9.2 Dimensions of Shutters

9.3 MARKING

Door shutters shall be clearly and indelibly marked on exposed edge of a rail with the following information:

a) Manufacturer's name or trade-mark;
b) Whether the size of the shutter is 'Modular' or 'Non-modular';
c) Width and height for modular sizes as specified in Table1, or the actual size (width and height in case of non modular sizes);
d) Lot or batch number and year of manufacture;
e) For indoor use only

9.4 TESTING REQUIREMENTS FOR SOLID PANEL FOAM UPVC DOOR SHUTTERS

Testing requirements are as per IS:15931:2012(2022) and test method is as per IS 4020. Testing requirements are as under.

SN	Test	Description
1	Dimensions and Squareness Test	Nominal width and height of door shutters shall be within a limit of +3 mm and - 0 mm The nominal thickness of the shutter shall be within limit of +2 mm and – 0 mm The difference in length of the diagonals shall not be more than 3 mm.
2	General Flatness Test	The twist, cupping and warping of door shutters shall not exceed 2 mm.
3	Impact Indentation Test	Shutters shall have no defect such as cracking, tearing or delamination and the depth of indentation shall not be more than 0.3 mm.
4	Slamming Test	Shutter shall not have any visible damage in any part at the end of 50 successive impacts.
5	Edge Loading Test	The deflection of the edge of the door shutter at the maximum load shall not be more than 8 mm. On removal of the loads, the residual deflection shall not be more than 0.7 mm, failing which the test may be repeated on the other edge in the reverse direction.
6	Shock Resistance Test	There shall be no visible damage in any part of the door shutter after twenty five blows on both sides of the shutter. Slight depression at the struck point shall be permissible. When tested in accordance with a normally hung door shutter with hanging, fixings and fastenings should withstand without any significant permanent deformation and without deterioration, one impact on both sides of the shutter.
7	Buckling Resistance Test	The shutter shall not show any deterioration and any residual deformation more than 5 mm after 30 min of unloading (initial deflection will not be relevant).
8	Misuse Test	There shall not be any permanent deformation of the fixing or any other part of the door set hindering its normal working after the test.
9	Screw Withdrawal Test	on the stiles where the hinges are fitted as well as where fittings and fixtures are mounted. The required load to withdraw the screw completely shall not be less than 1 000 N. On withdrawal, there shall be no visible damage to the surface either by delamination or extra embossing at the points of withdrawal.

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Chapter 10

GLASS FIBER REINFORCED PLASTICS DOORS (GRP)

10.0 GLASS FIBER REINFORCED PLASTICS DOORS (GRP)

Glass Fiber Reinforced Plastics popularly known as GRP is a general term relating to the reinforcement of plastic with fibrous glass, normally be used internally and governed by 14856:2000 (2022).

10.1 DIMENSIONS, SIZES AND TOLERANCES FOR GLASS FIBER REINFORCED PLASTICS DOORS

The finished dimensions and tolerances of the different components of door shutter shall be as given in Table 10.1.

Table 10.1 Dimension and Tolerances of Components of Glass Fiber Reinforced Plastics Doors (Ref: Table 1 of IS 14856)

SN.	Description	Width in mm	Thickness in mm
1	Vertical stile, top and freeze rail	90±3	30±1or 35±1
2	Lock rail	120±3	30±1or 35±1
3	Bottom rail	150±3	30±1or 35±1

- Minimum thickness of GRP laminate of hollow rails and stiles shall be 3 mm.
- Minimum thickness of GRP laminate used for panel in the shutter shall be 5 mm.

10.2 SIZE AND TYPE OF GLASS FIBER REINFORCED PLASTICS DOORS

Sizes and types of the shutters shall generally conform to the modular sizes specified in Table 10.2.

Table 10.2 Dimensions of Glass Fiber Reinforced Plastics Doors Shutters (Ref: Table 2 of IS 14856)

SN	Designation of Door Shutters	Width	Height
		mm	mm
(1)	(2)	(3)	(4)
i)	8 DS 20	700	1 905
ii)	8 DS 21	700	2 005
iii)	9 DS 20	800	1 905
iv)	9 DS 21	800	2 005
v)	10 DS 20	900	1 905
vi)	10 DS 21	900	2 005
vii)	12 DT 20	1 100	1 905
viii)	12 DT 21	1 100	2 005

Tolerances: Tolerances on the sizes of door shutters shall be + 0 / - 4 mm’

10.3 GENERAL REQUIREMENTS FOR GLASS FIBER REINFORCED PLASTICS DOORS

- The surface of the moulded shutters shall be free from any visible defects such as small pores, crazing, blistering, wrinkling, impurities, defective impregnation, colour blots and aggregate defects.
- Scattered pin holes duly repaired and finished by applying resin and not noticeable shall be acceptable.
- Panels, rails and stiles of the door shutters shall be flat and shall have smooth and level surface.
- Shutter shall be finished in colour and design as required by the purchaser.

10.4 MARKING

All door shutters conforming to this specification shall be marked with the following information:

a) Name of manufacturer or trade-mark, if any; and
b) Lot num her/date of manufacture for identification

10.5 TESTING REQUIREMENTS FOR GLASS FIBER REINFORCED PLASTICS DOORS

Testing requirements of material is as per clause 10.1 of IS 14856 also required.
Testing requirements for shutters are as per IS 14856:2000 (2022) and method of test is as per IS 4020 and are detailed as under:

SN	Test	Description
1	Dimensions and Squareness Test	The dimensions of nominal width and height shall be within a limit of ± 1.5 mm. The door shutter shall not deviate by more than 1mm on a length of 500 mm. The thickness of the door shutter shall be uniform throughout with the permissible variation of not more than 0.8 mm between any two points. The nominal thickness of the shutter shall be within a limit of +1.5mm.
2	General Flatness Test	The twist, cupping and warping shall not exceed 6 mm.
3	Local Planeness Test	The depth of deviation measured at any point shall not be more than 0.5 mm.
4	Slamming Test.	Door shutters, when tested in accordance with 2.1 of IS 4020 (Part 10), shall not have any 50 successive impacts. Door shutters, when tested in accordance with 3.1 of IS 4020 (Part 10), shall not have any visible damage in any part of the door at the end of I00 successive impacts.
5	Impact Indentation Test	Shall have no defects such as cracking, tearing or delamination and the depth of indentation shall not be more than 0.2 mm.
6	Edge Loading Test	The deflection of the edge at the maximum load shall not be more than 5 mm. On removal of the loads, the residual deflection shall not be more than 0.5 mm, failing which the test may be repeated on the other

		edge in the reverse direction. Also there shall be no lateral buckling by more than 2 mm during loaded condition and no residual lateral buckling after removal of the load.
7	Shock Resistance Test	There shall be no visible damage in any part of the door after twenty-five blows on each end. Door shutters, when tested in accordance with 3.1 of IS 4020 (Part 8), the normally hung shutter, with hangings, fixings and fastenings should withstand without any significant permanent deformation and without deterioration the five impacts on both sides of the shutter.
8	Buckling Resistance Test	Shall not show any deterioration and any residual deformation more than 5 mm after 15 min of unloading and the initial deflection also shall not be more than 50 mm.
9	Misuse Test	There shall not be any permanent deformation of the fixing or any other part of the door set in hindering its normal working after the test.

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Chapter 11

BAMBOO-JUTE COMPOSITE HOLLOW CORE DOOR SHUTTER

11.0 BAMBOO-JUTE COMPOSITE HOLLOW CORE DOOR SHUTTER

Bamboo-jute composite hollow core door shutters are governed by IS 16096:2013.

11.1 SIZES OF BAMBOO-JUTE COMPOSITE HOLLOW CORE DOOR SHUTTER

Sizes of the door shutters shall generally conform to the modular sizes specified in Table 11.1. Sizes other than modular sizes as agreed to between the manufacturer and the purchaser may also be permitted. The nominal thickness of the shutters shall be as specified in Table 11.1.

For sizes other than modular sizes the nominal thickness of the shutters shall be as agreed to between the manufacturer and the purchaser but shall not be less than that specified for the nearest higher modular size of shutter given in Table 11.1.

Table 11.1 Dimensions and Thickness of Bamboo-Jute Composite Hollow Core Door Shutter (Ref: Table 1 of IS 16096)

SN	Designation of Door Shutters	Width mm	Height mm	Thickness mm
(1)	(2)	(3)	(4)	(5)
i)	8 DS 20	700	1905	25
ii)	8 DS 21	700	2005	25
iii)	9 DS 20	800	1905	25
iv)	9 DS 21	800	2005	25
v)	10 DS 20	900	1905	25
vi)	10 DS 21	900	2005	25
vii)	12 DT 20	1100*	1905	30
viii)	12 DT 21	1100*	2005	30

Note:
1. D = Door, S = Single Shutter, and T = Double Leaf Shutter.
2. The designation indicates the size of door opening, the first number referring to width in modules of 100 mm and the last number the height in modules of 100 mm.

In arriving at the standard widths and heights of flush door shutters, allowance have been made as given in Fig.11.1 In case, the modular height of door opening is taken from finished floor level, the height of the flush door shall be the one given in the bracket.
*Combined width of two shutters in closed position.

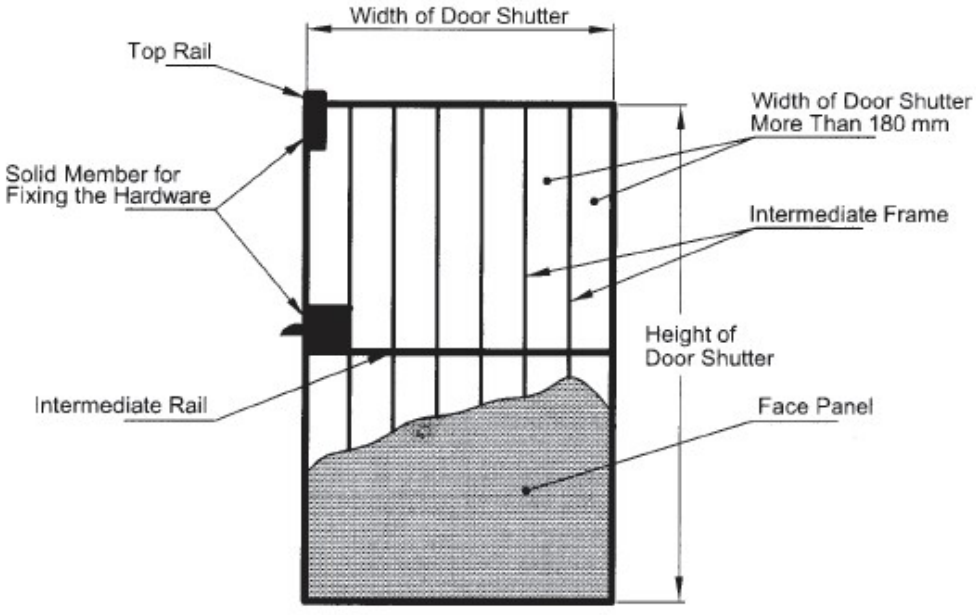


Fig. 11.1 Typical Illustration of Hollow Door Shutter

11.2 COMPONENTS OF BAMBOO-JUTE COMPOSITE HOLLOW CORE DOOR SHUTTER

Components are shown in fig 11.1 above.

Components	Description
Hollow Core	Bamboo-jute composite frame for holding the core shall be constructed from stiles and top, bottom and one intermediate rail (*see also* Fig. 11.1). In each segment of the core, bamboo-jute composite intermediate frames minimum 20 mm wide and minimum 15 mm thick shall be fixed, equally spaced at a maximum of 180 mm from frame to frame and frame to stile.
Stiles and Rails	Stiles and rails shall be of one piece constructed from bamboo-jute composite, each not less than 50 mm wide and 15 mm thick.
Face Panel	Face panel shall be made of plane bamboo-jute composite sheet of minimum 2.5 mm thick. The face panels shall be glued on both faces of the core and riveted to the framework with sufficient number of aluminium rivets. Riveting shall be done after drilling only. Counter sunk shall be done on face panel to maintain the surface planeness.

11.3 GENERAL REQUIREMENTS FOR BAMBOO-JUTE COMPOSITE HOLLOW CORE DOOR SHUTTER

- All the four edges of the door shutters shall be square. The shutter shall be free from twist or warp in its plane. The surface of door shutters shall be generally of smooth finish. Minor deviations from the smooth finish without impairing the strength or performance of the shutters may be permitted.

- Both faces of the door shutters shall be sanded to a smooth even texture.
- Door shutters shall be primer coated, if required by the purchaser.



Fig 11.2 Bamboo-Jute Composite Hollow Core Door Shutter

11.4 MARKING

Each door shutter shall be legibly and indelibly stamped or marked by any suitable method with the following information:

a) Name of the manufacturer or trade mark, if any;
b) Lot No./ Year of manufacture;
c) Whether the size of the shutter is 'Modular' or 'Non-modular'; and
d) Nominal dimensions.

***

Chapter 12

OTHER DOORS

12.0 OTHER TYPES OF DOOR

In addition to described in earlier chapters, some other types of door also available. We discussed in brief in this handbook for ready reference.

12.1 PANEL PVC DOOR SHUTTER

Panel PVC Shutters are factory made shutter and shall be brought to site fully assembled. The Solid Panel PVC Door shall be fabricated from 5 mm PVC sheet. The sheets used may be in plain colour, printed design or pre laminate veneer shade. Shutter shall be made of PVC material conforming to IS 10151. At present there is no Indian standard specification for PVC Door, however requirement as per CPWD specification has been discussed. (Ref.: CPWD specification volume I-2019 Para 9.19.4)

12.1.1 Components of PVC Shutter: Components shown in fig. 12.1 below.

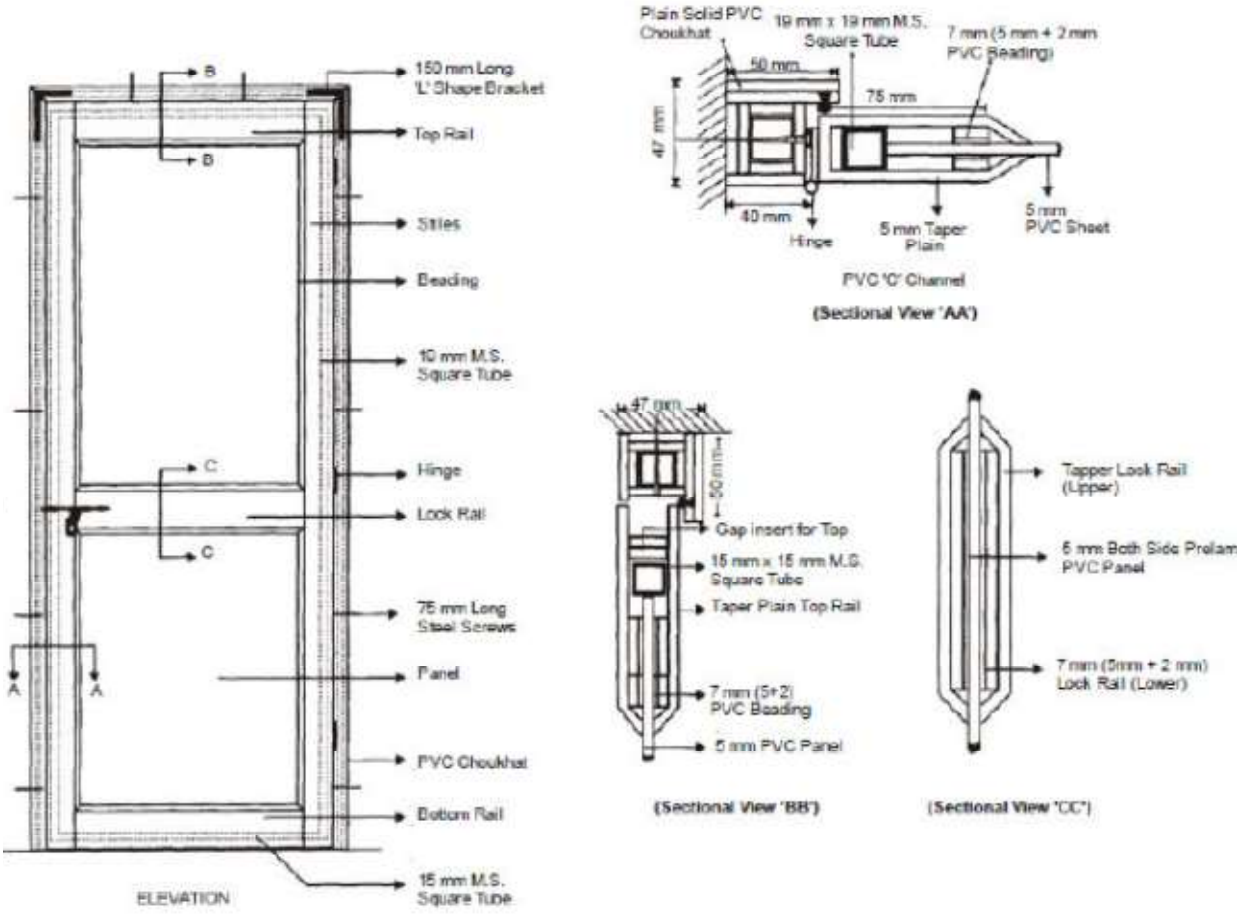


Fig.12.1 Components of PVC door

12.1.2 Test requirements for PVC Door: Testing requirements for PVC door as per reference of CPWD specification volume I-2019 Para (9.19.4) are as under. The method of testing in accordance with IS 4020.

SN	Test	Description
1	Dimension and Squareness Test	The dimensions of nominal width and height will be within a limit of + 5 mm. The door shutter shall not deviate by more than 1 mm on a length of 500 mm. The thickness of the door shutter shall be uniform throughout with the permissible variation of not more than 0.8 mm between any two points. The nominal thickness of the shutter shall be within a limit of + 1.5 mm.
2	General Flatness Test	The twist, cupping and warping shall not exceed 6 mm.
3	Local Planeness Test	The depth of deviation measured at any point shall not be more than 0.5 mm.
4	Impact Indentation Test	shall have no defects such as cracking, tearing or delamination and the depth of indentation shall not be more than 0.2 mm.
5	Edge Loading Test	The deflection of the edge at the maximum load shall not be more than 5 mm. On removal of the loads, the residual deflection shall not be more than 0.5 mm, failing which the test may be repeated on the other edge in the reverse direction. Also there shall be no lateral buckling by more than 2 mm during loaded condition and no residual lateral buckling after removal of the load.
6	Shock Resistance Test	Shall be no visible damage in any part of the door after twenty five blows on each end.
7	Buckling Test	Shall not show any deterioration and any residual deformation more than 5 mm after 15 min. of unloading and the initial deflection also shall not be more than 50 mm.
7	Slamming Test	Shall not have any damage in any part of the door at the end of successive impacts.

12.2 CUPBOARD SHUTTER

Cup Board Shutter shall be with pre-laminated flat pressed three layers particle board or with Veneered particle board. Width and height of the shutters shall be as per drawings. All four edges of the shutters shall be square. The shutter shall be free from twist or warp in its plane.

Pre laminated flat presses three layers shall conform to IS 12823. Veneer particle board shall conform to IS 3087. The boards with BIS Certificate marks shall only be accepted.

Nominal thickness of shutter may be 25, 30 or 35 mm.



Fig 12.2 Cup Board Shutter

12.2.1 Rebating: In the case of double leaves shutters the meeting of stiles shall be rebated by 8 mm to 10 mm.

12.2.2 Tolerance: Tolerance on width and height shall be + 3 mm and tolerance on nominal thickness shall be ± 1.2 mm.

12.3 WIRE GAUGE SHUTTER

Wire gauge shutters (Fly proof) shutters prevent entry of mosquitoes, flies insects etc. into a building. At the same time they also allow free circulation of air. Wire gauge shutter is almost similar to panelled door. Wire gauge is used in panel.

As per Indian Railway Unified Specifications 2009 para (7.2.10), 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 selvedge by one or more wires in each edge.

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

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.

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.



Fig 12.3 Wire Gauge Shutter

12.4 12 MM THICK FRAMELESS TOUGHENED GLASS DOOR SHUTTER

This is a clear 12 mm toughened safety glass frameless shutter having a consulate top and bottom self closer mechanism with a pivot connecting to a discrete metal patch fitting at the top and bottom corners to the door.

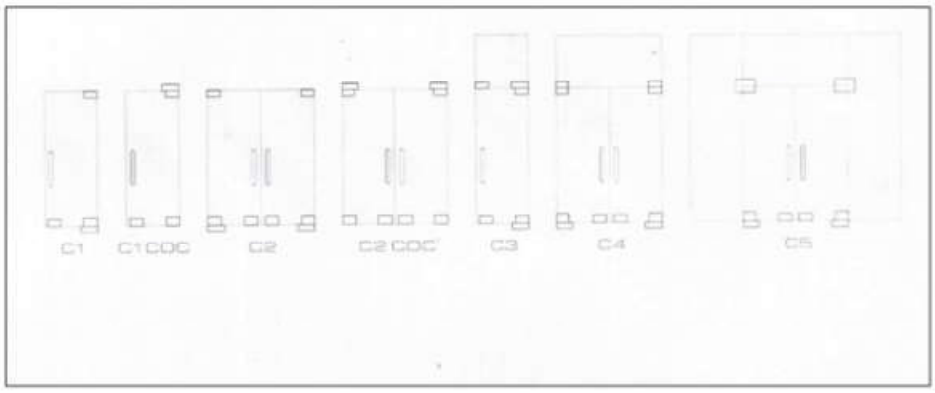
The 12 mm thick clear toughened safety glass frameless shutter is fixed with the help of corner patch fittings. The corner patch fittings are simply a bolt through glass metal fitting requiring a

corner cut out and hole in the glass. These discrete corner patch fittings provide a sleek and clean frameless look. The lock body patch fitting can also be installed where there is a necessity to provide locking arrangements for frameless shutter. The maximum size of frameless doors shutters using corner patch fittings should not exceed from 1000mm X 2400mm. Bigger size doors should not be fixed with these fittings.



Fig 12.4 Frameless Toughened Glass Door Shutter

The frameless toughened glass door shutters of required thickness as specified in the item should be installed with the help of 304 grade stainless steel patch fittings of approved brand and manufacturer. These fittings should be complete in all respect with top and bottom pivots and double action hydraulic floor spring types fixing arrangement. These fittings should be based on a modular system, consisting of a base unit, functional inserts, and clip-on covers in a wide range of finishes. The fittings should be suitable to support the weight of the complete glass door in such a way that the movement of the door is smooth and free. The fittings should be got approved from the engineer-incharge and all the fixings etc. shall be done as per manufacturer specification and corresponding codes described in the description of the fitting.



12.5 ALUMINUM DOORS

Material, fabrication and dimensions of aluminium doors, windows and ventilators manufactured from extruded aluminium alloy sections of standard sizes and designs complete with fittings, ready for being fixed into the building shall be as per IS 1948.

Their sizes are derived after allowing 1.25 mm clearances on all the four sides for the purpose of fitting the doors, windows and ventilators into modular openings.The sizes for doors, windows and ventilators frames shall not vary by more than ±1.5 mm.

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Fig 12.5 Aluminum Door

REFERENCE

SN	Description
1.	Panelled and Glazed Door Shutters (IS 1003 Part 1:2003 (2018).
2.	Ledged, Braced and Battened Timber Doors (IS 6198:1992)
3.	Wooden Flush Door Shutters (Solid Core Type) Plywood Face Panels (IS 2202 Part 1:2023)
4.	Wooden Flush Door Shutters (Cellular, Hollow and Tubular Core Type) (IS 2191 Part 1:2022) Ply Wood Face Panel
5.	Rolling Shutter (IS 6248)
6.	Collapsible Steel Gates (IS 10521:1983 (2022)
7.	Mild Steel Sliding Door (Top Hung Type) IS10451: 1983 (2022)
8.	Steel Door (IS 1038:1983(2022)
9.	Moulded High Density Fiber (HDF) Paneled Door Shutters (IS 15380)
10.	Solid panel foam UPVC door Shutters (is 15931)
11.	Glass Fiber Reinforced Plastics Doors (GRP) (IS 14856)
12.	Bamboo-Jute Composite Hollow Core Door Shutter (IS 16096:2013)
13.	Indian Railways USSOR 2010
14.	CPWD DSR 2023

 **NOTES** 

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If at any point contradiction is observed, then Indian Standards, regulations issued by Government bodies, Railway Board/RDSO guidelines shall be referred.

हमारा उद्देश्य

अनुरक्षण प्रौद्योगिकी और कार्यप्रणाली को उन्नयन करना तथा उत्पादकता और रेल्वे की परिसंपत्ति एवं जनशक्ति के निष्पादन में सुधार करना जिससे अन्तर्विषयों में विश्वसनीयता, उपयोगिता और दक्षता प्राप्त की जा सके।

यदि आप इस संदर्भ में कोई विचार और सुझाव देना चाहते हों तो कृपया हमें इस पते पर लिखें।

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