भारतीय मानक

Indian Standard

IS 16074 : 2024

इस्पात के सपाट दरवाज़े के शटर्स — विशिष्टि

(पहला पुनरीक्षण)

Steel Flush Door Shutters — Specification

(First Revision)

ICS 91.060.50

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

July 2024 **Price Group 11**

Doors, Windows and Shutters Sectional Committee, CED 11

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Doors, Windows and Shutters Sectional Committee had been approved by the Civil Engineering Division Council.

Factory made steel flush door shutter from galvanized steel is gaining lot of usage and application due to the quality and tolerances of manufacturing. All preparations for door hardware and screws, including finish paint to be done in the factory before it is shipped out of the factory. The product (door shutters) has multiple uses in terms of its functional and aesthetic requirements. Steel flush door shutters are sturdy and require proper specification based on application as the sheet vary from one manufacturer to the other. Hence there is a need to formulate a standard which not only guides the industry but also ensures bringing a quality product in line with other national standards.

These doors are custom made to various specifications of infill material like mineral wool or polyurethane foam or honey comb kraft paper or steel stiffeners with an outer skin of steel sheet, and are used in indoor and outdoor applications in both residential and commercial buildings. This standard, published in 2013, permits different sizes to suit various frame types for multiple application.

Based on the experience gained in the last one decade and latest practices in manufacturing of the steel door shutters, in this first revision the following major modifications have been incorporated:

a) Classification of the steel door shutters has been modified based on applicability;

b) Material clause has been modified;

c) Criteria based on wall opening size for dimensions of steel door shutter have been introduced;

d) Construction clauses have been modified;

e) Based on classification, minimum steel shutter thickness criteria have been introduced;

f) Clause on workmanship and finish has been modified;

g) Door handing clause has been introduced;

h) Marking clause has been modified; and

j) Recommended guidelines for installation of steel door shutters have been added as annex to this standard.

The composition of the Committee responsible for the formulation of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

STEEL FLUSH DOOR SHUTTERS — SPECIFICATION

(First Revision)

1 SCOPE

This standard specifies the requirements regarding materials, construction, types, sizes, workmanship, finishes and tests of steel flush door shutters for internal and external use in residential and commercial buildings.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in the text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 10428 shall apply (*see also* Fig. 1).

4 CLASSIFICATION

Based on the applicability, the steel door shutters shall be classified as follows:

Light duty — Recommended use for low frequency openings such as apartments, dormitories, and hotels. Not subjected to any kind of misuse.

Medium duty — Recommended use for medium frequency opening such as main entrance to apartments, dormitory buildings, stairwells, storage and mechanical rooms.

Heavy duty — Recommended use for high frequency openings such as the entrances to schools, offices, industrial buildings, stairwells, public restrooms, and manufacturing areas.

Extra heavy duty — Recommended use for very high frequency openings. It also includes areas like main entrance to schools, offices, industrial buildings, public buildings,metro stations/buildings and locker rooms.

5 MATERIAL

The steel door shutters shall be manufactured by one of the following types of steel sheets given in Table 1. However, the minimum thickness of the steel sheets as per classification of the door shutters is given in Table 1.

5.1 Galvanized Steel

Galvanized steel door shutters shall be manufactured from galvanized steel sheets conforming to IS 277 with a minimum zinc coating (both sides) grade of 120 g/m^2.

5.2 Pre-Coated Steel

Pre-coated steel door shutters shall be manufactured from the pre-painted galvanized steel sheets conforming to IS 14246. The top coat of paint type epoxy/polyester polyurethane/PVDF/PVF2/silicon modified polyester (SMP)/high durable polyester shall have coating thickness of minimum 30 microns. The back coat of material alkaloid epoxy or polyester shall have coating thickness of minimum 7 microns. The colour shade of top coat may be as agreed between the manufacturer and the purchaser.

5.3 Stainless Steel

Stainless steel door shutters shall be manufactured from SS 304/SS 316/SS 316L grade steel sheets conforming to IS 6911. Stainless steel doors shutters may have a satin or bright natural finish as agreed between the manufacturer and the purchaser.

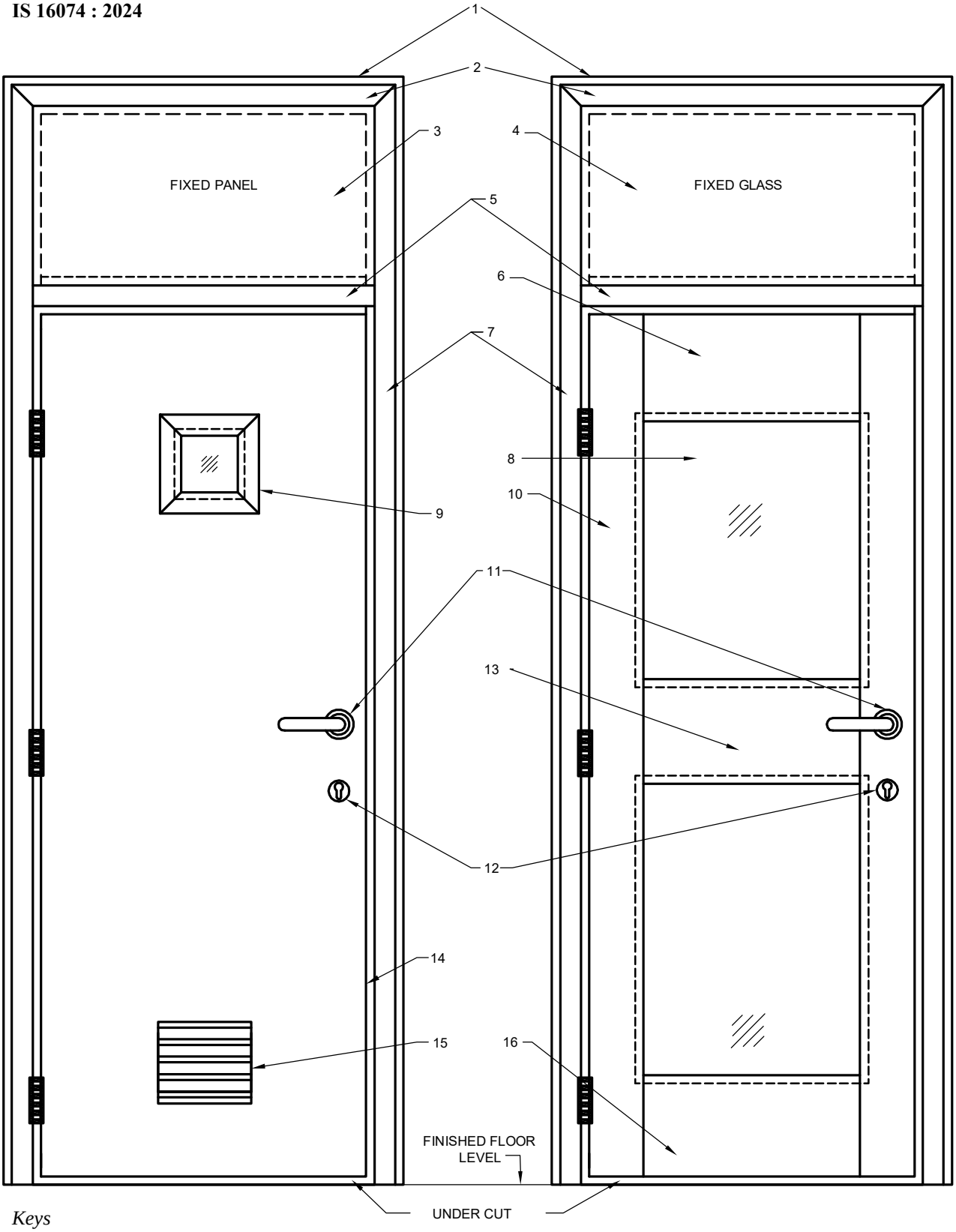
6 SIZES AND TOLERANCES

6.1 Wall Opening Size

Wall opening or the masonry opening is a finished plastered opening which is provided for fixing of frame inside the opening. For partition walls and steel structure the same will apply (*see* Fig. 2).

6.2 Frame Opening Size

Frame opening is the frame outer to outer dimensions as shown in Fig. 2 for widths and heights. This shall be less than the wall opening width for fixing the frame inside the opening. For masonry opening, steel and partition walls, the recommended gap on all three sides for fixing of frame is 5 mm.



Keys

1 Wall opening
2 Head jamb/head member
3 Fixed overpanel – Flush
4 Fixed overpanel – Glazed
5 Transom/Horizontal mullion
6 Top rail
7 Frame
8 Glazing
9 Vision pane/vision lite
10 Stile (hinge)
11 Lock with lever handle
12 Cylinder/escutheion
13 Mid rail
14 Flush shutter
15 Louver
16 Bottom rail

FIG. 1 DOOR TERMINOLOGY

6.3 Shutter Opening Size

Shutter opening size is calculated from the inside of the door frame for both width and height. This includes the gaps between the frame and the shutter, this is different from the actual shutter size. The actual shutter size will be 3 mm short from all three sides plus the bottom undercut as applicable (*see* Fig. 2).

6.4 Clear Passage Size

This is the dimension between the frame soffit for width and between soffit of head member and finished floor level for height.

NOTE — However, it need to differentiate between the frame clear passage and the actual clear passage while calculating the exact dimension for movement of equipment. Actual clear passage may get impacted because of the shutter thickness and hardware projection (*see* Fig. 2) in open condition.

6.5 Dimensions

The dimension of the wall opening shall be used to define the requirement of suitable frame and shutter for that opening. It is mentioned as width and height in millimetres (mm). The shutter's dimension calculation depends on the wall opening and face of the frame including the tolerances. The example of shutter's dimension calculation formula for Fig. 2 is given as follows:

Wall opening = Wall opening width (WOW) × Wall opening height (WOH)

Frame opening width (FOW) = WOW – 10 mm

Frame opening height (FOH) = WOH – 5 mm

Shutter width = FOW – [(Frame face × 2) + (Gap between frame and shutter 3 mm × 2)]

Shutter height = FOH – [(Frame face + 3) + undercut)]

Shutter width for double leaf door = FOW – [(Frame face × 2) + (Gap between frame and shutter 3 mm × 2) + Gap between two shutters 6 mm)]

Each door leaf width = Shutter width for double leaf door)/2

6.6 Sizes

The standard wall opening sizes shall be as per Table 2. Shutter width and height shall be declared by the manufacturer based on the standard wall openings mentioned in Table 2.

NOTE — Door shutter can be manufactured with other width and height for wall openings as agreed to between the manufacturer and the purchaser or as declared by the manufacturer.

6.7 Tolerances

The tolerances for door shutter widths, heights and thickness shall be as given in Table 3.

Table 1 Minimum Sheet Thickness as per Classification of Steel Door Shutters

(*Clauses* 5 *and* 7.1.3.3)

Sl No.	Material	Light Duty	Medium Duty	Heavy Duty	Extra Heavy Duty
		mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)	(6)
i)	Mild steel sheet	0.60	0.8	1.2	1.6
ii)	Galvanized steel sheet	0.60	0.8	1.2	1.6
iii)	Stainless steel sheet	0.50	0.6/0.8	1.2	1.6
iv)	Pre-painted galvanized steel sheet	0.60	0.8	NA	NA

Table 2 Standard Wall Opening Sizes

(*Clause* 6.6)

Sl No.	Door Type	Wall Opening Width (WOW)	Wall Opening Height (WOH)
		mm	mm
(1)	(2)	(3)	(4)
		Single Leaf Door	
i)	SD7	750	2 000/2 100
ii)	SD9	900	2 000/2 100
iii)	SD10	1 000	2 000/2 100
iv)	SD11	1 100	2 000/2 100
v)	SD12	1 200	2 000/2 100
		Double Leaf Door	
vi)	DD12	1 200	2 000/2 100
vii)	DD15	1 500	2 000/2 100
viii)	DD18	1 800	2 000/2 100
ix)	DD20	2 000	2 000/2 100
x)	DD22	2 200	2 000/2 100
xi)	DD24	2 400	2 000/2 100

NOTES

1 Sizes mentioned are for standard wall opening heights only, however additional heights can be provided as per manufacturer recommendation up to 2 400 mm, 2 700 mm and 3 000 mm.

2 Same will be applicable for doors with transoms and fixed panels.

3 Standard sizes of door frames are covered in IS 4351.

4 The standard widths and heights for steel flush door shutters may be arrived at as shown in Fig. 2. In case of modular height, it is taken from the finish floor level of the wall opening height.

Table 3 Tolerances on Dimension

(*Clause* 6.7)

Sl No.	Dimensions	Tolerance
		mm
(1)	(2)	(3)
i)	Shutter width	± 2
ii)	Shutter height	± 2
iii)	Shutter thickness	± 1.5

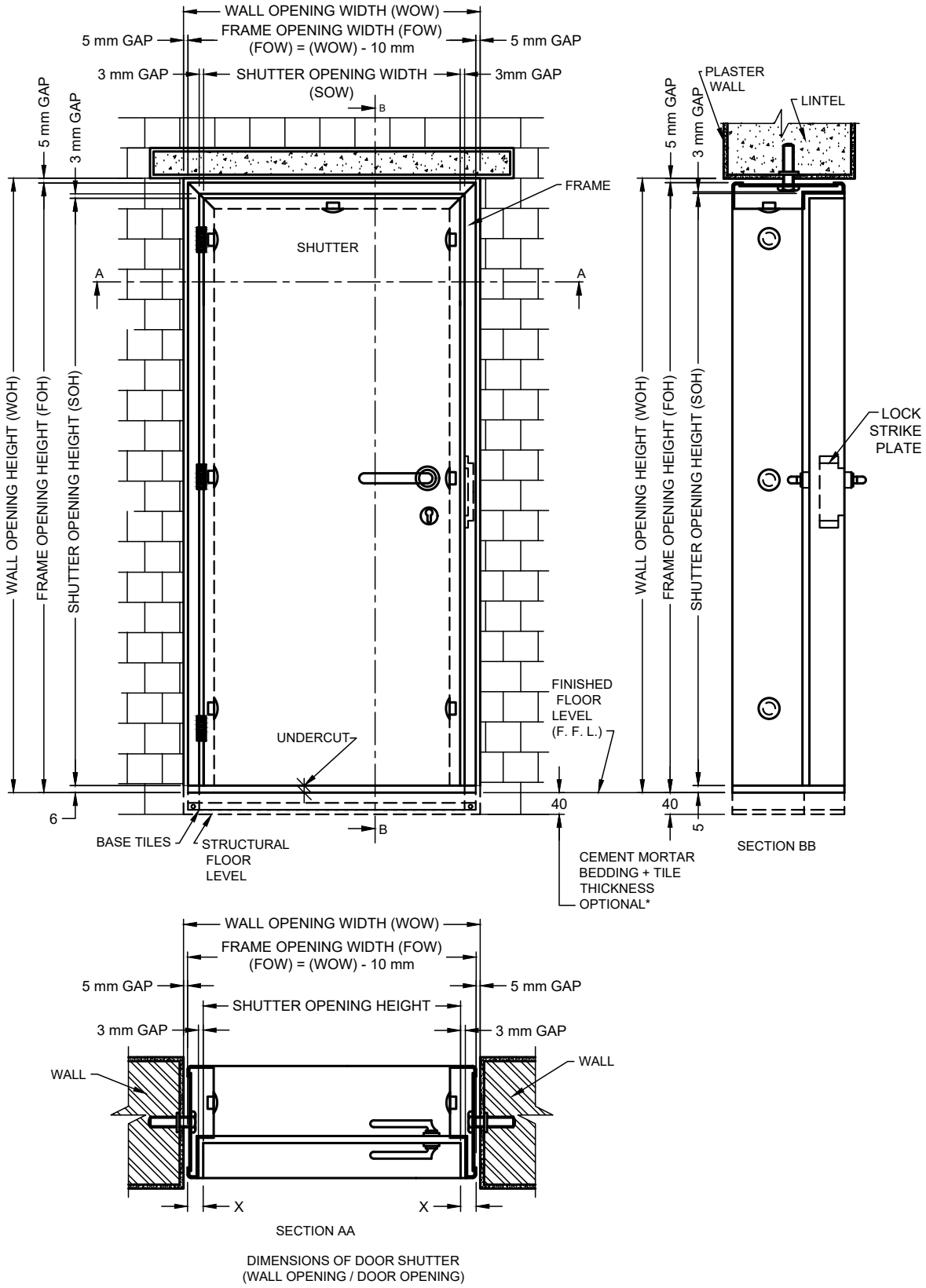


FIG. 2 WALL OPENING/FRAME OPENING/SHUTTER OPENING (WIDTH × HEIGHT)

6.8 Shutter Thickness

The nominal thicknesses of door shutters shall be 30 mm, 35 mm, 40 mm and 50 mm. The door shutter can be manufactured with thickness other than above as agreed between the manufacturer and the purchaser or as declared by the manufacturer. However, based on the classification (*see* 4) the minimum thickness of the shutter shall be as given in Table 4.

7 CONSTRUCTION AND WORKMANSHIP

Construction covers the requirements for shutter construction, including a vision panel, a louver and hardware preparation (if required).

The additional information for recommended installation guidance for doors and hardware are given in Annex B. As applicable, shutters shall be mortised, reinforced, drilled and tapped to receive mortised hinges, locks, latches, and flush bolts. An informatory annex on the list of Indian Standards on hardware used in doors is given in Annex C.

7.1 Shutter Construction

A door shutter may be constructed in multiple ways (*see* Fig. 3), namely, with or without seam vertical edges to form a double skinned shutter with different infill material.

7.1.1 *Joints*

7.1.1.1 *With seam doors*

Also known as the doors with an interlock on the vertical edge or stile of shutter. It has two skins, a pan and a lid, and they are interlocked to form a hollow section with infill material (*see* Fig. 3A).

7.1.1.2 *Without seam doors*

Also known as seamless doors, where in the interlock is not visible or is hidden by metal putty or by seamless welding to give a smooth vertical edge (*see* Fig. 3A).

The top and bottom of the door shall be closed with either flush or inverted channels or closures. The channels or closures shall have a minimum material thickness of 0.8 mm (*see* Fig. 3B).

7.1.2 *Infill Core*

Various infill materials are used as core material based on size, application. The infill core shall be one of the following materials.

7.1.2.1 *Honey comb kraft paper*

The core is made of a special resin bonded paper and is designed as a honeycell. This shall be glued on the inner surface of the door skin with special polyurethane resin (PUR) glue. It gives moderate sound reduction and minimal insulation (*see* Fig. 4A).

7.1.2.2 *Polyurethane foam (PUF) core*

The foam injected shall have a minimum 40 kg/m^3 density inside the hollow section of the door. The PUF or puff foams shall be conforming to IS 12436. It gives high insulation and minimal sound reduction (*see* Fig. 4B).

7.1.2.3 *Mineral wool core*

Use of mineral wool shall be defined by the density of the infill material. Minimum density of mineral wool for the infill material shall be 96 kg/m^3 and shall confirm to IS 8183. The mineral wool core shall be bonded to door skins with special polyurethane resin (PUR) (*see* Fig. 4C).

7.1.2.4 *Polystyrene core*

Expanded polystyrene of minimum density 20 kg/m^3 of self-extinguishing type in the form of finished boards or blocks conforming to IS 4671 shall be used as a core. The expanded polystyrene shall be bonded to door skins with special polyurethane resin (PUR) glue (*see* Fig. 4D).

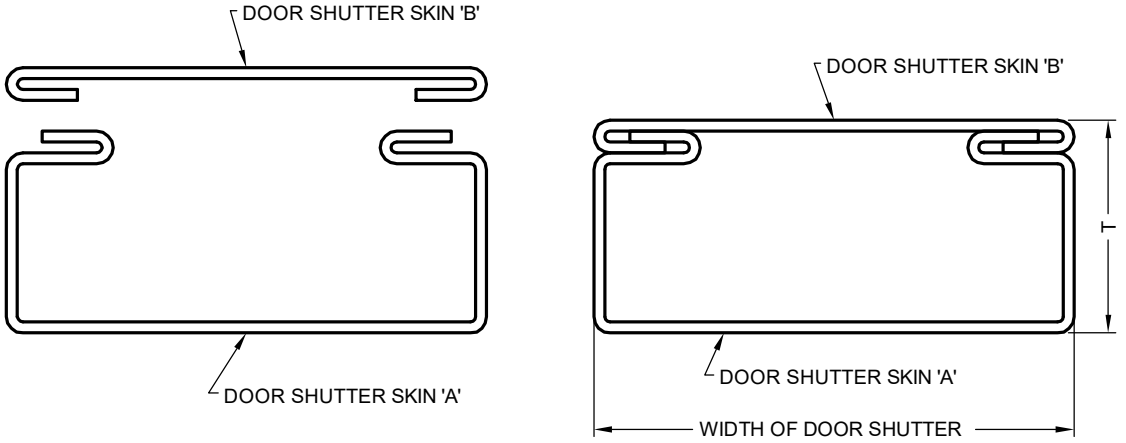
7.1.2.5 *Steel stiffened core*

It is a combination of vertical steel stiffeners and mineral wool as an infill material. Steel stiffeners minimum 0.8 mm, are spot welded forming U-section at an interval of 150 mm and filled with mineral wool/fiber glass as a infill material. Recommended use of this core is in doors meant for external application or subject to misuse (*see* Fig. 4).

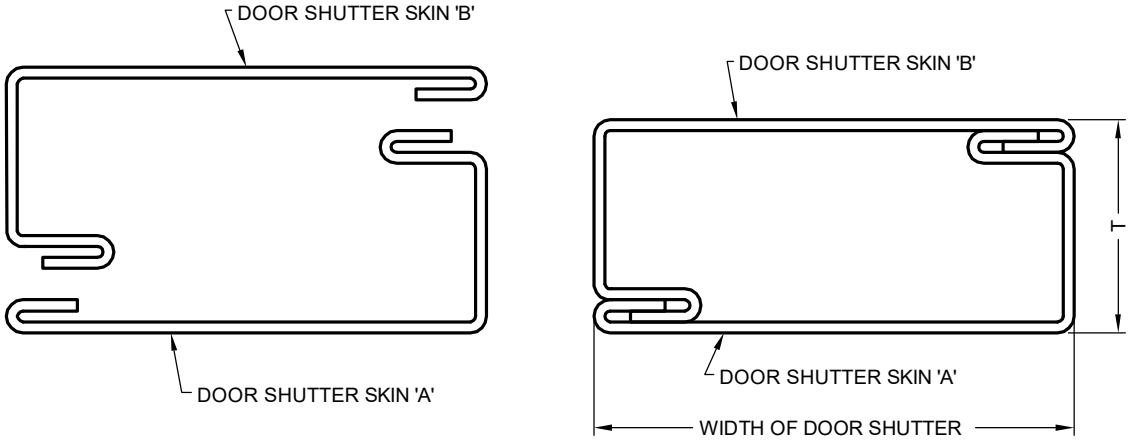
Table 4 Minimum Shutter Thickness

(*Clause* 6.8)

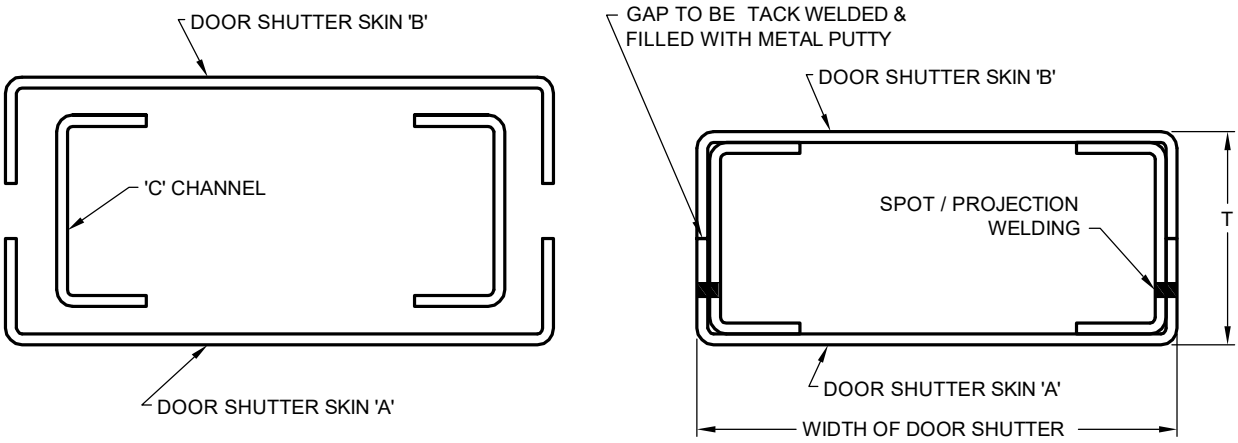
Sl No.	Classification	Minimum Shutter Thickness mm
(1)	(2)	(3)
i)	Light Duty	30
ii)	Medium Duty	35
iii)	Heavy Duty	40
iv)	Extra Heavy Duty	45



LOCK SEAM JOINT - ONE SIDE



LOCK SEAM JOINT - OPPOSITE SIDE



SEAMLESS JOINT

3A DIFFERENT TYPES OF VERTICAL JOINTS OF A SHUTTER PANEL

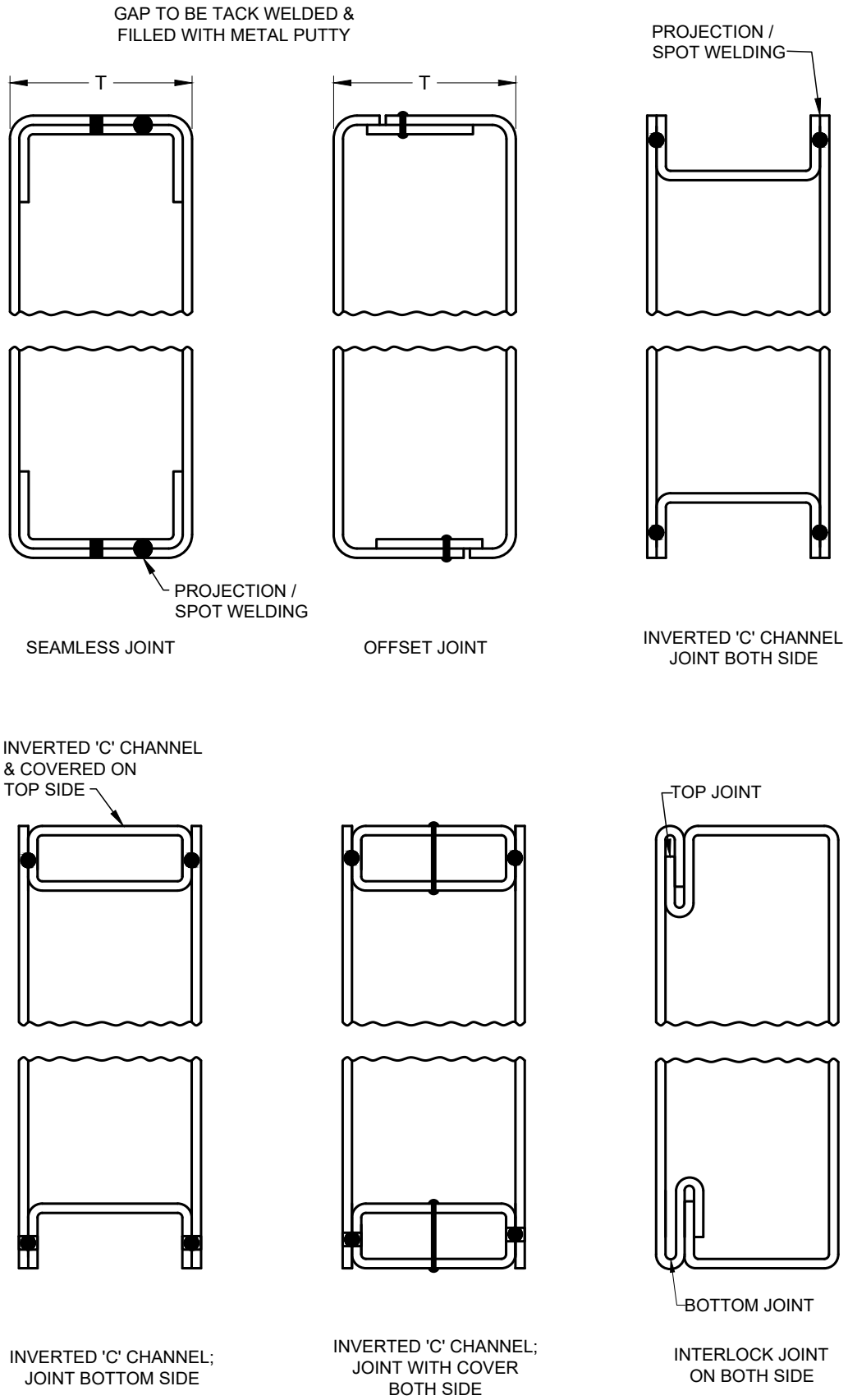
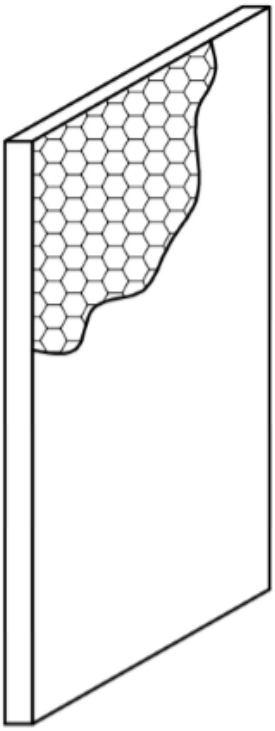
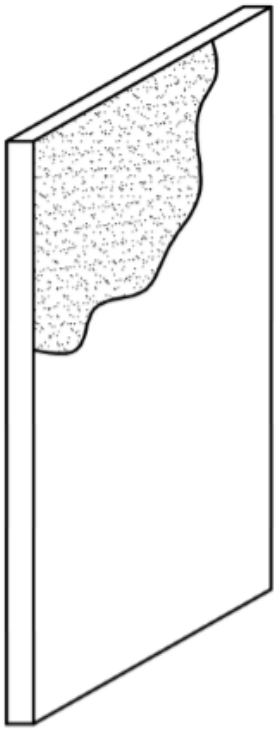


FIG. 3B DIFFERENT TYPES OF JOINTS AND FIXING AT TOP AND BOTTOM OF A SHUTTER PANEL

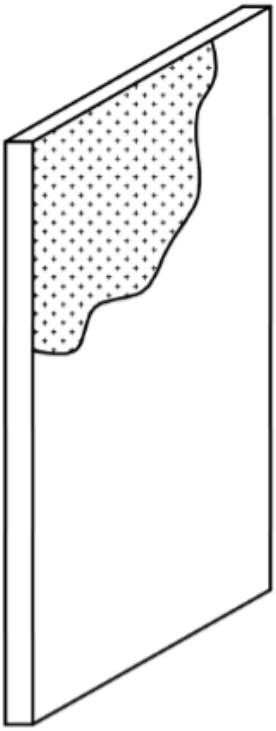
FIG. 3 TYPICAL ILLUSTRATION OF DOOR SHUTTER CONSTRUCTION



4A HONEYCOMB KRAFT PAPER CORE

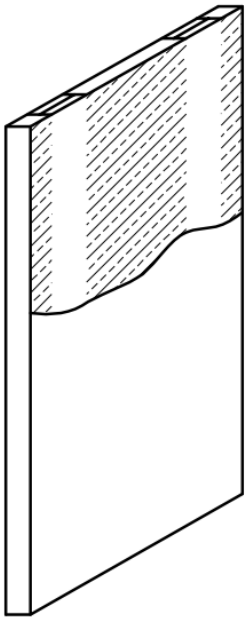


4B POLYURETHANE FOAM CORE



4C MINERAL WOOL CORE

4D POLYSTYRENE CORE



4E STEEL STIFFENED CORE FILLED WITH MINEREAL WOOD

FIG. 4 DIFFERENT TYPES OF INFILL MATERIAL CORES

7.1.3 *Overall Construction*

The door shutters shall be suitably reinforced from inside based on the construction, hardware to be mounted and type of material like galvanized steel, pre-coated steel, etc. Similarly, for doors with mineral wool, there is a possibility of infill material sagging due to lower density of mineral wool, hence it is recommended to provide additional steel channels to stop any sagging when the door is in operation.

7.1.3.1 *Fully flush door*

A design of door formed from two sheets of metal, top and bottom of the door may be either flush, or closed with recessed channel end closures. There will not be any recess on the face of the double skin door leaf for glass pane and louvers. Seams shall not be visible on surfaces other than door edges only.

7.1.3.2 *Rail and stile door*

Door shutter consisting of one center panel and one lock stile and one hinge stile. Stiles are butted to and interlock with panels. Door shutter using stiles and rails either mitred or butted, the corner joints being welded shall be ground smooth. Panels interlock with the stiles and rails, and are stiffened by internal reinforcing joint lines between the panels, stiles and rails may be left visible. Minimum size of the rail and stile can be varied from manufacturer to manufacturer. However, it is recommended to have a minimum size of 100 mm rail or stile to accommodate hardware. Maximum size of the rail and stile shall not exceed 150 mm.

7.2 Vision Panel

When doors are desired to contain glazed openings, the manufacturer's standard vision panel kit shall be supplied. This may be of multiple sizes and shapes. Vision pane fixing varies from manufacturer to manufacturer, some of the widely used method includes, clip on arrangement, surface mounting with screws and beeding stop. Care shall be taken in making sure that the screws are not visible on the non-secured side. Examples of vision panel fixing with beading and clipon are as given in Fig. 5A and Fig. 5B respectively. The glass used shall be of minimum thickness not less than 4 mm and conforming to IS 2835 or IS 2553 (Part 1). Position of the vision panel shall be minimum 125 mm away from the edge of the shutter and the centreline of the vision panel from the finished floor level (FFL) may vary based on purchaser requirement and the application. For the location of vision panel on shutter (*see* Fig 6).

7.3 Louvres

Louvre is the opening in the door with a series of slats or blades to allow passage of air. As and when required, standard steel doors can be provided with a variety of louver designs and sizes. Louvres commonly used in standard steel doors are of the 'insert' type designed to be mounted into a cutout in the door and an overlapping frame. Inverted 'V' blade, 'Z' blade and inverted 'Y' are available in a wide range of sizes. Insert louvres intended for exterior doors or other doors where security is a consideration, the design requirements of the louvres shall be agreed between the steel door manufacturer and the purchaser. A clear space of minimum 100 mm on vertical and top side, and 200 mm from bottom of door shutter shall be kept between the edge of the door shutter and the louvres opening (*see* Fig. 6).

7.4 Astragal

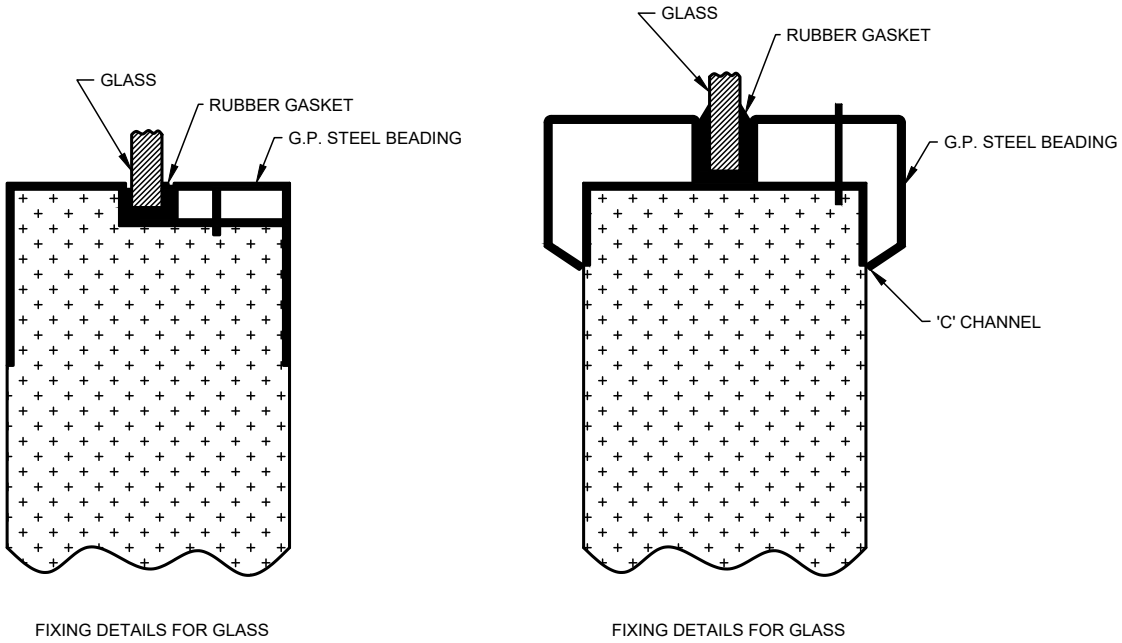
Astragals are required for pair of door shutters to close the gap on the meeting stile of the door. Astragals can be either integrated or surface mounted. Astragals may or may not be required on pairs of doors. Pairs of door shutters that do require an astragal shall have at least one that projects a minimum of 20 mm beyond the edge of the door to which the astragal is attached. Pairs of doors that are required in a means of egress may not be equipped with an astragal that inhibits the free use of either leaf (*see* Fig. 7).

7.5 Workmanship

All the four edges of the shutter shall be square and rounded ensuring that there are no sharp edges or burrs which might hurt the end user during usage. No visible welding joints and sharp corners shall be allowed on either side of the surface of the shutter unless otherwise agreed between the manufacturer and the purchaser. The dimension tolerances shall be ± 1.5 mm, for all the applicable components of the door shutter construction. All welding shall be grinded, smoothened and phosphated to give additional protection before taking it for finishing the product.

7.6 Hardware Reinforcement

Provide hardware reinforcement of minimum sheet thickness as shown in Table 5. For additional information, *see* Annex B for recommended installation guide for doors and hardware. For details of hardware reinforcement *see* Fig. 8. As applicable, door shutters shall be reinforced, drilled and tapped to receive mortised hinges, locks, latches, and flush bolts.



5A VISION PANEL FIXING WITH BEADING

5B VISION PANEL FIXING WITH CLIPON

FIG. 5 EXAMPLES OF VISION PANEL FIXING

Table 5 Minimum Sheet Thickness of Hardware Reinforcement Thickness

(*Clauses* 7.6, 7.6.2 *and* 7.6.3)

Sl No.	Hardware Item	Sheet Thickness	
		mm	Gauge (*see* Note)
(1)	(2)	(3)	(4)
i)	Hinges	3.0	10
ii)	Mortise lock or deadbolt	1.6	16
iii)	Bored lock or deadbolt	1.6	16
iv)	Flush bolt front	1.6	16
v)	Surface bolt	1.6	16
vi)	Surface applied closer	1.6	16
vii)	Hold open arm	1.6	16
viii)	Pull plates and bar	1.2	18
ix)	Surface exit device	1.6	16
x)	Floor checking hinge	4.0	7
xi)	Pivot hinge	4.0	7
xii)	Continuous hinge	Not required	
xiii)	Kick plate/push plate	Not required	

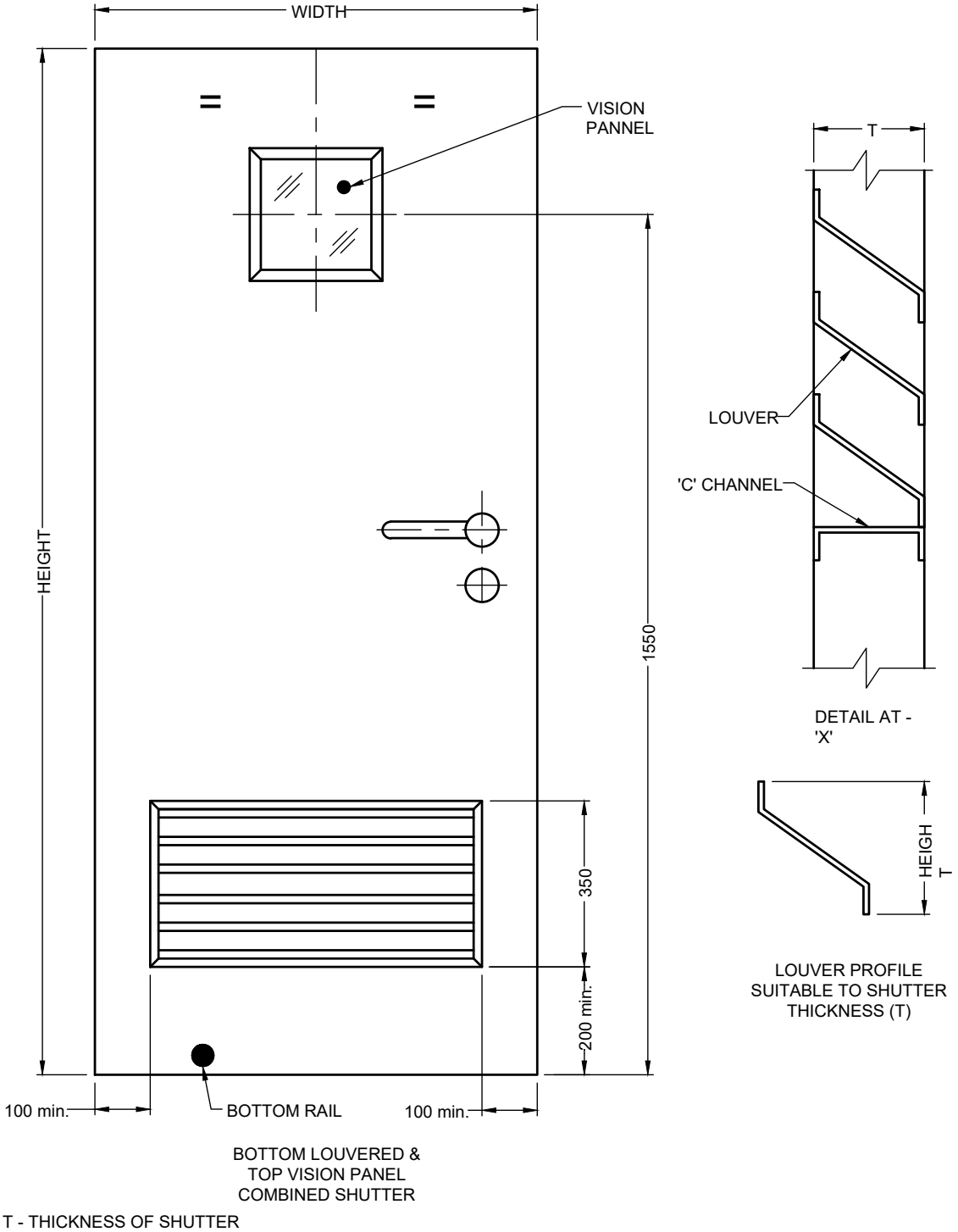
NOTE — Gauge to be used for reference purposes only.

7.6.1 *Hinges*

All doors up to 50 mm thickness shall have hinge of minimum size 100 mm × 75 mm × 3 mm and for doors above 50 mm thickness, the minimum size of hinges shall be 100 mm × 89 mm × 3 mm for better coverage on the door stile. A cutout of size suitable to hinges shall be made in door skin. The template drilled and tapped hinge plates of steel strips of minimum thickness 3 mm shall be welded in the cutout and hinges shall be fixed with machine screw conforming to IS 1365 (*see* Fig. 9). In case of composite thickness of hinge plate and steel channel, the minimum thickness shall be 3.6 mm. *See* Table 6 for the recommended type of hinges for door shutters.

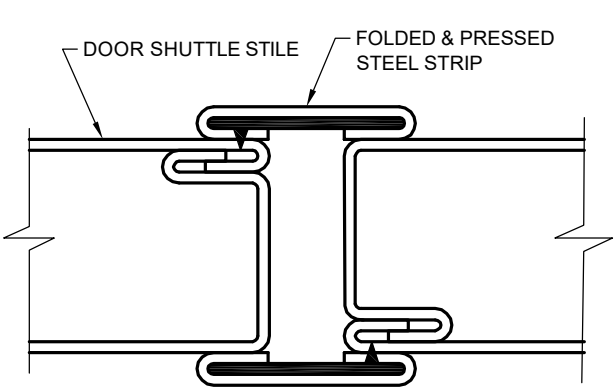
7.6.2 *Mortise/Rim Lock/Night Latch/Dead Bolt*

Provision shall be made to fix these hardware fittings. The slot and hole suitable for the lock shall be pierced into the door shutterand stiffeners of steel sheet of minimum thickness as mentioned in the Table 5.

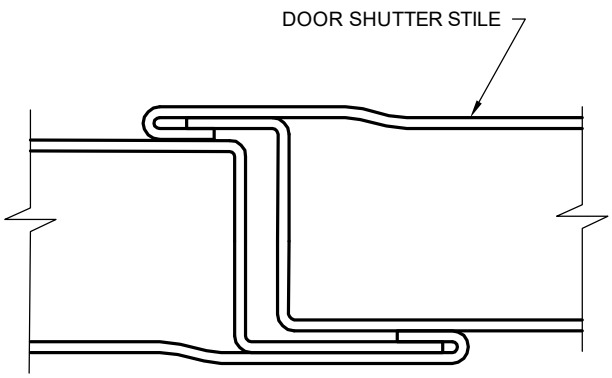


All dimensions in millimetres.

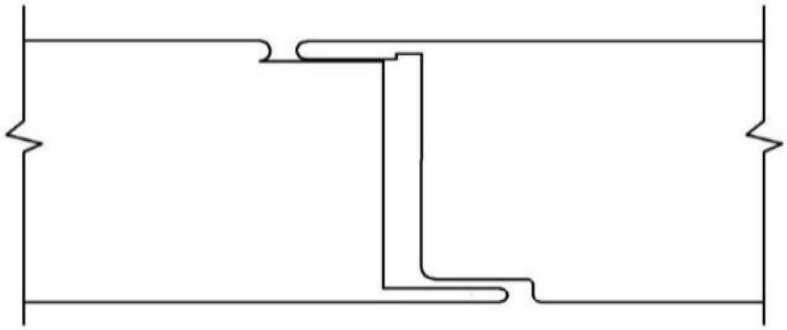
FIG. 6 EXAMPLE OF LOCATION OF VISION PANEL AND LOUVRE ON SHUTTER



7A OVERLAP STRIP ON BOTH SIDE



7B INTEGRAL ASTRAGAL PROJECTED TYPE



7C INTEGRAL ASTRAGAL PROJECTED TYPE

FIG. 7 EXAMPLE OF TYPES OF ASTRAGALS

Table 6 Recommended Types of Hinges to be Used for Door Shutter

(*Clause* 7.6.1)

SI No.	Type of Hinge	Size of Hinge mm			Refer to Indian Standard	Suitable for Shutter Thickness mm
		Length	Breadth	Thickness		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Steel butt hinge — Medium weight	100	58	1.9	IS 1341	–
ii)	Stainless steel ball bearing hinges	100	58	2.5	–	–
iii)	Stainless steel butt hinges	100	58	1.9	IS 12817	30 to 35
iv)	Mild steel parliament hinges	125	100	2.5	IS 362	–
v)	Steel rising butt hinges	100	65	2	IS 9106	–
vi)	Stainless steel ball bearing butt hinges	100	75	3	–	40 to 50

7.6.3 *Flush Bolt* (*Concealed*), *Handle, Door Closure*, *Door Stopper*

Provisions shall be made for these hardware fittings in the door shutter as agreed to between the manufacturer and the purchaser or as per the architectural drawings declaration given by the purchaser. Necessary stiffeners as mentioned in the Table 5 shall be welded in the inner side of the door shutter. The drilling and tapping for fixing of these hardware fittings shall be done at the site.

7.6.4 *Surface Exit Device, Panic Bar, Floor Checking Hinge, Door Hold Open Arm*

Provisions shall be made for these hardware fittings in the door shutter as agreed to between the manufacturer and the purchaser or as per the architectural drawings declaration given by the purchaser. Necessary slots or holes shall be made in the factory and drilling and taping shall be done at site as required.

7.6.5 S*urface Applied Hardware*

When specified, doors and frames shall be reinforced for surface applied hardware. If required, the drilling and/or tapping may be done at site for all surface applied hardware.

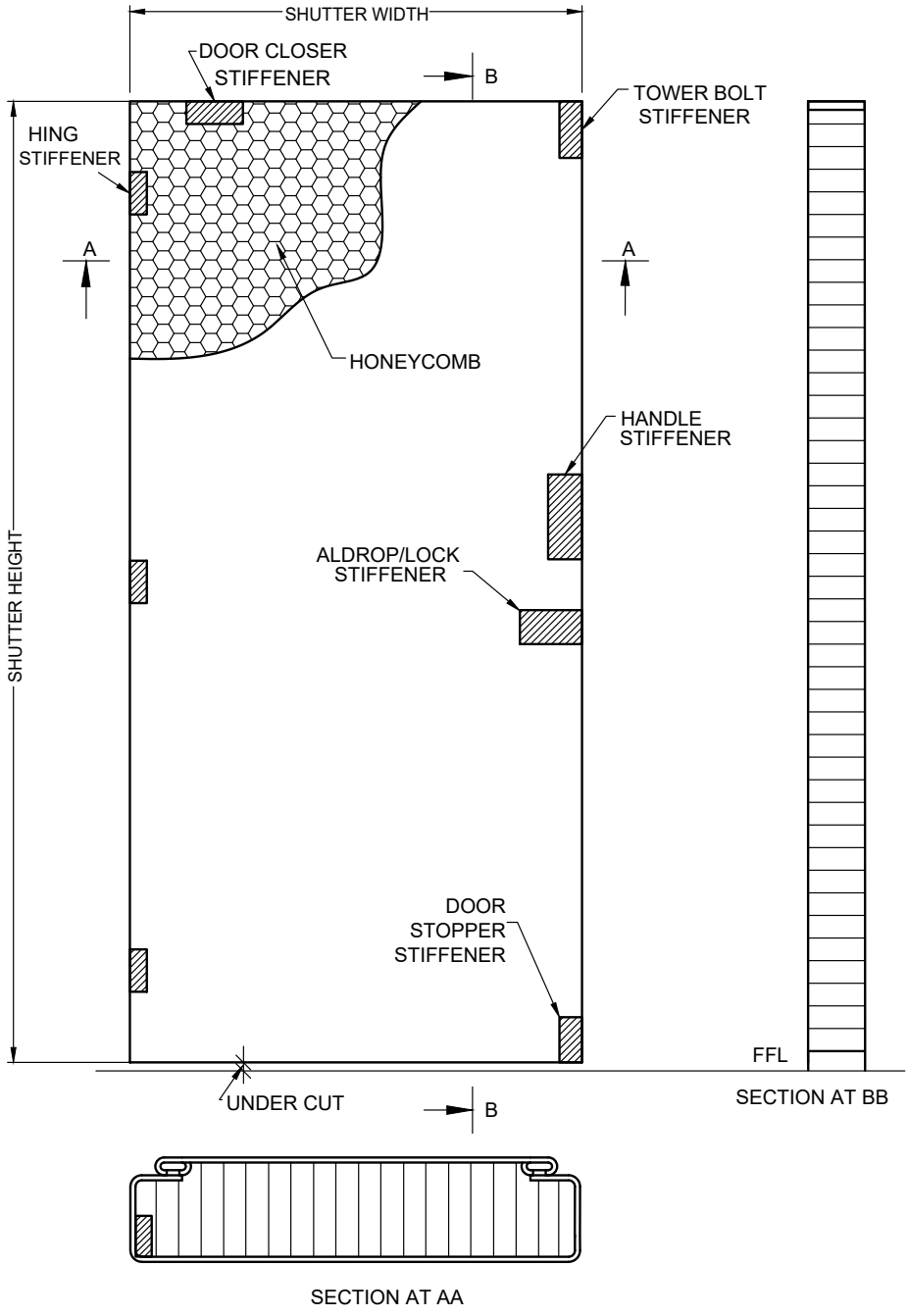


FIG. 8 TYPICAL DETAILS OF HARDWARE REINFORCEMENT SHUTTER

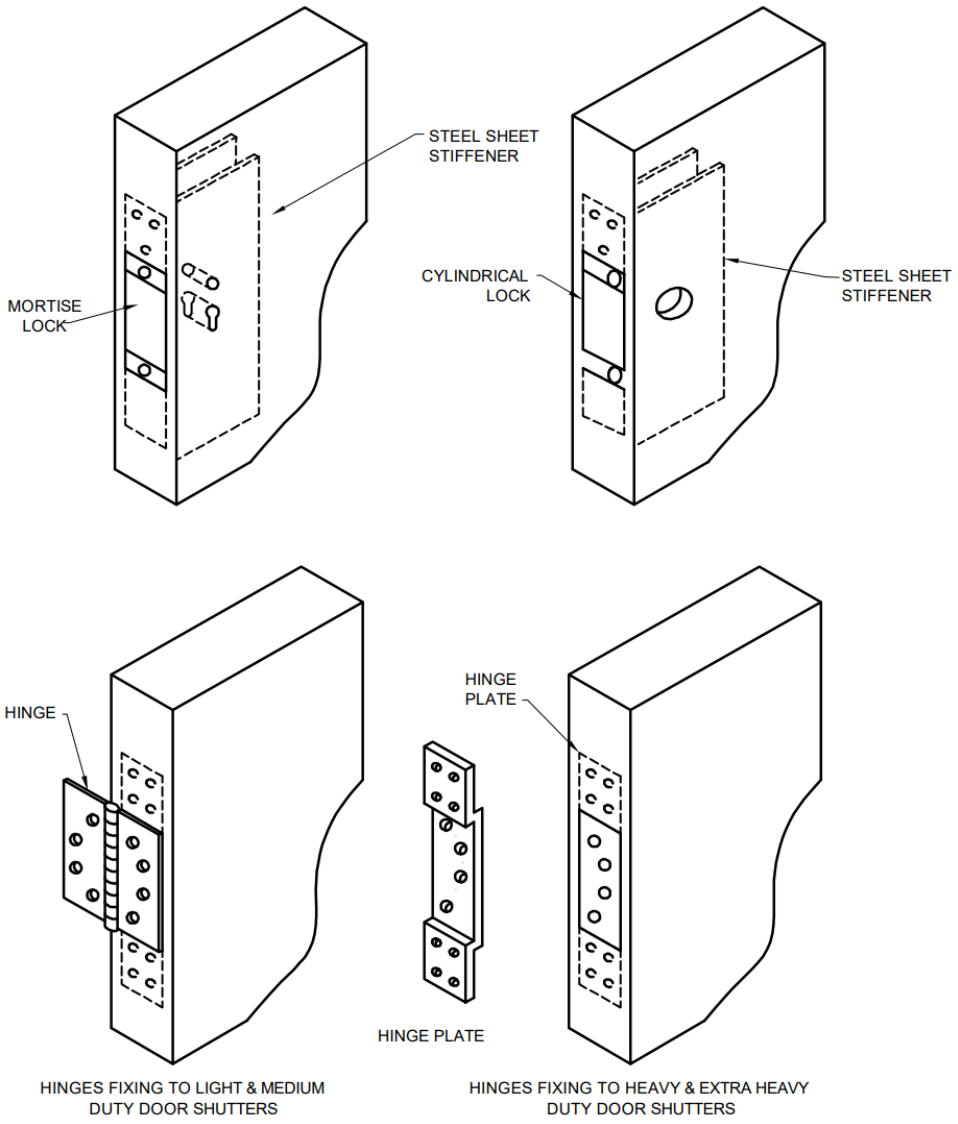


FIG. 9 EXAMPLES MORTISE LOCK AND HINGE PREPARATION

7.6.6 *Function Holes*

The preparation for locks and/or exit devices shall include reinforcements.

7.6.7 *Anchor or Pivot Reinforced Hinges*

Where anchor or pivot hinges are desired, the appropriate recessing and reinforcing shall be provided. Mounting holes shall be field drilled and tapped by others.

7.6.8 *Hinge Location*

The minimum number of hinges to be provided based on height of the wall opening are given in Table 7 and for recommended location of fixing of hinges (*see* Fig. 10). For shutter width more than 1 110 mm, one more number hinge shall be provided to the number indicated in Table 7.

7.6.9 *Hardware Locations*

The recommended location for hardware on the door shutter is given in Table 8. Other items of hardware shall be located according to the door and/or hardware manufacturer's directions. This includes the door closers, floor springs, overhead door holders, pocket pivot, and any specialized purpose hardware.

Table 7 Minimum Hinge Quantity Per Door

(*Clause* 7.6.8)

Sl No.	Wall Opening Height mm	Minimum Number of Hinges
(1)	(2)	(3)
i)	2 100	3
ii)	2 200	4
iii)	2 300	4
iv)	2 400	4
v)	2 500	5
vi)	2 600	5
vii)	2 700	5
viii)	2 800	6
ix)	2 900	6
x)	3 000	6

Table 8 Recommended Hardware Location

(*Clause* 7.6.9)

Sl No.	Hardware Items	Locations
(1)	(2)	(3)
i)	Locks, latches, roller latches and double handle sets	900 mm to 1 100 mm centerline of lock strike from bottom of frame
ii)	Rim and mortise panic devices	
iii)	Aldrop	800 mm to 1 000 mm centerline from FFL
iv)	Cylindrical and mortise deadlocks (*see* Note)	1 219 mm (48") to centreline of strike from bottom of frame
v)	Push plates	1 150 mm from bottom of frame
vi)	Pull plates	Centreline of grip 1 050 mm from bottom of frame
vii)	Combination push bar:	Centreline of 1 050 mm from bottom of frame
viii)	Hospital arm pull	Centreline of lower base is 1 143 mm (45") from bottom of frame with grip open at bottom

NOTE — Cylindrical and mortise deadlock strikes will be located at 1 219 mm (48") from the bottom of the frame unless otherwise specified.

8 WORKMANSHIP AND FINISH

8.1 Pre-treatment and Phosphating

8.1.1 *Door Shutters of Mild Steel Sheet*

The surface of the door shutters manufactured from cold rolled mild steel sheet shall be thoroughly cleaned so as to be free from rust, dirt and oil, etc, by chemical means like pickling and phosphating [for guidance *see* IS 1477 (Part 1)]. The shutters shall then be finished with either painting or powder coating, as agreed to between the manufacturer and the purchaser.

8.1.2 *Door Shutters of Galvanized Plain Steel Sheets*

The surface of the door shutters manufactured from galvanized plain steel sheet shall be pre-treated and phosphated by chemical means [for guidance *see* IS 1477 (Part 1)]. No pickling isrequired for galvanized surface. The shutters shall be finished with either painting or powder coating, as agreed to between the manufacturer and the purchaser or declared by the manufacturer.

8.1.3 *Stainless Steel Door Shutters*

The surface of the stainless steel shutters shall be pre-treated as per the procedure laid down in IS 1477 (Part 1), in which pickling shall be carried out by using mixed acid of nitric plus hydrofluoric acid and the surface passivated by using nitric acid followed by rinsing with water and drying. Unless otherwise specified by the purchaser, stainless steel door shutters need not be painted or powder coated.

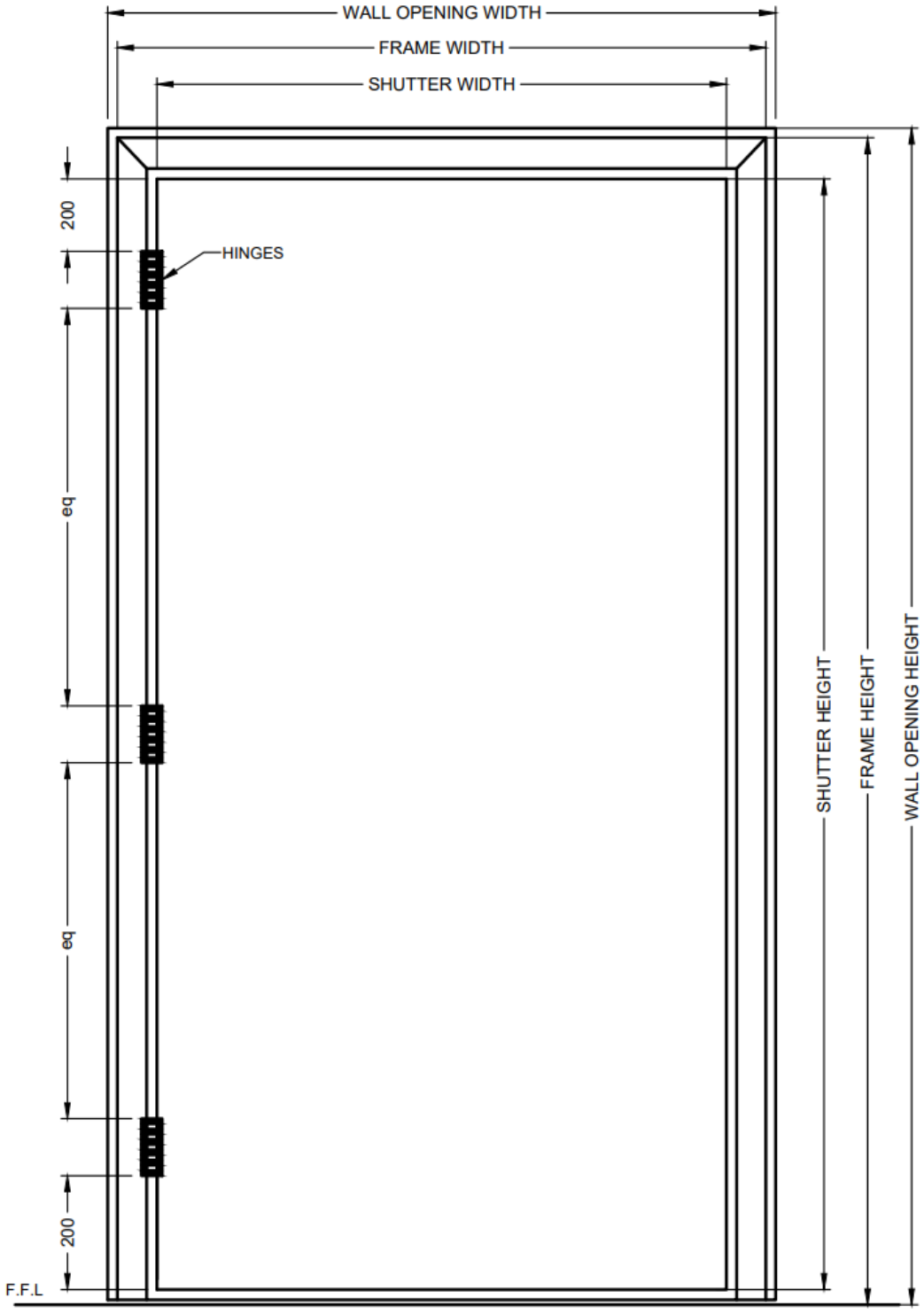
8.2 Painting

8.2.1 *Prime Finish*

Doors shall be thoroughly cleaned and chemically treated to insure maximum paint adhesion. All surfaces of the door shutter exposed to view shall have coat of rust inhibiting primer, either air-dried or baked-on.

8.2.2 *Factory Applied Finish Paint*

When specified by purchaser, doors shall be finish painted on all surfaces of the door exposed to view. The type of paint and colour may be as agreed to between the manufacturer and the purchaser.



All dimensions in millimetres.

FIG. 10 RECOMMENDED HINGE LOCATION

8.3 Powder Coating

Where the door shutter is to be finished by powder coating, the surface of the shutter shall be provided with powder coating conforming to IS 13871, after pre-treatment and phosphating. The colour of the coating shall be as agreed to between the purchaser and the manufacturer.

8.4 Wood Grain Effect Finish

For wood grain effect finish, after pre-treatment and phosphating, the surface of the shutter shall be given wood grain effect finish either by powder coating and sublimation of polyester film or by staining wood grain effect with special liquid paint. The colour shade that is, natural teak, walnut, dark mahogany, moorish teak, pine, oak, beech, etc, can be as agreed between the manufacturer and the purchaser or as declared by the manufacturer.

8.5 Pre-painted Sheet

Door shutter shall be manufactured from pre-painted galvanized or aluminum zinc alloy metallic coated steel sheet (plain). The colour shade of pre-painted door shutter as agreed between the manufacturer and the purchaser or as declared by the manufacturer.

9 DOOR HANDING

Door handing requirements shall be based on the following criteria, for both single leaf door handing (*see* Fig. 11A) and for double leaf (*see* Fig. 11B):

a) Door handing shall be ascertained from the locking side/key side or the side from which it is to be secured. It is usually outside. For example, for a main entrance door or the bed-room door, the locking side will be the outside or the key side; and

b) Check the opening direction of the door if it is opening away or towards:

   1) If it is opening away and an user is using the left hand to push open then it is called a left hand door (LH);

   2) If it is opening away and an user is using the right hand to push open then it is called a right hand door (RH);

   3) If it is opening towards and an user is using the left hand to pull open then it is called a left hand reverse door (LHR); and

   4) If it is opening towards and an user is using the right hand to pull open then it iscalled a right hand reverse door (RHR).

10 TESTS

The following tests shall be conducted on the door shutter in accordance with IS 4020 (Parts 1 to 16).

10.1 Dimensions and Squareness Test

When tested in accordance with IS 4020 (Part 2), the width and height of the door shutters shall be within the limit specified in 6.7. 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 the limit specified in 6.8.

10.2 General Flatness Test

When tested in accordance with IS 4020 (Part 3), the twist, cupping and warping in door shutter shall not exceed 5 mm.

10.3 Local Planeness Test

When tested in accordance with IS 4020 (Part 4), the depth of deviation measured at any point of the door shutter shall not be more than 0.5 mm.

10.4 Impact Indentation Test

When tested in accordance with IS 4020 (Part 5), the door shutter shall have no defect, such as, cracking, tearing or delamination and the depth of indentation shall not be more than 0.2 mm for ‘light duty and medium duty’ shutters and not more than 0.1 mm for ‘heavy duty and extra heavy duty’ shutters.

10.5 Flexure Test

Door shutters when tested in accordance with IS 4020 (Part 6), the deflection at the maximum load shall not be more than one fifteenth of the length and one twentieth 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.

10.6 Edge Loading Test

When tested in accordance with IS 4020 (Part 7), the deflection of the edge of the door shutter at the maximum load shall not be more than 5 mm. On removal of the load, 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. There shall be no lateral buckling by more than 2 mm during loaded condition and no residual lateral buckling of more than 1 mm after removal of the load.

10.7 Shock Resistance Test

10.7.1 When tested in accordance with **2.1** of IS 4020 (Part 8), there shall be no visible damage in any part of the door shutter after twenty-five blows on each end of the shutter.

10.7.2 When tested in accordance with **3.1** of IS 4020 (Part 8), the normally hung door shutter with hangings, fixing and fastenings shall withstand without any significant permanent deformation and without deterioration after five impacts on both sides of the shutter.

10.8 Buckling Resistance Test

When tested in accordance with IS 4020 (Part 9), the door shutter shall not show any deterioration and residual deformation of more than 5 mm after 15 min of unloading. The initial deflection, 5 min after application of load, shall be not more than 25 mm.

10.9 Slamming Test

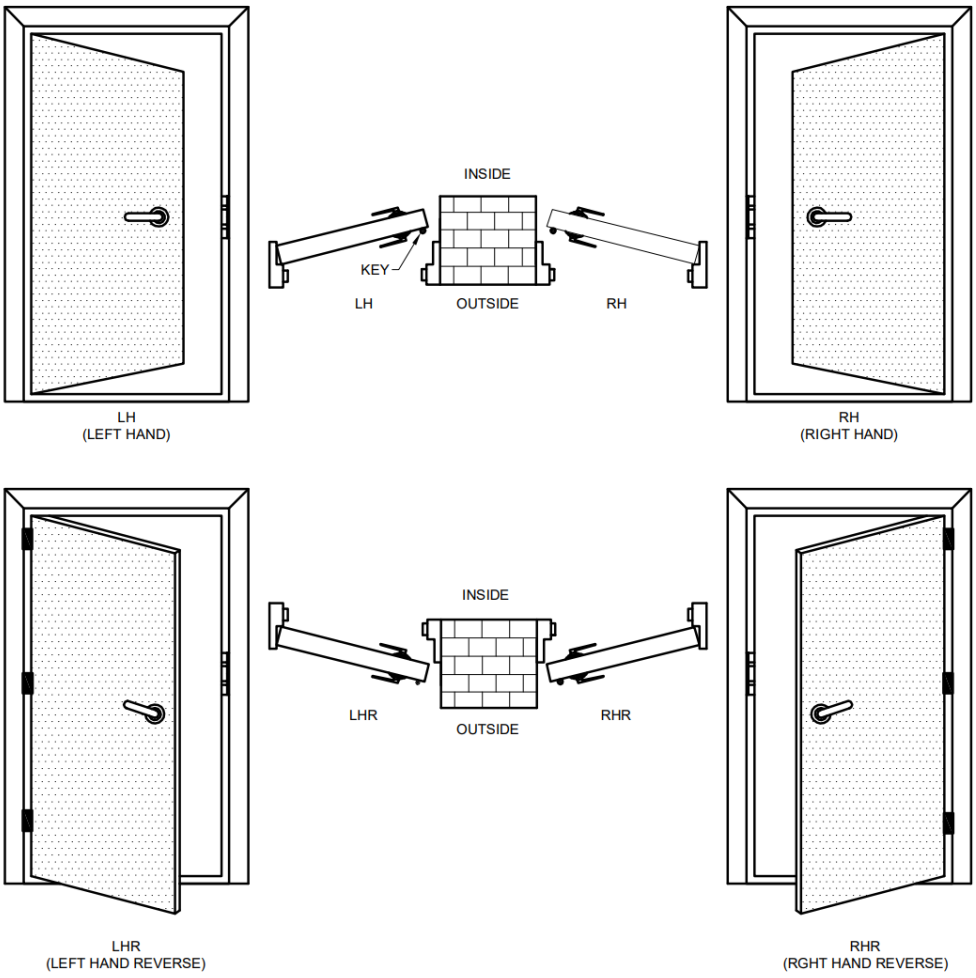
10.9.1 Any one of the following tests given in 10.9.2 and 10.9.3 shall be used.

10.9.2 When tested in accordance with **2.1** of IS 4020 (Part 10), the door shutter shall not have any visible damage in any part of the door at the end of 50 successive impacts.

10.9.3 When tested in accordance with **3.1** of IS 4020 (Part 10), the door shutter shall not have any visible damage in any part of the door at the end of 100 successive impacts.

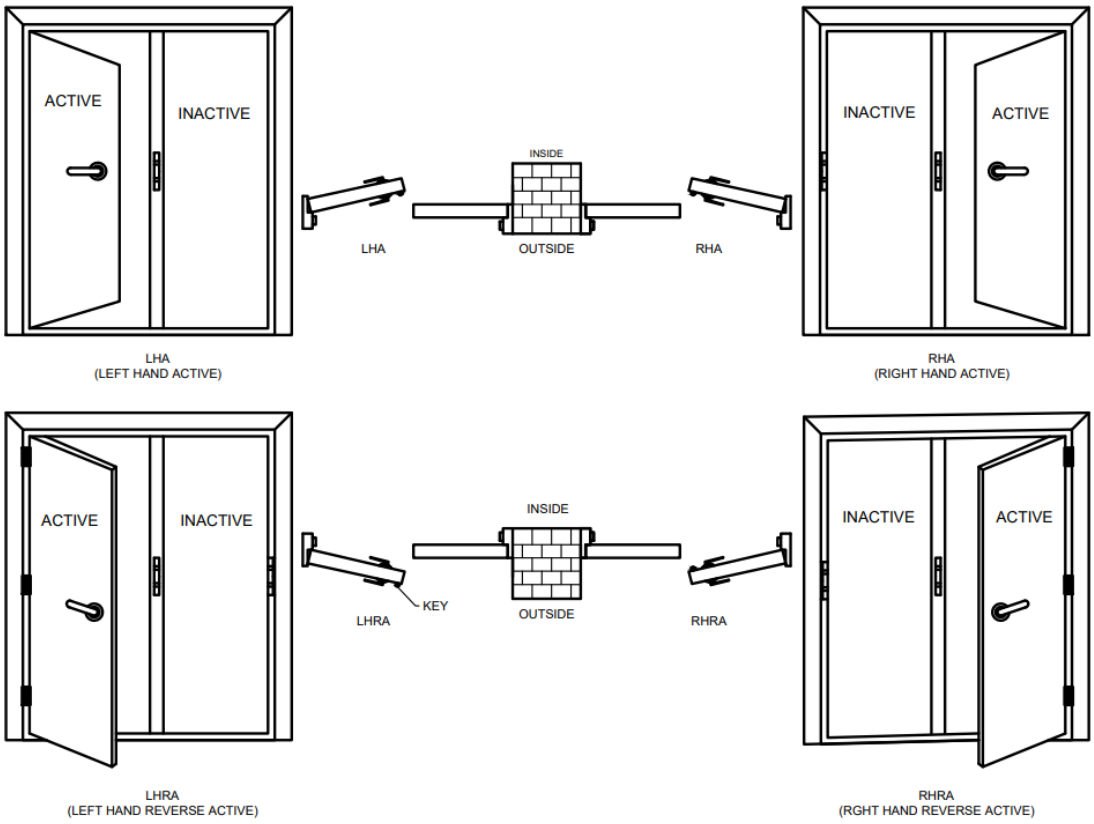
10.10 Misuse Test

When the door shutter is tested in accordance with IS 4020 (Part 11), there shall not be any deformation of the fixing or any other part of the door-set in hindering its normal working after the test.



NOTE — To identify the handling of doors refer from key side (always key is outside)

11A DOOR HANDING FOR SINGLE LEAF DOOR



NOTE — To identify the handling of doors refer from key side (always key is outside)

11B DOOR HANDING FOR DOUBLE LEAF DOOR

FIG. 11 DOOR HANDING FOR DIFFERENT DOORS

11 SAMPLING AND CRITERIA FOR CONFORMITY

11.1 Lot

In any consignment, all the steel door shutters of the same duty type and with same construction, and manufactured under similar conditions of production shall be grouped together to constitute a lot.

The sampling and criteria for conformity for steel door shutters shall be as given below.

11.2 Sample Size

11.2.1 The number of specimens to be taken for testing of shutters for dimensions and squareness, general flatness and local planeness shall be in accordance with col (3) of Table 9.

11.2.2 For slamming test, the number of shutters to be taken for testing shall be as per col (5) of Table 9.

11.2.3 For impact indentation test, one shutter shall be tested on production of 1 000 shutters of the same size, duty and construction.

11.2.4 For flexure, edge loading, shock resistance, misuse and buckling resistance tests, the shutters shall be tested once a year and whenever the design and construction is changed.

11.2.5 *Criteria for Conformity*

The lot shall be declared as conforming to the requirements of the standard when the number of defective samples does not exceed the permissible number given in col (4) of Table 9.

12 MARKING

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

a) Name of the manufacturer;
b) Year of manufacture/batch number;
c) Shutter height, width and thickness;
d) Classification of shutter (*see* 4); and
e) Suitable for wall opening size.

12.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

13 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser shall supply the following information at the time of placing the order:

a) Type of door shutter including frame as per the nomenclature;
b) The classification, size, handing of door (right or left) and the way the door is required to open (inward or outward);
c) Whether single or double leaf door;
d) Details of hardware schedule fittings and accessories like hinges, mortise locks, latches, door closer and handles, etc; and
e) Door shutter finishes to be provided.

Table 9 Sample Size and Criteria for Conformity

(*Clause* 11.2.1, 11.2.2 *and* 11.2.5)

Sl No.	Lot Size	Sample Size	Permissible Number of Defectives	Sub-Sample Size
(1)	(2)	(3)	(4)	(5)
i)	Up to 50	5	0	1
ii)	51 to 100	8	0	2
iii)	101 to 150	13	1	2
iv)	151 to 300	20	2	3
v)	301 to 500	32	3	4
vi)	501 and above	50	5	5

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 277 : 2018	Galvanized steel strips and sheets (plain and corrugated) — Specification (*seventh revision*)
IS 362 : 1991	Parliament hinges — Specification (*fifth revision*)
IS 1341 : 2018	Steel butt hinges — Specification (*sixth revision*)
IS 1365 : 2022	Slotted countersunk flat head screws — Product Grade A (*fifth revision*)
IS 1477 (Part 1) : 1971	Code of practice for painting of ferrous metals in buildings: Part 1 Pretreatment (*first revision*)
IS 2553 (Part 1) : 2018	Safety glass — Specification: Part 1 Architectural, building and general uses (*fourth revision*)
IS 2835 : 1987	Specification for flat transparent sheet glass (*third revision*)
IS 4020	Door shutter — Methods of Tests:
(Part 2) : 1998	Measurement of dimensions and squareness (*third revision*)
(Part 3) : 1998	Measurement of general flatness (*third revision*)
(Part 4) : 1998	Local planeness test (*third revision*)
(Part 5) : 1998	Impact indentation test (*third revision*)
(Part 6) : 1998	Flexure test (*third revision*)
(Part 7) : 1998	Edge loading test (*third revision*)
(Part 8) : 1998	Shock resistance test (*third revision*)
(Part 9) : 1998	Buckling resistance test (*third revision*)
(Part 10) : 1998	Slamming test (*third revision*)
(Part 11) : 1998	Misuse test (*third revision*)
IS 4351 : 2003	Steel door frames — Specification (*second revision*)
IS 4671 : 2018	Expanded polystyrene for thermal insulation purposes — Specification (*second revision*)
IS 6911 : 2017	Stainless steel plate, sheet and strip — Specification (*second revision*)
IS 8183 : 1993	Bonded mineral wool — Specification (*first revision*)
IS 9106 : 1979	Specification for rising butt hinges
IS 10428 : 2022/ ISO 22496 : 2021	Windows and pedestrian doors — Vocabulary (*first revision*)
IS 12817 : 2020	Stainless steel butt hinges — Specification (*third revision*)
IS 12436 : 1988	Specification for preformed rigid polyurethane (PUR) and polyisocyanurate (PIR) foams for thermal insulation
IS 13871 : 2021	Powder coatings — Specification (*first revision*)
IS 14246 : 2013	Continuously pre-painted galvanized steel sheets and coils (*first revision*)

ANNEX B

(*Clauses 7 and 7.6*)

RECOMMENDED GUIDELINES FOR STEEL DOOR SHUTTER INSTALLATION

B-1 INSTALLATION

Doors shall be installed and fastened to maintain alignment with frames to achieve maximum operational effectiveness and appearance. Doors shall be adjusted to maintain perimeter clearances of maximum 3 mm to 4 mm. Shimming shall be performed by the installer as needed to assure that the proper clearances are achieved.

B-2 CLEARANCE GAPS

The clearance gap between the door leaf edge and the door frame shall be maintained for operation efficiency. Doors shall be hung to give an equal gap across the head and down both jambs. A gap of between 3 mm shall be maintained. Certain smoke/airtight seals might require a larger gap in order to operate without causing significant frictional increases, but the gap should remain within tolerances.

B-3 UNDER-DOOR (THRESHOLD) GAPS

Under-door (threshold) gaps should be in accordance with the manufacturer’s installation instructions for the particular door-set design. When fitted, smoke seals should give an even contact with the floor but, should not exhibit significant increased frictional forces that could interfere with the closing action of the door. The minimum undercut shall be 6 mm, additional undercut gap shall be according to the site requirement and manufacturer’s recommendation.

B-4 HARDWARE INSTALLATION

Installation of hardware items shall be in accordance with hardware manufacturer’s recommendations/templates. All hardware shall be reinforced with appropriate reinforcement including screws and fasteners as suggested by the hardware manufacturer's manual.

B-5 INSTALLATION OF FACTORY APPLIED FINISH PAINTED MATERIALS

In addition to storage and handling precautions, it is imperative that the work of all other rough trades must be completed prior to the installation of factory applied finished painted product.

B-6 DOOR AND FRAME MAINTENANCE

Once the doors and frames are installed, it is the responsibility of the owner or end user to properly maintain the doors and frames, and if available as per the manufacturer's maintenance manual.

Therefore, it is important that for periodic inspection, maintenance and repair of any damage to be undertaken on a regular basis. The marking of individual components can be an aid to the correct replacement of those components when necessary.

ANNEX C

(*Informative*)

(*Clause* 7)

LIST OF INDIAN STANDARDS AVAILABLE ON DIFFERENT TYPE OF HARDWARE AND FITTINGS USED IN DOOR SHUTTERS AND ITS INSTALLATION

C-1 This annex provide the information about the list of Indian Standard on hardware and fittings set that are used in the installation of doors. One or more of the items given below may be used. Purchaser of the door shutter may discuss with the manufacturer of the door shutter before installation. *See* Table 10.

Table 10 List of Indian Standards Available on Different Type of Hardware And Fittings Used in Door Shutters And its Installation

(*Annex* C-1)

Sl No.	Hardware/Element	IS No.	Title
(1)	(2)	(3)	(4)
i)	Hold fasts	IS 7196 : 1974	Specification for hold fast
ii)	Hinges	IS 205 : 1992	Non-ferrous metal butt hinges — Specification (*fourth revision*)
		IS 206 : 2010	Tee and strap hinges — Specification (*fifth revision*)
		IS 362 : 1991	Parliament hinges — Specification (*fifth revision*)
		IS 453 : 1993	Double-acting spring hinges — Specification (*third revision*)
		IS 1341 : 2018	Steel butt hinges — Specification (*sixth revision*)
		IS 3818 : 1992	Continuous (Piano) hinges — Specification (*third revision*)
		IS 3843 : 1995	Steel back flap hinges — Specification (*second revision*)
		IS 9106 : 1979	Specification for rising butt hinges
		IS 12817 : 2020	Stainless steel butt hinges — Specification (*third revision*)
iii)	Door handles	IS 208 : 2020	Door handles — Specification (*sixth revision*)
		IS 4992 : 2024	Door handles for mortice locks — Specification (*second revision*)
iv)	Aldrops	IS 2681 : 1993	Non-ferrous metal sliding door bolts (aldrops) for use with padlocks — Specification (*third revision*)
		IS 15834 : 2020	Stainless steel sliding door bolts (aldrops) for use with padlocks — Specification (*first revision*)
v)	Door stoppers	IS 1823 : 1980	Specification for floor door stoppers (*third revision*)
		IS 17296 : 2020	Stainless steel door stoppers — Specification

Table 10 (*Concluded*)

Sl No.	Hardware/Element	IS No.	Title
(1)	(2)		(4)
vi)	Door closers	IS 3564 : 1995	Hydraulically regulated door closers — Specification (*fourth revision*)
		IS 6343 : 1982	Specification for door closers (pneumatically regulated) for light doors weighing up to 40 kg (*first revision*)
		IS 14912 : 2001	Door closers, concealed type (hydraulically regulated) — Specification
vii)	Door locks	IS 281 : 2009	Mild steel sliding door bolts for use with padlocks — Specification (*fourth revision*)
		IS 7534 : 1985	Specification for sliding locking bolts for use with padlocks (*first revision*)
viii)	Tower bolts	IS 204 (Part 1) : 1991	Tower bolts — Specification: Part 1 Ferrous metals (*fifth revision*)
		IS 204 (Part 2) : 1992	Tower bolts — Specification: Part 2 Non-ferrous metals (*fifth revision*)
		IS 15833 : 2009	Stainless steel tower bolts — Specification

ANNEX D

(*Foreword*)

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

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