CED11(26384)P
August 2024

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG, NEW DELHI 110002

प्रारंभिक मसौदा

16 अगस्त 2024

हमारा संदर्भः 11/टी-49

तकनीकी समिति: दरवाजे, खिड़कियाँ और शटर विषय समिति, सीईडी 11

सीईडी 11 के सभी सदस्य

महोदय/महोदया,

निम्नलिखित मानक का मसौदा संलग्न हैं:

प्रलेख संख्या	शीर्षक
सीईडी 11(26384)पी	**स्टील डोर फ्रेम सेट विशिष्टता के लिए प्रारंभिक ड्राफ्ट –** ICS : 91.060.50

सम्मतियॉं भेजने की अंतिम तिथि: **15 सितम्बर 2024.**

सम्मति यदि कोई हो तो कृपया अधोहस्ताक्षरी को उपरिलिखित पते पर संलग्न फोर्मेट में भेजें या ced11@bis.gov.in पर ईमेल कर दें ।

धन्यवाद ।

भवदीय,

(**प्रदीप सिंह शेखावत**)
सदस्य सचिव सीईडी 11
वैज्ञानिक 'डी' (सिविल इंजीनियरी)
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दूरभाष : 011-23608490

संलग्न : उपरिलखित

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG, NEW DELHI 110002

PRELIMINARY DRAFT

16 August 2024

Our Ref: CED 11/T-49

TECHNICAL COMMITTEE: Doors, Windows and Shutter Sectional Committee, CED 11

ALL THE MEMBERS OF CED 11

Dear Sir/Madam,

Please find enclosed the following document:

Doc No.	Title
CED 11(26384)P	**Preliminary Draft for Steel Door Frame Set – Specification** ICS : 91.060.50

Last date for comments: **15 September 2024.**

Comments, if any, may please be made in the format as enclosed herewith and e-mailed to the undersigned at **ced11@bis.gov.in**.

Thanking you,

Yours faithfully,

(Pradeep Singh Shekhawat)
Member Secretary CED 11
Scientist 'D' (Civil Engineering)
E-mail: ced11@bis.gov.in
Telephone: 011-23608490

Encl: As above

FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS

(Please use A-4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/table/fig etc. be started on a fresh box. Information in column 3 should include reasons for the comments and suggestions for modified working of the clauses when the existing text is found not acceptable. Adherence to this format facilitates Secretariat's work) {Please e-mail your comments to **ced11@bis.gov.in**

***DOC. NO. & TITLE*: CED 11 (26384)P**

Preliminary Draft for Steel Doorset — Specification
ICS : 91.060.50
LAST DATE OF COMMENTS: 15/09/2024.

NAME OF THE COMMENTATOR/ORGANIZATION: _____

Sl. No.	Clause/Para/Table/ Figure No. Commented	Comments/Modified Wordings	Justification of the Proposed Change

BUREAU OF INDIAN STANDARDS

Preliminary Draft Indian Standard

STEEL DOORSET — SPECIFICATION

FOREWORD

(Formal clause will be added later)

Factory made steel doorset from galvanized steel is gaining lot of usage and application due to the quality and tolerances of manufacturing. It has been a general practice to have steel frame and shutter as two separate component material. It has been realized that steel door set with frames are manufactured with absolute accuracy and tolerances and the same cannot be achieved if it is not manufactured together. All preparations for door hardware and screws are made in the factory including finish painted before it is shipped out of factory. The product has multiple uses in terms of its functional and aesthetic requirements. Today there are manufacturers who are offering a wide range of steel door set also known as Hollow metal doors for various application viz, multipurpose doors, acoustic doors, lead line doors, and not the least fire doors. Steel flush door set are sturdier and requires proper specification based on application as the sheet vary from manufacturer to manufacturer. Hence there is a need to formulate a standard which not only guides the industry but also bring the quality of product in line with international standards.

These doors are custom made to various specification 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 industrial buildings.

It has been noticed that there is sufficient demand for steel door set as a complete assembly including hardware. Door shutter of sizes other than modular sizes. In view of the above, the standard permits standard and non-standard sizes with various frame types and hardware for multiple application.

In the formulation of this standard, due weightage has been given to standards and practices prevailing in the country.

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 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Preliminary Draft Indian Standard

STEEL DOORSET — SPECIFICATION

1 SCOPE

This standard species the requirements for a complete steel door-set assembly including frame, shutter, hardware as a complete unit, suitable for masonry, steel, dry wall partition etc. wall openings.

2 REFERENCES

The Indian Standards given in Annex A contain provisions which though reference in the text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to investigate the possibility of applying the most recent editions of the standards indicated.

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 and durability, all the steel door-set shall be classified as follows:

i) **Light Duty** – Recommended use for low frequency openings such as apartments, dormitory, hotel and motel units. Not subjected to any kind of misuse.

ii) **Medium Duty** – Recommended use for medium frequency opening such as main entrance to apartment, dormitory buildings stairwells, storage and mechanical rooms.

iii) **Heavy Duty** – Recommended use for high frequency openings such as the main entrances to schools, offices, industrial buildings, stairwells, public restrooms, and manufacturing areas.

iv) **Extra Heavy Duty** – Recommended use for very high frequency openings and are may subject to misuse. It also includes areas like main entrance to schools, offices, industrial building, public buildings, metros and locker rooms.

The minimum thickness of the steel sheets as per classification of the door frame and shutter shall be as given in Table 1.

5 MATERIAL

5.1 Galvanised steel

Steel doorset shall be manufactured from galvanized steel confirming to IS 277 with a minimum zinc coating (both sides) grade of 120 g/m^2.

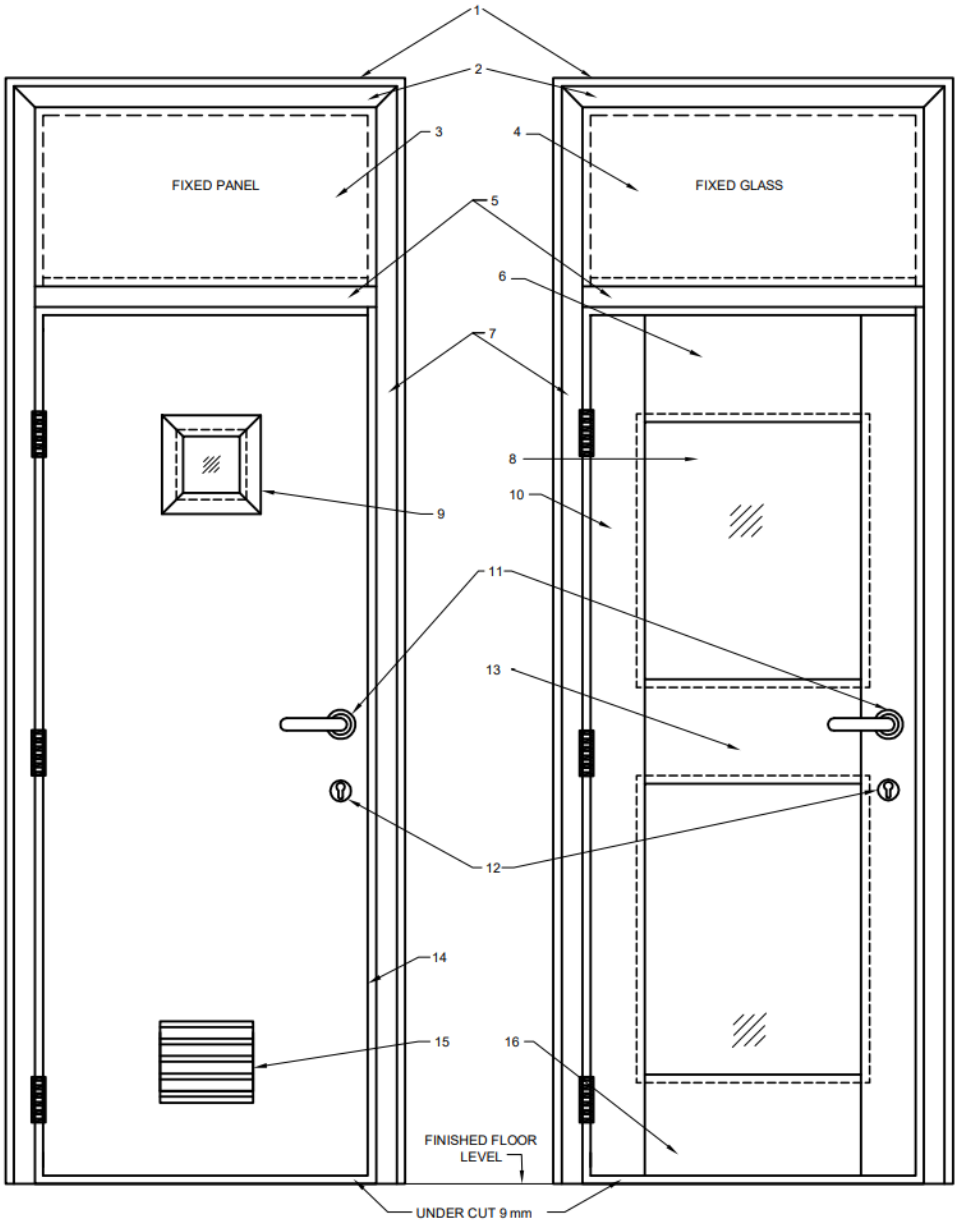
5.2 Pre-coated Steel

Precoated steel sheets are also used for doors and frames. The material used shall be as per IS 14246 precoated is only 15~30 micron of paint

5.3 Stainless Steel

Stainless steel doors and frames are fabricated from SS 304, and SS316 steel sheet as per IS 6911: 2017. Stainless steel doors are frequently used in sterile areas such as hospitals, food processing areas and laboratories where cleanliness is a concern. Type 304 is the most common type of stainless steel used in doorset manufacturing. In applications where more corrosion resistance is required, Type SS 316 and SS 316L stainless steel is used. Stainless steel doors and frames can have a satin or bright natural finish. The minimum grade should be SS304

Figure 1 – Door Terminology



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
9. Vision panel / Vision lite
10. Stile (Hinge)
11. Lock With lever handle
12. Cylinder / Escutheion
13. Mid rail
14. Flush Shutter
15. Louver

8. Glazing 16. Bottom Rail

Table 1 – Minimum Steel thickness as per Classification of Steel Door-Sets
(Clause 4)

Level	Duty	Frame		Shutter	
		(mm)	(gauge, *See Note*)	(mm)	(gauge, *See Note*)
1	Light Duty	1.2	18	0.8	22
2	Medium Duty	1.2	18	1.2	18
3	Heavy Duty	1.6	16	1.2	18
4	Extra Heavy Duty	2.0	14	1.6	16
NOTE – Gauge to be used for reference purposes only.					

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 the recommended gap for fixing shall be 5 mm on all three sides. For steel and partition walls the recommended gap is 2.5 mm on all three sides.

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. 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).

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 x height and in millimetres (mm). The shutter calculation formula is shown as an example for better understanding only. See. Fig 2.

Wall opening width (WOW)
Wall opening height (WOH)
Wall opening = WOW x WOH
Frame opening width (FOW) = (WOW) – 10mm
Frame opening height (FOH) = (WOH) – 5mm
Shutter width = (FOW) – ((frame face x 2) + (gap between frame & shutter 3mm x 2))
Shutter height = (FOH) – ((frame face + 3) + 9mm undercut))

Shutter width for double door
Shutter width = (FOW) – ((frame face x 2) + (gap between frame & shutter 3mm x 2) + Gap between two shutters 6mm)
= Shutter width / 2

6.6 Sizes

The standard wall opening sizes shall be as per Table 2. The mentioned sizes are for single leaf and double leaf door application. Same shall be applicable for doors with transoms and fixed panels.

Shutter width and height may vary based on manufacturer frame profile hence the gaps shall be specified between the frame and shutter and meeting stile of shutter for double leaf door (See figure – 2)

Table – 2 – Standard Wall Opening Sizes

(Clause 6.6)

Sl.No	Door type	Wall opening width (WOW)	Wall opening height (WOH)	Frame opening width (FOW)	Frame opening height (FOH)	Type
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	SD7	750	2100	740	2095	Single leaf
2	SD9	900	2100	890	2095	
3	SD10	1000	2100	990	2095	
4	SD11	1100	2100	1090	2095	
5	SD12	1200	2100	1190	2095	

6	SD15	1500	2100	1490	2095	Double leaf
7	SD18	1800	2100	1790	2095	
8	SD20	2000	2100	1990	2095	
9	SD22	2200	2100	2190	2095	
10	SD24	2400	2100	2390	2095	
NOTE – The standard wall opening width and height mentioned above are as per industry standard. However for WOH above 2100 the following heights may be followed 2400 mm,2700 mm and 3000 mm.						

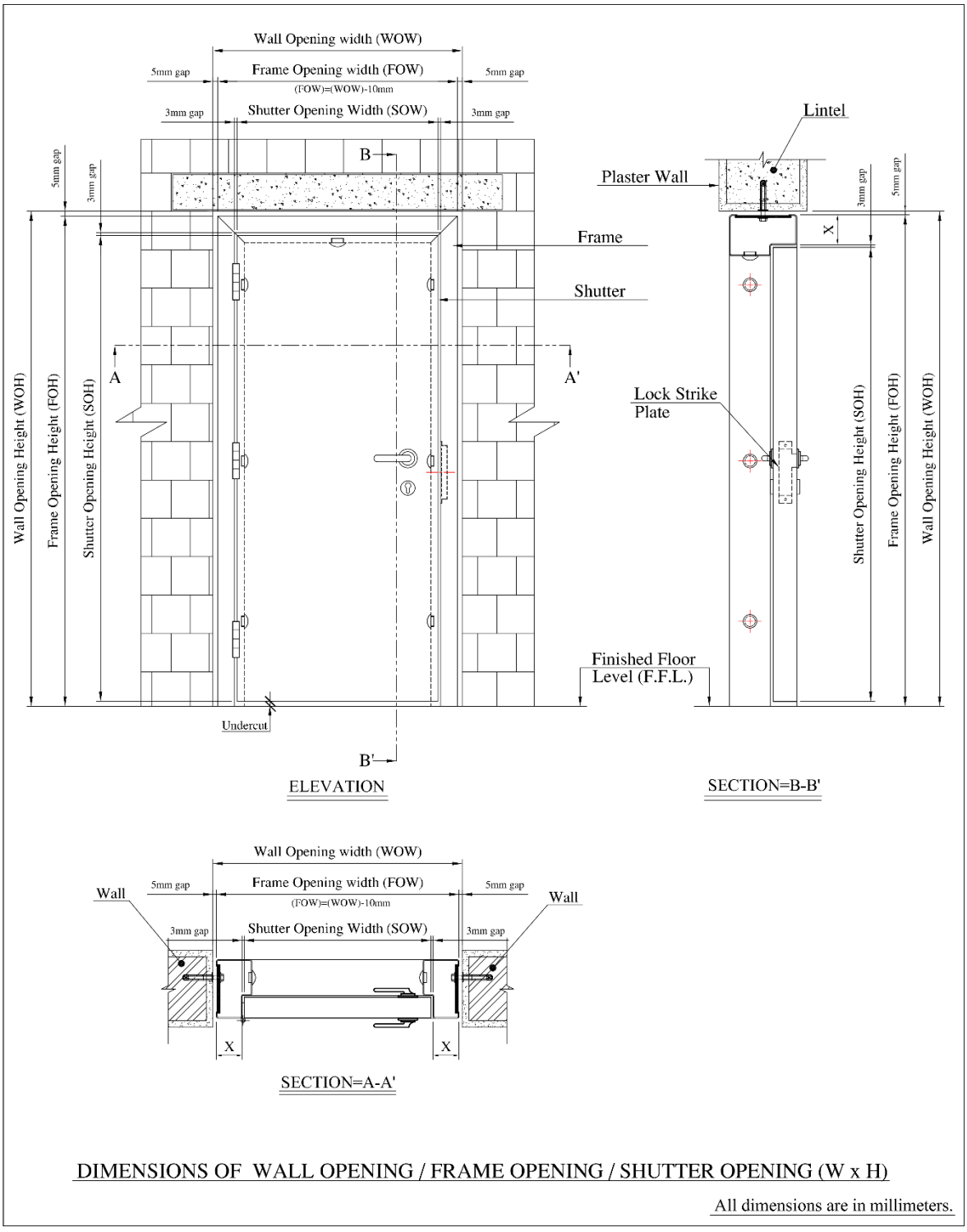
6.7 Tolerances

6.7.1 The following manufacturing tolerances shall apply for door widths and heights, both put together shall not be more than 2 mm.

Dimensions	*Tolerance*
Frame & shutter width	+/- 1 mm
Frame & shutter height	+/- 1 mm
Shutter thickness	+/- 1 mm

6.7.2 *Clearances* - The edge clearances of door shutter shall not exceed the following:

i) Between shutter and frame at top head and vertical jambs – minimum 3 mm. Not exceeding 5mm.
ii) Between shutter bottom and finished floor level – minimum 6 mm.
iii) Between edges of double leaf shutter or at meeting stile of shutter- minimum 6 mm



Notes & illustration:

Wall opening = width x height
Wall opening width (WOW)
Wall opening height (WOH)
Shutter opening width (SOW)
Shutter opening height (SOH)
Frame opening width (FOW) = (WOW) – 10mm

Frame opening height (FOW) = (WOW) – 5mm

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

7 CONSTRUCTION AND WORKMANSHIP

A steel door-set consists of the frame, shutter (door leaf) and the required hardware. Hardware is omitted as mentioned earlier as part of this standard, hence the following shall apply only for frame and shutter construction, including hardware preparation.

7.1 FRAME CONSTRUCTION

Frames for doors, transoms, sidelights, mullions, interior glazed panels and other openings, where indicated, shall be either knockdown field assembled type, or welded unit. Frame sheet thickness shall be as per the Table 1 given. These frames shall be designed to be mounted on various types of opening viz, masonry, dry wall, steel structure etc.by just changing the fixing anchors. All frames shall have back bend so that at the time of fixing it does not take the shape of the wall. See figure 3

Frames shall have grooved profile to take inbuilt sealing system on the rebate stop. Wherever, it is not possible to provide grooved profile due to design or material thickness surface seals to be used for protection against loss of energy.

7.1.1 *Frame Nomenclature*

Frame nomenclature see figure 3

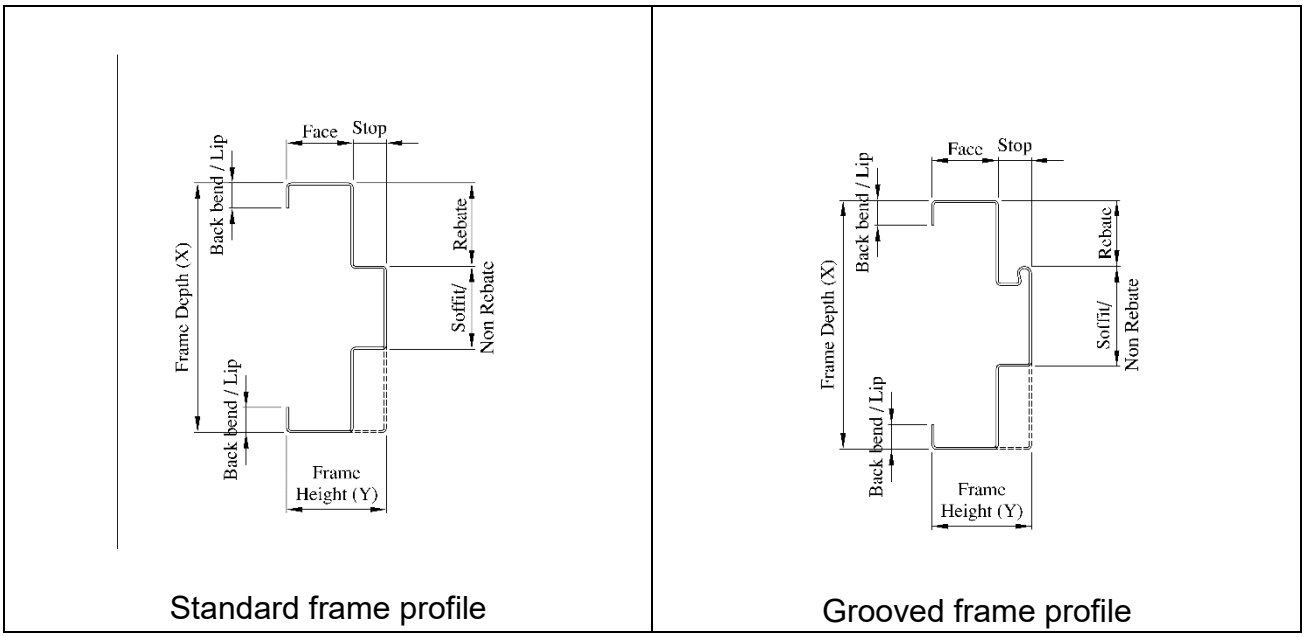


FIG. 3 FRAME NOMENCLATURE.

7.1.2 *Frame Reinforcement*

Provide hardware reinforcement of minimum sheet thickness as shown in Table 5 and for additional information refer Installation guide for doors and hardware as mentioned later in this section. Frames shall be mortised, reinforced, drilled and tapped to receive mortised

hinges, locks, latches, and flush bolts as required. (*See Fig. 4*)

7.1.2.1 *Mortar Guards*

Mortar guard galvanized sheet 1.00 mm thick or of any other thickness shall be welded or clipped to the frame preparation for hinges, mortise locks and latches slots, etc. (*see* Fig. 4)

7.1.2.2 *Lock Strike Plate*

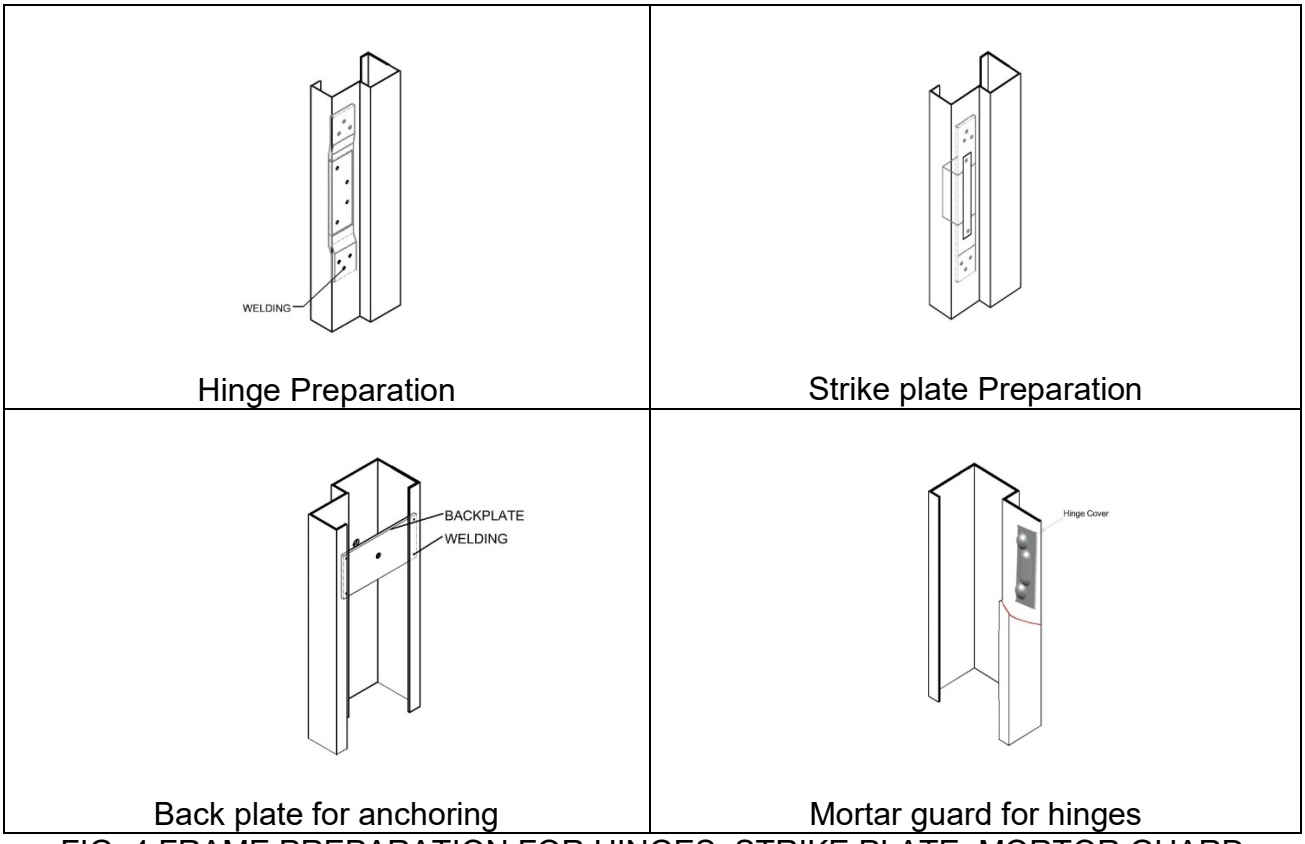
Provision shall be made to fix lock strike plates of mortise locks or latches, complying with the relevant Indian Standards. A slot suitable for lock strike plate shall be made into the rebate of the frame and necessary fixing arrangement and mortar guard from the inside of the frame shall be provided (*see* Fig. 4).

7.1.2.3 *Shock Absorbers*

For side-hung door there shall be not less than two buffers of rubber or other suitable material inserted in holes in the rebate of the strike jamb and the top head member. Shock guard shall be located 300 mm from top closing edge of the door. Not required in case of grooved frames with seals.

7.1.2.4 *Rubber / EPDM Seal*

The Rubber / EPDM Seal of suitable size shall be provided to the grooved profile steel door frame.



Hinge Preparation | Strike plate Preparation

Back plate for anchoring | Mortar guard for hinges

FIG. 4 FRAME PREPARATION FOR HINGES, STRIKE PLATE, MORTOR GUARD

7.1.3 *Frame Assembly*

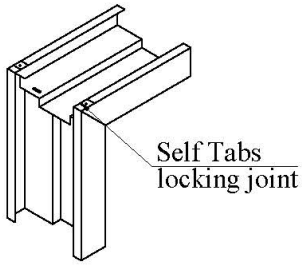
7.1.3.1 *Knockdown frame*

Knockdown frame shall be either butted or mitered in construction. Frame material thickness shall be always more than or equal to shutter sheet thickness. Butted frames shall be perpendicular assembled with bolts, the head jamb of the profile shall be 3mm short of the side jambs for better seating. Mitered frames shall be assembled with self-tabs and with 45° cut on the face of the frame or pressed lock plates with 45° cut to the profile as per manufacturer's design. Frames shall be checked once assembled for rigidity and alignment once assembled for better performance. See figure 5.

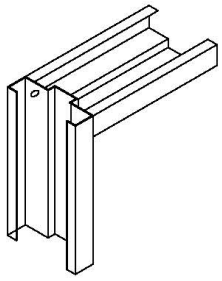
7.1.3.2 *Welded frame*

In welded frames the joint between the head and jamb faces shall be completely arc welded along their length either internally or externally. The remaining elements of the frame profile, i.e., soffit, stops, rabbets, are not welded. Face joints shall be ground and finished smooth with no visible seam. Face joints at meeting mullions or between mullions and other frame members shall be completely arc welded externally, ground, and finished smooth. See figure 5.

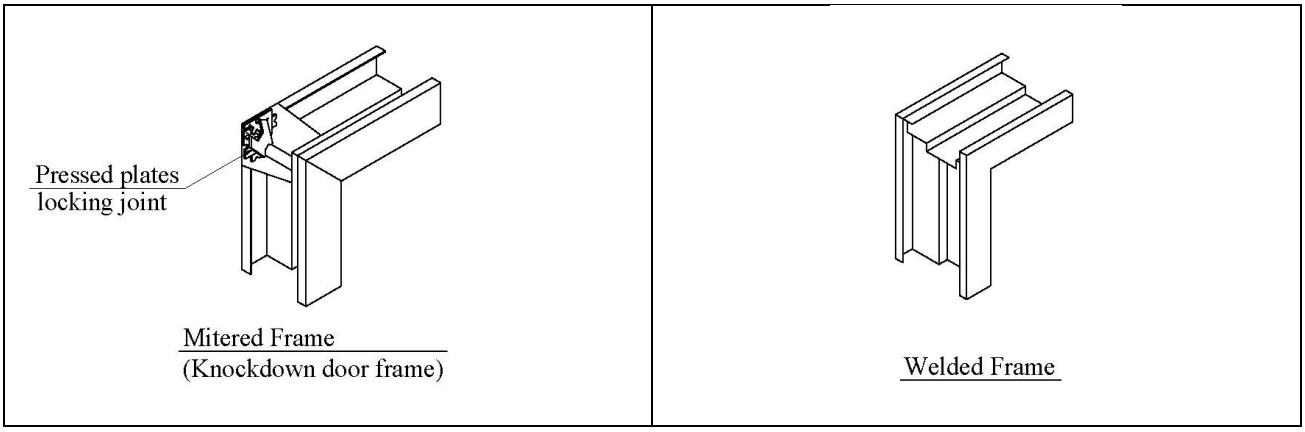
Since welded frame are assembled and shipped from factory additional tie rod or spreader bar has to be provided for shipping and handling of frames. This temporary spreader bar shall be removed and a setting spreader shall be used for installation of the frame.



Mitered Frame
(Knockdown door frame)



Butted Frame
(Knockdown door frame)



7.1.4 Frame types

There are various types of frames which can be used in building based on durability, application and type of door. Since all metal frames are made to specific architectural requirement it is important to define the types and the permissible limit of construction to avoid non-performance of the product. (*See* Fig. 6) Basic design construction of the frame profile can be single rebate or double rebate, with architrave or without architrave. All frame shall be designed to suit various wall opening depths, this may vary from 50mm profile to maximum 350mm profile, See table 3 for combination of frame depths with various sheet thickness.

Frames with architrave shall be with one side architrave or both side architraves depending upon the architectural requirement. These frame are handed and needs special attention in defining the push and pull side of the frame. For both side architrave, steel frame shall have two piece or (A+B) frame. One piece shall be fixed from inside and another piece shall be fixed from outside. For further understanding the following types of frame profiles as shown in Fig. 6.

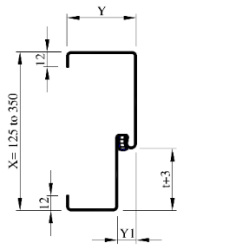
TABLE 3 -SHOWING WALL DEPTHS WITH MINIMUM SHEET THICKNESS AND NUMBER OF ANCHORS

Frame type	Wall depth Min	Wall depth Max	Sheet thickness (Min)	Anchor on wall depth
Grooved frame / Non-grooved frame/ with architrave one side	125mm	200mm	1.2mm	1
Grooved frame / Non-grooved frame/ with architrave one side	201mm	350mm	1.6mm	2
Double swing door frame	150mm	150mm	1.2mm	1
Double egress door frame	150mm	150mm	1.2mm	1

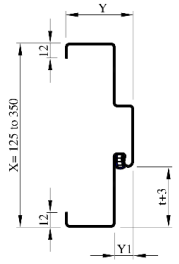
For recommended standard frame profiles please refer the following table which are commonly used for steel doorset, see table 4. However the manufacture can offer the frame dimension based on table 3, if it is non-standard profile

TABLE 4 RECOMMENDED STANDARD PRESSED STEEL FRAME PROFILE

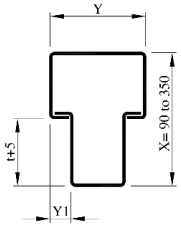
Sl No.	Type	Size		Rebate
		X (Depth) mm	*Y (Height)* mm	
(1)	(2)	(3)	(4)	(5)
i)	Non-Grooved	100	60	Single
ii)	Non-Grooved	125	60	Single
iii)	Non-Grooved	150	60	Double
iv)	Grooved	125	55	Single
v)	Grooved	150	55	Double
vi)	Architrave	125	70	Single
vii)	Architrave	150	70	Double
viii)	Double swing	150	40	NA
ix)	Double egress	150	70	Triple



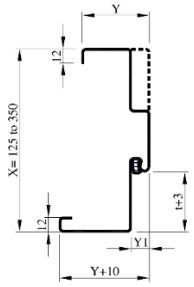
Grooved single rebate profile



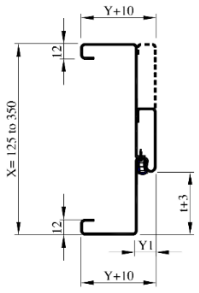
Grooved double rebate profile



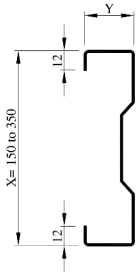
Standard Single Rebate Transom/Mullion



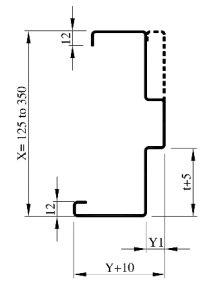
Single / Double rebate with pull side architrave



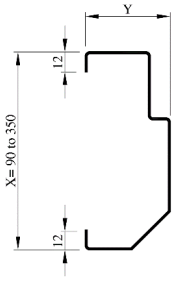
Single /Double rebate with both side architrave



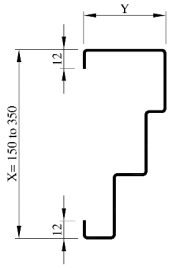
Single rebate Double swing



Single / Double rebate
with pull side architrave



Chamfered Door Frame



Double Egress

PRESSED STEEL DOOR FRAME STANDARD PROFILES.

X = Frame Depth
Y = Frame Height
Y1 = Stop (15mm. Minimum)
Back bend = 12mm minimum
* 't' is the thickness of the shutter.
All dimensions are in millimeters.

FIG. 6 SOME OF THE COMMONLY USED TYPE OF FRAME

7.2 SHUTTER OR DOOR LEAF CONSTRUCTION

There are multiple ways a door shutter is constructed, viz, with or without seam vertical edges to form a double skinned shutter with infill material. The infill material may be selected based on the requirement as mentioned below. The minimum steel thickness for each specific gage is derived from the Table-1 mentioned for specific application and durability.

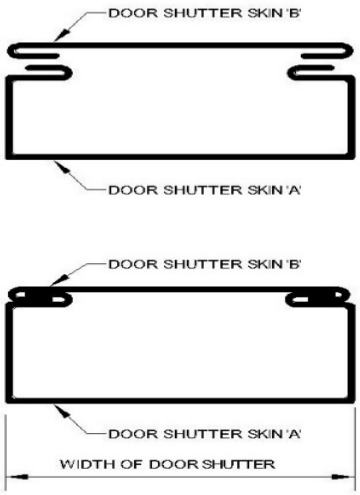
The top and bottom of the door shall be closed with either flush or inverted channels or closures. The channels or closures shall have a minimum material thickness of 0.8mm.

With seam doors – are 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.7*)

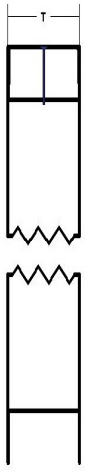
Without seam doors – are also known as seamless doors, where in the interlock is not visible or hidden by metal putty or by seamless welding to give you smooth vertical edge.

Irrespective of the construction and infill material these doors shall be of thickness minimum 35mm to a maximum of 60mm. The thickness of the shutter may be defined by manufacturer based on hardware, infill material, construction methodology or application.

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, used for the construction of door. Similarly, for doors with mineral wool, there is a possibility of material sagging due to lower density of mineral wool and may need additional steel channels to stop any sagging of material over a period of time.



Shutter construction at Stile edges



Shutter construction Top & Bottom

FIG. 7 TYPICAL SHUTTER CONSTRUCTION.

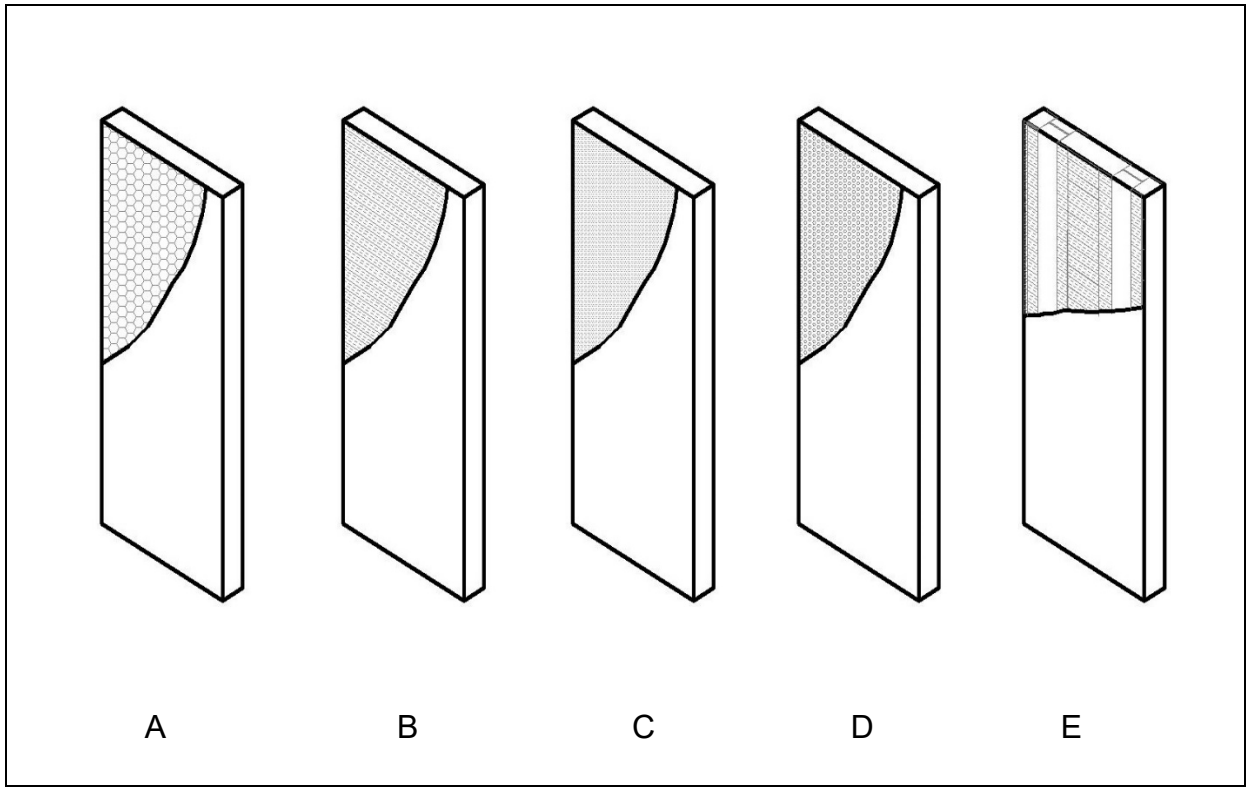


FIG. 8 TYPICAL INFILL MATERIAL FOR DOOR SHUTTER.

7.2.1 *Infill Core*

Various infill materials are used based on size, application and properties. The core design shall be at the discretion of the manufacturer, provided they qualify the performance test criteria as outlined in the end of section.

a) Honey comb kraft paper – This is the most commonly used infill material by the door manufacturer as it gives a perfect structural bonding between two skins of door leaf. The core is made of special resin bonded paper and is designed as honey cell. This is glued on the inner surface with special polyurethane resin (PUR) glue. It gives moderate sound reduction and minimal insulation. See infill Figure 8

b) Mineral wool core – This is also one of the commonly used infill material where the requirement is for insulation. Use of mineral wool shall be defined by the density of the infill material. Minimum recommended density for the infill material shall be 96 kg/m^3. Minerwool shall confirm to IS 8183 Lower density infill material will sag over a period of time and leaves a hollow section on the top of the door leaf. It gives high insulation and minimal sound reduction. The Mineral wool or Rockwool core shall be bonded to door skins with special Polyurethane resin (PUR). See infill Figure 8

c) Polyurethane core – Also known as PUF is also used as a infill material for door construction. The foam is injected, minimum 40 kg/m^3 density inside the hollow section of the door. Some manufacturers use puff foams as an alternative, however the density and usage has to be tested for performance requirement conforming to

IS12436. It gives high insulation and minimal sound reduction. See infill Figure 8

d) Polystyrene core– Expanded Polystyrene of minimum density 18 kg/m3 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). Not a common infill material but use of polystyrene foam as an infill core for hollow metal doors is used for moderate insulation and minimal sound reduction.

e) Steel stiffened core – It's a combination of vertical steel stiffeners and mineral wool as an infill material. Steel stiffeners minimum 0.8mm, are spot welded forming U section at an interval of 150mm and filled with mineral wool/ fiber glass as a filler material. Used on doors meant for external application or subject to abuse. See infill Figure 5

f) Manufacturer's Proprietary core – The manufacturer can use proprietary core design and developed by them and as agreed between purchaser and the manufacturer. Hollow metal door manufacturers have proprietary core, particularly for high performance products.

7.2.2 *Astragal*

Astragals are required for pair of doors to close the gap on the meeting stile of the door. Astragals can be either integrated or surface mounted, it varies based on manufacturer capabilities. Astragals may or may not be required on pairs of doors depending upon the individual door manufacturers. Pairs of doors that do require an astragal shall have at least one that projects a minimum of 20mm beyond the edge of the door to which the astragal is attached. In some situations, a coordinator may be needed to allow the inactive leaf to close ahead of the active leaf. This ensures proper latching of pairs of doors. (*See Fig. 9*)

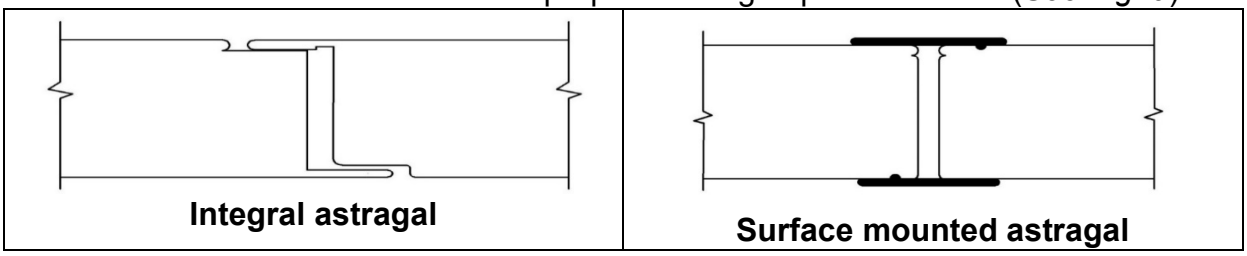


FIG. 9 COMMON TYPES OF ASTRAGALS

7.2.3 *Types Of Door Leaf Construction*

Various door types are shown in the standard door types with nomenclature **Annex - C**

7.2.3.1 *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 are visible on door edge only.

7.2.3.2 *Rail & stile door* - a model of door consisting of one center panel and one lock stile and one hinge stile. Stiles are butted to and interlock with panels, an archaic construction method. A model of door using stiles and rails either mitred or butted, the corner joints being welded and 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 & Stile will vary from manufacturer to manufacturer. However, it is recommended to have minimum 100mm rail or stile to accommodate hardware. Maximum size shall not exceed 150mm.

7.2.3.3 *Embossed door* - a door design incorporating decorative panels formed or embossed into door faces. When specified, door faces shall be fabricated of textured and/or embossed steel. These materials shall meet the requirements of Table 1. These designs may be on one side or both side of the double skin doors.

7.2.3.4 *Vision pane* - When doors are specified to contain glazed openings, the manufacturer's standard lite kit shall be supplied. This may be of multiple sizes and shapes as shown in the standard door types. 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 should be taken in making sure the screws are not visible on the non-secured side. *(See Fig. 10)*

7.2.3.5 *Louvers* - an opening in the door with a series of slats or blades to allow passage of air. Standard steel doors can be provided with a variety of louver designs and sizes. Louvers 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, inverted "Y" are available in a wide range of sizes. Also available from some steel door manufacturers is a pierced louver design. Insert louvers intended for exterior doors or other doors where security is a consideration should have fasteners or materials specified accordingly. *(See Fig 10)*.

NOTE- If a louver door is required to provide security, the steel door manufacturer should be consulted.

7.2.4 *Workmanship*

All the four edges of the shutter shall be square and rounded ensuring there are no sharp edges or burrs which might hurt the end user during usage. This shall be applied for both frame and shutter. No visible welding joints and sharp corners shall be allowed on either side of the surface of the shutter unless otherwise there is a product specific requirement and / or agreed between Purchaser and Manufacturer. The tolerance shall be ± 1 mm, for all the applicable components of the door shutter construction. All welding shall be grinded, smoothened and phosphate it to give additional protection before taking it for finishing the product.

7.2.4.1 *Hardware Preparations*

Provide hardware reinforcement of minimum sheet thickness as shown in Table 5 and for additional information on location (*See Fig. 11*) and for fitting guidance refer Annex B.

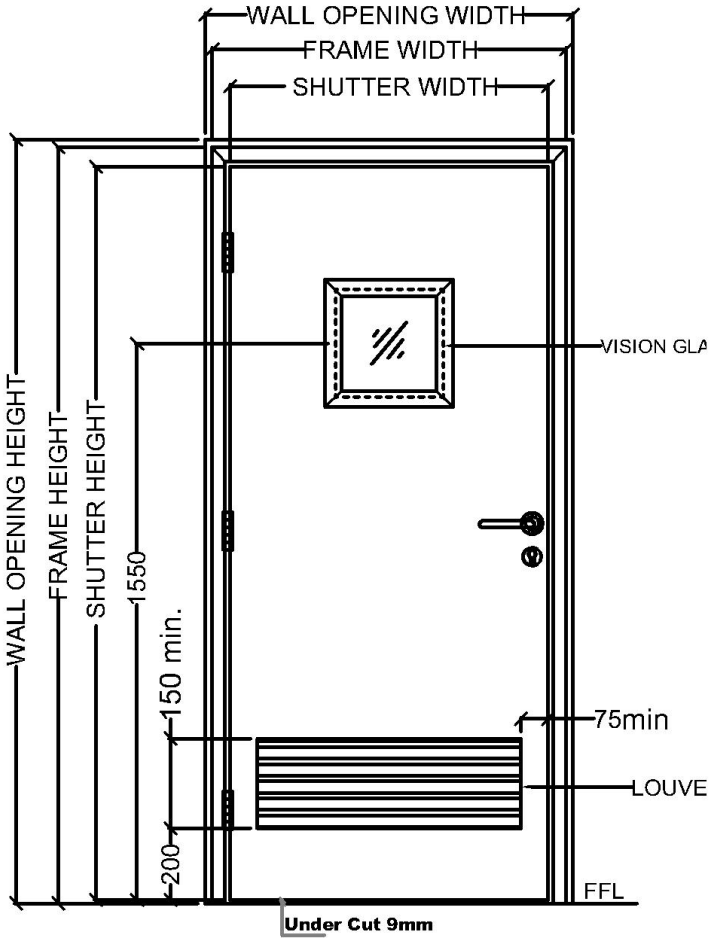


FIG. 10 LOCATION OF VISION PANE AND LOUVER ON SHUTTER

TABLE 5 MINIMUM HARDWARE REINFORCEMENT THICKNESS FOR FRAME AND SHUTTER

Hardware Item	Shutter		Frame	
	mm	Gauge [1]	mm	Gauge[1]
Hinge [35 mm – 60 mm} thick shutter	3.0	10	3.0	10
Mortise Lock or Deadbolt	1.6	16	1.6	16
Bored Lock or Deadbolt	1.6	16	1.6	16
Flush Bolt Front	1.6	16	1.6	16
Surface Bolt	1.6	16	1.6	16
Surface Applied Closer	1.6	16	1.6	16
Hold Open Arm	1.6	16	1.6	16
Pull Plates and Bar	1.2	18	1.2	18
Surface Exit Device	1.6	16	1.6	16
Floor Checking Hinge	4.0	7	4.0	7
Pivot Hinge	4.0	7	4.0	7
Continuous Hinge	Not required		Not required	
Kick plate / Push plate	Not required		Not required	

Guage to be used for reference purposes only.

1

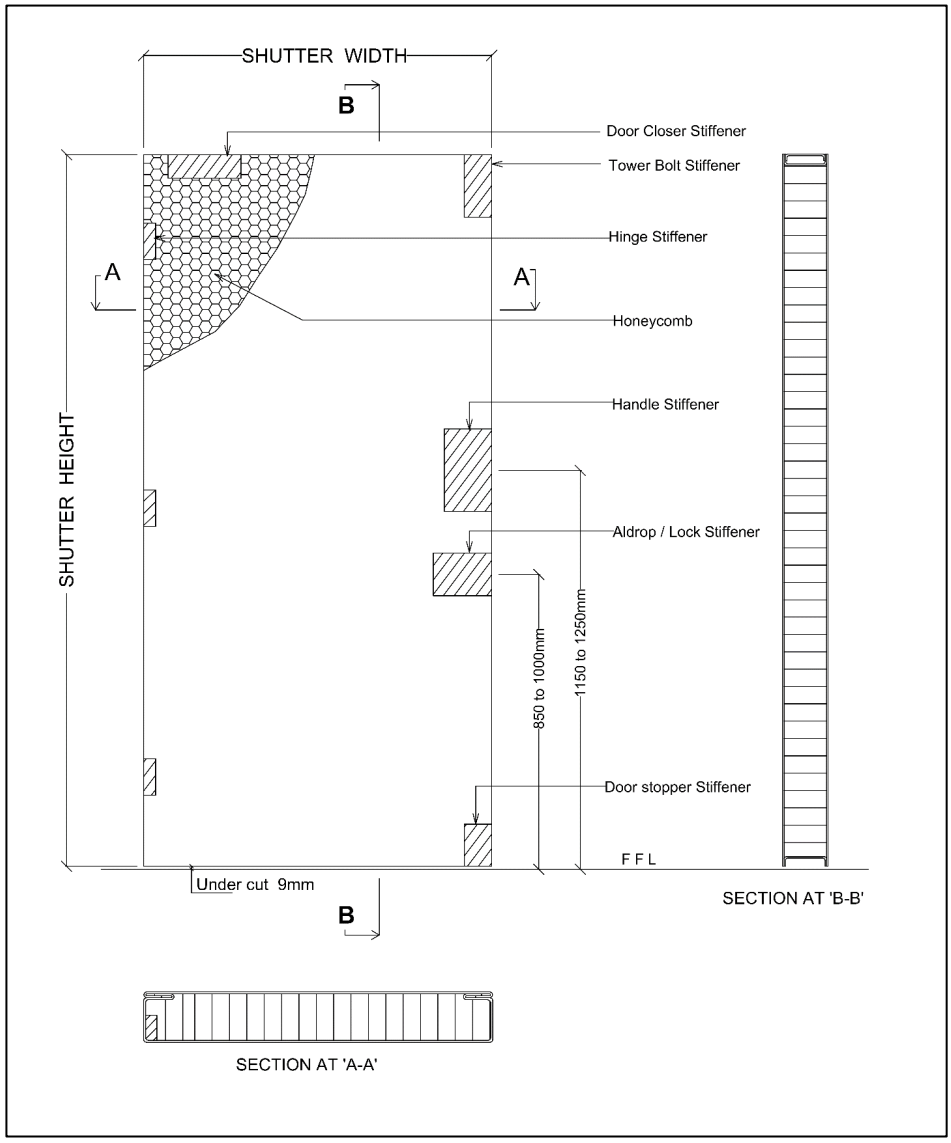


FIG. 11 TYPICAL HARDWARE REINFORCEMENT FOR SHUTTER

7.2.4.1.1 *Mortise Hardware Preparations*

Necessary stiffener of steel strips of minimum thicknesses as mentioned in the Table 5 shall be provided from the inner side of the door frame and shutter for the fixing of various types of hardware fittings. Doors and frames shall be reinforced, drilled and tapped to receive mortised hinges, locks, latches, and flush bolts as required. (*See Fig. 12*)

7.2.4.1.2 *Surface Applied Hardware*

When specified, doors and frames shall be reinforced for surface applied hardware. Drilling

and/or tapping shall be completed by others.

7.2.4.1.3 *Function Holes*

The preparation for locks and/or exit devices shall include reinforcements (as shown in Table 5).

7.2.4.1.4 Anchor or Pivot Reinforced Hinges

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

7.2.4.2 *Hinge Preparations & Location*

The number of hinges to be provided is based on height of the wall opening and width of the shutter. For details on number of hinges to be provided refer figure 13 for door leaf thickness up to 50 mm.

Doors above 50 mm thick shall require additional hinge to be added to the above workings. Secondly, all doors up to 50 mm require minimum hinge size of 100 mm x 75 mm and doors above 50 mm thick shall require minimum 114 mm x 100 mm x hinge size for better coverage on the door stile. (*See Fig. 13*) for recommended location of hinge.

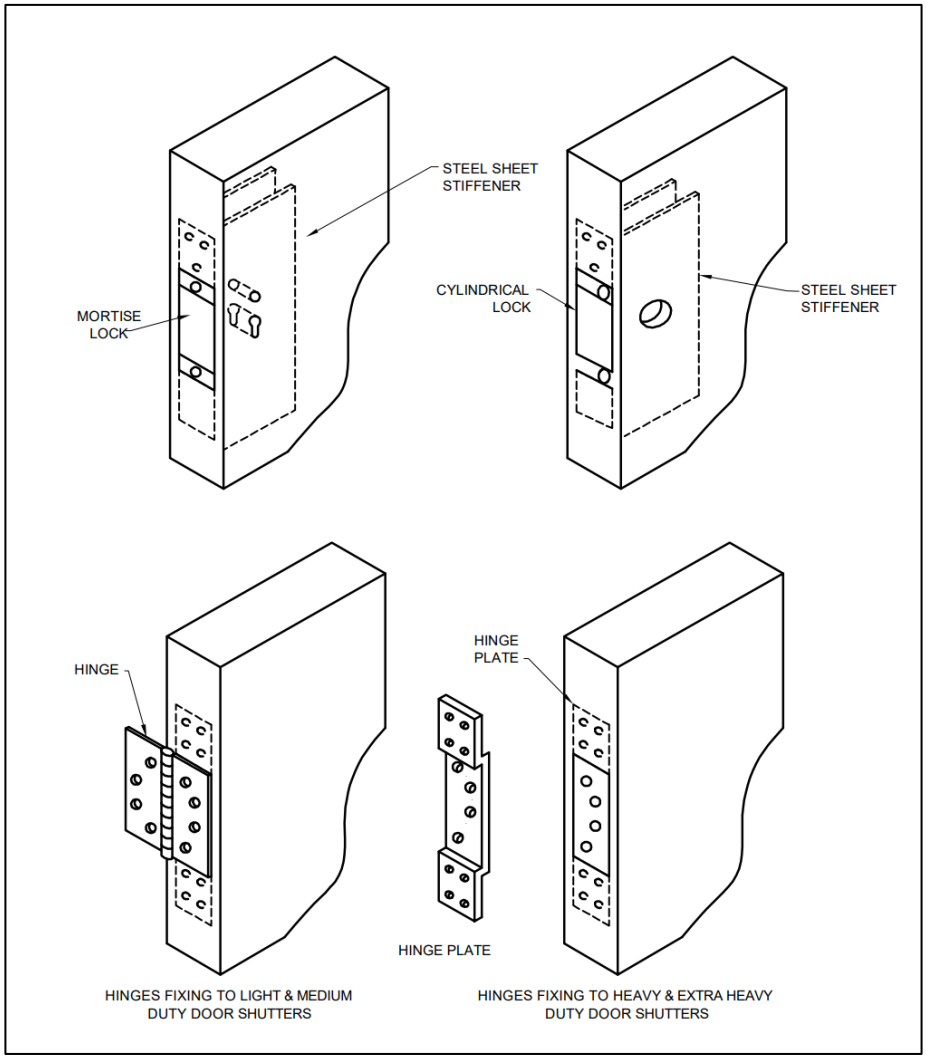
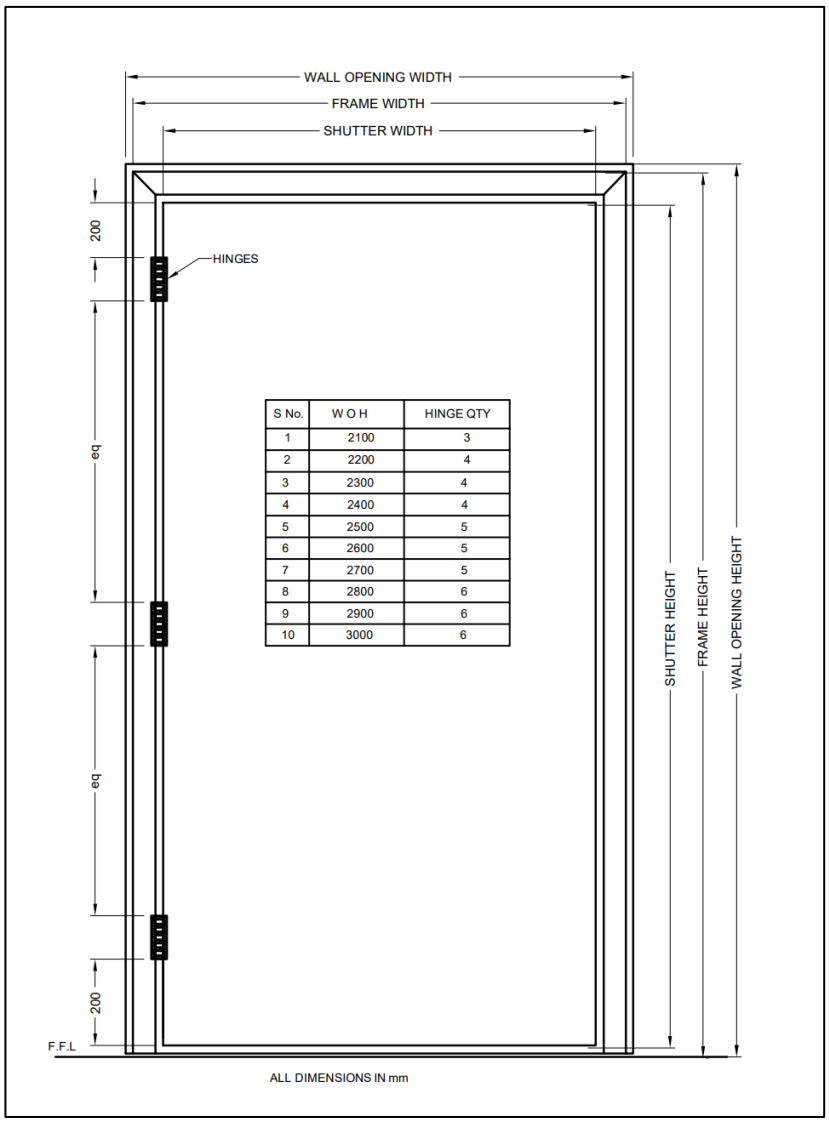


FIG. 12 HINGE AND LOCK REINFORCEMENT.



S No.	W O H	HINGE QTY
1	2100	3
2	2200	4
3	2300	4
4	2400	4
5	2500	5
6	2600	5
7	2700	5
8	2800	6
9	2900	6
10	3000	6

FIG. 13 RECOMMENDED HINGE LOCATION.

7.2.5 *Hardware Locations*

Hardware shall be located in accordance with recommended Table 6. 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 most specialized purpose hardware.

8 FINISH

8.1 Pre-treatment and Phosphating

8.1.1 *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 conforming to IS 1477 (Part 1). No pickling is required for galvanized surface. The shutters shall be finished with either painting or powder coating, as may be as agreed to between the manufacturer and the purchaser.

TABLE 6 HARDWARE LOCATION

Locks, Latches, Roller Latches and Double handle sets	965 mm – 1050 mm Centerline of LockStrike from bottom of frame
Rim and Mortise Panic Devices	
Cylindrical and Mortise Deadlocks (1)	1219 mm to Centerline of Strike from bottom of frame
Push Plates	1150 mm from bottom of frame
Pull Plates	Centerline of Grip 1050 mm from bottom of frame
Combination Push Bar	Centerline of 1050 mm from bottom of frame
Hospital Arm Pull	Centerline of Lower Base is 1143 mm from bottom of frame with grip open at bottom

(1) Cylindrical and Mortise Deadlock strikes shall be located at 1219 mm from the bottom of the frame unless otherwise specified or agreed between the manufacturer and the purchaser.

8.1.2 *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, doors shall be finish painted on all surfaces of the door exposed to view. The factory applied finish paint shall meet the performance requirements and acceptance criteria as stated in IS 1477 (Part 2). The type of paint and colour shall be as agreed between the manufacturer and the purchaser.

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

If wood grain effect finish is required, after pre-treatment and phosphating, the surface, 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 i.e. natural teak, walnut, dark mahogany, moorish teak, pine, oak, beech etc may be agreed between the manufacturer and the purchaser.

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 may be agreed between the manufacturer and the purchaser.

9 DOOR HANDING

Door handing followed shall be universal based on the following criteria. We recommend the following 4 handing to be followed (see figure 14A & 14B)

a. Door handing should be ascertained from the locking side/ key side or the side from which you will secure the door. It is usually outside. Eg, for a main entrance door or the bedroom door, the locking side will be the outside or the key side
b. You need to check the opening direction of the door if it opening away from you or towards you.
c. If it is opening **away** from you and you are using the left hand to **push** open then it is called a left hand door **(LH)**
d. If it is opening **away** from you and you are using the right hand to **push** open then it is called a right hand door **(RH)**
e. If it is opening **towards** from you and you are using the left hand to **pull** open then it is called a left hand reverse door **(LHR)**
f. If it is opening **towards** from you and you are using the right hand to **pull** open then it is called a right hand reverse door **(RHR)**
g. For double leaf doors the word active should be included to denote the handing of door.

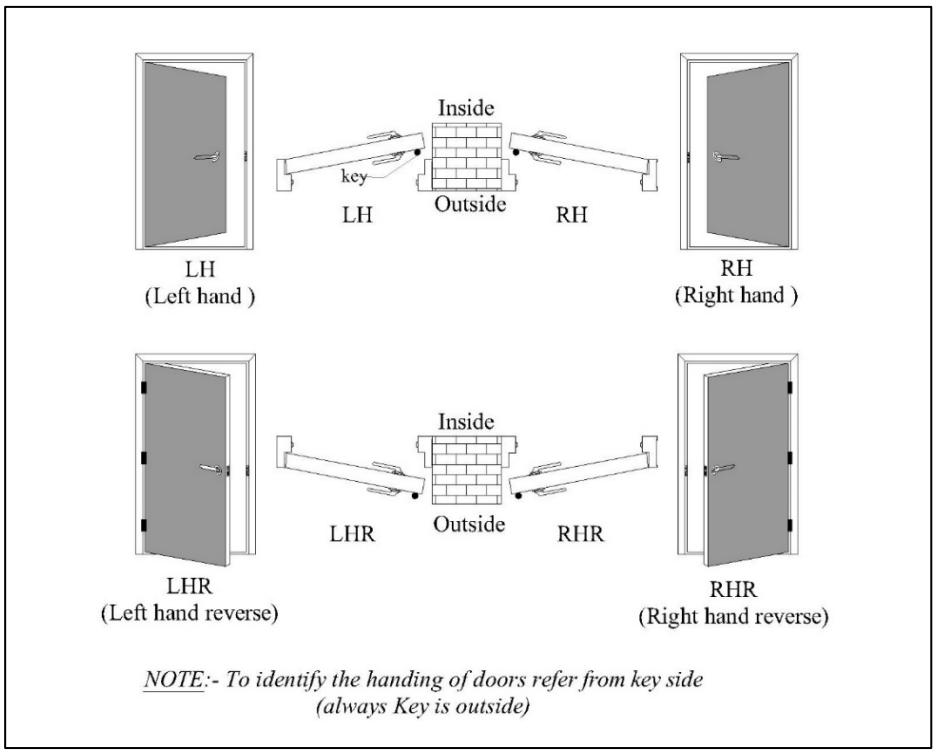


FIG. 14A DOOR HANDING FOR SINGLE LEAF DOORSET

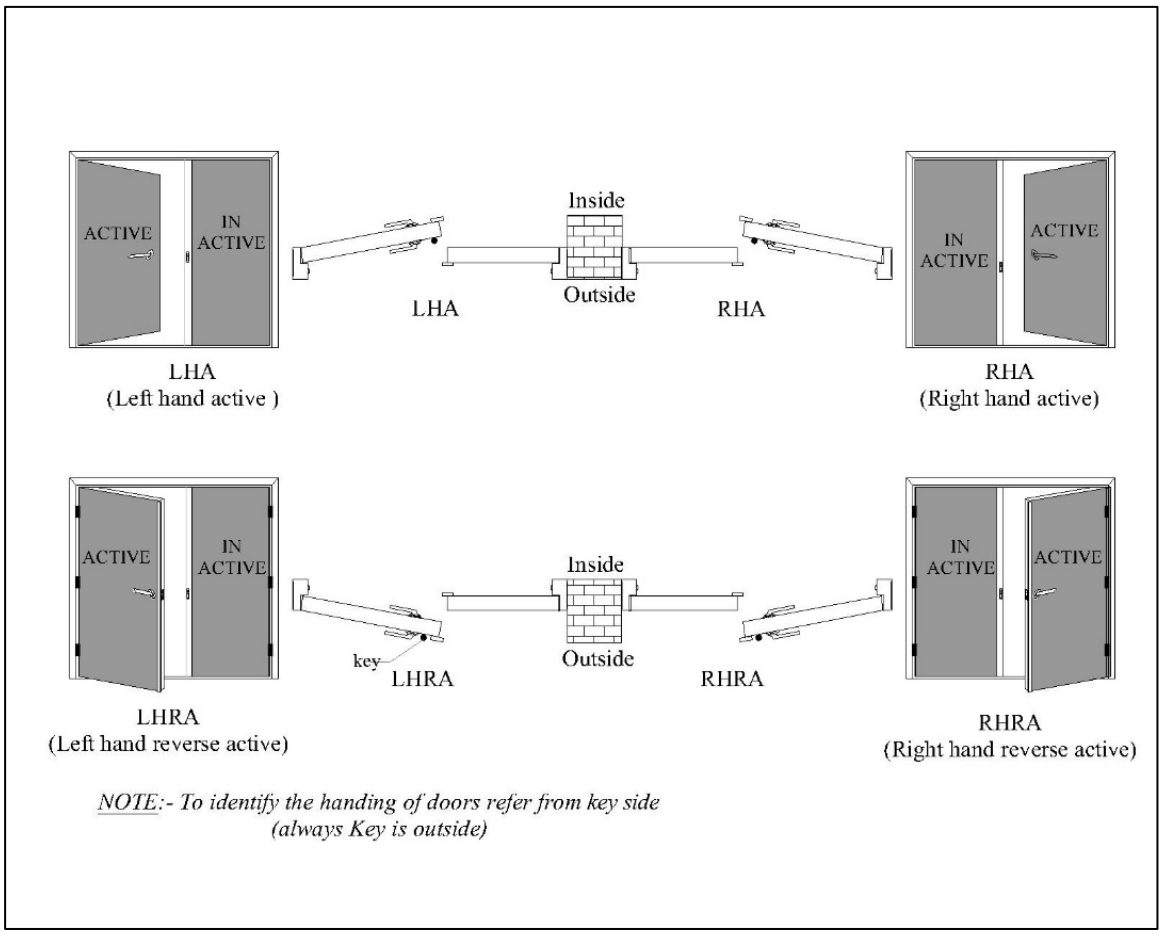


FIG. 14B DOOR HANDING FOR DOUBLE LEAF DOORSET.

10 TESTS (For complete door set)

10.1 Purpose

The primary purpose of this procedure shall be to establish a standard method of testing the performance of a steel door mounted in a hollow metal frame or channel iron frame installed with appropriate anchors, under conditions that might reasonably be considered an accelerated field operating condition.

10.2 Apparatus and Equipment

The apparatus and equipment used shall be the same when testing doors or frames with frame anchors. The main testing structure shall be constructed as shown in figures 1 and 2. The structure shall conform to the parts shown, except the opening width and height are permitted to vary to allow the testing of various door sizes. The test frame for testing doors and frames shall be anchored in such a manner as to ensure rigidity.

The swinging mechanism shall be in two parts:

10.2.1 *Door Opener*

The door opener shall be an air cylinder positioned at 65° to the plane of the door in its closed and latched position that will actuate an exit device mounted on the test door. The contact point shall be set to push the door open 60° ± 5°, and retract to allow the door closer to bring the door back into its original closed position and then begin the cycle again. See the requirements in figures 1 and 1A.

10.2.2 Hardware

The locks, lever handles or exit device, door closer and hinges used in testing shall be selected based on the door manufacturers' recommendations for the testing level described in Swing Test Form 1. The manufacturer and model numbers shall be recorded in the report. All hardware shall be applied to the door and frame with fasteners provided by the hardware manufacturer (for example, machine screws or sex bolts) in the location recommended by the door manufacturer. The device shall be set to close the door at a rate of 15 cycles, ± 1, per minute. Inspect all hardware and silencers at regular intervals, and adjust or replace as necessary. It is acceptable to apply lubrication to hinges and exit devices.

NOTE- Where the applicable Test Standards have been followed, this information shall be recorded in the test report.

10.3 PREPARATION FOR TEST

The door shall be hung in the frame on the hinges. Care shall be taken to ensure the hinges are properly applied to the door and frame as recommended by the hinge manufacturer, and any hinge fillers or shims, are in place. The clearances between the door and the frame shall be recorded in the test report. The door frame shall be securely fastened to the test frame opening structure in accordance with the door manufacturer's instructions. The manufacturer is permitted to select anchors for specific wall applications (i.e., wood stud anchors or steel stud anchors, loose or welded in or existing masonry wall anchors). Silencers shall be installed on the frame and the stop face of the door shall contact the silencers. Alternatively in case of inbuilt seals silencers may not be required. The frame shall be plumb, square, and rigid. When applicable, wall surface materials (e.g., drywall) shall be applied to the test frame opening at the frame throat to simulate actual construction conditions.

10.4 TEST SPECIMEN

10.4.1 Doors

Unless specified otherwise, the test shall be performed on a 900 x 2100mm nominal size door. A detailed description of the construction of the door and the applicable processes such as welding, bonding, etc., used for attaching components, shall be recorded in the test report, Swing Test Form 1, under the "remarks" section.

10.4.2 Frames

Unless specified otherwise, the test shall be performed on a 900 x 2100 nominal size frame having Minimum 125mm jamb depth. A detailed description of the door frame and the

applicable processes such as welding, bonding, etc. used for attaching components, shall be recorded in the report, Swing Test Form 2, under the “remarks” section. A detailed description of the frame and anchoring system which shall cover all details of the anchors, as well as the means of attachment in the frame and the weight of the door used for the test shallbe recorded in the test report, Swing Test Form 2.

10.5 SWING TEST

10.5.1 *Doors*

Duration of the test shall be 250,000 cycles with latching for Level C doors; 500,000 cycles with latching for Level B doors; and 1,000,000 cycles with latching for Level A doors. A general inspection of the door shall be made at 25,000 cycle intervals for the first 100,000 cycles and at 50,000 cycles thereafter. A mechanical counter or equivalent shall be used to record the cycles. The general inspection shall cover perimeter clearances between door and frame and all components readily accessible, such as door face skins, exposed hinge and lock stiles, flush closing channels, end closures, hinge reinforcements, and lock body/face plate reinforcements and shall cover the integrity of assembly methods used to connect the door components. Doors which have passed the cycling criteria at one level shall be deemed to have passed all lower levels. The results shall be recorded on a standard performance report, Swing Test Form 1.

10.5.2 *Frames and Frame Anchors*

Duration of the test shall be 250,000 cycles for Level C frames; 500,000 cycles for Level B frames; and 1,000,000 cycles for Level A frames. A general inspection of the frame shall be made at 25,000 cycle intervals for the first 100,000 cycles and at 50,000 cycle intervals thereafter. The general inspection shall cover perimeter clearances between door and frame and all frame components readily accessible, such as corner clips and screws, corner tabs and slots, head and jamb tabs/slots hinge reinforcements, and strike reinforcements and shall cover the integrity of assembly methods used to connect the frame components Door frames which have passed the cycling criteria at one level shall be deemed to have passed all lower levels. The results shall be recorded as part of the test report, Swing Test Form 2.

10.6 Twist Test

The twist test is applicable in evaluating door construction only. The deterioration of the door strength during the cycle test, if any, shall be checked through a series of twist tests. These twist tests shall be performed before the cycle test begins and then at 25,000 cycle intervals for the first 100,000 cycles and at 50,000 cycle intervals for the balance of the test. During the twist test, the hinge pins and silencers shall be removed from the door and frame assembly and the exit device shall be unlatched. The door is then clamped in place as noted in figure 2.

If necessary to facilitate twist testing, the door is permitted to be taken from the test fixture and installed in a separate twist fixture. Loads in 13.6kg increments shall be applied at the upper or lower lock edge corner through the screw jack and force gauge in the area illustrated in figure 2. The deflection noted on the dial indicator shall be plotted against the load applied to the corner on Twist Test Form 3. A maximum 136 Kg. load shall be applied. The load shall

then be reduced in 13.6 Kg. increments and corresponding deflections recorded and plotted on Twist Test Form 3. A smooth curve drawn through the points shall graphically demonstrate the reaction of the door to increasing and decreasing pressures at different cycle intervals.

At the completion of each twist test, the hinges shall be reassembled by means of inserting the hinge pins, silencers shall be reinstalled, the exit device shall be latched, and the assembly shall be subjected to another 25,000 or 50,000 cycles. The condition of the silencers shall be noted and replacements made where deemed necessary.

10.7 Acceptance Criteria

10.7.1 *Doors*

10.7.1.1 Doors shall not show any visual indication of metal fatigue, cracking or deformation at hardware cut outs or along form contours. Door must remain operable during the test. If the door fails to operate, it will be deemed to have passed the last passed cycle.

10.7.1.2 Doors of laminated construction (cores laminated to face sheets, channels or stiffeners laminated to face sheets, etc.) shall not delaminate in excess of 10% of the total surface area.

10.7.1.3 In doors of welded construction (stiffeners or channels welded to face sheets, etc.) breakage of welds shall not exceed 10% of the total weld of those face stiffeners.

10.7.1.4 Top, bottom or edge channels shall remain securely in place, without any weld breakage.

10.7.1.5 Where seams occur on doors, there shall be no opening or spreading of the seam.

10.7.1.6 All hardware reinforcements shall remain securely in place and show no visual signs of metalfatigue, cracking or deformation.

10.7.1.7 As a result of the twist test, the maximum deflection permitted shall not exceed 62mm when loaded to 136Kg for Level C. For Level B and Level A doors the maximum deflection shall not exceed 31mm when loaded to 136Kg.

10.7.1.8 Permanent deflection for doors shall not exceed 3mm when load is removed after each twist test.

10.7.1.9 Tapped holes shall not strip.

10.7.1.10 At the completion of the swing and twist tests, the door shall be fully operable. If the door becomes inoperable, the door will be considered to have failed and the previous passed cycle will be recorded.

10.7.1.11 Upon completion of the foregoing checks and measurements, remove door from test structure and cut door into four equal sections with a horizontal and a vertical cut at the center of the door height and door width. Internal construction of door shall be inspected

visually for delamination, metal fatigue, cracking and weld failure. The results of this inspection shall be recorded in the test report.

10.7.2 Frames and frame anchors

10.7.2.1 Frames shall remain plumb, square, rigid, and show no visual signs of metal fatigue, cracking, or deformation at hardware cut outs or along form contours.

10.7.2.2 Corners shall stay aligned with seams in a closed position.

10.7.2.3 Perimeter clearances between door and frame shall not be greater than 1.6mm from those listed at onset of test.

10.7.2.4 All hardware reinforcements shall remain securely in place and show no visual signs of metal fatigue, cracking or deformation.

10.7.2.5 Tapped holes shall not strip.

10.7.2.6 At any time during the test, the frame shall not limit door operation. If during the test the door becomes inoperable, it shall be determined whether a defective door frame, hardware reinforcement,hinge, frame anchor, etc., caused the failure and shall be so noted in the test report.

11 SAMPLING AND CRITERIA FOR CONFORMITY

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

11.1 Sample Size

11.1.1 *Lot* - The number of specimens to be taken for testing the quality of shutters for dimensions and squareness, general flatness and local planeness shall be in accordance with IS 4020 column 2 and 3 of Table 7.

11.1.2 For acceptance criteria for physical endurance of steel doors, frames and anchors of the doors shall be subjected to additional test as defined in Annexure D.

11.1.3 For acceptance criteria of factory applied paint finish the doors shall be subjected to 500hrs of salt sprey test. The material sheet thickness, coating shall be same as the product under consideration.

11.1.3 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 7.

TABLE 7 SAMPLE SIZE AND CRITERIA FOR CONFORMITY

Sl. no. (1)	Lot Size (2)	Sample size (3)	Permissible no. of defectives (4)
i)	1 to 50	1	0
ii)	51-100	2	0
iv)	101-500	3	0
v)	501 and above	4	1

NOTE — For lot size 25 or less, number of samples to be taken for testing shall be as agreed tobetween the manufacturer and the purchaser

12 MARKING

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

i) Name of the manufacturer,
ii) Labelling or certificate number if any,
iii) Year of manufacture/ Batch number,
iv) Type of shutter,
v) Shutter thickness, and
vi) Suitable for wall opening size

12.2 BIS Certification Marking

The door-set may also be marked with the Standard Mark.

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standard Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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, so that he can supply the complete door-set including hardware with suitable screws.
e) Door-set finishes to be provided.

ANNEX A
(Clause 2)

IS No.	*Title*
277 : 2003	Galvanized steel sheets (Plain and corrugated) — Specification (*sixth revision*)
1477	Code of practice for painting of ferrous metals in buildings:
(Part 1) : 1971	Pre-treatment (*first revision*)
(Part 2) : 1971	Painting (*first revision*)
4043 : 1969	Recommendations for symbolic designation of direction of closing and faces of doors, windows and Shutters
6911 : 1992	Stainless steel plate, sheet and strip — Specification (*first revision*)
10428 : 1983 & ISO22496	Glossary of terms relating to doors
13871 : 1993	Powder coatings — Specification
14246 : 1995	Continuously pre-painted galvanized steel sheets and coils — Specification
IS 12436	Specification for preformed rigid polyurethane (PUR) and polyisocyanurate (PIR) foams for thermal insulation
IS 8183	Bonded Mineral Wool – Specification expanded polystyrene for thermal insulation purposes.
IS 4671	Specification for expanded polystyrene for thermal insulation purposes.
IS 2553 (Part 1)	Safety glass Specification
IS 2835	Specification for Flat Transparent sheet glass.
IS 4020 (Part 1-16): 1998	Door shutters – Methods of test

ANNEX B
GUIDELINES FOR DOOR-SET STORAGE, INSTALLATION AND MAINTAINANCE

B-1 Job Site Storage

All doors and frames shall be stored horizontally under cover. The units shall be placed on at least100 mm high wood sills or in a manner that will prevent rust or damage. The use of non-vented plastic or canvas shelters that can create a humidity chamber shall be avoided. If the wrapper on the door becomes wet, it must be removed immediately. Proper jobsite storage is extremely important in maintaining the quality and integrity of the factory applied paint. Improper storage of material will have an adverse effect on the factory applied paints.

B-2 Frame Installation

B-2.1 Frames shall be installed plumb, level, rigid and in true alignment as recommended in the erection instructions for steel frames and installation guide for doors and hardware. All frames, other than drywall slip-on types, shall be fastened to the adjacent structure so as to retain their position and stability. Slip-on dry-wall frames shall be installed in prepared wall openings in accordance with manufacturer's instructions. The maximum allowable gap between the frame and wall shall not be more than 5 mm and should be sealed with proper sealant once the frames are installed. It is critical that correct methods of installation are adopted to ensure that a door-set. For anchor locations please (*See Fig 15*) and for no of anchors see Table 8.

It is recommended that installation of door-sets is carried out by the manufacturer or, alternatively, by installers trained in fixing metal door-sets in accordance with the manufacturer's fixing instructions. The same shall be guaranteed by the manufacturer on completion of installation.

B-2.1.1 *Sealing Between Door Assembly and Surrounding Structure*

In order to close the gap between the wall or partition when fitted with a door assembly, the junction between the two elements should be adequately sealed. Ideally a wall or partition should be built up to the rear of the door frame without gaps. This is not always possible, and to ensure easy installation of the door assembly, the opening should be made within the permissible tolerance of 5 mm on all three sides. The gap between door frame and wall opening can vary greatly and is usually masked with an architrave or with sealant. For partitions the maximum gap shall not be more than 2.5 mm on all three sides.

B-2.1.2 Where grouting is required in masonry installations, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Head members of frames shall not be grouted with the grout mixture. Grout shall be mixed with cement and sand slurry in 1:4 ratio.

Steel frames, may not necessarily require grouting, however grouting may be done based on the wall construction to keep the anchors intact. Grouting shall not be used for frames installed in plasterboard walls and steel structure.

Alternative use of polyurethane foam is also recommended for all kind of frames, which is available from various manufacturers for dry fixing.

TABLE 8 RECOMMENDED NO. OF ANCHORS AS PER DOOR HEIGHT

S.NO	W O H	No Of Anchors for Hinge and Strike Jambs	
	Upto	1.2mm Frame Sheet Thk	1.6mm Frame Sheet Thk
1	2100	3	4
2	2200	4	5
3	2300	4	5
4	2400	4	5
5	2500	5	6
6	2600	5	6
7	2700	5	6
8	2800	6	7
9	2900	6	7
10	3000	6	7

No Of Anchors for Head Jambs	
W O W Upto	Anchor Qty
1000	1
1001 to 1500	2
1501 to 2000	3
2001 to 2600	4

B-3 Door leaf Installation

B-3.1 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. Shimming shall be performed by the installer as needed to assure the proper clearances are achieved.

B-3.1.1 *Clearance Gaps*

The clearance gap between the door leaf edge and the door frame shall be maintained for operation efficiency. Doors should be hung to give an equal gap across the head and down both jambs. A typical gap of 3 to 4 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 tested tolerances.

B-3.1.2 *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 maximum undercut gap shall be according to the site requirement and manufacturer recommendation.

B-4 Hardware Installation

Installation of hardware items shall be in accordance with good practices and 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.

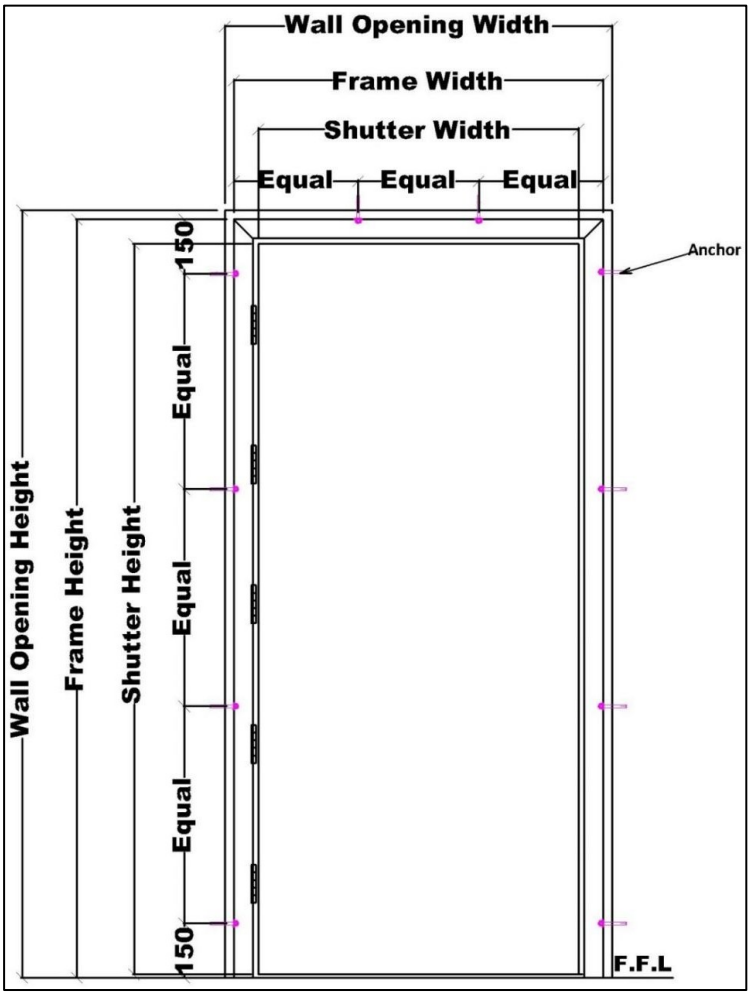


FIG. 6 RECOMMENDED ANCHORING LOCATION

B-4.1 Fixing of Smoke Seal

When it is necessary to fit seals on site, either in the frame or the door edge, it is important to follow the manufacturer’s recommendations precisely for the type and mode of operation of the door concerned. Care is necessary when fitting self-adhesive seals to ensure that the groove is dry and free from dust or sawdust to ensure a good bond. The self-adhesive action deteriorates at lower temperatures, and additional mechanical fixing might be necessary if the seals are fitted at temperatures below 10 °C. Seals may be surface-mounted if they are sufficiently thin, but such seals are more prone to detachment than those fitted into grooves.

B-6 Installation of Factory Applied Finish Painted Materials

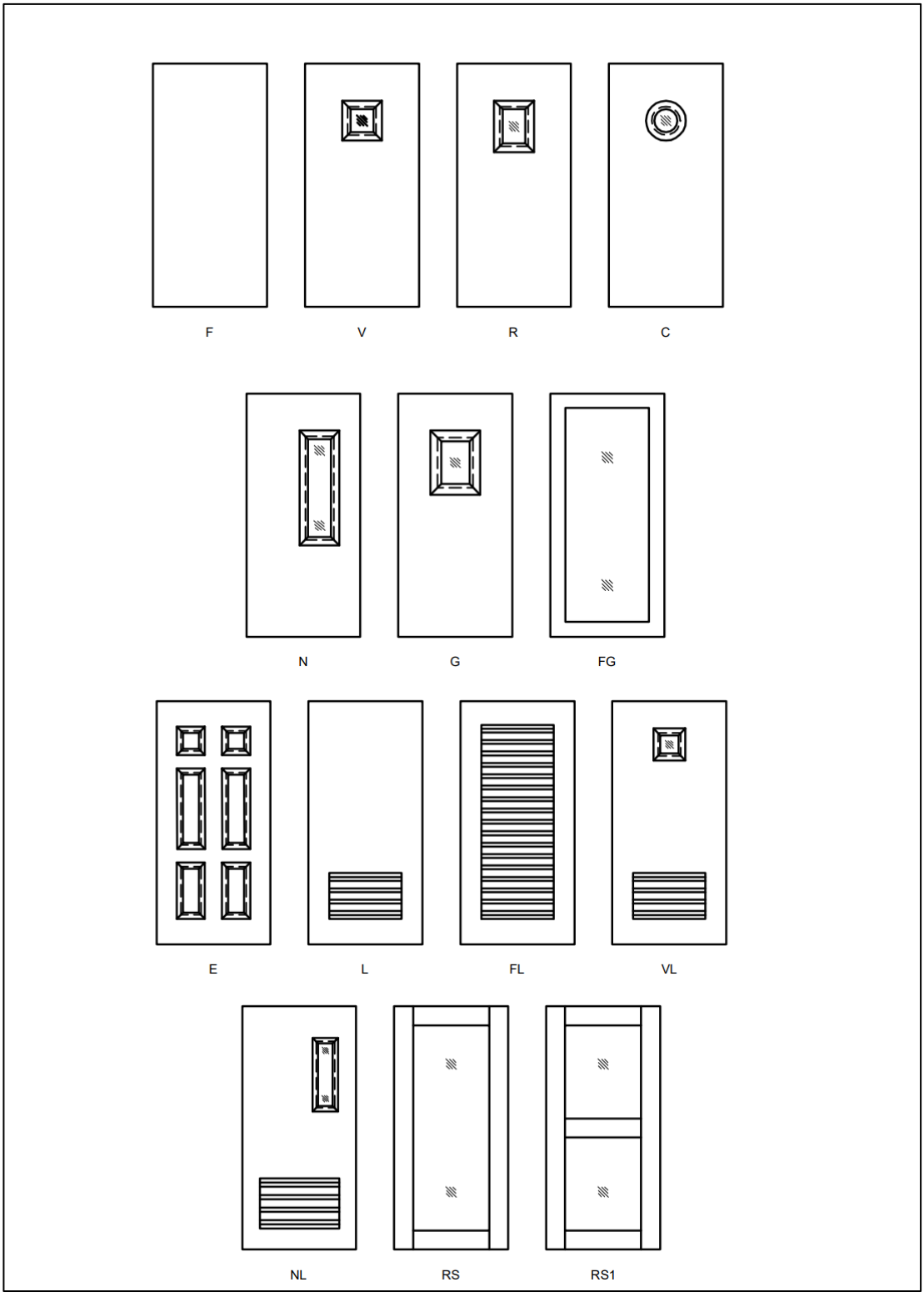
In addition to storage and handling precautions, it is imperative that the work of all other rough trades must be completed prior to the installation of factory applied finished painted product.

B-7 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 in accordance with good practices and as per the manufacturer's maintenance manual.

It is important, therefore, 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 – Standard door type nomenclature



ANNEXURE – D

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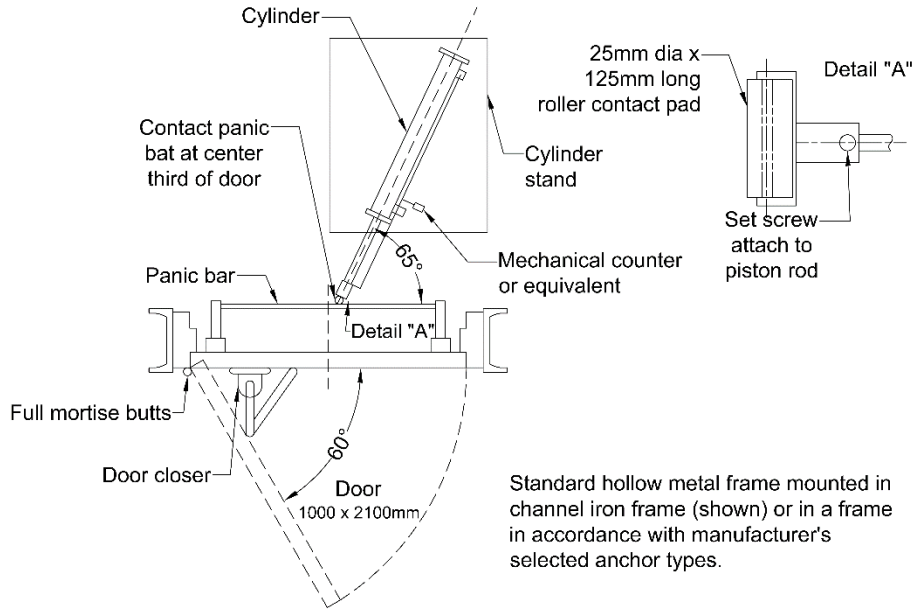


Figure 1 - Swing test detail for standard frame

FIG.1 SWING TEST DETAIL FOR STANDARD FRAME.

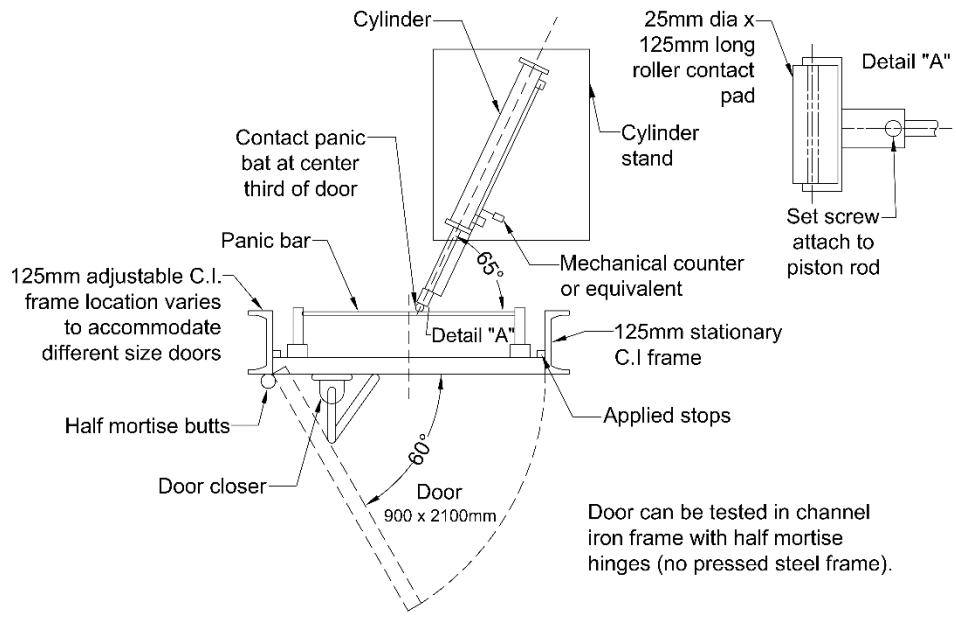


Figure 1A - Swing test detail for channel iron frame

FIG.1 SWING TEST DETAIL FOR CHANNEL IRON FRAME.

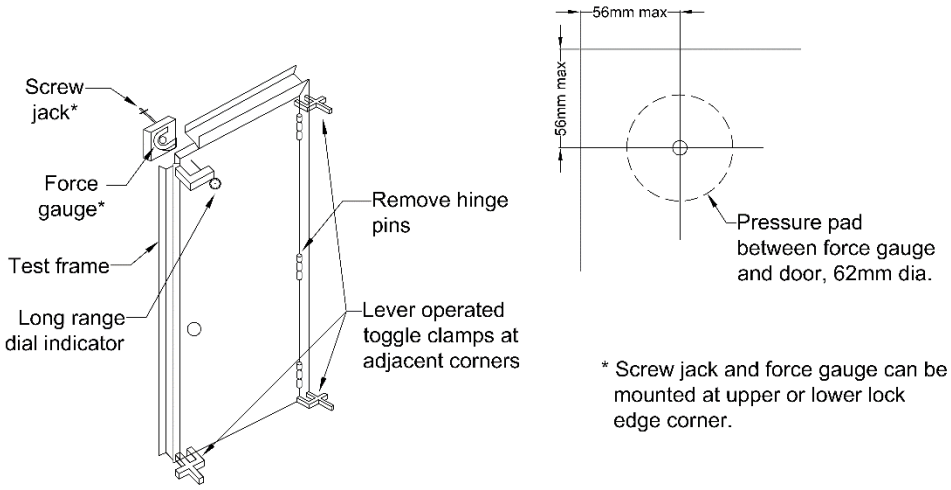


Figure 2 - Twist test detail

FIG.2 TWIST TEST DETAIL

Performance Report — Swing Test Form 1

Date _____

Test# _____

Manufacturers _____ Type and Size of Doors _____

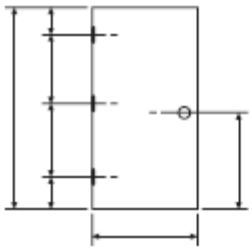
Weight of Door _____

Inspection at indicated cycle intervals (1)	1 25 M	2 50 M	3 75 M	4 100 M	5 150 M	6 200 M	7 250 M	8 300 M	9 350 M	10 400 M	11 450 M	12 500 M	13 550 M	14 600 M	15 650 M	16 700 M	17 750 M	18 800 M	19 850 M	20 900 M	21 950 M	22 1000 M
Condition of edge weld/bond																						
Condition of lock prep.																						
Condition of hinge prep.																						
Top																						
Center																						
Bottom																						
Condition of top closure																						
Condition of bottom closure																						
Condition of door core/stiffeners																						
Condition of panels — general																						
					Level C Door ↑					Level B Door ↑											Level A Door ↑	

(1) Indicates condition in appropriate columns:

S — Satisfactory

Use footnotes under Remarks for further explanation



Hinge Manufacturer & Number _____

Lock Manufacturer & Number _____

Closer Manufacturer & Number _____

Remarks:

_____

_____

_____

_____

Performance Report — Swing Test Form 2

Date _____

Test# _____

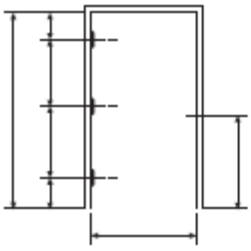
Manufacturers _____

Jamb Width _____ Type and Size of Frame _____

Weight of Door _____ Type of Anchors _____

Inspection at indicated cycle intervals [1]	1 25 M	2 50 M	3 75 M	4 100 M	5 150 M	6 200 M	7 250 M	8 300 M	9 350 M	10 400 M	11 450 M	12 500 M	13 550 M	14 600 M	15 650 M	16 700 M	17 750 M	18 800 M	19 850 M	20 900 M	21 950 M	22 1000 M
Condition of general appearance																						
Condition of perimeter clearance																						
Condition of strike prep.																						
Condition of hinge prep.																						
Top																						
Center																						
Bottom																						
Condition of silencers																						
Condition of wall anchors																						
Condition of floor anchors																						
Condition of miters																						
					Level C Door ↑					Level B Door ↑											Level A Door ↑	

[1] Indicates condition in appropriate columns:
S — Satisfactory
Use footnotes under Remarks for further explanation



Hinge Manufacturer & Number _____

Lock Manufacturer & Number _____

Remarks:

_____

_____

_____

_____

Performance Report — Twist Test Form 3

Test No. _____ Date _____

Product Description _____