

**SECTION – X / A**  
**WOODEN JOINERY**

**1.0 GENERAL**

**1.1 INDIAN STANDARDS**

Work shall be carried out to Indian Standards and Code of practices. In absence International standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies / conflict noticed shall be directed to the PM for his direction / approval. However as a general rule more stringent specification shall take precedence.

1. IS 287 Recommendation for maximum permissible moisture content for timber used for different purposes in different zones.
2. IS 401 Code of practice for preservation of timer.
3. IS 848 Specification for synthetic resin adhesives for plywood (phenolic and amino plastic).
4. IS 851 Specification for synthetic resin adhesive for construction (non-structural) in wood.
5. IS 852 Specification for animal glue for general wood working purposes.
6. IS 1003 Specification for timber paneled and glazed shutters  
Part 1 Door shutters
7. IS 1141 Code of practice for seasoning of timber
8. IS 1328 Specification for veneered decorative plywood
9. IS 1508 Specification for external for use in synthetic resin adhesives (urea-formaldehyde) plywood.
10. IS 2036 Phenolic laminated sheet
11. IS 2202 Specification for wooden flush door shutter (Solid core type)  
Part I Plywood face panels  
Part II Particleboard and hard board face panels
12. IS 2221 Method of test for Amino plastic moulding material
13. IS 4020 Method of tests for shutters  
Part 1 to 15
14. IS 4021 Specification for timber doors, window and ventilator frames.
15. IS 4913 Code of practice for selection, installation and maintenance of timber doors and windows.
16. IS 7196 Specification for hold fast

17. IS 7638 Method of sampling for plywood, fibre hardboard, insulation boards and particle boards
  18. IS 9307 Method of Test for wood based structural sandwich construction.  
Part 2 Edgewise compression test.  
Part 3 Flat wise compression test.  
Part 4 Shear test
  19. IS 12120 Code of practice for preservation of plywood and other panel products.
- 1.2 Quality Assurance
- 1.2.1 Comply with standards specified for material and workmanship
- 1.2.2 Supervision and workmen employed shall be experienced in field of carpentry works and shall be able to guarantee workmanship and finish of standards as established and approved by the PM.
- 1.2.3 Shutters manufacturer shall have ISI certification and each shutter received at site shall bear stamp of ISI, manufacturer and type of product, batch no., etc.
- 1.2.4 Shutter manufacturer shall have minimum 7 (seven) years experience in this product.
- 1.3 Submittals
- 1.3.1 For approval the contractor shall submit with detail note
- a) Literature / Catalogue of product to be used.
  - b) Test certificates from independent laboratories conforming that product meets standards specified.
  - c) Manufacturers certification that product meets / exceeds specification for the project.
  - d) Samples
    - i) Timber piece - 300x100x60 mm 3 Nos.
    - ii) Shutter - corner piers showing detail construction.
    - iii) Veneers - 300x300mm
    - iv) Laminates - 300x300 with shade samples
    - v) Samples with polish / paint finish as specified.
    - vi) Joinery details
- 1.3.2 Shop Drawings
- The contractor shall prepare joinery detail drawing for site measurement. Drawings shall indicate each material, its installation, fixing details, finishing etc. all in plan, elevation, section and typical details
- 1.4 Delivery, storage and handling
- 1.4.1 Care should be exercised during loading, unloading and handling of the door frames and panels to prevent hippling, dent, staining or other physical

damages to these components. The materials should be protected with polythene sheets via 'shrink-wrapping' or 'strap wrapping' methods.

- 1.1.2 Upon receiving, the materials should be checked to ensure their type, finishes and dimensions are in accordance with the approved samples. The delivered materials should also be inspected to be in good physical condition.
- 1.4.3 Where applicable, it is advisable to send the materials directly to the units where they are to be installed. It is important to note that delivery to site at an unnecessary early stage may result in damages to the products during storage and unnecessary handling.
- 1.4.4 The storage space should be sheltered, well ventilated, clear from debris and kept dry at all times. Door frames and panels should be stacked horizontally on raised ground to prevent warpage and other possible damages caused by the surface.
- 1.4.5 The appearance of some timbers and veneers should not be left unprotected in direct sunlight. It is advisable to protect them with opaque covers to avoid direct sunlight.
- 1.4.6 Fittings and fixtures should be stored in such manner to prevent contact with water, staining by foreign materials or other damages.

## **2.0 MATERIAL**

### **2.1 Timber**

- 2.1.1 Timber shall be of quality as specified in BOQ and well-seasoned. When a kind of timber is not specified, good quality teak wood shall be used. It shall have uniform color, be free from defects such as cracks, dead knots, soft spongy spots and waves of injurious open shapes. Grains shall be reasonably straight. The individual hard and sound knot shall not be larger than 6 sq cm. The aggregate area of all knots shall not exceed 0.5% area of a piece. All timber is sawn unless otherwise stated.
- 2.1.2 All timber shall be treated with chemical wood preservatives and be kiln seasoned to IS 1141 and conform to IS 287 for moisture content. Moisture content shall be between 12% to 15%. It shall be prior to being brought to site and report shall be submitted to the Engineer. All timber to be treated shall be finished to final dimension before it is treated. Treated timber brought to site shall accompany inspection report. In case of fabricated joinery item, it shall accompany along with same.
- 2.1.3 Timber used shall be treated with 10 years guarantee and approved anti-termite treatment.
- 2.1.4 Timber received at site shall be marked and stamped for approval prior to being used at site.
- 2.1.5 Sizes specified are not indicative and shall be correct finished sizes within allowable tolerances.

- 2.1.6 All timber shall be finished to required dimension and texture prior to being treated for chemical preservation.
- 2.2 Plywood
- 2.2.1 Plywood used shall be WBP type, of specified thickness and conforming to IS test as specified.
- Marine ply shall be used in damp and exposed weather location / conditions.
- 2.2.2 Veneers of plywood faces to be painted or finished with similar treatment and be totally free from knots, worm and beetle holes, splits, stains of glue or other acceptable defects.
- 2.2.3 Plywood face to be natural face finished and shall be totally free from knots, worm and beetle, holes, stains of glue splits or other acceptable defects.
- 2.3 Plastic Laminated Sheets
- 2.3.1 Plastic laminated sheets shall be 1 mm thick with an amino plastic facing, cigarette-proof and shall comply with standards and specifications.
- 2.3.2 Sheets shall be of approved manufacturer from his range in approved colour.
- 2.4 Flush Shutters
- 2.4.1 Readymade flush shutters shall be as specified and shall comply to respective code of practice. Manufacturer's certificate confirming that shutters supplied comply to IS shall have to be obtained and submitted to the PM. Also, a copy of test certificate from an independent laboratory shall be obtained. Door shutter shall be tested from a laboratory to get confirmation that door shutter complies to IS specifications.
- 2.4.2 Shutters shall be of specified thickness. They will have natural ply or teak wood veneer finish or 1.2 mm thick melamine sheets as specified. These shall be hot pressed and bonded with water resistant formaldehyde synthetic resin of exterior quality as per IS specifications. The adhesive used for bonding cross band to core and face veneers to cross band shall conform to IS 848 (Phenolic and Aminoplastic). Ensure that the adhesives are unaffected by any timber treatment.
- 2.4.3 Tolerance on width and height shall be + 2 mm. Tolerance on thickness shall be + 1 mm. Thickness of shutter shall be uniform throughout. Variation permissible shall be 0.8 mm.
- 2.5 All fittings and fixtures shall be as specified in schedule or bills of quantity or as directed by the PM. It shall be conforming to IS and shall be of Brass of approved make. Fittings shall be guaranteed by the manufacturer for its performance. Woods screws shall be matching and of type as required for each fitting and shall conform to IS.
- 2.6 Nails / screws
- All nails, screws etc. shall be hot dip galvanised or of brass or nonferrous material.
- 2.7 Adhesives
- Adhesives and glue shall be as per IS for exterior quality and water repellent (WBP grade). It shall confirm to BS 1203 Animal glues shall not be permitted.

2.8 Approved primer and sealer for the paint shall be used.

### **3.0 SCOPE OF WORK**

#### **3.1 Frames**

Size of timber shall be specified in the BOQ. Frames shall be rebated to house the shutter. They may be rebated on both sides, or rounded or moulded, etc. as per drawing if specifically referred in BOQ. For single rebate, depth shall be 15 mm.

Frames shall be finished smooth to receive paint, polish or any other specified finish. Surface abutting against masonry or concrete must be with anti-termite treatment and a coat of boiling coal tar or any other approved wood preservative or primer applied prior to placing in the final position.

#### **3.2 Flush shutters**

Provide approved quality and make flush shutter of size and thickness with required fire rating if any, required fittings and fixtures, and finished as specified in drawing / BOQ. Work shall include testing at independent laboratory supervision submitting guarantee for quality, fire rating if any etc to PM for work and executed.

3.2 Providing, preparing, moulding teak wood architraves of details as given by the PM. Work shall including preparing, seasoning, moulding, cutting, fixing with headless nail, etc. all complete and approved painted or polished as specified by the PM.

### **4.0 WORKMANSHIP**

#### **4.1 General**

4.1.1 Timber brought at site shall be as approved by the PM.

4.1.2 No timber shall be painted, tarred, oiled, etc. before its inspection by the PM. Any effort to hide the defects by plugging, painting, etc. shall render the piece to be rejected by the PM.

4.1.3 All rejected timber shall be removed at once from the site of work.

4.1.4 All sawing of timber shall be done in straight lines and planes of uniform thickness.

4.1.5 All joints shall be tongued and grooved or of the type shown in the drawings specified in the item or as directed by the PM. All joints shall be glued with approved water repellent adhesive.

Joints shall be strong, neat and shall fit without wedging or filling. They shall be pinned with hard wood or bamboo pins of 10- 15 mm dia after the members of the frame are glued and pressed together in a suitable vice-mechanism. Also jointing concealed pins shall be provided.

4.1.6 Prior to jointing, wood members of frame shall be planed smooth and accurate to the full depth. Rebates, roundings, mouldings, etc. as shown in the drawing shall be done before the members are joined.

4.1.7 No defects which reduce the strength of the connection are permitted at joints, bearing or assembly connections.

- 4.1.8 All timber items shall be subjected to inspection by the PM prior to any treatment to be carried out. No item shall be installed unless it is approved by the PM.
- 4.1.9 Woodwork in contact with masonry or concrete shall be painted with hot bitumen collator before being placed in position.
- 4.2 Flush Shutters
  - 4.2.1 The timber used in core of flush door shall be from species specified in Appendix A of IS 2202-part I. For styles, rails and lapping timber specified in-group 2 of Appendix A shall be used. Moisture content in the timber shall not be more than 12% when tested according to IS 1708.
  - 4.2.2 Timber shall be seasoned, chemically treated and anti-termite treated. It shall be free from decay and insect attack.
  - 4.2.3 Plywood used in flush shutters shall conform to BWP grade.
  - 4.2.4 Cross band used in flush door shutters shall conform to the requirements laid down in BWP grade plywood.
  - 4.2.5 Adhesives used shall be phenol formaldehyde synthetic resin conforming to BWP type. All bonding such as core members to one another including core frame, lapping, cross band and plywood to core and face veneers to cross band shall be with phenol formaldehyde or as approved exterior quality.
  - 4.2.6 Construction shall conform to specification given in IS 2202 Part I.
    - 4.2.6.1 A frame constructed of styles and rails shall be provided for holding the core. Width shall not be less than 50 mm and more than 100 mm inclusive of lapping if provided.
    - 4.2.6.2 Core may be of wooden strips, particleboard, combination of block board and particleboard.
    - 4.2.6.3 Styles and rails shall be made of one or more pieces glued together.
    - 4.2.6.4 Levelling by planning of surfaces shall be carried out at each stage of construction to eliminate impressions of the core strips on the outside face.
    - 4.2.6.5 Face panel shall be formed by gluing by hot press process on both faces of the core. Face panels shall be minimum 6 mm ply. Direction of grain on face to be vertical.
    - 4.2.6.6 Lapping may be internal or as edge-band as specified and approved by the PM. External lapping shall be solid and minimum 6 mm thick on the face of the door. Edge band lapping shall have a total depth of minimum 25 mm. Joints shall not be permitted in lapping.
    - 4.2.6.7 Double leaved shutters shall be rebated meeting either by splayed or square type. Thickness of lapping shall not be less than 35 mm.
    - 4.2.6.8 Opening for glazing and ventilation shall be provided if specified. Opening of glazing shall be lipped internally with solid timber.
    - 4.2.6.9 Shutters shall be shop-prepared for taking mortise locks or latches as may be ordered. Sizes of block for fixing hardware shall conform to IS 2209.
  - 4.2.7 All four edges of shutters shall be square or free from twist or warp in its plane. Both faces shall be sanded to a smooth even texture.

4.2.8 The shutters shall be sampled as per criteria given in Appendix B of IS 2202 part I and tested as per detail given in clause 9 of IS 2202 part I for

- a) End Immersion Test
- b) Knife Test
- c) Glue Adhesion Test

4.3 Fittings and fixtures

4.3.1 The fittings shall be as specified in BOQ or the drawings for door shutters. All fittings and fixtures shall be new, sound and strong, required screws for fixing shall be in the same colour and included in the pricing. Fittings and fixtures shall be as approved by the PM and conform to IS. Providing and fixing shall also include making grooves, chases, reinforcing, etc. Any fixtures damaged during fixing shall be removed and replaced with new one.

4.3.2 All items shall be carefully positioned and securely fitted. They shall be to correct line level and plumb. Any damage or denting etc. to fitting and fixtures shall be avoided with extra care.

4.3.3 Fittings and fixtures fixed shall be carefully protected during painting, polishing etc. or shall be removed and refix after.

## **5.0 MEASUREMENT**

5.1 Shutters shall be measured in square meter for type and thickness as specified in drawing and BOQ.

5.2 The price for an item shall include supply of specified quality, quantity and type of timber, sawn, cut, jointed, framed and fixed in position including supply and fixing of approved anti-corrosive treated fixtures, straps, bolts, hold-fasts, spikes, nails, screws, etc. supplying and applying glue, coal tar, paint and anti-termite treatment. The item shall also include all materials, labour, scaffolding, use of equipment, etc.

5.3 Fixtures and fitting shall be as specified in the drawing or the BOQ.

5.4 If woodwork is found to be defective due to bad workmanship, shrinkage, etc. within 1 year after completion of work, the defective woodwork shall be re-fixed by the contractor at his cost to the satisfaction of the PM. This includes the repairs required to complete the work as it was finished earlier.

5.6 Glass shall be included in the price complying to specification given in BOQ.

## **6.0 GURANTEE**

Contractor shall guarantee shutters and timber work for two year or warrantee as per main contract period against defective material, workmanship.

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**SECTION – X / B**

**STEEL DOOR FRAMES AND SHUTTERS**

**1.0 GENERAL**

**1.1 INDIAN STANDARDS**

Work shall be carried out to Indian Standards and Code of practices. In absence International standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies / conflict noticed shall be directed to the PM for his direction / approval. However, as a general rule more stringent specification shall take precedence.

- |   |         |  |
|---|---------|--|
| 1 | IS 226  | Structural steel (Standard quality) superseded by IS 2062:1992       |
| 2 | IS 277  | Specification for galvanized steel sheets                            |
| 3 | IS 1367 | (Part 1-19) Technical supply conditions for threaded steel fasteners |
| 4 | IS 1977 | Structural steel (ordinary quality)                                  |
| 5 | IS 2062 | Steel for general structural purposes                                |
| 6 | IS 4351 | Specification for steel door frames                                  |
| 7 | IS 4736 | Hot - dip zinc coating on mild steel tubes                           |

**1.2 Quality Assurance**

1.2.1 Material used shall conform to IS. It shall withstand stresses and strains to which it is subjected.

1.2.2 Fabrication, assembly, erection, fastening, etc. shall be in accordance to details approved by PM.

1.2.3 Manufacturer shall have minimum five years experience in these products. Works shall be carried out under qualified supervisions.

**1.3 Submittals**

**1.3.1 Products**

- a) The contractor shall submit detailed catalogues, literature for products proposed to be used by him. He shall submit detail comparison for properties, test etc specified in BOQ and those of products he intends to use.
- b) Certificate of manufacturer of products that it conforms or exceeds specification given in contracts and its suitability for use.
- c) Manufacturer and the contractor shall give guarantee for performance and durability.

### 1.3.2 Shop drawing

The contractor shall submit including required designing shop drawing for doorframes, shutters complete with

- ☐ Plan, elevation with relative position of adjacent works
- ☐ Details of tracks, guides, rollers, hood, locking arrangement
- ☐ Full size details with specification of materials, sizes spacing of welds, screws bolts, rivets, anchors etc.
- ☐ Construction, fabrication and erection details
- ☐ Fitting and fixtures with type size, brand and fixing details.
- ☐ Finishing details

### 1.3.3 Samples

Samples of following shall be submitted along with submittals

- ☐ Frame corner 300 x 300 mm with corner construction and finish
- ☐ Shutter frame corner with inner construction details, stiffening, its welding, riveting, bolting, insulation etc.
- ☐ PVC / neoprene beadings
- ☐ GI anchors
- ☐ Fittings and fixtures

## 2.0 MATERIALS

### 2.1 Structural steel

Steel structures subjected to dynamic loading, where fatigue, wide fluctuation of stresses expected, and reversal of stresses expected steel conforming to IS 226 and 2062 shall be used. Rolled and finished steel section's dimension and weight shall conform to IS 1852 and shall be within permissible tolerances. Steel sections shall be free from rust, scaling/pitting, cracks, surface flaws laminations, rough and imperfect edges and all other harmful defects. Mechanical and chemical properties shall be as per IS.

### 2.2 Rivets

Rivets used in work shall conform to IS 1148. It shall be free from defects, excessive rust, and scaling/pitting. They shall be well protected and securely stored at site.

### 2.3 Bolts

Bolts conforming to IS 1367 shall be used. Bolts may be turned and fitted or black bolts. Bolts, nuts shall be free from excessive rust, scaling/pitting, crack or any other defects. They shall be with sharp, defined threads and heads. They shall be well protected and securely stored at site.

### 2.4 Electrodes

Covered welding electrodes conforming to IS 814 shall be used in metal arc welding. Electrodes shall be fresh and packed in watertight packing as

received from manufacturers with date of manufacture. They shall be stored in damp proof store.

**2.5 Fittings and fixtures**

Fittings and fixtures shall be with IS mark and as required for respective locations. Thickness, size shall be as specified, and the contractor shall ensure that material withstands the type of loading they are subjected to

Finishing of fittings and fixtures shall be in conformity to specification. Also it shall be noted that fitting and fixtures material are compatible and no harmful electrolytic / anodic actions are likely to take place.

**2.6 Screws, bolts, nuts etc shall be compatible with fitting and fixtures provided.**

**2.7 Delivery, storage and Handlings.**

**2.7.1 Fabricated products shall be handed over and transported to site with precautions not to damage, bend, dent, sag etc.**

**2.7.2 Fabricated finished product shall be received with self-adhesive protective coating prior to being transported to site.**

**2.7.3 Store all material in dry, lockable ventilated place. Material shall be placed on runners/packing and they are off the ground minimum 150mm.**

**2.7.4 Inspect material received for dimension, quality and finish. Replace all damage materials immediately. All acceptable material shall be repacked and stored.**

**2.7.5 Special care shall be taken to store glass.**

**3.0 SCOPE OF WORK**

Providing, designing, drawing, fabricating, shifting and installation of steel door frames and shutters and shutters with accessories such as anchorage, fittings, fixtures finishing etc complete as per specification, conforming to IS and as accepted and approved by the PM to his entire satisfaction. Item proposed under this shall be

☐ Pressed sheet Fire rated metal door frame

☐ Pressed metal sheet Fire rated shutters

**4.0 WORKMANSHIP**

**4.1 General**

**4.1.1 Fabrication shall be carried out only after approval to shop drawings by PM. Work shall be carried out at factory and shall be with proper tools and tackles and complying to Engineering practices. Factory shall be accessible to Architect's and PM's representative at all times. Points to be noted are**

**4.1.2 Cutting**

Cut shall be by sawing, shearing or blanking. Flame cutting shall be avoided. However, if permitted, cut edges shall be ground back to clean, smooth edges. Cut shall be accurate, clean, sharp, square and free of burrs, without deforming adjacent surfaces of metals.

**4.1.3 Holes**

Holes shall be drilled or cleanly punched to achieve accurate, clean, neat and sharp without deforming adjacent surfaces of metals. Gas cutting of hole not permitted.

**4.1.4 Junctions / Assembly**

Connections and junctions shall be located as approved in drawings. Connections shall be tight joints capable of developing full strength within members. Joints and connections shall be flush unless specified differently. In exposed condition where required water draining arrangement shall be provided. Provision for thermal movement jointing shall be provided at locations approved by the PM.

**4.1.5 Welding**

Welding shall be in accordance with recommendations of the Indian Standard code of practice. Welder shall be trained and certified as per IS 817. Work shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted.

Exposed welds shall be finished free of imperfections such as pits, runs, splatter, cracks, wrapping, dimpling, depressions or other forms of distortion, discoloration. Exposed welds shall be ground flush and dressed smooth to match adjoining surfaces.

**4.1.6 Bolts and Screws**

Threaded connections shall be with tight threads entirely concealed. At exposed locations lock nuts, bolts and screw heads, shall be flat and countersunk. Cut off projecting ends of exposed bolts and screws flush with nuts or adjacent metal.

**4.1.7 Site fixing**

Work shall include providing and fixing nonferrous anchor bolts / insert plates, plates or other anchoring devices for fixing into or to concrete, masonry or other trades of work. All these shall be with approval of the Architect and the Engineer.

**4.1.8 Finishing**

Work shall be clean, free from dirt, stains, grease, scratches, distortion, waves, dents, buckles, tool marks, burrs, etc. and defects which mar appearance of finish work.

**4.1.9 Mock-up Samples**

The contractor shall prepare mock-up samples as per approved shop drawing. Mock-up samples shall be to full size and shall be true representation of actual works to be carried out at site.

**4.2 Steel Door Frames****4.2.1 Pressed metal sheet frames shall be fabricated out of GI sheet of 1.2 mm thickness. Steel shall conform to IS 277 of GPL grade with Z 120 coating or its equivalent BS and fabrication to IS 4351. Pre-punched sheet shall be**

pressed / folded / rolled under hydraulic press to get desired shape / profile frame sections. Frames shall be single or double rebated as per architectural details. Rebate sizes shall be suitable for shutter thickness and minimum tolerance required.

4.2.3 Construction

Frames shall be welded or rigidly fixed together by mechanical means. Frames shall have door threshold or shall be provided with temporary base tie by screwing to keep in correct position. Required corner plate also shall be provided to keep the frames at right angles.

- \* Frames may be supplied welded or in knock down condition.
- \* Frames shall be supplied with GI holdfast suitable for the profile of the section and length of the hold fast shall be of 225 mm long.
- \* Frame shall be primed with special etched primer. Further it shall be primed and painted as per specification or system specialist.
- \* Fire rated steel door frame shall be single rebate profile of minimum size 125mm x 75 mm made out of 1.20mm (18gauge) minimum thick galvanized steel sheet. NDRF 125x75 Frames shall be Butt jointed and field assembled with self-bolted. The frames shall be finished with Thermosetting Powder Coating in desired RAL Shade.

4.2.4 Frame shall be installed and fully grouted with cement concrete mix 1:3:6.

4.2.5 Door frames shall be prepared by pre-punching sheets to receive hinges, tower bolts, shock absorbers. These shall be further strengthened and required arrangement by tapping to fix screws to secure hinges, tower bolts, aldop, lock striking plate, door closure etc. Location of all fittings and fixtures shall be as per IS code or as detailed in shop drawing and as approved by PM.

4.2.6 All punched locations shall be guarded by suitable size mortar guard to keep pockets free for unhindrance performance of the fittings and fixtures.

4.2.7 Rubber buffers shall be fitted within rebates minimum six numbers per frame.

4.2.8 Frames shall be welded or fixed rigidly together by mechanical means. Frames shall be kept in correct shape by providing right angle corner plates and tie bar/rod at bottom during transport and till fixed, grouted and secured.

4.2.9 'T' shape hold fast of GI strips 225 mm long with split ends shall be provided by manufacturer of the frame.

4.2.10 Frames shall be fixed in position to correct line, level and plumb. All door shutter tops shall be aligned in one level. Frames shall be braced and supported when masonry is in progress. Hollow portions of frames shall be filled up with lean cement concrete mortar simultaneously. Holdfast shall be provided along with masonry and grouted in concrete 1:3:6. Bracing and supports of frames shall be removed only when masonry and grout within hollow metal frame is set.

**4.3 Pressed metal sheet shutters**

- 4.3.1 Pressed sheet metal double skin hollow doors shutters with seam joints shall be fabricated out of galvanized steel sheet of 1.25 mm thickness. Shutters profile shall be constructed by pressing and folding pre-punched sheets with hydraulic press to correct size and shape as per detailed drawing of the architect. (Profile may be single rebated or double rebated). Rebate shall be suitable to receive thickness of door shutter to be received.

Fire rated steel frames and shutters shall be fabricated as per IS 3614 Part II or BS 4765 part 20 and 22.

4.3.2 Construction

Flush Steel Shutters shall be of thickness as specified and required for specific fire rating and shall be constructed by using steel sheets conforming to IS or BS 6687. Shutters shall be stiffened with pressed sheet metal channels, 'z' section etc. as per design of manufacturer. Further shutters shall be filled with suitable for required fire rating mineral wool or special resin bonded honeycomb core as approved or other approved filling material.

Shutters shall be prepared and stiffened with minimum 4 mm thick plate to receive, locks, tower bolts, aldrops, door closures, handles, glazing etc. Tapping of threads shall be matching to threads of fittings and fixtures screw / bolts.

Fire rated Door shutter thickness shall be as specified in the BOQ, fully flush double skin door with or without vision lite. Door leaf shall be manufactured from 1.0mm minimum thick galvanised steel sheet. The internal construction of the door should be rigid reinforcement pads for receiving appropriate hardware. The infill material shall be Rockwool treated with Viper FRS 881 LH.

Shutters shall be complete with all accessories and where specified shutters shall include automatic door closure linked to the active fire fighting system with fusible link, auto flush bolts, panic devices etc.

- 4.4 Frames and shutters shall be protected and maintained till completion of project.
- 4.5 Frames and shutter manufacturer shall give guarantee and give fire rating certificate where ordered. Manufacturer shall be from approved list of Tariff Advisory Committee (TAC) in case of fire rated door shutters.
- 4.6 Rate shall include
- \* Material
  - \* Labour
  - \* Handling
  - \* Fixing
  - \* Grouting including cement grout material
  - \* Protecting till handing over to the Employer

4.7            Measurements and Rates

- a)        Frames and shutters shall be measured in square meter out to out.
- b)        Fire rated shutter shall be tested and certified by CBRI, Roorkee only along with fittings and fixtures. The contractor give warrantee of fire rated.
- c)        In addition, the Contractor shall be required to give warranty of fire rated doors on required amount of stamp paper for 10 years in format enclosed.
- d)        Rates shall include
  - ☐        Designing
  - ☐        Material
  - ☐        Labour
  - ☐        Fitting and fixtures
  - ☐        Handling
  - ☐        Fabrication
  - ☐        Erection
  - ☐        Finishing
  - ☐        Maintenance
  - ☐        Warranty for One year.

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**SECTION – X / C**  
**ALUMINIUM JOINERY**

**1.0 STANDARDS**

1.1 Work under this contract shall be carried out to following Indian or International standards. Any conflict noticed in various standards and building regulations shall be reported to the PM and his direction and approval to be obtained. However it shall be noted as general rule that the more stringent specification shall apply. All standards shall be the latest revisions.

- |     |                   |  |
|-----|-------------------|--|
| 1.  | IS 456-2000       | Plain and reinforced concrete.   |
| 2.  | IS 875            | Designed loads for building structures.  |
|     | (Part I, II, III) |  |
| 3.  | HE9 WP            | Aluminium Extrusion  |
|     | (IS 63400 WP)     |  |
| 4.  | IS 1608           | Tensile strength   |
| 5.  | IS 1948           | Specification for aluminium doors, windows and ventilators.                              |
| 6.  | IS 2853           | Specification for toughened glass.   |
| 7.  | CP 118            | Structural use of Aluminium  |
| 8.  | ASTM C 1046       | Standard specification for Heat treated float glass FT and HS coated and uncoated glass. |
| 9.  | IS 3548           | Glazing in building  |
| 10. | IS 3921           | Aluminium channels   |

1.2 Quality Assurance

1.2.1 Manufacturer shall certify that sections extruded conforms IS / BS / ASTM standards specified.

1.2.2 Manufacturer shall have minimum ten years experience in extrusion.

1.2.3 The design engineer of the contractor shall have minimum five years experience in designing similar work.

1.2.4 The Contractor's design engineer shall certify that design meets standards, are safe and acceptable to local authorities.

1.2.5 Obtain aluminium through one source for each type.

1.3.0 Submittals

1.3.1 The Contractor shall submit detail literature, catalogues along with certification that material meets or exceeds standards specified.



1.3.2 The Contractor shall submit design calculations for every unit and shall include method of statement for fabrication, installation.

1.3.3 Shop drawings

Shop drawings shall be complete with following

- a) Fully dimensioned plans and elevations with detail co-ordination keys.
- b) Locations of exposed fasteners and joints.
- c) Indicate fabrication, installation and finish of specified systems.

Details shall be complete with following

- ☐ Members dimensioned.
- ☐ Joint connections for framing systems for doors, windows, louvers etc.
- ☐ Anchorage.
- ☐ System reinforcements, if any
- ☐ Expansion and contraction provisions, if any.
- ☐ Hardware including locations, mounting heights, reinforcements and special installation provisions, if any.
- ☐ Glazing methods and accessories.
- ☐ Notes on Internal sealant requirements and recommended types.

1.3.4 Contractor shall submit proforma of warranty from various manufacturers / suppliers for approval.

1.4 Delivery, Storage and Handling

1.4.1 Doors and frames cardboard wrapped and crated to provide protection during transit at site store. Additional care shall be taken to prevent damage to factory finish surfaces.

1.4.2 Inspect door frames and shutter on receipt at site to notify damage to supplier if found. Minor damages shall be repaired at site provided refinishes items match new work and acceptable to the PM. Remove and replace damage item that cannot be repaired.

1.4.3 Store all material in dry lockable, ventilated shed. It shall be stored on wooden runners / packings and shall be off the ground minimum 150mm. In case of package damaged and wet during transit replace with new dry once.

## **2.0 MATERIAL**

2.1 Aluminium

2.1.1 Aluminium Extrusion shall be of fully heat-treated aluminium alloy confirming to IS (63400 WP/HE9WP) or equivalent BS standards 6063- T5. Framing material shall comply as under

For extrusion Alloy to BS 6063 - T5 or T6, and ASTM B221

For sheets Alloy to BS 5005 - H16 and ASTM B 209

Other alloys and temper recommended by the manufacturer appropriate for specified finish.

Minimum thickness 2.0 mm for framing members and rails, 1.8 mm for sheets and for glazing stops and similar components. Glazing beads shall be screw less type fitted into the frames.

2.1.2 The extrusion shall be clean, straight and sharply defined lines. It shall be free from distortion and defects impairing strength, durability and appearance. Profiles shall be able to meet required strength in respect of tensile, shear and bending stresses. They shall be rigid and capable of providing local and lateral stability.

2.1.3 Internal reinforcement if any shall be of hot dip galvanized steel bars / pipes with separators to withstand designed criteria.

2.1.4 Polyester Powder Coating

Polyester Powder Coating should be confirming to minimum requirements as per BS6496. The powder coating system should be applied with the following minimum

Dry film thickness (DFT) should be minimum 60 micron

In two coat system is used, the topcoat should be of minimum thickness of 25 micron.

The coating should be free of flow lines, streaks, blisters, pin holes, tears, damages or any other surface defects.

Coating system to be applied by an approved applicator of polyester powder manufacturer and agreed by the PM. To ensure consistency of appearance single supplier and applicator should be used for the entire project.

2.2 Fasteners

2.2.1 All fixing anchor, bolts, screws, nuts, washers or other miscellaneous anchoring / fixing devices shall be of non-magnetic stainless steel or other noncorrosive materials compatible and approved by PM. These materials shall be compatible with finished aluminium used in work and shall provide adequate strength.

1. Exposed conditions : Stainless steel with EPDM or Neoprene Gasket washers.

2. Concealed Conditions : Steel or Cadmium plated

2.2.2 Where screws, bolts or other fastenings are exposed they shall match the colour of the metal with which they are used.

2.2.3 All concealed fastenings that are not required to be stainless steel shall be hot dipped galvanized steel.

2.3 Separators

Separators between steel and aluminium members where required shall be rigid type, high impact resistant, smooth both sides Teflon with a minimum thickness of 0.8mm as approved by the PM.

- 2.4 Sealant.
- 2.4.1 Sealant shall be silicone Sealant as manufactured by Dow Corning corporation or equivalent and / or other equivalent approved compatible with aluminium, glass and adjoining works.
- 2.4.2 All sealant applications must be clearly designated on the applicable shop drawing details and referenced to a master sealant schedule specifying materials, special instructions and application procedures.
- 2.4.3 The sealant shall be quality controlled one-part low modulus silicone conforming to BS 5889. Structural silicone shall only be factory applied selected colour silicone to PM's approval.
- 2.4.4 Runs of sealant to joints between frames and structure shall not be less than 6mm width and thickness and where greater than 6mm width the depth shall not be less than half the width.
- 2.4.5 Joint fillers and back-up materials shall be polyethylene foam, sponge neoprene as per the written recommendations from the approved sealant manufacturer for each specific application. Shape, size, hardness, compatibility, and bond breaking requirements are all factors to be considered.
- 2.4.6 All sealant must be non-staining and compatible with adjoining and/or adjacent sealant, back-up materials, substrate materials and their respective finishes and/or applied colour coatings.
- 2.5.0 Aluminium Flashings
- Aluminium sheets conforming to BS and ASTM shall be minimum 1.012 mm thick. Pre-pressed, cut to correct length flashing for each location of window sills shall be factory coated in approved shade and colour.
- 2.6.0 Ironmongery
- 2.6.1 Fittings and fixtures (Ironmongery) shall be installed with all necessary / required best quality hardware. It shall be matching to adjacent powder coated finishes. All ironmongery used shall be approved by the PM prior to being installed and shall be noted accordingly in shop drawings. All Samples and catalogues for Ironmongery shall be submitted by the contractor along with shop drawings.
- 2.6.2 All locks to be used shall be with arrangement to receive master key cylinders and contractor shall co-ordinate with the Employer prior to window being notched and back body being provided for approval of the PM.
- 2.7.0 Glass
- 2.7.1 Glass shall be single or double insulated hermetically sealed.
- 2.7.2 Glazing shall be as noted for in BOQ and Drawings for each unit. The thickness shall be as per design requirements considering all factors.
- 2.8.0 Gaskets
- The gaskets shall be EPDM or Neoprene. It shall be high resistance to aging, prolong periods of compressive stress, ability to recover from compression deformation, to allow joint movements.

2.9.0 Scaffolding / Hoisting

2.9.1 The Contractor shall be responsible to provide, erect and remove double legged steel scaffolding. Scaffolding shall be rigid, strong and suitable for work. It shall provide access to all places.

2.9.2 The contractor shall be responsible to provide required hoisting equipments to lift and transport glass at various levels to approval of the PM.

**3.0 SCOPE OF WORK**

3.1 The Contract is for, and the contractor shall be responsible for design, prepare shop drawings based on actual site measurement, fabricate, supply, install of all items based on concept architectural drawings and specification given for guidance. It shall be responsibility of the Contractor to propose his own design which meets the requirements and passes the tests specified. Further he shall take responsibility to complete work and guarantee as per approved design, shop drawing by the PM.

3.2 In brief list of items to be included are summarised but should not be taken as complete and conclusive.

- ☐ Design Aluminium window, doors etc.
- ☐ Glass and glazing as specified.
- ☐ Aluminium louvers
- ☐ All anchors fixing, attachments, reinforcement for mullions and transoms.
- ☐ Sealants within and around perimeter of all work.
- ☐ Interface with adjacent systems.
- ☐ Heavy duty hardware with friction stay hinges for hold open facility as required
- ☐ Weather strips as required.
- ☐ EPDM or Neoprene gasket
- ☐ Providing and paying for all samples, mock-ups, tests within or off site.
- ☐ All labour, supervision and quality control.
- ☐ Scheduling and monitoring of the work.
- ☐ Coordination of work with main contractor and other trades.
- ☐ Storage and handling, protection and cleaning.
- ☐ Testing during and on completion including paying for all test.
- ☐ Guarantee the work and materials.

3.3 Design Criteria

3.3.1 The various aluminium extruded sections shall be designed as per IS codes

- ☐ Wind pressure at 150 kg/sq m.
- ☐ Dead loads

- ☐ Live loads.
- ☐ Loads due to climatic conditions.
- ☐ Maximum deflection of exterior member shall not exceed 1/200 of the span of the member or 19 mm whichever is less.
- ☐ Make provisions for water entering at joints and condensation occurring within wall construction to drain to exterior face.

3.4 Submittals

3.4.1 Contractor shall submit design calculation along with method of statement and shop drawings meeting criteria specified.

3.4.2 Shop drawings

Shop drawings shall be complete with following

- a) Fully dimensioned plans and elevations with detail co-ordination keys.
- b) Locations of exposed fasteners and joints.
- c) Indicate fabrication, installation and finish of specified systems.

Details shall be complete with following

- ☐ Dimensioned members.
- ☐ Joint connections for framing systems for doors, windows, louvers etc.
- ☐ Anchorage.
- ☐ System reinforcements, if any
- ☐ Expansion and contraction provisions, if any.
- ☐ Hardware including locations, mounting heights, reinforcements and special installation provisions, if any.
- ☐ Glazing methods and accessories.
- ☐ Notes on Internal sealant requirements and recommended types.

3.4.3 Samples

The contractor shall submit for approval two sets of labelled samples of each required material for aluminium, glass, Ironmongery fabricated together in 300 x 300 L-shaped section. These shall be in specified colour and shall be exact representative of actual material to be used. All catalogues, test reports and other details of product from proposed manufacturer shall be submitted for approval of the PM. Also submit sealant product information and colour for approval by the PM.

3.4.4 Contractor shall submit proforma of warranty from various manufacturers / suppliers for approval.

- 3.5 Mock - up
- 3.5.1 Contractor shall prepare full size mock - up for typical window and install at location approved by the PM for his final approval at no extra cost to the contract.
- 3.6 Testing
- The PM reserves the right to get actual test of following to be carried out at site / off site from independent laboratory at the contractors cost prior to approval.
- a) Structural test under uniform static pressure.
  - b) Preliminary loading
  - c) Air infiltration.
  - d) Water infiltration under static pressure.
- 4.0 WORKMANSHIP**
- 4.1 On approval of shop drawing the contractor shall check actual site dimensions of opening on site and accordingly manufacturing shall be carried out in consultation of PM. He shall prepare shop drawing to this dimension and get approved co-ordination required to suit conditions.
- Approval of shop drawing does not absolve the contractor of his responsibility nor fulfilling his obligation in meeting requirements as specified and performance with guarantee as required.
- Further no claims for extra cost on account of changes to shop drawing or actual execution are carried out shall be payable unless basic design criteria or concept drawings are revised by PM.
- 4.2 All joints in frames shall be machined and fitted to form hair line joints prior to assembly. Electrically welded joints shall be prepared but mechanical joints shall be permitted. All corners, junctions, shall be mechanically cleated and assembled to provide strong and rigid framework. Joints shall be sealed. Required permissible tolerance for expansion and contraction shall be provided. The jointing accessories such as cleats, brackets, etc. shall be of such material as not to cause any bimetallic action. All accessories shall be such that they are fully concealed.
- 4.3 The fabrication of windows shall be done in suitable parts / sections to facilitate easy transportation, handling and installation. Adequate provision shall be made in the window members for anchoring to supports and fixing of hardware and other fixtures as approved by the PM.
- 4.4 Glass
- 4.4.1 The contractor shall cut glass sizes by field measurements or dimensionally approved shop drawings. The responsibility for correct glass sizes shall rest with the contractor. No cracked, chipped or disfigured glass shall be accepted.

- 4.4.2 Glazing shall be carried out with following precautions
1. Glazing work shall be carried out through experienced skilled workmen conforming to best practices. All instructions of glazing manufacturer shall be followed.
  2. Tong marks shall be concealed within rabbet.
  3. Glazing rabbets shall be clean, dry and free from any material that might adversely affect the bond and seal of glazing materials or the drainage.
  4. Glass shall be centred in each opening to provide recommended clearances. Setting blocks shall be at least 10 mm in thickness and full width of rabbet and placed at glass quarter points. They shall be of a type and length recommended by the glass manufacturer.
  5. Exposed sealant shall be tooled smooth and top surfaces sloped to drain water away from glass.
  6. Beads sealant, tapes, etc. used shall be mitred at each corner.
  7. Glass shall have safety marking as approved by the PM at eye level.
  8. Installation completed shall be sound, watertight, free from defects and to acceptable standard of PM.
- 4.5 Joints around aluminium work and building such as at heads, jams, sills between masonry / concrete etc. shall be grouted with silicone sealants.
- 4.6 Doors shall be fitted with approved hardware and operating devices. Mechanisms shall be such that they operate smoothly and freely without noise and excessive friction and shall be adequate for intended purpose. Doors and sashes shall be hung on aluminium butt hinges. Lock set shall be of approved quality and with provision to receive master key cylinder if to be provided by the Employer. They shall be with required type of handles.
- In sliding units, adjacent aluminium members shall not slide upon each other. They shall be separated by material which does not interfere with sliding action.
- All external shutters shall be fully watertight. Glazing of shutters shall be from inside, secured by aluminium beads fitted into extruded frames and sealed with EPDM or Neoprene gaskets in vertical and horizontal direction.
- Spring shutters shall be hung on pivot / floor springs. Springs can be single or double action as required. For double leaf shutters one shutter must be provided with concealed two tower bolts.
- 4.7 Fixed glazing shall be from outside and shall be secured with aluminium beads fitted into extruded frames and EPDM or Neoprene gaskets. It shall be ensured that it is fully water-tight and secured.
- 4.8 Louvers shall be as per design and shall be such that it prevents any back flow of rainwater into the interior of the buildings under any conditions. Provides mosquito and bird screen.

- 4.9 Antigalvanic Action
- 4.9.1 Isolate dissimilar metal surfaces to prevent galvanic action. Materials used for this purpose shall be non-absorptive.
- 4.9.2 All steel parts shall receive a protective treatment commensurate with their respective functions. The treatment shall be one or more of those described above, and approved by the PM.
- 4.9.3 Aluminium surfaces in contact with mortar, concrete fireproofing, plaster, masonry and absorptive materials shall be coated with an anti-galvanic, moisture-barrier material.
- 4.10 Sealant and Gasket Applications
- 4.10.1 Sealant and gaskets shall be provided where shown on the drawings or required for a permanently watertight installation.
- 4.10.2 The design of all sealed joints shall be in accordance with the recommendation of the sealant and/or gasket manufacturer.
- 4.10.3 Protect all adjoining surfaces not to receive sealant and gaskets against staining by masking and/or other methods.
- 4.10.4 Joints and joint surfaces shall be clean, dry and free of any material that may have an adverse effect on the bonding and/or seal of the sealant and gasket materials.
- 4.10.5 Apply sealant and gaskets under the conditions recommended by the manufacturers. Prime all surfaces to receive sealant and gaskets unless recommended otherwise, in writing, by the Manufacturers. Use no sealant that has started to set in its container or a sealant that has exceeded the shelf life published by the manufacturer.
- 4.10.6 Fill all joints continuously and completely with sealant, forming a neat, uniform, concave bead. Finish the material flush with adjoining flush surfaces unless otherwise shown on the drawings. All sealant surfaces shall be tooled smooth.
- 4.11 Gaskets
- Provide and install EPDM or Neoprene Gaskets of approved size and profile at all locations as called for to render the windows absolutely air-tight and weather tight. Produce samples of the gaskets for approval and procure after approval only.
- 4.12 Storage and Handling
- 4.12.1 Wherever possible all materials shall be stored in dry, well- ventilated conditions prior to fabrication.
- 4.12.2 No metal or glass shall be left exposed to the external elements prior to fabrication.
- 4.12.3 Adequate storage facilities must be provided for all materials prior, during and following fabrication. The Contractor is to submit full details of these facilities for the approval of the PM.



- 4.12.4 No materials or assembled units are to be left exposed to adverse weather conditions prior to erection at site.
- 4.12.5 Handling of glass shall be kept to a minimum and all glass shall be carefully protected from soiling and from condensation and other moisture.
- 4.13.1 All work shall be erected / installed to correct line, level, plumb and fastened securely in correct vertical and horizontal alignment.
- 4.13.2 Full survey record for site work shall be submitted to PM and required measures if any taken shall be noted on shop drawings with approval of the PM.
- 4.13.3 Proper lighting and safety equipments such as safety belts, helmets etc. shall be provided and strict observation shall be done.
- 4.13.4 Contractor shall supply suitable tools to enable the installation to proceed safely and to the highest standards.
- 4.14 Double legged, self-supporting and accessible at all location. Scaffolding as required for the work shall be provided by the contractor to the approval of the PM.

## **5.0 INSPECTION**

All shop and field materials and workmanship shall be subject to inspection by the PM at all times. These inspections shall not relieve the Contractor from the obligation to provide materials conforming to all requirements of the Contract Document and matching approved samples. The Contractor/Specialist shall promptly correct any deficiencies reported and carry out his own control measure for all materials whether inspected or not.

## **6.0 TEST**

- 6.1 The contractor shall provide all test instruments and other temporary provisions to enable the test to be carried out on the works so specified. In typical portions the work shall be physically tested in accordance with specification and actual by throughing water with hose pipe. Area to be tested shall be directed by the PM.
- 6.2 The Contractor shall give reasonable notice of the tests in writing, to the PM, who shall have the option of being present at all such tests.
- 6.3 Complete records of the tests (whether successful or unsuccessful) shall be maintained by the Specialist. Preliminary copies shall be issued to the PM to whom, at the conclusion of all such tests, the Contractor shall supply two bound and compiled sets of all results.
- 6.4 In the event that such testing should result in uncontrolled leakage, the Contractor shall eliminate the causes of such leakage at no additional cost to the Employer. Remedial measures must maintain standards of quality and durability and are subject to approval. Provide powered scaffold, hose, and sufficient personnel to operate scaffold and hose.
- 6.5 Acoustic levels shall be checked with decibel meter.

- 6.6 PM, if dissatisfied or on account of any reason attributable to the Contractor shall neither be eligible for any payment nor shall have recourse to approval. He shall not be eligible for any claim on the employer.

## **7.0 CLEANING**

- 7.1 The Contractor shall ensure that all actions are taken during installation to eliminate the effects of corrosive substances on the finishes.
- 7.2 The Contractor shall clean both internal and external surfaces to remove corrosive substances, dust or cement/mortar dropping during the installation as may be directed and instructed by the PM.
- 7.3 The internal surfaces of glass and aluminium frame are to be cleaned with compatible cleaning agents prior to the installation of the internal protective sheeting.
- 7.4 The Contractor shall provide written verification that cleaning agents are compatible with aluminium, stainless steel, glass coatings, granite, glazing materials and sealants. In no case shall alkaline or abrasive agent be used to clean the surface. Care shall be taken during cleaning to avoid scratching of the surface by grit particles.
- 7.5 Prior to snagging inspections the Contractor shall, remove the internal protection sheets and carry out a thorough cleaning of all glass and aluminium.
- 7.6 The Contractor shall also make good any physical damage to the structure including scratches, dents, abrasions, pitting, etc. to the satisfaction of the PM.
- 7.7 Manufacturer's delivery or job markings on glass and adhesive for manufacturer's labels shall be either a neutral or slightly acidic material. In no case shall such material be alkaline; any staining of glass by alkaline material will be cause for rejection of the glass.
- 7.8 After the installation of each pane of glass all markings and labels shall be carefully and completely removed from the panes. Thereafter no markings or labels of any sort shall be placed on the glass.
- 7.9 Glazed openings shall be identified by suitable warning tapes or flags attached with a non-staining adhesive or other suitable means to the framing of the opening. Tapes or flags shall not be in contact with glass.
- 7.10 As soon as it is practically possible after the issuance of the occupation Permit for the Building, the Contractor is to carry out a complete cleaning of the external face.

## **8.0 WARRANTY**

Prepare and submit in accordance with contract for

1. Warranty jointly signed by manufacturer, installer and Contractor agreeing to repair and/or replace assemblies which fail in material or workmanship during warranty period of 10 years.
2. Warranty stating insulated glass units to be free from condensation, fogging and obstruction of vision due to film on internal surface for 10 years.

## **9.0 MEASUREMENTS**

### **9.1 Frame Work**

9.1.1 The length of each extruded section used for fabrication of the door / joinery shall be measured correct to 1 mm. In case the sizes of doors / joinery that are manufactured, happen to be the sizes specified in the drawings, only the theoretical dimensions arrived by reducing the overall sizes should be considered.

9.1.2 The weight of material used shall be calculated on the basis of actual weight of extruded sections used for fabrication and shall be compared with the weights given in the manufacturer's catalogue, subject to the condition that the variation in actual weight should not exceed  $\pm 10\%$  than the weights specified in manufacturer's catalogue, payment shall be made for the actual weight of the extruded section. The final weights shall be calculated in kgs up to two places of decimal.

9.2 Glazing : Length and width of opening for glazing inserts shall be measured correct to a cm and area for payment shall be calculated in sqm nearest to 0.01 sqm.

9.3 Panelling with different types of materials : Length and width of opening for glazing inserts shall be measured correct to a cm and area for payment shall be calculated in sqm. nearest to 0.01 sqm.

9.4 Panelling with Aluminium sheet : The length and breadth of the panel inserts shall be measured correct to a cm and the area calculated to the nearest 0.01 sqm. The weights of panel used shall be calculated :

i) As per manufacturer's catalogue.

ii) The actual weight of sample of sheet used should be found out and weight of panel actually used. (Actually, calculated weight shall be recorded subject to condition that variation in actual weight shall not exceed  $\pm 10\%$  than weight specified in the manufactures catalogue).

9.5 Fittings : All fittings for doors / joinery except hinges and handles shall be enumerated.

## **10.0 RATE**

10.1 The rate shall include the cost of material and labour for all operations described above except the coast of glazing and panelling. It shall include screws expansion hold fastener, snap beading including filling with necessary PVC / neoprene felt, cleats etc. The rate does not include the cost of fittings except hinges and handles.

10.2 The rate however includes the cost for providing aluminium alloy doors / joinery for the openings of all shapes and sizes.

10.3 The cost of glazing, panelling and additional fittings shall be paid under separate item, as described herein.

10.4 Rate shall include for windows in openings of all shapes including circular, segmental or other shapes and sizes.

- 10.5 Rate shall also include the cost of automatic closing latch in the sliding window while manufacturing.

\* \* \* \* \*



**SECTION – X / D**  
**FITTINGS AND FIXTURES**

**1.0 GENERAL**

**1.1 Standards**

Work shall be carried out to Indian Standards and Code of Practices. In absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be directed to the PM for his direction/approval. However as a general rule more stringent specification shall take precedence.

- |      |          |   |
|------|----------|---|
| (1)  | IS 204   | Specification for tower bolts   |
|      | Part – 1 | Ferrous metal   |
|      | Part – 2 | Non-ferrous metal   |
| (2)  | IS 205   | Specification for non - ferrous metal butt hinges                         |
| (3)  | IS 208   | Door handles  |
| (4)  | IS 281   | Specification for mild steel sliding door bolts for use with padlocks     |
| (5)  | IS 362   | Specification for Parliament hinges                                       |
| (6)  | IS 363   | Specification for hasps and staples                                       |
| (7)  | IS 364   | Fanlight catch – Specification  |
| (8)  | IS 452   | Specification for door spring rat tail type                               |
| (9)  | IS 453   | Double acting spring hinges – Specification                               |
| (10) | IS1019   | Specification for Rim latches   |
| (11) | IS 1341  | Steel butt hinges – Specification   |
| (12) | IS 1823  | Specification for floor door stoppers                                     |
| (13) | IS 2209  | Specification for mortice locks (vertical type)                           |
| (14) | IS 2681  | Non-ferrous metal sliding door bolts (aldrop) for use with pad locks      |
| (15) | IS 3564  | Hydraulically reagaluted door closers – Specification                     |
| (16) | IS 3818  | Continuous (piano) hinges – Specification                                 |
| (17) | IS 3843  | Steel back flap hinges  |
| (18) | IS 3847  | Mortice night latches – Specification                                     |
| (19) | IS 4621  | Specification for indicating bolts for use in public baths and lavatories |
| (20) | IS 4992  | Specification for door handles for mortice locks (vertical type)          |
| (21) | IS 5187  | Specification for flush bolts   |
| (22) | IS 5899  | Specification for bathroom latches  |
| (23) | IS 5930  | Specification for mortice latch (vertical type)                           |

- |      |          |  |
|------|----------|--|
| (24) | IS 6315  | Floor springs (hydraulically regulated) for heavy door – Specification                     |
| (25) | IS 6343  | Specification for door closers (Pneumatically regulated) for light door weighing upto 40kg |
| (26) | 6607     | Specification for rebated mortice locks (vertical type)                                    |
| (27) | IS 7196  | Specification for hold fast  |
| (28) | IS 9197  | Specification for double action floor springs (without oil check) for heavy doors          |
| (29) | IS 7534  | Specification for sliding locking bolts for use with padlocks                              |
| (30) | IS 7540  | Specification for mortice dead locks   |
| (31) | IS 8756  | Specification for ball catches for use in wooden almirahs                                  |
| (32) | IS 8760  | Specification for mortice sliding door locks with lever mechanism                          |
| (33) | IS9899   | Specification for Hat, coat and wardrobe hooks   |
| (34) | IS 10090 | Specification for numericals   |
| (35) | IS 12817 | Stainless steel butt hinges – Specification  |

## 1.2 Fittings

1.2.1 Fittings shall be of M.S., brass, aluminium or stainless steel as specified. These shall conform to respective IS and for duty to be employed. Fittings shall be smooth, free from sharp edges, corners. flaws and other defects. Holes for screws shall be counter sunk finish.

Finish of M.S. shall be chromium plated, copper oxidised (black finish) or black enamelled painted.

Brass shall be chromium plated, bright satin finish or copper oxidised.

Aluminium fittings shall be dyed anodic coating grade not less than AC10 of IS 1868.

Screws for fittings shall be of same metal as of fittings and same finish. Aluminium fittings shall be fixed with brass CP or stainless-steel screws.

1.2.2 All fittings shall be conforming to IS standards applicable. Sampling shall be as specified for each case. Material, workmanship, manufacturing and finish shall conform to IS or exceeds minimum requirement given. All fittings shall be “ISI” marked or approved manufacturer by the PM.

## 2.0 **HOLD FAST (HOTDIP GALVANISED)**

Hold fast shall conform to IS 7196

Hold fast shall be fabricated out of M.S. flats 40x5mm thick 300mm long. These shall free of dents and burns. M.S. flat bent at one end 50mm with a counter sunk hole of 11mm dia to received wood screws. 100mm long other end shall be forked and bent right angles in opposite direction fabricated hold fast shall be hot-dip galvanised. Hold fast shall be grouted into cement concrete mix 1:3:6 size of block to be 300x100x150mm high.

Generally the Rate of Frame shall be inclusive of holdfast otherwise it shall be measured in numbers.

Each hold fast shall be clearly and permanently marked with the name of the manufacturer or his trade-mark, if any.

The product may also be marked with Standard mark.

### **3.0 HINGES**

Material and finish shall be as specified in drawing or BOQ. These may be light duty, medium duty or heavy duty and as per location. These shall be fabricated from plates, cast or extrusion as case may be, but shall be strong and free of any flows and defects. Number of knuckles shall be as required for location and duty. Hinge pin shall be strong and shall give free easy movement; it shall be free of any play and shake. Pins shall be riveted. Screw holes shall be counter sunk heads.

Each hinge shall be clearly mark with the name of manufacturer or trade mark, if any. The hinge may also be marked with the Standard Mark.

### **4.0 SLIDING DOOR BOLTS**

M.S. shall conform to IS 281. Brass and aluminium shall conform to IS 2681. Material and finish shall be as specified in BOQ or drawings along with sizes. Bolts shall be smooth, finish and free of any defects.

Each sliding door bolts shall be stamped, preferably on the hasp, with the same manufacturer's name or trade mark.

Sliding door blot may also be marked with the standard mark.

### **5.0 TOWER BOLTS**

These shall conform to IS 204. Bolts shall be strong made up of single piece, correct shape, smooth and free of any defects. Holes for fixing screws shall be counter sunk

Flush bolts shall conform to IS 5187. Looking bolts shall conform to IS 7534.

Each tower bolt shall be clearly marked with the name of manufacturer or trade mark. The tower bolt may also be marked with the standard mark.

### **6.0 DOOR LATCH**

These shall be of material, size and finish as specified. They shall be smooth functionable and free of defects.

### **7.0 INDICATING BOLT**

These shall be cast brass or aluminium specially provided for general / mass use of toilets. Material, finish and design shall be as detailed in drawing or BOQ and as approved by the PM.

### **8.0 MORTICE LOCK AND LATCH**

Mortice locks shall conform to IS 2209 Locks shall be 65, 75 or 100mm as specified. The measured length shall not very more than 3mm. Material for various components and parts shall be as specified in IS. Locks shall have non-interchange ability higher the specified in IS i.e. minimum 250 locks to have non-interchange ability. Depth of body shall not be more than 15mm. For end clean plate free of rivets shall be provided locking bolts minimum section shall be 8 x 25mm. Minimum throw of locking bolt shall be 12mm. Lever locking mechanism shall be provided. Minimum levers shall be 6 (six) false dummy levers shall not be used. Guide pins, bolts shall be suitably



coated and protected. Latch bolts shall be minimum 12 x16mm of recommended material. Bolts shall be reversible and of universal handing. Follower shall have square holes. Latch bolts shall have spring, smooth, bright or satin finish. Striking plates shall have two rectangular slots to suit locking bolts and latch bolt.

Body shall be finishes smooth and coated with coatings as specified / approved.

Locks shall be supplied with three keys. It shall conform to IS. Locks shall be sample and tested as per IS 2209. Locks shall have markings

- Manufacturers name, trade mark
- Year of supply
- Size of mortice lock
- Number of levers
- Country of origin

## **9.0 MORTICE NIGHT LATCH**

these shall conform to IS 3847. Material shall as recommended in IS but shall be as specified in drawing or BOQ. This lock shall have a single spring bolt withdrawn from the outside by key and from inside by a handle and with an arrangement where by the lock can be prevented from being opened by its key from outside while night latch is use inside the room.

All other details shall be same as mortice locks and latch given in 8 here above.

Each mortice night latch shall be stamped with the following information:

- a) Manufacturer's name, or trade-mark;
- b) Size of night latch;
- c) Number of leavers;
- d) Country of origin; and
- e) Year of supply, if specified by the purchaser.

The mortice night latch may also be marked with the Standard Mark.

The keys shall be stamped on the head with the serial number-of the night latch.

## **10.0 HANDLES**

10.1 Handles for mortice locks shall conform to IS 4992. Handles may be knob or handle type as specified / approved by the PM. Material finish shall be as specified. These shall be suitable for locks and shutter. Handle shall be smooth with sharp edges removed. Finish shall be as specified and approved. It shall have marking such as name of manufacturer, year and country of origin. It shall be received at site in packed condition. It shall be tested as per criteria given in IS.

Each door handle shall be stamped with the following information:

- a) Name of the manufacturer or his trademark,
- b) Year of manufacture, and

c) Country of origin.

The door handle may also be marked with the IS1 Certification Mark.

10.2 Handles for doors and windows shall conform to IS 208. Material, shape, finished shall be as specified in BOQ and drawings. All edges and corners shall be pencile rounded and smooth. Handles shall be able to provide adequate strength and easy mechanical means to operate. It shall be free of all defects.

Each door handles shall bear the manufacturer's name or trademark. The product may also be marked with standard mark.

### **11.0 CUPBOARD OR WARDROBE LOCK**

This should generally conform to IS 729. The size of the cupboard lock shall be 40,50,65 & 75mm. This shall be made of cast brass and shall be of the best make of approved quality. These shall be finished bright or chromium plated or oxidised or as specified. The size pf lock shall be denoted by the length of the face across the body in mm.

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

Each lock shall be stamped with the following information:

- a) Manufacturer's name or trademark,
- b) Number of levers,
- c) Size of the lock and grade,
- d) Serial number of the lock, and
- e) Year of supply ( if specified by the purchaser ).

The lock may also be marked with the ISI Certification Mark.

### **12.0 BALL CATCHES FOR WOODEN ALMIRAH**

This should generally conform to IS 8756. These may be brass sheets or cast brass with steel balls of size 6,7,5,9.5 or 12mm dia as specified. The size shall be denoted by the external diameter of the cylinder holding the steel ball with spring. When the almirah is in the closed position it shall be retained in that position by the spring section of the ball catch and shall be so in continuous usage. The door shall open only when it is pulled open.

Each ball catch shall be clearly marked with the manufacturer's name or trademark.

Ball catch may also be marked with ISI certification mark.

### **13.0 FINGER PLATE**

This shall be finishes bright, chromium plated, oxidised of brass or anodised aluminium or transparent plastic or as specified. This shall be made from brass or aluminium plate of 1.6mm thickness with bevelled or square edge as specified.

The size of the plate shall be 300x65mm unless otherwise specified. The shape and pattern shall be approved by the PM.

**14.0 KICKING PLATES**

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

**15.0 HANGING RUBBER DOOR STOPPER**

These shall be of cast brass, finished bright, chromium plated or as specified. Aluminium stopper shall be anodised and the anodic coating shall not be less than grade AC-10 of IS1868. The size and pattern of the door stopper shall be approved by the PM. the size shall be determined by its length.

**16.0 HYDRAULIC DOOR CLOSERS**

- 16.1
- a) Pneumatically regulated door closers for use on light weight shutters weighing upto 40kg shall conform to IS 6343
  - b) Hydraulic regulated exposed type door closer for use on shutter weighing upto 80kg shall conform to IS 3564
  - c) Hydraulic regulated concealed type in floor door closed for use on shutter weighing upto 125 kg shall conform to IS 6315

16.2 Closers shall be manufactured and tested as per specification. Preferably they shall be universal type. Material and finish shall be as specified in BOQ or drawings or as instructed by the PM. Closers shall satisfy

- a) Correct type door closer shall be used for location
- b) Door closer shall operate smoothly, quietly without any undue play during openings and closing operation
- c) Closer shall work satisfactorily at all temperatures with minor adjustment to regulating screw
- d) Closing time should be easily adjustable
- e) Closers shall be easily repairable or replaceable
- f) All parts be tested and closer shall pass endurance test

Each closer shall be marked with the following information :

- a) Manufacturer's name or trade-mark;
- b) Right closer, left closer or universal closer or 'R', 'L' or 'U' respectively;
- c) Size of the closer;
- d) Type of the closer; and
- e) Serial number.

Each door closer may also be marked with the Standard Mark.

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**SECTION – X / E**  
**SUNDRY METAL WORK**

**1.0 GENERAL**

**1.1 INDIAN STANDARDS**

Work shall be carried out to Indian Standards and Code of practices. In absence International standards shall be followed. These shall be latest issues. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies / conflict noticed shall be directed to the PM for his direction / approval. However as a general rule more stringent specification shall take precedence.

1. IS 226 Specification for structural steel standard quality.
2. IS 277 Specification for galvanized steel sheets.
3. IS 806 Code of practice for use of steel tubes in general building construction.
4. IS 814 Welding electrodes.
5. IS 815 Classification and coding of covered electrodes for metal arc welding of structural steels.
6. IS 816 Code of practice for use of metal arc welding for general construction in mild steel.
7. IS 817 Code of practice for training and testing of metal arc welders.
8. IS 822 Code of procedure for inspection of welds.
9. IS 823 Code of procedure for Manual for metal arc welding in mild steel.
10. IS 1239 Specification for mild steel tubes, tubulars and other wrought steel fittings.
11. IS 1977 Structural steel (ordinary quality)
12. IS 2062 Steel for general structural purposes
13. IS 2713 Part I Specification for Tubular steel poles

**1.2 Quality Assurance**

1.2.1 Material used shall conform to IS. Members shall withstand stresses and strains to which they are subjected.

1.2.2 Fabrication, assembly, erection, fastening, etc. shall be in accordance to details approved by PM.

1.2.3 Manufacturer shall have minimum five years experience in these products. Works shall be carried out under qualified supervisions.

1.2.4 Welders employed shall be certified welders as per IS 817.

**1.3 Submittals.**

**1.3.1 Products**

- a) The contractor shall submit detailed catalogues, literature for products proposed to be used by him. He shall submit detail

comparison for properties, test etc specified in BOQ and those of products he intends to use.

- b) Certificate of manufacturer of products that it conforms or exceeds specification given in contracts and its suitability for use.

### 1.3.2 Shop Drawings

The contractor shall prepare detail shop drawings based on Architects concept drawing. Drawings shall show in detail the arrangement of components, the sequence and details of fabrication, assembly and installation of components. Further they shall give

- ☐ Relative position of all adjacent walls, beams, columns, slab all clearly drawn with jointing techniques.
- ☐ Full size details including isometric drawing of jointing method.
- ☐ Type of materials, sizes, location and spacing of screws, bolts, welds, anchoring etc.

## 2.0 MATERIAL

### 2.1 Structural steel

Steel conforming to IS 226 and 2062 shall be used for steel subjected to dynamic loading, fatigue, wide fluctuation of stresses expected and reversal of stresses. Rolled and finished steel section's dimension and weight shall conform to IS 1852 and shall be within permissible tolerances. Steel sections shall be free from rust, scaling/pitting, cracks, surface flaws laminations, rough and imperfect edges and all other harmful defects. Mechanical and chemical properties shall be as per IS.

### 2.2 Rivets.

Rivets used in work shall conform to IS 1148. It shall be free from defects, excessive rust, and scaling/pitting. They shall be well protected and securely stored at site.

### 2.3 Bolts

Bolts conforming to IS 1367 shall be used. Bolts may be turned and fitted or black bolts. Bolts, nuts shall be free from excessive rust, scaling/pitting, crack or any other defects. They shall be with sharp, defined threads and heads. They shall be well protected and securely stored at site.

### 2.4 Electrodes

Covered welding electrodes conforming to IS 814 shall be used in metal arc welding. Electrodes shall be fresh and packed in watertight packing as received from manufacturers with date of manufacture. They shall be stored in damp proof store.

### 2.5 Tools, Equipments and Machines

Gas cutting sets, drilling machines, welding machines, chain pulley box, winch, cranes etc used shall conform to respective IS. Capacity and type shall be as per requirement of works. Equipments, tools and machines shall be used with proper safety mechanism and shall have all safety devices built in. They shall be well-maintained and routine checks for safety shall be carried out on periodic basis as specified.

2.6 Delivery and storage

Approved material conforming to IS and specification shall be procured by the contractor (or supplied free/basic price by the Client/Employer) as per schedule. Each batch of material shall be received with manufacturers, certificate conforming chemical and mechanical properties. Storing yards shall have hard paved grounds and should be well drained. Steel shall be stored on raised platform in these yards. Steel shall be kept covered with plastic to avoid rusting. Yards shall be maintained clean so as to avoid any contamination due to dust, mud, oil, grease etc. Scrap and full-length steel shall be stacked separately. Further each type/categories of steel shall be stacked separately.

**3.0 SCOPE OF WORK**

3.1 Providing, designing, preparing shop/fabrication drawing, getting approval from PM, fabrication, assembly, transport/shift, load, unload, erect including cleaning, priming, finishing with paint or process specified, actual site measurement etc complete for following types of works.

- ☐ Railing / Handrails
- ☐ Angle Frames and Grills
- ☐ Kitchen / vanity support platforms
- ☐ Grills / Jalis
- ☐ Gates
- ☐ Ladder

3.2 Coordination with actual site schedule, sequence of working and to complete as per programme to approval of the PM.

**4. WORKMANSHIP**

4.1 General

4.1.1 Fabrication shall be carried out only after approval to shop drawings by Architect. Work shall be carried out at factory and shall be with proper tools and tackles and complying with engineering practices. Factory shall be accessible to PM's and his representative at all times.

4.1.2 Cutting

Cut shall be by sawing, shearing or blanking. Flame cutting shall be avoided. However if permitted, cut edges shall be ground back to clean, smooth edges. Cut shall be accurate, clean, sharp, square and free of burrs, without deforming adjacent surfaces of metals.

4.1.3 Holes

Holes shall be drilled or cleanly punched to achieve accurate, clean, neat and sharp without deforming adjacent surfaces of metals. Gas cutting of holes not permitted.

4.1.4 Junctions / Assembly

Connections and junctions shall be located as approved in drawings. Connections shall be tight joints capable of developing full strength within members. Joints and connections shall be flush unless specified differently. In exposed condition where required water draining arrangement shall be

provided. Provision for thermal movement jointing shall be provided at locations approved by the PM.

4.1.5 Welding

Welding shall be in accordance with recommendations of the Indian Standard code of practice. Welders shall be trained and certified as per IS 817. Work shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted.

Exposed welds shall be finished free of imperfections such as pits, runs, splatter, cracks, wrapping, dimpling, depressions or other forms of distortion, discoloration. Exposed welds shall be ground flush and dressed smooth to match adjoining surfaces.

4.1.6 Bolts and Screws

Threaded connections shall be with tight threads entirely concealed. At exposed locations lock nuts, bolts and screw heads, shall be flat and countersunk. Cut off projecting ends of exposed bolts and screws flush with nuts or adjacent metal.

4.1.7 Site fixing

Work shall include providing and fixing nonferrous anchor bolts / insert plates, plates or other anchoring devices for fixing into or to concrete, masonry or other trades of work. All these shall be with approval of the PM and the Consultant.

4.1.8 Finishing

Work shall be clean, free from dirt, stains, grease, scratches, distortion, waves, dents, buckles, tool marks, burrs, etc. and defects which mar appearance of finish work.

4.1.9 Mock-up Samples

The contractor shall prepare mock-up samples as per approved shop drawing. Mock-up samples shall be to full size and shall be true representation of actual works to be carried out at site.

4.2 Railing / Handrails / Guardrails

4.2.1 Metal handrail/guardrail shall be provided around opening, stairs, balconies, parapet or elsewhere as shown in drawing. Handrails /guardrails shall include handrails / guardrails, its supports, in fills required fastening / securing arrangement and finish.

4.2.2 Material used shall be mild steel, stainless steel or aluminium with or without combination of concrete, masonry, timber etc.

4.2.3 Railing shall be detailed by Architect in plan; however, where designing is part of the contractors work, the contractor shall take care of

(1) Design loads

- ☐ Uniformly distributed load at top of rail to be 1000 kg/sqcm applied perpendicular to plane of railing.
- ☐ Concentrated load of 1000 kg/m
- ☐ In fill panel to have load 150 kg/sqm



- (2) Concealed fixing
  - (3) To coordinate shop drawing with actual site measurement in consultation with the PM
  - (4) Arrangement to fix rail with adjacent work without damaging surrounds and rails.
  - (5) Rails shall extend one tread length about 270 to 300 mm at free end.
  - (6) Clear space between all components shall not be more than 100 mm, unless specially shown in architectural concept detail drawing.
- 4.2.4 Railing fabrication, erection shall be as per approved method by PM.
- 4.2.5 Railing shall be as far as possible prefabricated shifted to site in knock down condition with markings ready to assemble and erect without any special aids.
- All joints, assemblies shall be smooth finished with tight hairline joints. All ends shall be closed / capped. All assemblies, fitting & fixture shall be concealed type to the extent possible and exposed once finished as specified in drawings. Assembled railing shall be secured tight with finished surfaces. They shall not damage nor stain base and surroundings.
- Securing / anchoring system shall be well grouted with base or jambs. Where required use no shrink compound in addition to metal fasteners. Expansion anchors, expansion shields, toggled bolts etc shall be used to fix rails with walls basis.
- Expansion joints within structures shall be provided with slip joints and shall have one end free within sleeve.
- 4.2.6 On completion and prior to handover railing shall be touched as required.
- 4.2.7 Railing shall be protected by the contractor till it is handed over to the PM/Employer with required protection measures. All cost of protection and maintenance shall be to the contractors account.
- 4.3 Structural Framework
- 4.3.1 Structural steel framework shall be designed, drawn, fabricated and erected by the contractor for
- ☐ Vanity counters
  - ☐ Kitchen platforms
  - ☐ Framework for openings
- 4.3.2 Based on concept architectural drawing the contractor shall design, draw shop drawing to approval of the PM.
- 4.3.3 Steel used shall be new and hot dip galvanized or epoxy coated on fabrication.
- 4.3.4 Work shall be carried out to correct line level and plumb through experienced fabricators and IS approved welders.
- 4.4 Grills / Gates
- 4.4.1 Gates or security grill or architectural grills shown in drawing shall be fabricated as detailed in drawings.
- 4.4.2 The contractor shall prepare shop drawing giving details of connection, assembly and security fixing with structure.

The contractor shall not deviate from size, thickness and shape of each member as detailed by the PM in his concept drawings unless such grills are subjected to loads, stresses. In case of security grills safety norms shall be followed. Any changes to size, shape, thickness, material due nonconformity to local safety regulations shall be brought to notice of the PM and coordinated with the PM while preparing shop drawing to obtain approval of the PM.

- 4.4.3 Material shall conform to respective IS and shall be new. Fabrication, erection shall be through experienced approved skilled work force. Welders shall be IS certified.
- 4.4.4 Prior to fabrication actual site measurement shall be taken and coordinated into the shop drawing. Allowance for site fixing shall be considered and incorporated during fabrication.
- 4.4.5 Prior to erection, site surrounds shall be inspected, and surrounds shall be finished to acceptable standard.
- 4.4.6 Erection shall be done with due care not to damage adjacent surfaces. Fixing shall be done with fasteners by drilling holes or welding or as detailed and approved. Work shall be to correct line, level, plumb and shall be aligned with surround. Special care shall be taken that work is fully secured.
- 4.4.7 On completion of erection, required touch-up and finishing shall be completed to grills and surroundings to approval of the PM.

## **5.0 MEASUREMENTS**

- 5.1 Work shall be measured as under.
- Railing shall be measured in running meter or square meter as detailed in Bills of quantity. Other miscellaneous metal work shall be measured in kg.
- 5.2 Rates shall include
- \* Design
  - \* Shop drawing preparation
  - \* Coordination with actual site dimension
  - \* Material procurement
  - \* Fabricating with required tools, plants, equipment
  - \* Erection with required tool plants and equipment
  - \* Finishing and touch-up
  - \* Shifting, transporting, loading, unloading
  - \* Labour cost
  - \* Protection and maintenance
  - \* Warranty if any for particular product

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