

# GENERAL TECHNICAL SPECIFICATIONS

## FOR BUILDING WORKS

Name of Work- Repairing and Renovation to Pashu Davakhana  
building at village:- Rakhej Ta:- Sutrapada Dist:- Gir Somnath

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Name of Work :- Repairing and Renovation to Pashu Davakhana building at village:- Rakhej Ta:- Sutrapada Dist:- Gir Somnath

### SPECIFICATIONS

Item No.	Item of work	Item No.	Page No.
	<b>General Technical Specifications</b>	Attached	
1	Providing and fixing FRP frame size 125x65 mm and 35mm thick FRP shutter with wood grain raised paneled design finish shutter having extra reinforcement on sides & edges in Gel coat finish. The core of the shutter & frame is to be filled up with injected polyurethane foam done in situ alongwith embedded wooden pieces for stiffening & also taking hinges & finitres. The whole FRP frame & shutter is to be water proof weather proof, termite proof & resistance to mild acid/alkali. Rates are to be inclusive of S.S hinges with fastener sleeve & alluminium fixtures & fastenings.	Attached	
2	Providing and fixing standared extruded of alluminium section of size 63mm x 38.10mm x 1.2mm (Jindal Section :2434, @ Wt. 0.643 Kg/mt) with colour Powder Coated alluminium frame for ventilation with 5 mm thick frosted glass as details etc complete for Ventilation	Attached	
3	Granite slab 18mm thick slab in risers of steps dedo and pillares laid 10mm thick cement 1:3(1-cement: 3 coarse sand) and jointed with grey cement slurry including rubbing,polishing etc complete.(Granite JAMS & SILL)	Attached	
4	Providing and fixing M.S. grills of required pattern to wooden frames of windows etc. with M.S. flats at required spacings and frame alround, square or round bars with round headed bolts and nuts or by screws (A) Plain Grill.	Attached	
5	Wall painting (two coats) with plastic emulsion paint of approved brand and manufacture on undecorated wall surface to give an even shade including throughly brushing the surface free from mortar droppings and other foreign matter and sand papered smooth.	Attached	
6	Finishing wall with weather proof exterior emulsion paint on wall surface (two coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remains of loose powdered materials.etc complete	Attached	
7	Providing and fixing P.V.C. Pipe 10kgf/sq.cm Rain water spout of 50mm dia.	Attached	
8	Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low densidy, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(D) 40mm	Attached	
9	Providing and fixing to wall ceiling and floor 6.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low densidy, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(B) 25mm	Attached	
10	Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm2 working pressure polythene pipes of the following outside Dia. Low densidy, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(F) 75mm	Attached	
11	Providing and fixing Gun metal check or non-return fullway wheel valve.(C) 25mm dia.	Attached	
12	Providing and fixing screw down bib taps of following size.(A) Brass screw down bib tap polished bright. (i) 15mm dia.	Attached	
13	Providing erecting and fixing double coated Syntex PVC. (ISI) water tank of required capacity No. with all necessary fittings and connection etc. complete on terrace.	Attached	
14	Providing and laying broken chine mosaic flooring for terrace using 12 mm to 20 mm broken pieces of glazed tiles to be laid over cement mortar 1:3 to plain or slope and to be tempered to bring mortar creme out upto surface using white cement including rounding off junctions and extending them upto 15 cm along the wall,clearing with water and oxalic acid etc. as directed.	Attached	
15	Providing water proofing water repellent compound on cieliling for waterproofing including cleaning the surface,removing dirt and other foreign materials etc	Attached	
16	Supplying and fixing total electrification work with concealed wiring including standard ISI mark moduler switches, copper wire gauge minimum 3/20 & above, 8 nos of lighting point, 2 nos fans, 8 nos LED bulbs including electric accesseries like MCB with distribution box, Switch board & Exhaust fen as directed by Engineer - in -charge.	Attached	
17	Providing and Painting of typical Logo. Writing letter or figures on any surface with Thick White Paint Incl. stops, comas, hyphens etc as required) : Indian (Letters/figures). as per instruction of engg. In charge.	Attached	

Item No.	Item of work	Item No.	Page No.
18	Carring out plinth treatment to post construction / existing structure by spraying chemical solution for termite control treatment including labour and material consistment with I.S.I specification. Using Chlordene and Chiorpurfiles 20 EC. As Per 6131_paret- II Consentration Weight one percent is recommended i.e one litre 20 EC chemical emulsion with 19 liter give 1 % concentration inclusive of one litre chemical emulsion appication at the rate of 5 Litre chemical / Sqm of surface is recommended as per I.S	Attached	
19	Carrying out wall treatment for termite control including spraying with chemical solution in oil base including labour and material Using Chlorpyriphos 20 ECAs per IS 6313 part - II (1% concentration by mass) is recommended i.e one litre chemical emulsion diluted with 19 liter oil base. Total solution will be 20 liters inclusive of one liter chemical emulsion application at the rate of 7.5 litre chemical / Sqm of surface is recommended as per I.S.	Attached	
20	20mm thick sand faced cement plaster on walls upto height 10 metres above ground level consisting of 12mm thick backing coat of C.M. 1:3 (1-cement : 3-sand) and 8mm thick finishing coat of C.M. 1:1 (1-cement : 1-sand) etc. complete.	Attached	
21	Providing Septic tank of size 2.50mtr x 1.50mt x 1.50mt I/I dimension with 0.23mtr thick walls including plastering and filling with brick bats with top slab in CC 1:2:4 (1-cement:2-sand:4-coarse aggregate) including centreing and shuttering and reinforcement and etc complete.	Attached	
22	White Stone Bela mesonry block in course in superstructure with stone of approved quality in Lime Mortar 1:5 (1-Cement :5- course sand) including packing the joints etc. complete.	Attached	
23	Marble Slab Polished marble stone Rajnagar Makarana 20mm size 60 x 45 cms.	Attached	

(                      )  
Deputy Executive Engineer  
Panchayat R.& B. Sub Division  
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(                      )  
Executive Engineer  
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Gir Somnath

# **SPECIFICATIONS OF MATERIALS**

**1.1** Water shall not be salty brackish and shall be clean, reasonably clear and free objectionable quantities of silt and traces of oil injurious alkalies, salts, organic matter and other deleterious material which will either weaken the mortar of concrete or cause efflorescence or attack the steel in R.C.C. Container For transport, storage and handling of water shall be clean Water shall conform to the standard specified in I.S. :456-1978.

**1.2** If required by the Engineer in charge it shall be tested by comparison with distilled water Comparison shall be made by means of standard cement tests for soundness time of setting ad mortar strength as specified in I.S. 269-1976. Any indication of unsoundness, charge in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar pre appeared with water sample when compared with results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

**1.3** Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of mortar or concrete during curing of those which produce objectionable stains of their unsightly deposits o concrete or mortar surfaces

**1.4** Hard and bitter water shall not be used for curing

**1.5** Potable water will generally found suitable curing mortar or concrete.

## **M-2 Lime.**

**2.1** Lime shall be hydraulic lime as per (I.S. 712-1973) Necessary tests shall be carried out as per I.S. 6932(parts I to X)1973.

**2.2** The following field tests are to be carried out :

(1) A very rough idea can be formed about the type of lime by its visual examination i.e. fat lime bears pure white color, lime in for of porous lumps of dirty white color indicates quick lime and solid lumps are the un-burnt lime stone.

(2) Acid tests for determining the carbonate content in lime Excessive amount of impurities and rough determination of class of lime.

**2.3** Storage shall comply with I.S. 712-1973. The slaked lime, if

stored shall be kept in a weather proof and damp-proof shed with impervious floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged in any way shall be rejected and all rejected materials shall be removed from site of work.

**2.4** Field testing shall be done according to I.S.1624-1974 to show the acceptability of materials.

### **M-3 Cement.**

**3.1** Cement shall be ordinary Portland slag cement as per I.S. 269-1976 OR Portland slag cement as per I.S. 455-1976.

### **M-4 White Cement.**

**4.1** The white cement shall conform to I.S. 8042-E-1978.

### **M-5. Colored Cement**

**5.1** Colored cement shall be with white or grey Portland cement as specified in the item of the work.

**5.2** The pigments used for colored cement shall be of approved quality and shall not exceed 10% of cement used in the mix. The mixture of pigment and cement shall be properly ground to have a uniform color and shade.

**5.3** The pigments shall have such properties as to provide for durability under exposure to sunlight and weather. The pigment shall have the property such that it is neither affected by the cement nor detrimental to it.

### **M-6 Sand.**

**6.1** Sand shall be natural sand, clean, well graded, hard strong, durable and gritty particles free injurious amounts of dust, clay lumps, nodules, soft or flaky particles shall, alkali salts organic matter, loam, mica or other deleterious substances and shall be got approved from the Engineer-in-Charge. The sand shall not contain more than 8 percent of silt as determined by field test. If necessary the sand shall be washed to make it clean.

**6.2 Coarse Sand :** The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse sand shall be as under :

I.S. Designation	Sieve passing sieve	Percentage by weight Designation	I.S. Sieve percentage by weight passing sieve.
4.75 mm.	100	600 Micron	30-100
2.36 mm.	90 to 100	300 Micron	5-70
1.18 mm.	70 to 100	150 Micron	0-50

### 6.3 Fine Sand :

The fineness modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under :

I.S. Designation	Sieve passing sieve	Percentage by weight	Designation by I.S. Sieve	percentage by weight passing sieve.
4.75 mm.	100	600 Micron		40-85
2.36 mm.	100	300 Micron		5-50
1.18 mm.	75 - 100	150 Micron		0-10

### M-7 Stone Dust

**7.1** This shall be obtained from crushing hard black trap of equivalent. It shall not contain more than 8 % of silt as determined by field test will measuring cylinder. The method of determining silt contents by fields test is given as under.

**7.2** A sample of stone dust to be tested shall be placed without drying in 200 mm. measuring cylinder. The quality of the sample shall be such that it fills the cylinder up to 100 mm. mark. The clean water shall be added up to 150 mm. mark. The mixture shall be stirred vigorously and the content allowed to settle for 3 hours.

**7.3** The height of silt visible as settled layer above the stone dust shall e expressed as percentage of the height of the stone dust below. The stone dust containing more than 8 % silt shall be washed so as to bring the content within the allowable limit.

**7.4** The fineness modules of stone shall not be less than 1.80.

### M-8 Stone Grit.

**8.1** Grit shall consist of crushed or broken stone and be hard, strong, dense, durable, clean of proper gradation and free from skin or coating likely to prevent proper adhesion of mortar. Grit shall generally be cubical in shape and as far as possible flakey elongated pieces shall be avoided. It shall generally comply with the provisions of I.S. 383-1970. unless special stone of particular quarries is mentioned grit shall be obtained from the bet black trap or equivalent hard stone as approved by the Engineer in charge. The grit shall have not deleterious with cement.

**8.2** The grit shall conform to the following gradation as per sieve analysis :

I.S. Designation	Percentage by weight passing sieve.	I.S. Designation	Sieve	Percentage by weight passing sieve.
12.50 mm.	100	600 Micron		0-20 %
10.00 mm.	85 - 100	300 Micron		0-25

**8.3** The crushing strength of grit will be such as to allow the concrete in which it used to build up the specified strength of concrete.

**8.4** The necessary tests for rit shall be carried out as per the requirements of I.S.2386-(PARTS-I TO VIII)1963, as per instructions of the Engineer in charge. The necessity of test will be decided by the Engineer in charge.

## **M-9 Cinder**

**9.1** Cinder is well burnt furnace residue which has been fused or sintered into lumps of varying sizes.

**9.2** Cinder aggregates shall be well burnt furnace residue obtained from furnace using coal fuel only it shall be sound clean and free from clay, dirt, ash or other deleterious matter.

**9.3** The average grading for cinder aggregates shall be as mentioned below :

I.S. Sieve Designation	Percentage passing sieve.	I.S. Sieve Designation	Percentage passing
20.00 mm.	100	4.75 mm.	70%
10.00 mm.	86	2.36 mm.	52%

## **M-10 Lime Mortar**

**10.1 Lime :** Lime shall conform to specification M-2 Water shall conform to specification M-1 Sand. Sand shall conform to specification M-6.

### **10.2 Proportion of Mix :**

**10.2.1.** Mortar shall consist of such proportions of slaked lime and sand as may be specified in item. The slaked lime & sand shall be measured by volume.

### **10.3 Preparation of mortar**

**10.3.1** Lime mortar shall be prepared by wet process as per I.S. 1625-1971. Power driven mill shall be used for preparation of lime mortar. The slaked lime shall be placed in the mill in an even layer and ground for 180 revolutions with a sufficient water. Water shall be added as required during grinding (care being taken not to add more water) that will bring the mixed material to a consistency of stiff past. Thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

### **10.4 Storage :**

**10.4.1** Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin or open sheds.

### **10.5 Use :**

**10.5.1.** All mortar shall be used as soon as possible after grinding. It should be used on the day on which it prepared. But in no case mortar made earlier than 36 hours shall be permitted for use.

## **M-11 Cement Mortar**

**11.1** Water shall conform to specification M-1 Cement. Cement shall conform to specifications M-3 sand. Sand shall conform M-6.

### **11.3 Proportion of Mortar :**

**11.3.1.** In hand mixed mortar, cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogeneous, mixture of uniform color is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform color so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed.

**11.3.2** The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 min.

## **M-12 Stone Coarse Aggregate For Nominal mix Concrete.**

**12.1** Coarse aggregate shall be of machine crushed stone of black trap or equivalent and be hard strong dense, durable clean and free from skin and coating likely to prevent proper adhesion of mortar.

**12.2** The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement and ordinary reinforced cement concrete shall generally be as per the table given below. However, in case of reinforced cement concrete the maximum limit may be restricted to 6mm. less than the minimum lateral clear distance between bars or 6mm. less than cover whichever is smaller.

**TABLE**

I.S. Sieve Designations	Percentage passing for single Sized aggregates of Nominal size			I.S. Sieve Designation	Percentage passing for single Sized aggregates of Nominal size		
	40 mm.	20 mm.	16		40 mm.	20 mm.	16
	-	-	-	12.5 mm.	-	-	-
80 mm.	100	-	-	10 mm.	0.5	0.2	0.3
63 mm.	85-100	100	-	4.75 mm.	-	0.5	0.5
40 mm.	0-20	85-100	100	2.35 mm.	-	-	-
20 mm.		85-100			mm.		
16 mm.	mm.						

**Note :** This percentage may be varied some what by the Engineer in charge when considered necessary for obtaining better density and strength of concrete.

**12.3** The grading test shall be taken in the beginning and at the change of source of materials. The necessary tests. Indicating I.S.:383-1970 and 456-1978 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately

and handled in such a manner as to prevent the intermixing of different aggregates. if the aggregates are covered with dust, they shall be washed with water to make them clean.

### **M-13 Black Trap or Equivalent Hard Stone Coarse**

**13.1** Aggregates For Design Mix Concrete : Coarse aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard, strong, dense, durable, clean and free from kin and coating likely to prevent proper adhesion of mortar.

**13.2** The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious with cement.

**13.3** The necessary tests indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability of the material.

**13.4** If aggregate is covered with dust it shall be washed with water to make clean.

### **M-14 Brick Bats Aggregates :**

**14.1** Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense bricks. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40mm. 50 mm. size unless otherwise specified in the item. The under burnt or over burnt brick bats shall not be allowed.

**14.2** The brick bats shall be measured by suitable boxes or as directed.

### **M-15 Bricks**

**15.1** The bricks shall be hand or machine moulded and made from suitable soils and kiln burnt. They shall be free from cracks and flaws and modules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform color. The bricks shall be moulded with a frog of 100 mm. x 40 mm. and 10 mm. to 20mm. deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 600 mm.

**15.2** The size of modular bricks shall be 190 mm. x 90 mm. x 90 mm.

**15.3** The size of conventional bricks shall be as under :

(9" x 4 3/8" x 2 3/4") 225 x 110 x 75 mm.

**15.4** Only bricks of one standard size shall be used on one week. The following tolerance shall be permitted in the conventional size adopted in a particular work. Length + 1/8" (3.0 mm) Width + 1/16" (1.50 mm.) Height + 1/16" (1.50 mm.)

**15.5** The crushing strength of the bricks shall not be less than 35 kg/sq. cm. The average water absorption shall not be more than 20 percent by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per I.S. 3495 (Part-I to IV)-1976.

### **M-16 Stone.**

**16.1** The stone shall be of the specified variety such as Granite/Trap Stone/Quartzite or any other type of good hard stones. The stones shall be only from defects like cavities, cracks, sand holes, flaws injurious veins, patches of loose or soft materials and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight. When tested in

accordance with I.S. 1124-1974. The minimum crushing strength of stone shall be 200 Kg./Sq. Cm. unless otherwise, specified.

**16.2** The sample of the stone to be used shall be got approved before the work is started.

**16.3** The khanki facing stone shall be dressed y chisel as specified in the item for khanki facing required shape and size. The face of the stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm. nor shall it have depressions more than 10 mm. from the average wall surface.

### **M-17 Laterite Stone.**

**17.1** Laterite stone shall be obtained from the approved quarry. It shall be compacted in texture sound, durable and free from soft patch. It shall have minimum crushing strength of 100 Kg./Sq. Cm. in its dry condition. It shall not absorb water more than 20% of its own weight, when immersed for 24 hours in water after quarrying, the stone shall be allowed to weather for some time before using in work.

**17.2** The stone shall be dressed into regular rectangular blocks so that all faces are free from waviness and unevenness, and the edges true and square.

**17.3** Those types of stone in which white clay occurs should not be used.

**17.4** Special corner stones shall be provided where so directed.

### **M-18 Mild Steel Bars**

**18.1** Mild steel bars reinforcement for R.C.C. work shall conform I.S. 432(Part-II)1966 and shall be of tested quality. It shall also comply with relevant part of I.S. 456-1978.

**18.2** All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose or thick rust at the time of placing.

**18.3** For the purpose of payment, the bar shall be measured correct up to 10 mm. length and weight payable worked out at the rate specified below.

1.	6 mm.	0.22 Kg./Rmt.	8.	20 mm.	2.47 Kg./Rmt.
2.	8 mm.	0.39 Kg./Rmt.	9.	22 mm.	2.98 Kg./Rmt.

3.	10 mm.	0.62 Kg./Rmt.	10.	25 mm.	3.85 Kg./Rmt.
4.	12 mm.	0.89 Kg./Rmt.	11.	28 mm.	4.83 Kg./Rmt.
5.	14 mm.	1.21 Kg./Rmt.	12.	32 mm.	6.31 Kg./Rmt.
6.	16 mm.	1.58 Kg./Rmt.	13.	36 mm.	7.99 Kg./Rmt.
7.	18 mm.	2.00 Kg./Rmt.	14.	40 mm.	9.86 Kg./Rmt.

### **M-19 High Yield Strength Deformed Bars**

**19.1** High yield strength steel deformed bars shall be either cold twisted other rolled and shall conform to I.S. 1786-1966 and I.S. 1139-1966 respectively.

**19.2** Other provisions and requirements shall conform to specification No. M-18 for Mild Steel Bars.

### **M-20 High Tensile Steel Wires.**

**20.1** The high tensile wires for use in prestressed concrete work shall conform to I.S. 2090-1962.

**20.2** The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength the minimum strength shall be taken as per para 6-1 of the I.S. 1785-1962. Testing shall be done as per I.S. requirements.

**20.3** The high tensile steel shall be free from loose mill scale, rust, oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through a pressure box containing Carborundum.

**20.4** The high tensile wire shall be obtained from manufactures in coils having diameter not less then 350 times the diameter of wire itself so that wire springs back straight on being uncoiled.

### **M-21 Mild Steel Binding Wire**

**21.1** The mild steel wire shall e of 1.63 mm. or 1.22 mm. (16 to 18 gauge ) diameter and shall conform t I.S. 280-1972,

**21.2** The use of black wire will be permitted for binding reinforcement bars. It shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

### **M-22 Structural Steel**

**22.1** All structural steel shall conform to I.S. 226-1985. The steel shall be free from the defects mentioned in I.S. 226-1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defect affecting the strength and durability. River bars shall conform to I.S. :1148-1973.

**22.2** When the steel is supplied by the Contractor test certificate of the manufacturer shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

### **M-23. Galvanized Iron Sheets**

**23.1.** The galvanized iron sheets shall be plain or corrugated sheets of gauges as specified in item. The G. I. Sheets shall conform to I.S. 277-1977. The sheets shall be undamaged in carriage and handling either by rubbing off of zinc coating or otherwise. The shall have clean and bright surface and shall be free from dents, bends, holes, rust white powdery deposit.

**23.2.** The length and width of G.I. sheets shall be as directed as per site condition.

#### **M-23.A : G.I. Valleys gutter, ridges**

**23.A.2.** Valleys gutters and flashings shall also be of galvanized sheet of thickness as specified in item. Valleys shall be 900 mm. wide overall and flashing shall be 380 mm. wide overall. They shall be bent to the required shape without damage to the sheet in the process of bending.

### **M-24. Asbestos Cement Sheets**

**24.1.** Asbestos cement sheets plain, corrugated of semi corrugated shall conform to I.S. 459-1970. The thickness of the sheets shall be as specified in the tem. The sheets shall be free from all defects such as cracks, holes, deformities chipped edges or otherwise damaged.

#### **24.2. Ridges & Hips :**

**24.2.1.** Ridges and hips shall be of same thickness as that of A.C. sheets. The types, of ridges shall be suitable for the type of sheets and location.

**24.2.2.** Other accessories to be used in roof such as flashing pieces eaves filler pieces, valley gutters, northern light and ventilator curves, barge boards etc. shall be of standard manufacture and shall be suitable for the type of sheets and location.

### **M-25. Manglore Pattern Roof Tiles**

**25.1.** The Mangalore pattern tiles shall conform to I.S. 654-1972 for Class AA or Class A type as specified in item. Samples of the tiles to be provided shall be got

approved from the Engineer-in-Charge. Necessary tests shall be carried out as directed.

#### **M-26. Shuttering.**

**26.1.** The shuttering shall be either of wooden planking of 30 mm. minimum thickness with or without steel lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical bullies properly cross braced together so as to make the centering rigid. In places of bullie props, brick pillar of adequate section built in mud mortar may be used.

**26.2.** The form work shall be sufficient strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of live load of men work in over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall permit leakage of cement grout.

**26.3.** If at any stage of work during or after placing concrete in the structure the form work sags or bulges out beyond the required shape of the structure. The concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be inspected by and got approved from the Engineer in charge, before the reinforcement bars are placed in position.

**26.4.** The props shall consist of bullies having 100 mm. min. diameter measured at mid length and 80 mm. at thin end shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm. thick and min. bearing area of 0.10 sq. m. laid on sufficiently hard base.

**26.5.** Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jacking the concrete.

**26.6.** The timber used in shuttering shall not be dry as to absorb water from concrete and swell or bulge nor so green or wet as to shrink after erection. The timber shall be properly sawn and planed on the sides and the surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

**26.7.** As far as practicable clamps shall be used to hold the forms together and use of nails and spikes avoided.

**26.8.** The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacture may be applied in place of soap solution. In case of steel shuttering either soap solution or raw linseed

oil shall be applied after thoroughly cleaning the surface under no circumstances black or burnt oil shall be permitted.

**26.9.** The shuttering for beams and slabs shall have camber of 4 mm. per meter (1 in 250) or as directed by the Engineer in charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the projected length or as directed by the Engineer in charge.

#### **M-27. Expansion Joints- Pre-molded filler**

**27.1.** The item provides for expansion joints filler shall not get deformed or broken by twisting bending or other handling when exposed to atmospheric condition. Pieces roof joints filler that have been damaged shall be rejected.

**27.3.** Thickness of the pre-molded joints filler shall be 25 mm. unless otherwise specified.

**27.4.** Pre-molded bituminous joints filler shall conform to I.S. 1838-1961.

#### **M-28. Expansion joints-copper strips and hold fasts**

**28.1.** The item provide for expansion joints in R.C.C. frame structure for internal joints, as well as exposed joints, with the use of pre-molded bituminous joints filler.

**28.2.** Copper sheet shall be of 1.25 mm. width and or 1.25 mm. width and the "U" shape in the middle. Copper strip shall have holdfast of 3mm. diameter copper rod fixed to the plate soldered on strip at intervals of about 30 cm. r as shown in the drawing or as directed. The width of each flange (horizontal side) of the copper plate to be embedded in the concrete work shall be 25 mm depth of "U" to be provided in the expansion joint, in the copper plate shall be of 25 mm.

#### **M-29. Teak wood**

**29.1.** The teak wood shall be of good quality as required for the item to be executed. When the kind of wood is not specially mentioned, good Indian teak wood as approved shall be used.

**29.2.** Teak wood shall generally be free from large, lose dead or cluster knots flaws shakes, warps, twists, bends or any other defects. It shall generally be uniform in substance and of straight fibers as far as possible. It hall be free from not decay, harmful fungi and other defects of harmful nature which will affect the strength, durability or its usefulness for the purpose for which it is required. The color shall be uniform as far as possible. Any effort like paining using any adhesive materials made to hide the defects shall render the pieces liable to rejection by the Engineer in charge.

**29.3.** All scantlings, planks etc., shall be sawn in straight lines and planes in the direction of grains and of uniform thickness.

**29.4.** The tolerances in the dimensions shall be allowed at the rates of 1.5 mm. per face to be planed.

**29.5.** First class teak wood shall have no individual hard and sound knots, more than 6 sq. cm in size and the aggregate area of such knots shall not be more than 1 % of area of piece. The timber shall be closed grained.

**29.6.** Second Class Teak Wood :

**29.6.1.** No individual hard and sound knots shall be more than 15 sq. cms. in size and aggregates area of such knots shall be not exceed 2 % of the area of piece.

**M-29. A Non-teak wood :**

The non teak wood shall be chemically treated, seasoned as per I.S. Specifications and of good quality. The type of wood shall be got approved before collecting the same on site Fabrication of wooden members shall be started only after approval.

For this purpose wood of Bio, kalai, Sires Saded Behda, Jamun, Sisoo will be used for door where as only Kalai, Sires, Halda, Kalam etc. will be permitted for shutters after proper seasoning and chemical treatment.

The non teak wood shall be free from large, loose dead of cluster knots, flows, shakes, warps, bends or any other defects. Its shall be uniform in substance and of straight fibers as far as possible. It shall be free from rots, decay, harmful fungi and other defects of nature which will effect the strength, durability or its usefulness for the purpose for which it is required. The color of wood shall be uniform as far as possible. The scantalings planks etc. shall be saw in straight lines and planes in the direction of grain and of uniform thickness. The department will use the Agency to produce certificate from Forest Department in event of dispute and the decision of the department shall be final and binding to the contractor. The tolerance in the dimension shall be allowed at 1.5 mm. per face to be planed.

**M-30. Wooden flush door shutters (solid core)**

**30.1.** The solid core type flush door shutters shall be of decorative or non decorative type as specified in the drawing. The size and thickness of the shutter shall be as specified in drawings or as directed. The timber species for core shall be as specified in drawings or as directed. The timber species for core shall be used as per I.S. 2202(Part-1)1980. The timber shall be free from decay and insect attack, knots and knot holes less than half the width of cross section of the members in which they occur may be permitted. Pitch pockets, pitch streaks and harmless pin holes shall be permissible except in the exposed edges of the core members. The commercial plywood cross-bands shall conform to I.S. 303-1275.

**30.2.** The face panel of the shutters shall be formed by gluing by the the hot press process on both faced the core with either plywood or cross-bands and face veneers. The hopping rebating opening of glazing venation etc., shall be provided if specified in the drawing.

**30.3.** All edges of the door shutters shall be square. The shutters shall be free from twist or warp in its plane. Both faces of the shutters shall be sand papered to smooth even texture.

**30.4.** The shutters shall be tested for-

**(1) End immersion test :** The test shall be carried out as per I.S. 2202-(Part-1)1980. There shall be not delamination at the end of the test.

**(2) Knife Test :** The face panel when tested in accordance with I.S. 1659-1979 shall pass the test.

**(3) Glue adhesion test :** The flush door shall be tested for glue adhesive test in accordance with I.S. 2202(part-1)1980. The shutters shall be considered to have passed the test if no delamination occurs in the glue lines in the plywood and if no single delamination more than 80 mm. in length and more than 3 mm. in depth has occurred in the assembly glue lines between the plywood face and the style and rail. Delamination at the corner shall be measured corner shall be measured continuously around the corner. Delamination at the knots, knot hole and other permissible wood defects shall not be considered in assessing the sample.

**30.5.** The tolerance in size of slid core type flush door shall be as under :

In Nominal thickness  $\pm 1.2$  mm. In Nominal height  $\pm 3$  mm.

**30.6.** The thickness of the shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm. when measured at any two points.

### **M-31. Aluminum doors, windows ventilators**

**31.1.** Aluminum alloy used in the manufacture of extruded window sections shall conform to I.S. DESIGNATION HEA-WP of I.S. 733-1975 and also to I.S. Designation WVG-WP of I.S. 1285-1975. The section shall be as specified in the drawing and design. The fabrication shall be done as directed.

**31.2.** The hinges shall be cast or extruded aluminum hinges of same type as in window but of larger size.

**31.3.** The hinges shall normally be of 50 mm. projecting type Non-projecting type of hinges may also be used if directed. The handles of door shall be of specified design. A suitable lock for the door operable either from outside or inside shall be provided in double shutter door, the first closing shutter shall have concealed aluminum alloy bolt at top and bottom.

## **M-32.Rolling Shutters**

**32.1.** The rolling shutters shall conform to I.S. 6248-1979. Rolling shutters shall be supplied of specified type with accessories. The size of the rolling shutters shall be specified in the drawings. The shutters shall be specified in the drawings. The shutters shall be constructed with interlocking path sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm. wide for shutters up to 3.5 m. width not less than 1.25 mm. thick and 80 mm. wide for shutters 3.5 m. in width and above unless otherwise specified.

**32.2.** Guide channels shall be of mild steel deep channel section and of rolled pressed or built up (fabricated) jointless construction. The thickness of sheet used shall not be less than 3.15 mm.

**32.3.** Hood covers shall be made of M.S. Sheets not less than 0.90 mm. thick. For shutters having width 3.5 Meter and above, the thickness of M.S. sheet for the hood cover shall not be less than 1.25 mm.

**32.4.** The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire of strip of adequate strength to balance the shutters in all position. The spring pipe shaft etc. shall be supported on strong M.S. of malleable C.I. brackets. The brackets shall be fixed on or under the lintel as specified with crawl plugs and screws bolts etc.

**32.5.** The rolling shutters shall be of self rolling up to 8 sq. m. clear area without ball bearing and up to 12 sq. m clear area with ball bearing. If the rolling shutters are of larger, then gear operated type shutters shall be used.

**32.6.** The locking arrangement shall be provided at the bottom of shutter at both ends. The shutters shall be opened from outside.

**32.7.** The shutters shall be completed with door suspension shafts, locking arrangements pulling hooks, handles and other accessories.

## **M-33.Collapsible Steel Gate**

**33.1.** The collapsible steel gate shall be in one or two leaves and size as per approved drawings or as specified. The gate shall be fabricated from best quality mild steel channels, flats etc. Either steel pulleys or ball bearings shall be provided in every double channel. Unless otherwise specified the particulars of collapsible gate shall be as under. :

(a) Pickets : These shall be of 20 mm. M.S. channels of heavy sections unless otherwise shown on drawings. The distance centre to centre of pickets shall be 12 cms. with an opening or 10 cms.

- (b) Pivoted M.S. flats shall be 20 mm. x 6 mm.
- (c) Top and bottom guides shall be from tee or flat iron of approved size.
- (d) The fittings like stoppers fixing, locking cleats, brass handles and cast iron rollers shall be of approved design and size.

#### **M-34. Welded Steel Wire Fabric**

**34.1.** Welded steel wire fabric for general purpose shall be manufactured from cold drawn steel wire. "as draw" or galvanized steel conforming to I.S. 226-1975. With longitudinal and transverse wire securely connected at every intersection by a process of electrical resistance welding and conforming to I.S. 4948-1974. It shall be fabricated and finished in workmanlike manner and shall be free from injurious defects and shall be rust proof. The type of mesh shall be oblong or square as directed. The mesh sizes and sizes if wire for square as well as oblong welded steel wire fabric shall be as directed. The steel wire fabric in panels shall be in one whole piece I earth panel as far as stock sizes permit.

#### **M-37. Plywood**

**37.1.** The plywood for general purpose shall conform I.S. 303-1975.

Plywood is made by cementing together then boars or sheets of wood into panels. There are always an odd number of layers 3,5,7,9, ply etc. The plies are placed so that grain of each layer is at right angles to the grain in the adjacent layer.

**37.2.** The chief advantages of plywood over a single board of the same thickness is the more uniform strength of the plywood, along the length and width of the plywood and greater resistance to cracking and splitting with change in moisture content.

**37.3.** Usually synthetic resins are used to gluing, phenolic resins are usually cured in a hot press which compresses and simultaneously heats the plies between hot plates which maintain a temperature of 90 degree C to 140 degree C and a pressure of 11 to 14 kg./sq. Cm. on the wood. The time of heating may be anything from 2 to 60 minutes depending upon thickness.

**37.4.** When water glue are used the wood absorbs so much water that the finished plywood must be dried carefully. When synthetic resins are used as adhesive the finished plywood must be exposed to an atmosphere of controlled humidity until the proper amount of moisture has been absorbed.

**37.5.** According to I.S. 303-1975 the plywood for general purpose shall be of the grades namely BWR and CWR, depending up to the adhesives used for bonding the veneers, and it will be further classified into six types namely AA,AB, AC,BB, BC and CC based on the quality of the two faces each face being of three kinds namely A, B & C after pressing, the finished plywood should be reconditioned to a moisture content not less than 8 percent and not more than 16 %.

### 37.6. Thickness of plywood Boards

TABLE

Board	Thickness	Board	Thickness	Board	Thickness	Board	Thickness
3 ply.	3 mm.	5 ply	5 mm.	7 ply	9 mm.	9 ply	16 mm.
	4 mm.		6 mm.		13 mm.		19 mm.
	5 mm.		7 mm.		16 mm.	11 ply.	19 mm.
	6 mm.		8 mm.	9 ply.	13 mm.		25 mm.

### M-38. Glass.

**38.1.** All glass shall be of the best quality, free from specks, bubbles, smoke veins, air holes blister, and other defects. The kind of glass to be used shall be as mentioned in the item or specification or in the special provision or as shown in detailed drawings. Thickness of glass panes shall be uniform. The specifications for different kinds of glass shall be as under.

### 38.2. Sheet Glass

**38.2.1.** In absence of any specified thickness or weight in the item or detailed specifications of the item of work, sheet glass shall be weighing 7.5 Kg/Sq. m. for panes up to 600 mm. x 600mm.

**38.2.2.** For panes larger than 600 mm. x 600 mm. and up to 800 mm. x 800 mm. the glass weighing not less than 8.75 Kg/Sq. m. shall be used for bigger panes up to 900 mm. x 900 mm. glass weighing not less than 8.75 Kg./Sq. m. shall be used. For bigger panes up to 900 mm. x 900 mm. glass weighing not less than 11.25 Kg. / Sq. m. shall be used

**38.2.3.** Sheet glass shall be patent flattened glass of best quality and for glazing and framing purposes shall conform to I.S. 1762-1960. Sheet glass of the specified colors shall be used. If so shown, on detailed drawings or so specified. For important buildings and for panes with any dimension over 900 mm. plate glass of specified thickness shall be used.

### 38.3. Plate Glass :

**38.3.1.** When plate glass is specified it shall be "polished patent plate glass" of best quality. It shall have both the surface ground flat and parallel and polished to obtain clear undisturbed vision and reflection. The plate glass shall be of the thickness mentioned in the item or as shown in the detailed drawing or as specified.

In absence of any specified thickness, the thickness of plate glass to be supplied shall be 6 mm. and a tolerance of 0.20 mm shall be admissible.

#### **38.4. Obscured Glass :**

**38.4.1.** This type of glass transmits light so that vision is partially or almost completely obscured. Glass shall be plain rolled, figured, ribbed or fluted or frosted glass as may be specified as required. The thickness and type of glass shall be as per details on drawings or as specified or as directed.

#### **38.5. Wired Glass:**

**38.5.1.** Glass shall be with wire netting embedded in a sheet of plate glass. Electrical welded 13 mm. Georgian square mesh shall be used. Thickness of glass shall not be less than 6 mm. Wired glass shall be of type and thickness as specified.

#### **M-39. Acrylic Sheets**

**39.1.** Acrylic sheets shall be of thickness as specified in the item and of an specified shape and size as the case may be panels may be flat or curved. It should be light in weight. It shall be colorless or colored or opaque as specified in the item. Colorless sheet shall be as transparent as the finest optical glass. Its light transmission rate shall be about 95 % Transparency shall not be affected for the sheets of larger thickness. It shall be extremely resistant to sunlight weather and low temperatures.

It shall not show any significant yellowing or change in physical properties or loss of light transmission over a longer period of use. The sheet shall be impact resistant also sheets should be of such quality that they can be cut bent jointed as desired. Solution for the joints shall be used as per the requirement of manufacturer.

#### **M-40. Particle board**

**40.1.** The particle boards used for face panels shall be of best quality free from any defects. The particle boards shall be made with phenolaldehyde adhesive. The particle boards shall conform I.S. 3087-1965 "Specification for wood particle board for general purpose". The size and the thickness shall be as indicated.

#### **M-41. Expanded polystyrene or framed sty roper slabs.**

**41.1.** The expanded polystyrene ceiling boards and tiles shall be of approved make and shall be of sizes, thickness, finish and color as indicated. It shall be of high density and suitable for use as insulating material. The insulating material shall be like slab of thermo Cole etc.

#### **M-42. Resin bonded fiber glass**

**42.1.** Resign bonded fiber glass tiles or rolls shall be of approved make and shall be of sizes thickness, and finish as indicated.

**42.2.** For test of Mineral wool thermal insulation Blanket I.S. 3144-1965 shall be **followed.**

**42.3.** Insulation wool blanket shall be with the following coverings on one or both sides as indicated. :

- (1) Bituminised hessian Kraft paper suitable for use in position where moisture has to be excluded.
- (2) Hessian cloth or Kraft paper, for keeping out dust.
- (3) G. I. wire netting, suitable for sources to be plastered over.

#### **M-43. Fixture and fastenings**

##### **43.1. General :**

**43.1.1.** The fixtures and fastenings, that is butt hinges tee and strap **hinges steel door bolts, tower bolts, door latch, bath room latch, handles, door stopper**, casement window fasteners, casement stays and ventilators catch shall be made of the metal as specified in the item or its specification.

**43.1.2.** They shall be of iron, brass, aluminum chromium plated iron, chromium plated brass copper oxidized iron, copper oxidized brass or anodized aluminum as specified.

**43.1.3.** The fixtures shall be heavy medium or light type. The fixtures and fastenings shall be smooth finished and shall be such as will ensure ease of operations.

**43.1.4.** The samples of fixtures and fastenings shall be got approved as regards, quality and shape before providing them in position.

**43.1.5.** Brass and anodized aluminum fixtures and fastenings shall be bright finished.

##### **43.2. Holdfasts :**

**43.2.1.** Holdfasts shall be mad from mild steel flat 30 cm. length and one of the holdfasts shall be bent at right angle and two nos. of 6 mm. diameter holes, shall be made in it for fixing it to the frame with screws. At the other end, the holdfast shall be 'forked and bent at right angles in opposite directions.

**43.3. Butt hinges :**

**43.3.1.** Railway standard heavy type butt hinges shall be used when so specified.

**43.3.2.** Tee and strap hinges shall be manufactured from M.S. Sheet.

**43.4. Steel door bolts (Aldrops):**

**43.4.1.** The aldrops as specified in the item shall be used and shall be got approved.

**43.5. Tower bolts (Barrel Type):**

**43.5.1.** Tower bolts as specified in the item shall be used and shall be got approved.

**43.6. Door Latch :**

**43.6.1.** The size of door latch shall be taken as the length of latch.

**43.7. Bathroom Latch :**

**43.7.1.** Bathroom latch shall be similar to tower bolt.

**43.8. Handle :** The size of the handles shall be determined by the inside grip length of the handles. Handles shall have a base plate of length 50 mm. more than the size of the handle.

**43.9. Door Catch :**

**43.9.1.** Door catch shall be fixed at a height of about 900 mm. from the floor level such that one part of the catch is fitted on the inside of the shutter and the other part is fixed in the wall with necessary wooden plug arrangements for appropriate fixity. The catch shall be fixed 20 mm. inside the face of the door for easy operation of catch.

**43.10. Door Stoppers :**

**43.10.1.** Door stoppers shall be either floor door stopper type or door catch type. Floor stopper shall be of overall size as specified and shall have a rubber cushion.

**43.11. Wooden Door Stop with hinges :**

**43.11.1.** Wooden door stop of size 100 mm. x 60 mm. x 40 mm. shall be fixed on the door frame with a hinges of 75 mm. size and at a height of 900 mm. from the floor level. The wooden door stop shall be provided with 3 coats of approved oil paint.

**43.12. Casement Window Fastener :**

**43.12.1.** Casement window fastener for single leaf window shutter shall be left or right handled as directed.

**43.13. Casement stays (Straight Ped Stay):**

**43.13.1.** The stays shall be made from a channel section having three holes at appropriate position so that the window can be opened either fully or partially as directed. Size of the stay shall be 250 mm. to 300 mm. as directed.

**43.14. Ventilator Catch :**

**43.14.1.** The pattern and shape of the catch shall be as approved.

**43.15. Pivot :**

**43.15.1.** The base and socket plate shall be made from minimum 3 mm. thick plate and projected pivot shall not be less than 12 mm. diameter and 12 mm. length and shall be firmly riveted to the base plate in case of iron pivot and in single piece plate in the case of brass pivot.

**M-44. Paints :**

**44.1. (A) Oil paints :**

**44.1.1.** Oil paints shall be of the specified color and as approved. The ready mixed paints shall only be used. However, if ready mixed paint of specified shade or tint is not available white ready mixed paint with approved Steiner will be allowed. In such a case, the contractor shall ensure that the shade of the paint so allowed shall be uniform.

**44.1.2.** All the paints shall meet with the following general requirements :

(i) Paints shall not show excessive setting in a freshly opened full can and shall easily be redispersed with a paddle to a smooth homogeneous state. The paint shall show no curding, livering, caking or color separation and shall be free from lumps and skins.

(ii) The paint shall not skin within 48 hours in a three quarters filled closed container.

(iv) The paint shall dry to a smooth uniform finish free from roughness, grit unevenness and other imperfections.

**44.1.3.** Ready mixed paint shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures whatsoever.

**44.2. (B) Enamel paints :**

**44.2.1.** The enamel paint shall satisfy in general requirements in specification of oil paints. Enamel paint shall conform to I.S. 2933-1975.

**M-45. French Polish**

**45.1.** The French polish of required tint and shade shall be prepared with the below mentioned ingredients and other necessary materials.

(i) Denatured spirit of approved quality (ii) Chandras (iii) Pigment.

**45.2.** The French polish so prepared shall conform to I.S. :348-1968.

**M-46. Marble chips for marble mosaic terrazzo**

**46.1.** The marble chips shall be of approved quality and shades. It shall be hard, sound, dense and homogeneous in texture with crystalline and coarse grains. It shall be uniform in color and free from stains cracks, decay and weathering.

**46.2.** The size of various colors of marble chips ranging from the smallest up to 20 mm shall be used where the thickness of top wearing layer is 6 mm. size. The marble chips of approved quality and colors only as per grading as decided by the Engineer-in-charge shall be used for marble mosaic tiles or works.

**46.3.** The marble chips shall be machine crushed. They shall be free from foreign matter, dust etc. Except as above, the chips shall conform to I.S. 2114-1962.

**M-47. Flooring Tiles.**

**47.1.(A) Plain Cement tiles :**

**47.1.1.** The plain cement tiles shall be of general purpose type. These are the tiles in the manufacture of which no pigments are used. Cement used in the manufacture of tiles shall be as per Indian Standards.

**47.1.2.** The tiles shall be manufactured from a mixture of cement and natural aggregates by pressure process. During manufacture the tiles shall be subjected to pressure of not less than 140 Kg. /Sq. Cm.

The proportion of cement to aggregate in the backing of the tiles shall be not less than 1 :3 by weight. The wearing face, through the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm. size. The proportions of cement to aggregate in the wearing layer of the tiles shall be three parts of cement to one parts of chips by weight. The minimum thickness of wearing layer shall be 3 mm. The color and texture of wearing layer shall be uniform throughout its face and thickness. On removal from mold, the tiles and shall be kept in moist condition continuously at least for seven days and subsequently, if necessary, for such long period as would ensure their conformity to requirements of I.S. 1237-1980 regarding strength resistance to wear and water absorption.

**47.1.3.** The wearing face of the tiles shall be plane, free from projections, depressions and cracks and shall be reasonably parallel to the back face of the tile. All angles shall be right angle and all edges shall be sharp and true.

**47.1.4.** The size of tiles generally be square shapes 24.85 Cm. x 24.85 Cm. or 25 Cm. x 25 Cm. The thickness of tiles shall be 20 mm.

**47.1.5.** Tolerance of length and breadth shall be  $\pm 1$  mm. tolerance of thickness shall be  $\pm 5$ mm.

**47.1.6.** the tiles shall satisfy the tests as regards transverse strength resistance to wear and water absorption as per I.S. 1237-1980.

#### **47.2.(B) Plain Colored Tiles :**

**47.2.1.** The tiles shall have the same specification as for plain cement tiles as per (A) above expect that they shall have a plain wearing surface wherein pigments are used. They shall conform the I.S. 1237-1980.

**47.2.2.** The pigments used for coloring cement shall not exceed 10 % by weight of cement uses in the mix. The pigments, synthetic or otherwise, used for coloring tiles shall have permanent color and shall not contain materials detrimental to concrete.

**47.2.3.** The color of the tiles shall be specified in the item or as directed.

#### **47.3.(C) Marble mosaic tiles :**

**47.3.1.** These tiles have same specification as per plain cement tiles except the requirements as stated below.

**47.3.2.** The marble mosaic tiles shall conform to I.S. 1237-1980. The wearing face of the tiles mechanically ground and filled. The wearing face of tiles shall be free from projections depressions and cracks and shall be reasonably parallel to the back face of the tiles. All angles shall be right angles and all edges shall be sharp and true.

**47.3.3.** Chips used in the tiles be from smallest up to 20 mm. size. The minimum thickness of wearing layer of tiles shall be 6 mm. For pattern of chips to be had on the wearing face, a few samples with or without their full size photographs as directed shall be approved by the Engineer In Charge for approval.

**47.3.4.** Any particular samples if found suitable shall be approved by the Engineer in charge or he may ask for a few more samples to be presented. The samples shall have to be made by the contractor till a suitable sample is finally approved for use in the work. The contractor shall ensure that the tiles supplied for

the work shall be in conformity with the approved sample only, in terms of its dimensions, thickness of backing layer and wearing surface, materials, ingredients, color, shade, chips, distribution etc. required.

**47.3.5.** The tiles shall be prepared from cement conforming to Indian Standards or colored Portland cement generally depending upon the color of tiles to be used or as directed.

#### **47.4.(D) Chequered Tiles :**

**47.4.1.** Chequered tiles shall be plain cement tiles or marble mosaic tiles. The former shall have the same specification as per (A) above and the latter as per marble mosaic tiles as per (C) except as mentioned below.

**47.4.2.** The tiles shall be of nominal size 250 mm. x 250 mm. or as specified. The center to center distance of chequer shall not be less than 25 mm. and not more than 50 mm. The overall thickness of the tile shall be 22 mm.

**47.4.3.** The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not be less than 3 mm. The chequered tiles shall be plain colored or mosaic as specified. The thickness of the upper layer measured from the top of the chequers shall not be less than 6 mm. The tiles shall be given the first grinding with machine before delivery to site.

**47.4.4.** Tiles shall conform to relevant I.S. 1237-1980.

#### **47.5.(E) Chequered Tiles For Stair Cases :**

**47.5.1.** The requirements of these tiles shall be the same as chequered tiles as per (D) above except following respects :

(1) The length of a tile including nosing shall be 300 mm. (2) The minimum thickness shall be 28 mm. (3) The nosing shall have also the same wearing layer as at the top. (4) The nosing edge shall be rounded. (5) The front portion of the tile for a minimum length of 75 mm. from and including the nosing shall have grooves running parallel to nosing and at centers not exceeding 25 mm. Beyond that the tiles shall have normal chequer pattern.

#### **M-48. Rough Kotah Stone**

**48.1.** The kotah stones shall be hard even sound and regular in shape and generally uniform in color. The color of the stone shall generally be green. Brown colored shall not be allowed for use. They shall be without any soft veins, cracks or flaws.

**48.2.** The size of the stones to be used for flooring shall be of size 600 mm. x 600 mm. and/or size 600 mm. x 40 mm. as directed. However smaller sizes will be

allowed to be used to the extent of maintaining required pattern. Thickness shall be as specified.

**48.3.** Tolerance of minus 30 mm. on accounts of chisel dressing of edges shall be permitted for length as well as breadth. Tolerance in thickness shall be  $\pm 3$  mm.

**48.4.** The edge of stones shall be truly chiseled and table rubbed with coarse sand before paving. All angles and edges of the stones shall be true, square and free from chipping and surface shall be true and plain.

**48.5.** When machine cut edges are specified, the exposed and the edges at joints shall be machine cut. The thickness of the exposed machine cut edges shall be uniform.

#### **M-49. Polished Kotah Stones**

**49.1.** Polished Kotah stone shall have the same specification as per rough kotah stone except as mentioned below.

**49.2.** The stones shall have machine polished surface. When brought on site, the stones shall be single polished or double polished depending upon its use. The stones for paving shall generally be single polished. The stones to be used for dado, skirting, sink, veneering, sills, steps etc. where machine polishing after the stones are fixed in situ is not possible shall be double polished.

#### **M-50. Dholpur Stone Slab**

**50.1.** Dholpur stone slab shall be of best quality as approved by the Engineer in charge. The stone slab shall be without any veins, cracks and flaws. The stone slab shall be even sound and durable regular in shapes and of uniform color.

**50.2.** The size of the stone shall be as specified in the item or detailed drawing or as approved by the Engineer-in-charge. The thickness of the stone shall be as specified in the item of work with the permissible tolerance of  $\pm 2$  mm. The provision in respect of polishing as for polished kotah stone shall apply to polished Dholpur stone also. All angles and edges of the face of the stone slab shall be fine chiseled or polished as specified in the Item of work and all the four edges shall be machine cut. All angles and edges of the stone slab shall be true and plane.

**50.3.** The sample of stone shall be got approved by the Engineer in Charge for a particular work. It shall be ensured that the stones to be used in a particular work shall not differ much in shade or tint from the approved sample.

#### **M-51 Marble Slab**

**51.1.** Marble slab shall be white or of other and of best quality as approved by the Engineer in charge.

**51.2.** Slabs shall be hard, close, uniform and homogeneous in texture. They shall have even crystalline grain and free from defects and cracks. The surface shall be

machine polished to an even and perfect plane surface and edges machine cut true and square. The rear face shall be rough to provide key for the mortar.

**51.3.** Marble slabs with natural veins, if selected shall have to be laid as per the pattern given by the Engineer in charge. Size of the slab shall be minimum. 460 mm. x 450 mm. and preferably 600 mm. x 600 mm. However smaller sizes will be allowed to be used to the extent of maintaining required pattern.

**51.4.** The slab shall not be thinner than the specified thickness at its thinnest part. A few specimen of finished slab to be used shall be deposited by the Contractor in the office for reference.

**51.5.** Except as above the marble slab shall conform to I.S. 1130-1969.

### **M-52 Granite Stone slab**

**52.1.** Granite shall be of approved color and quality. The stone shall be hard, even sound and regular in shape and generally uniform in color. It shall be without any soft veins, cracks or flaws.

**52.2.** The thickness of the stone shall be specified in items.

**52.3.** All exposed faces shall be double polished to tender truly smooth and even reflecting surface. The exposed edges and corners shall be rounded off as directed. The exposed edges shall be machine cut and shall have uniform thickness.

### **M-53. P.V.C. Flooring**

**53.1.** P.V.C. sheets for P.V.C. floor covering shall be of homogeneous flexible type conforming to I.S. 3462-1966. The PVC covering shall neither develop any toxic effect while put to use nor shall give off any disagreeable odor.

**53.2.** Thickness of flexible type covering tiles shall be as specified in the description of the item.

**53.3.** The flexible type shall be backed with Hessian or other woven fabric. The following tolerances shall be applicable on the nominal dimensions of the rolls or tiles.

(a) Thickness  $\pm 0.15$  mm.

(b) Length or Width

(1) 300 mm. Sqr. Tiles  $\pm 0.20$  mm. (3) 900 mm. Sqr. Tiles  $\pm 0.60$  mm.

(2) 600 mm. Sqr. tiles  $\pm 0.40$  mm. (4) Sheets and roll  $\pm 0.10$  mm.

### **53.4. Adhesive :**

**53.4.1.** The adhesive for PVC flooring shall be of the type and make recommended by the manufactures of PVC sheets/tiles.

### **M-54. Facing Tiles**

**54.1.** The facing tiles (burnt clay facing bricks) shall be free from cracks and nodules of free lime. They shall be thoroughly burnt and shall have plane rectangular faces with parallel sides and sharp straight right angle faces. The texture of the finished surface that will be exposed when in place shall conform to an approved sample consisting not less than for stretcher bricks each representing the texture desired. The facing tiles shall have a pleasing appearance, sufficient resistance to penetration by rain and greater durability than common bricks. The tiles shall conform to I.S. 2691-1972.

**54.2.** The standard size of facing brick tiles shall be 19 x 9 x 4 cms. The facing brick tiles shall be provided with frog which shall conform to I.S. 11077-1976.

**54.3.** The permissible tolerance in dimensions specified above shall be as follows.

Size	Tolerance for	
	1 st. class Brick	2 nd. class Brick
Length	±6 mm.	±10 mm.
Width	±3 mm.	±7 mm.
Height	±1.5 mm.	±3 mm.

The tolerance for distortion or war page of face or individual brick from a plane surface and from straight line respectively shall be as follows :

Facing dimensions	Permissible tolerance.
Max. below 19 cms.	Max 2.5 mm.
-Do- above 19 mm.	Max 3.0 mm.

**54.5.** The average compressive strength obtained as a sample of five tiles when wetted in accordance with the procedure laid as per I.S. 1077-1976 shall be not less than 175 Kg./Sq. Cm.

**54.6.** The average water absorption for five bricks tiles shall not exceed 12 percent of average weight of brick before testing. The absorption for each individual bricks shall not exceed 25%

**54.7.** The brick tiles when tested in accordance with I.S. 1077-1976 the rate of efflorescence shall not be more than "Slightly effloresced".

#### **M-55. White glazed tiles**

**55.1.** The tiles shall be of best quality as approved by the engineer in charge. They shall be flat and true to shape. They shall be free from cracks, crazing sports, chipped edges and corners. The glazing shall be of uniform shade.

**55.2.** The tiles shall be nominal size of 150 mm. x 150 mm. unless otherwise specified. The maximum variation the stated sizes. Other than the thickness of tile shall be  $\pm 1.5$  mm. The thickness of tile shall be 6 mm. Except as above the tiles shall conform to I.S. 1977-1970.

#### **M-56 Galvanized iron pipes and fittings**

**56.1.** Galvanized iron pipes shall be of the medium type and or required diameter and shall comply with I.S. 1239-1979. The specified diameter of the pipes shall refer to the inside diameter of the bore. Clamps, screw and all galvanized iron fittings shall be of the standard 'R' or equivalent make.

#### **M-57. Bib cock and stop cock**

**57.1.** A bib cock is a draw off tap with a horizontal inlet and free outlet. A stop cock is a valve with a suitable means of connection for insertion in a pipe line for controlling or stopping the flow.

**57.2.** They shall be of screw down type and or brass chromium plated and of diameter as specified in the description of the item. They shall conform to I.S. 781-1977 and they shall be of best Indian make. They shall be polished bright.

**57.3.** The minimum finished weight of bib cock and stop cock shall be as given below :

Diameter	Bib cock	Stop cock	Diameter	Bib cock	Stop cock
15 mm.	0.25 Kg.	0.25 Kg.	6 mm.	0.40 Kg.	0.40 Kg.
20 mm.	0.30 Kg.	0.35 Kg.	6 mm.	0.75 Kg.	0.75Kg.

#### **M-58. Gun metal wheel valve**

**58.1.** The gun metal wheel valve shall be of approved quality. These shall be of gun metal fitted with wheel and shall be of gate valve opening full way and of the size as specified. These shall conform to I.S. 778-1971.

#### **M-59. White glazed porcelain wash basin**

**59.1.** Wash basin shall be of white porcelain first quality best Indian make and it shall conform to I.S. 2556(Part-IV)-1972 and I.S. 771-1979. The size of the wash basin shall be as specified in the item. Wash basin shall be of one piece construction with continued over flow arrangements. All internal angles shall be designed so as to facilitate cleaning. Wash basin shall have single tap hole or two holes as specified. Each basin shall have a circular waste hole which is either riveted or beveled internally with 65 mm. diameter at top and 10 mm. depth to suit the waste fitting. The necessary stud slot to receive the bracket on the under side of the basin shall be provided. Basin shall have an internal soap holder recess which shall fully drain into the bowl.

**59.2.** White glazed pedestal of the quality and color as that to the basin shall be provided where specified in the item. It shall be completely recessed at the back for reception of supply and wash pipe. It shall be capable of supporting the basin rigidly and adequately and shall be so designed as to make the height from floor to floor top of the rim of basin 750 mm. to 800 mm. as directed.

**M-60. European type water closet/with low flushing.**

**60.1.** The European type water closet shall be white glazed porcelain first quality and shall be of wash down type conforming to I.S. 2556-1973 and I.S. 771-1979.

**60.2.** 'S' trap shall be provided as required with water seal not less than 50 mm. The solid plastic seat and cover shall be of best Indian make conforming to I.S. 2548-1980. They shall be made of molded synthetic materials which shall be tough and hard with high resistance to solvents and shall be free from blisters and surface defects and shall have chromium plated brass hinges and rubber buffer of suitable size.

**M-61.Orissa type water closet**

**61.1.** The Specification of Orissa type white glazed water closet of first quality shall conform to I.S. 2256(Part-III)-1981 and relevant specification of Indian type water closet except that pan will be with the integral squattig pan of size 580 mm. x 440 mm. with raised foot rest.

**M-62. Indian type water closet**

**62.1.** The Indian type white glazed water closet of first quality shall be of size as specified in the item and conforming to I.S. 771-1979 and I.S. 2556-(Part-II)1981. Each pan shall have integral flushing. It shall have an inlet at back and an outlet at front for connecting flush pipes as directed. The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet and surface shall be uniform and smooth. Pan shall be provided with 100 mm. diameter 'p' or 's' trap with approximately 50 mm. Water seal and 50 mm. diameter vent horn.

**M-63. Glazed Earthen Ware Sink**

**63.1.** The glazed earthen ware sink shall be of specified size, color and quality. The sink shall conform to I.S. 771(part-II)1979. The brackets for sinks shall conform to I.S. 775-1970.

**63.2.** The pipes shall conform to I.S. 1239-(part-I)1973 and I.S. 404-1962 for steel and lead pipes respectively 32 mm. brass waste coupling of standard pattern with brass chain and rubber plug shall be provided with sink.

#### **M-64. Glazed earthen ware Lipped type flat back urinal/corner type urinal**

**64.1.** The lipped type urinal shall be flat back or corner type as specified in the item and shall conform to I.S. 771-1979. It shall be of best Indian make and size as specified and approved by the Engineer in charge. The flat back of corner type urinal must of 1<sup>st</sup> quality free from any defects, cracks etc.

#### **M-65. Low level Enamel flushing tank**

**65.1.** The low level enamel flushing tank shall be of 15 litres capacity. It shall conform I.S. 774-1971. The flushing cistern shall be of best quality and free from any defects. The flushing tank shall have outlet 32 mm. diameter. The outlet shall be connected with W.C. pan by lead pipe or P.V.C. as specified. The flushing tank shall be provided with inlet and outlet for fixing G.I. inlet pipes and over flow pipes. The flushing cistern shall be provided with chromium plated handle for flushing. The flushing tank shall be provided with bracket of cast iron so that it can be fixed on wall at specified height. The brackets shall conform to I.S. 775-1970.

#### **M-66. Cast iron flushing cistern.**

**66.1.** The cast iron flushing cistern shall be of 15 liters capacity. It shall conform to I.S. 774-1971. The flushing cistern shall be of best quality and free from any defects. The flushing cistern shall have outlet of 32 mm. dia. The lead pipe shall conform to I.S. 404(part-I)-1962. For fixing G.I. inlet pipes and overflow pipe 20 mm. dia. inlet and outlet shall be provided. The flushing cistern shall be provided with galvanized iron chain and pull of sufficient length and shall be got approved from the Engineer in charge. The cast iron flushing cistern shall be painted with one coat of anti corrosive paint and two coats of paints. The flushing cistern shall be fixed on two C.I. brackets. The C.I. brackets shall conform to I.S. 775-1970.

#### **M-67. Flush cock.**

**67.1.** Half turn flush cock (Heavy weight) shall be of gun metal chromium plated of dia. as specified in the description of the item. The flush cock shall conform to relevant Indian Standard.

#### **M-68. Cast iron pipes and fittings.**

**68.1.** All soil, water, vent and antisiphonage pipes and fitting shall conform to I.S. 1729-1964. The pipes shall have spigot and socket ends with head on spigot end. The pipes and fitting shall be true to shape smooth, cylindrical, their inner and outer surfaces being as nearly as practicable concentric. They shall be sound and nicely cast and shall be free from cracks, laps, pinholes or the imperfection and shall be neatly dressed and carefully fettled.

**68.2.** The end of pipes and fittings shall be reasonable sqr. to their axis.

**68.3.** The sand of cast iron pipes shall be of the diameter as specified in the description and shall be in length of 1.5 M., 1.8 m. including socket ends of the pipe unless shorter lengths are either specified or required at junctions etc. The pipes and fittings shall be supplied without ears unless specified or directed otherwise.

#### **68.4. Tolerances :**

**68.4.1.** The Standard weight and thickness of pipes shall be as shown in the following table.

A tolerance up to -10% may however be allowed against these standard weights.

Sr. No.	Nominal dia of bore	Thickness	Overall	Weight of pipe	
			1.5 m. long	1.8 m. long.	Excluding ears 2 m. long.
1.	75 mm.	5.0 mm.	12.38 Kg.	16.52 Kg.	18.37 Kg.
2.	100 mm.	5.0 mm.	18.44 Kg.	21.67 Kg.	24.15 Kg.

**68.4.2.** A tolerance up to 15 % in thickness and 20 mm. length will be allowed. For fittings tolerance in lengths shall be plus 25 mm. and minus 10 mm.

**68.4.3.** The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimensions specified for the corresponding sizes of straight pipes. The tolerance in weights and thickness shall be the same as straight pipes.

#### **M-69. Nahnhi Trap**

**69.1.** Nahnhi trap shall be of cast iron and shall be free from porosity or other defects which affect serviceability. The thickness of the base metal shall not be less than 6.5 mm. The surface shall be smooth and free from craze, chips and other flaws or any other kind of defects which affect serviceability. The size of nahnhi trap shall be specified and shall be of self cleaning design.

**69.2.** The nahnhi trap shall be of quality approved by the Engineer in charge and shall generally conform to the relevant Indian Standards.

**69.3.** The Nahnhi trap provide shall be with deep seal, min. 50 mm. except at places where trap with deep seal can not be accommodated. The cover shall be cast iron perforated cover shall be provided on the trap of appropriate size.

#### **M-70. Gully Trap**

**70.1.** Gully trap shall conform to I.S. 651-1980. It shall be one free from defects such as fire cracks or hair cracks. The glaze of the traps shall be free from crazing. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters.

**70.2.** The size of the gully trap shall be as specified in the item

**70.3.** Each gully trap shall have one C.I. grating of square size corresponding to the dimensions, of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300 mm. x 300 mm. the cover with frame inside dimensions 300 mm. x 300 mm. the cover and weighing not less than 4.53 Kg. and the frame not less than 2.72 Kg. The grating cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

#### **M-71. Glazed Stone Ware pipe and Fittings**

**71.1.** The pipes and fittings shall be of best quality as approved by the Engineer in charge. The pipe shall be of best quality manufactured from stone-ware of fire clay, salt glazed thoroughly burnt through the whole thickness, of a close even texture, free from air blows, fire blisters, cracks and other imperfections, which affect the serviceability. The inner and outer surfaces shall be smooth and perfectly glazed. The pipe shall be capable to withstand pressures or 1.5 M. lead without showing sign of leakage. The thickness of the wall shall not be less than 1/12<sup>th</sup> of the internal dia. The depth of socket shall not be less than 38 mm. The socket shall be sufficiently large to allow a join of 6 mm. around the pipe.

**71.2.** The pipes shall generally conform to relevant I.S. 651-1980.

#### **M-72. Wall Peg Rail**

**72.1.** The aluminum wall peg rail shall have three aluminum pegs approved quality and size. It shall be fixed on teakwood plank of size 450 mm. x 75 mm. x 20 mm. The teakwood shall be French polished or oil painted as specified.

#### **M-73. G.I. Water Spot**

**73.1.** The G.I. pipes of 40 mm. dia. shall be of medium quality and specials shall be of 'R' brand or a equivalent brand of best approved quality.

**73.2.** The pipe shall have length as required for the thickness of wall in which it is **fixed, and at outside end tee and bend cut at half the length shall be provided** and at other end coupling shall be provided to have better fixing. The water spout shall be provided as per detailed drawing or as directed.

#### **M-74 Asbestos Cement pipe(A.C. pipe)**

**74.1.** The asbestos cement pipe of diameter as specified in the description of the item shall conform to I.S. 1626-1980. Special like bends, shoes, cowls etc. shall conform to relevant Indian Standards. The interior of pipe shall have its smooth finish, regular, surface and regular internal dia. The tolerance in all dimensions shall be as I.S. 1626-(part-I)1980.

#### **M-75. Cyrdon Ball valve**

**75.1.** Ball valve of screwed type including polythene float and necessary level etc. shall be of the size as mentioned in the description of item and shall conform to I.S. 1703-1977.

#### **M-76. Bitumen Felt For Water proofing And Damp Proofing**

**76.1.** Bitumen felt shall be on the fibre bases and shall be of type 2 self finished felt grade 2 and shall conform to I.S. 1322-1970.

#### **M-77. Selected Earth.**

**77.1.** The selected earth shall be that obtained from excavated material or shall have to be brought from outside as indicated in the items. If item does not indicate anything the selected earth shall have to be brought from outside.

**77.2.** The selected earth shall be good yellow soil and shall be got approved from the Engineer in Charge. In no case black cotton soil or similar expansive and shrinkable soil shall be used. It shall be clean and free from all rubbish and perishable materials, stones or brick bats. The clods shall be broken to a size of 50 mm. or less. Contractor shall make his own arrangement at his own cost for land for borrowing selected earth. The stacking of material shall be done as directed by the Engineer in charge in such a way not to interfere with any constructional activities and in proper stacks.

**77.3.** When excavated material is to be used, only selected stuff got approved from the Engineer in charge shall be used. It shall be stacked separately and shall comply with all the requirements of selected earth mentioned above.

#### **M-78 Barbed Wire**

**78.1.** The barbed wire shall be of galvanized steel and it shall generally conform to I.S. 278-1978. The barbed wire shall be of type I whose nominal diameter for line wire shall be 2.5 mm. and point wire 2.24 mm. The nominal distance between two barbs shall be 75 mm. unless otherwise specified in the item. The barbed wire shall be formed by twisting together two line wires. One containing the barbs. The size of the line and point wires and barb spacing shall be as specified above. The permissible deviation from the nominal diameter of the line wire and point wire shall not exceed  $\pm 0.08$  mm.

**78.2.** The barbs shall carry four points and shall be formed by twisting two point wires, each two turns, lightly round one line wire, making altogether four complete turns. The barbs shall have a length of not less than 13 mm. and not more than 18 mm. The point shall be sharp and cut at an angle not greater than 35 degree of the axis of the wire forming the barbs.

**78.3.** The line and point wires shall be circular in section, free from scale and other defects and shall be uniformly galvanized. The line wire shall be in continuous length and shall not contain any welds other than those in the rod before it is drawn. The distance between two successive splices shall not be less than meters.

78.4. The lengths per 100 Kg. of barbed wire I.S. type-I shall be as under.

Nominal 1000 meter Minimum 934 Meter Max. 1066 M.

### **SPECIFICATIONS**

**Item No.01** Providing and fixing 125X65mm and 35mm thick FRP Shutter with Wood grain raised pannel design finish shutter having extra reinforcement on side and edges and in Gel Coat Finish. The core of the shutter is to be filled up with injected fire retardant grade polyurethane

foam done in situ along with embedded wooden pieces from stiffening and also for taking hinges and fixture. The whole FRP Frame and shutter isw to be water proof, weather proof, termite proof and resistance to mild acid/Alkali<sup>9</sup>. Rates are to be inclusive of S.S. hinges with necessary screws and aluminium fixtures and fastening.

## **FIBERGLASS REINFORCED PLASTIC DOORS AND FRAMES**

### **9.22 FIBRE GLASS REINFORCED PLASTIC (FRP) DOOR FRAMES**

Door Frames shall be three legged of cross section 90 mm x 45 mm having single rebate of size 32 mm x 15 mm to receive shutter of 30 mm thickness. The frame shall be made of laminate of thickness of 2 mm and shall be filled with wooden blocks of exterior grade MDF or seasoned and treated hard wood inside the laminate in all the three legs of the frame. The frame to be moulded by either hand lay up or resin transfer moulding process. The process shall consist of laying gelcoat at 1000 gms./m<sup>2</sup> and laid over with layer of FRP Mat (CSM mat) gelcoat and FRP (CSM Mat) are defined in IS 14856. The CSM mat shall be bonded with Isophatholic resin in the ratio not less than 1:2 (One part of Mat to two parts of Isopathlic resin and fillers & additives) by weight. The edge shall be sealed with gelcoat and FRP mat to obtain smooth finish. Sufficient roving shall be laid in the corner to have smooth curve while laying the CSM mat. (Fig. 9.23).

FRP door shall be manufactured as per specifications laid down in IS 14856, nomenclature of items & direction of Engineer-in-Charge.

#### **Tolerance**

Tolerance of size of frame to be  $\pm 2$  mm and on size of rebate to be + 1 mm.

#### **9.22.3 Finish**

The surface of the moulded frame shall be free from any visible defects such as small pores, crazing, blistering, wrinkling, impurities, defective impregnation, colour blots and aggregate defects, as mentioned in IS 14856. Scattered pin holes duly repaired and finished by applying resin and not noticeable shall be acceptable. Frame laminate shall be flat and shall have smooth and level surface. Laminate shall be finished in colour & shade as approved by Engineer-in-Charge.

#### **Fixing of Frame**

The frames are to be fixed in prepared openings in the walls. All civil work and tiling should be completed before the fixing of the frames. The frames are to be fixed directly on the plastered wall. In case tiling is to be done in the place the frames are to be fitted, a 50 mm strip should be left untiled at the location where the frames are to be fitted. The frames are erected in the prepared opening such that the vertical members of the door frame are embedded 50 mm in the floor. The frame shall be fitted truly in plumb. A minimum of three anchor bolts or screws of size 65/100 shall be used to fix each vertical member. One bolt shall be fixed at 200 mm from the top member and one bolt shall be fixed at 200 mm from the floor. The third anchor bolt

shall be fixed in the center. The top horizontal member shall be fixed using two 65/100 size anchor bolts or screws at a distance of 200 mm from both the corners.

#### **Measurement**

The outer length of the vertical and horizontal members of FRP door frame shall be measured in running metres including embedded length in floor corrected upto a cm.

#### **Rate**

The rate includes the cost of the materials and labour involved in all the operations described above. The cost of anchor bolts or screws for joining the frame is included in the rate. Any other hardware, which may be required, shall be paid with the area of complete Door item with shutter on Sqm. basis.

### **9.23 FIBRE GLASS REINFORCED PLASTIC (F.R.P.) SHUTTERS**

F.R.P. Shutters shall be manufactured conforming to the specifications as per IS 14856 and nomenclature of item & direction of Engineer-in-Charge. (Fig. 9.24A & 9.24B).

Blocks of any seasoned hardwood of bulk density not less than 450 kg./m<sup>3</sup> at 12 per cent moisture content or any other material of sufficient thickness and length shall be provided inside the shutter at suitable place to hold fittings and fixtures such as aldrops, tower bolt, handle, sliding door bolt, mortice lock etc. Blocks for hinges shall be provided at three locations, unless otherwise specified by the purchaser. One at the centre and other two at 200 mm from the top and the bottom of the shutter. Blocks shall be provided at predetermined places in the shutter so as to fix hinges mortice locks, tower bolts, aldrops, door closures, etc. The finished surface shall be buffed and polished with wax.

#### **Location of Fittings and Accessories**

The lock rail of door shutters shall be so placed that its centre line is at a height 850 + 5 mm from the bottom of the shutter. Door shutter shall be fixed to the frame with three hinges, unless otherwise specified by the purchaser, of the type specified. These locations shall be, one at centre and other two at 200 mm from the top and the bottom of the shutter, where blocks have already been provided and suitable indication by depressing the profile has been made. Screws for fixing the hinges shall be screwed in with screwdrivers & not hammered. The length of screw should be 8/30 mm. The hinges used shall be stainless steel or aluminum.

### **Sampling & Criteria for Conformity**

#### **9.19.3.1 General Precautions**

The test specimens shall not have been exposed to a temperature below 40°C for 24 hours immediately preceding the test and shall be free from all visible moisture. The specimen shall be inspected and any specimen with visible flaws shall be discarded.

If any test specimen fails because of mechanical reason, such as failure of testing equipment or improper specimen preparation, it shall be discarded and another specimen taken.

### 9.19.3.2 Sampling

Sampling criteria for conformity shall be in accordance with IS 4020 (Part –I)

Lot in any consignment of shutters shall be of the same grade and type and manufactured under similar conditions of production which shall be grouped together to form a lot.

The number of shutters to be selected at random from a lot shall depend upon its size and shall be in accordance with Col. 1 and Col. 2 of Table 9.23.

**TABLE 9.23**  
**No. of Sample and Criteria for Conformity**

<i>Sl. No.</i>	<i>Sample size</i>	<i>Permissible No. of Defects</i>
<i>(1)</i>	<i>(2)</i>	<i>(3)</i>
26 to 50	8	1
51 to 100	13	1
101 to 150	20	1
151 to 300	32	1
301 to 500	50	2
501 and above	80	2

**Note :** For lot size 25 or less, number of samples to be taken for testing shall be as agreed to between the manufacturer & Engineer-in-Charge.

*Number of Tests :* The samples selected as in column 2 of Table 9.23 shall be as agreed to between the manufacturer & Engineer-in-Charge.

**9.19.3.2.4 Criteria for Conformity :** The lot shall be considered conforming to the requirements if the number of samples failing to satisfy the requirements of characteristics does not exceed the permissible number mentioned in col. 3.

### **Finish**

The surface of the moulded frame shall be free from any visible defects such as small pores, crazing, blistering, wrinkling, impurities, defective impregnation, colour blots and aggregate defects, as mentioned in IS 14856. Scattered pin holes duly repaired and finished by applying resin and not noticeable shall be acceptable. Frame laminate shall be flat and shall have smooth and level surface. Laminate shall be finished in colour & shade as approved by Engineer-in-Charge.

## **SCHEDULE OF FITTING FOR DOORS AND WINDOWS** **(Clause 9.6.8)**

Sl. No.	Name of Fittings	Double leaf doors shutters panelled or glazed	Single leaf door shutters external panelled or glazed	Single leaf door shutters inter communicating panelled or glazed	Single leaf wire guaze door shutters	Single leaf wardrobe/ cupboard shutters	Single leaf window shutters panelled or glazed	Fan light/ clear storey window shutters	Designation no. of wood screw	Length in mm of wood screws IS 6760	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
1.	Butt Hinges 100 mm	6	3	3	3	-	-	-	9	40	
2	Butt Hinges 75 mm	-	-	-	-	-	2	2	8	20	
3	Butt Hinges 50 mm	-	-	-	-	1	1	-	6	20	For fixing wooden cleat
4	Piano Hinges	-	-	-	-	-	-	-	6	20	
5	Tower Bolt 250 mm	3	2	3	2	-	1	-	10	30	
6	Tower Bolt 150 mm	-	-	-	-	-	1	-	8	30	
7	Tower Bolt 100 mm	-	-	-	-	-	-	-	6	30	
8	Sliding door Bolt 300 mm	1	-	-	-	-	-	-	9	35	
9	Sliding door Bolt 250 mm	-	1	-	-	-	-	-	9	35	
10	Floor door stopper	2	1	1	-	1	-	-	9	30	
11	Door handle with plate 100 mm	2	2	2	1	-	-	-	6	25	
12	Window handle with plate 75 mm	-	-	-	-	-	1	-	6	20	
13	Casement stay 300 mm	-	-	-	-	-	1	-	6	30	
14	Helical door spring (Superior quality)	-	-	-	1	-	-	-	6	30	
15	Cupboard /Wardrobe Lock	-	-	-	1	1	-	-	6	20	
16	Fanlight Catch	-	-	-	-	-	-	1	8	30	

**Notes :**

**A : Door Shutters**

Door of room adjoining the verandah, corridor, lobby or hall, shall be considered as external door.

Where the height of the door leaf exceeds 2.15 metres above the floor level, one extra hinge shall be provided for every additional height of 0.50 metre, or part thereof and the length of top bolts shall be increased by the height of the leaf above 2.15 metres from floor level.

Single leaf door shutters of more than 0.80 m in width shall be provided with one extra hinge.

Fan light shutters of more than 0.80 metre width shall be provided with one extra hinge and extra quadrant stay.

In double leaf shutters of doors, two door bolts shall be fixed to the first shutter and one to the closing shutter at the top.

In case of single leaf inter communicating, panelled, glazed or panelled door shutter for bath and w.c. one tower bolts will be replaced by a bathroom latch.

For shutter exceeding 40 mm thickness, heavy type M.S. butt hinges of 125 x 90 x 4 mm shall be used.

In case of external door shutters, instead of sliding door ball mortice lock can be provided where specified.

Cupboard and wardrobe shutters will have ball catches where specified.

Finger plates shall be provided in case of bath and wc shutters in office buildings.

### **B : Window Shutters**

In case of windows with double shutters, two tower bolts shall be fixed to the closing shutters and one tower bolt to the first shutter at the top.

In case of window shutters, hooks and eyes may be provided in lieu of casement stays where specified.

Where the height of window shutter exceeds 1.20 metres one extra hinge shall be provided and length of top bolts shall be increased by height of the leaf above 2.15 metres from the floor level.

Window shutter with steel frames shall be provided with six hinges in case of double leaf shutters and three hinges in case of single leaf shutters, irrespective of height and width of shutters.

#### **9.23.6 Tests**

As per para 9.19.4 except clause (j), (k), (l) & (m).

**9.19.4.1** The door shutters shall be subjected to the following tests in accordance with IS 4020 (Part 1 to 16).

*Dimension and Squareness Test* : Door shutters when tested in accordance with IS 4020 (Part 2) the dimensions of nominal width and height will be within a limit of  $\pm 5$  mm. The door shutter shall not deviate by more than 1 mm on a length of 500 mm. The thickness of the door shutter shall be uniform throughout with the permissible variation of not more than 0.8 mm between any two points. The nominal thickness of the shutter shall be within a limit of  $\pm 1.5$  mm.

*General Flatness Test* : Door shutter, when tested in accordance with IS 4020 (Part 3) the twist, cupping and warping shall not exceed 6 mm.

*Local Planeness Test* : Door shutters, when tested in accordance with IS 4020 (Part 4), the depth of deviation measured at any point shall not be more than 0.5 mm.

*Impact Indentation Test* : Door shutters, when tested in accordance with IS 4020 (Part 5), shall have no defects such as cracking, tearing or delamination and the depth of indentation shall not be more than 0.2 mm.

*Edge Loading Test* : Door shutters, when tested in accordance with IS 4020 (Part 7) the deflection of the edge at the maximum load shall not be more than 5 mm. On removal of the loads, the residual deflection shall not be more than 0.5 mm, failing which the test may be repeated on the other edge in the reverse direction. Also there shall be no lateral buckling by more than 2 mm during loaded condition and no residual lateral buckling after removal of the load.

*Shock Resistance Test* : Door shutters, when tested in accordance with 2.1 of IS 4020 (Part 8) , there shall be no visible damage in any part of the door after twenty five blows on each end.

*Buckling Test* : Door shutters, when tested in accordance with IS 4020 (Part 9), shall not show any deterioration and any residual deformation more than 5 mm after 15 min. of unloading and the initial deflection also shall not be more than 50 mm.

*Slamming Test* : Door shutters, when tested in accordance with 2.1 of IS 4020 (Part 10), shall not have any damage in any part of the door at the end of successive impacts.

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

*Misuse Test* : Door shutters, when tested in accordance with IS 4020 (Part 11), there shall not be any permanent deformation of the fixing or any other part of the door set in hindering its normal working after the test.

~~*Screw Holding Test* : Door shutters, when tested in accordance with IS 4020—Part 16, the load shall not be less than 1000 N.~~

~~*End Immersion Test* : Door shutters, when tested in accordance with IS 4020—Part 13, the shutter shall not show any delamination.~~

~~*Knife Test* : Door shutter, when tested in accordance with IS 4020—Part 14, the grading shall be standard & excellent.~~

~~*Glue Adhesion Test* : Door shutters shall be tested in accordance with IS 4020—Part 15. There should be no delamination.~~

### **Fixing of Shutter**

FRP door shutter shall be side hung on three bolt hinges of size 100 mm, one at the centre and the other two at 200 mm from the top and bottom of the shutter. The flat of the hinges shall be neatly counter sunk in to the recesses cut out to the exact dimensions of the hinge flap. The door shall be drilled on the thickness to fit hinges. Screws for fixing the hinges shall be screwed in with screwdrivers and not hammered. The length of the screws should be 8 mm/30 mm. The hinges used should be of stainless steel.

### **Tolerance**

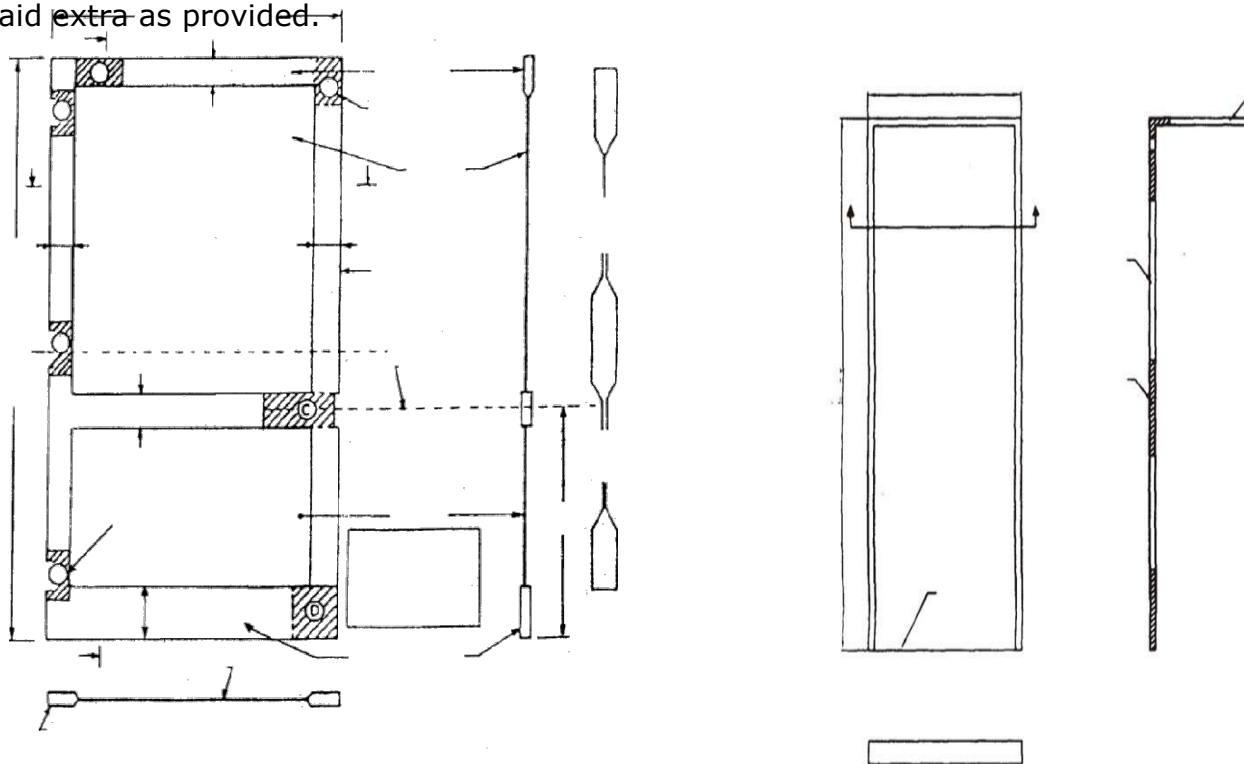
The tolerance on the width and the height of the door shall be  $\pm 5$  mm and the tolerance on the nominal thickness of the door shall be  $\pm 2$  mm.

### **Measurement**

Length and width of the shutters shall be measured to the nearest cm in closed position covering the rebates of the frames but excluding the gap between the shutter and the frame. Area is calculated to the nearest 0.01 sqm.

### Rate

The specified rate include the cost of the door shutter and labour involved in fixing of the shutter. Fittings & fixtures on the door shutter except hinges & screws shall be paid extra as provided.



### **SPECIFICATION For wood grain ( MDF) shutters-** **Specifications shall apply as per IS 14587:1998** **ATTACHED**

**Item No.02** Providing and fixing standard extruded of aluminium section of size 63mm x 38.10mm x 1.2mm (Jindal Section :2434, @ Wt. 0.643 Kg/mt) with colour Powder Coated aluminium frame for ventilation with 5 mm thick frosted glass as details etc complete for Ventilation

## 21.6 DOOR, WINDOW, VENTILATOR AND PARTITION FRAMES

### 21.6.1 Frame Work

First of all the shop drawings for each type of doors/windows/ventilators etc. shall be prepared by using suitable sections based on architectural drawings, adequate to meet the requirement/ specifications and by taking into consideration varying profiles of aluminium sections being extruded by approved manufacturers. The shop drawings shall show full size sections of glazed doors, windows, ventilators etc. The shop drawings shall also show the details of fittings and joints. Before start of the work, all the shop drawings shall be got approved from the Engineer-in-Charge.

Actual measurement of openings left at site for different type of door/window etc. shall be taken. The fabrication of the individual door/windows/ventilators etc. shall be done as per the actual sizes of the opening left at site. The frames shall be truly rectangular and flat with regular shape corners fabricated to true right angles. The frames shall be fabricated out of section which have been cut to length, mitered and jointed mechanically using appropriate machines. Mitered joints shall be corner crimped or fixed with self tapping stainless steel screws using extruded aluminium cleats of required length and profile. All aluminium work shall provide for replacing damaged/broken glass panes without having to remove or damage any member of exterior finishing material.

### 21.6.2 Fixing of Frames

The holes in concrete/masonry/wood/any other members for fixing anchor bolts/fasteners/screws shall be drilled with an appropriate electric drill. Windows/doors/ventilators etc. shall be placed in correct final position in the opening and fixed to Sal wood backing using stainless steel screws of star headed, counter sunk and matching size groove. of required size at spacing not more than 250 mm c/c or dash fastener. All joints shall be sealed with approved silicone sealants.

In the case of composite windows and doors, the different units are to be assembled first. The assembled composite units shall be checked for line, level and plumb before final fixing is done. Engineer -in-Charge in his sole discretion may allow the units to be assembled in their final location if the situation so warrants. Snap beadings and EPDM gasket shall be fixed as per the detail shown in the shop drawings.

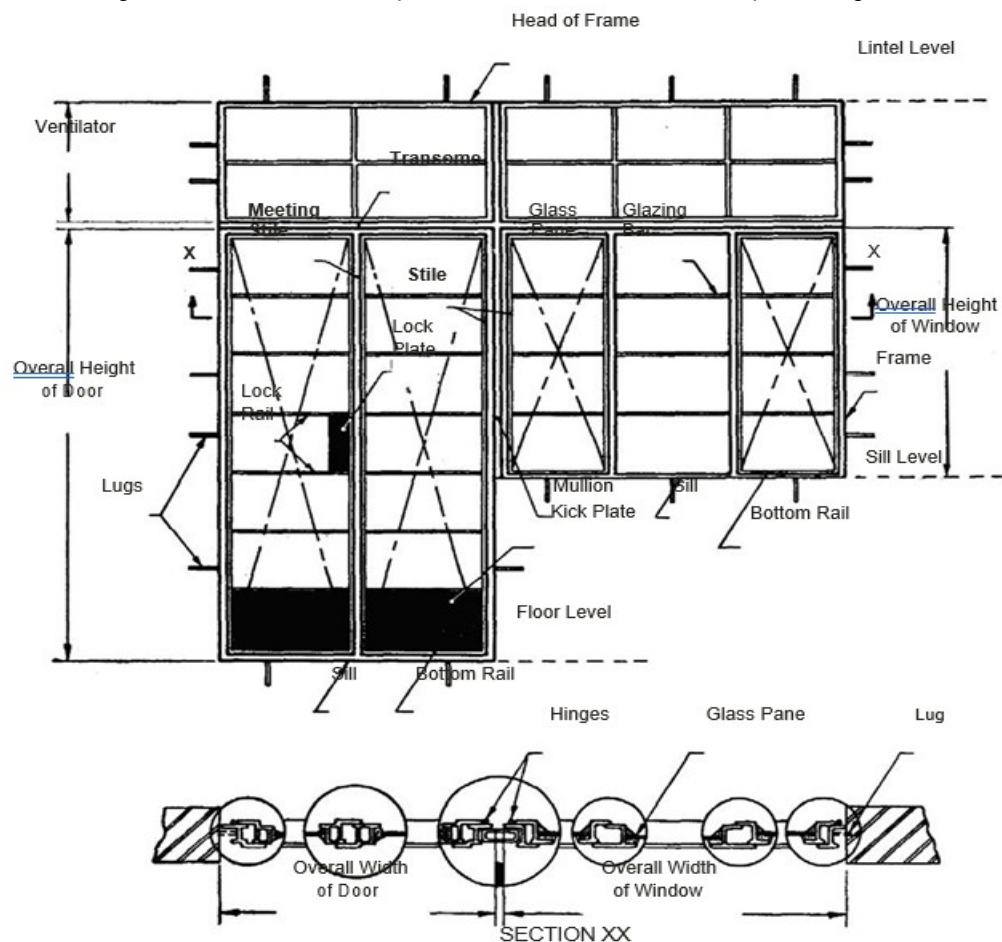


Fig. 21.1 : Terminology for Aluminium Doors, Windows and Ventilators

Where aluminium comes into contact with stone masonry, brick work, concrete, plaster or dissimilar metal, it shall be coated with an approved insulation lacquer, paint or plastic tape to ensure that electrochemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion.

The contractor shall be responsible for the doors, windows etc. being set straight, plumb, level and for their satisfactory operation after fixing is complete.

#### **21.6.3 Measurements**

If Item of Frame is paid to be paid separately, All the aluminium sections including snap beadings fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimeter. The weight calculated on the basis of actual average (average of five samples) weight of composite section in kilogram correct to the second place of decimal shall be taken for payment (weight shall be taken after anodizing). The weight of cleat shall be added for payment. Neither any deduction nor anything extra shall be paid for skew cuts. If item is complete with frame & Shutter then, it shall be paid as complete area of door/window/ventilator incl. frame & calculated on Sqm basis.

#### **21.6.4 Rate**

The rate shall include the cost of all the materials, labour involved in all the operations as described in nomenclature of item and particular specification.

### **21.7 DOOR, WINDOWS AND VENTILATOR SHUTTERS**

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

#### **21.7.1 Terminology**

The components of doors, windows and ventilators shall be defined as in Figure 21.1 Above.

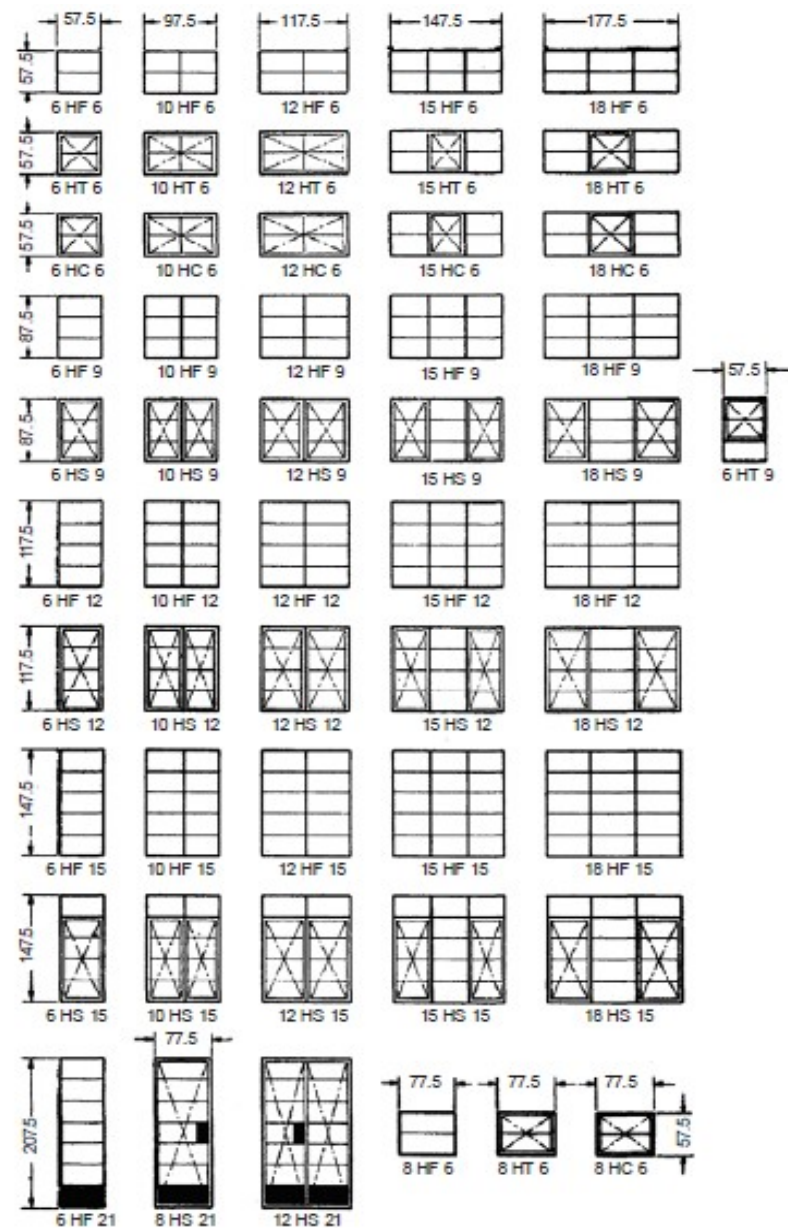
#### **21.7.2 Standard Sizes, Tolerances and Designations**

The types and the overall sizes of aluminium doors, windows and ventilators shall be as given in Figure 21.2. Their sizes are derived after allowing 1.25 mm clearances on all the four sides for the purpose of fitting the doors, windows and ventilators into modular openings.

#### **21.7.3 Tolerances**

The sizes for doors, windows and ventilators frames shall not vary by more than  $\pm 1.5$  mm.

**21.7.4 Material** Aluminium alloy extruded sections used in the manufacture of extruded window sections shall conform to IS 733. Hollow aluminium alloy sections used shall conform to IS 1285. Dimension and as weight per metre run of the extruded sections shall be given in Figure 21.3

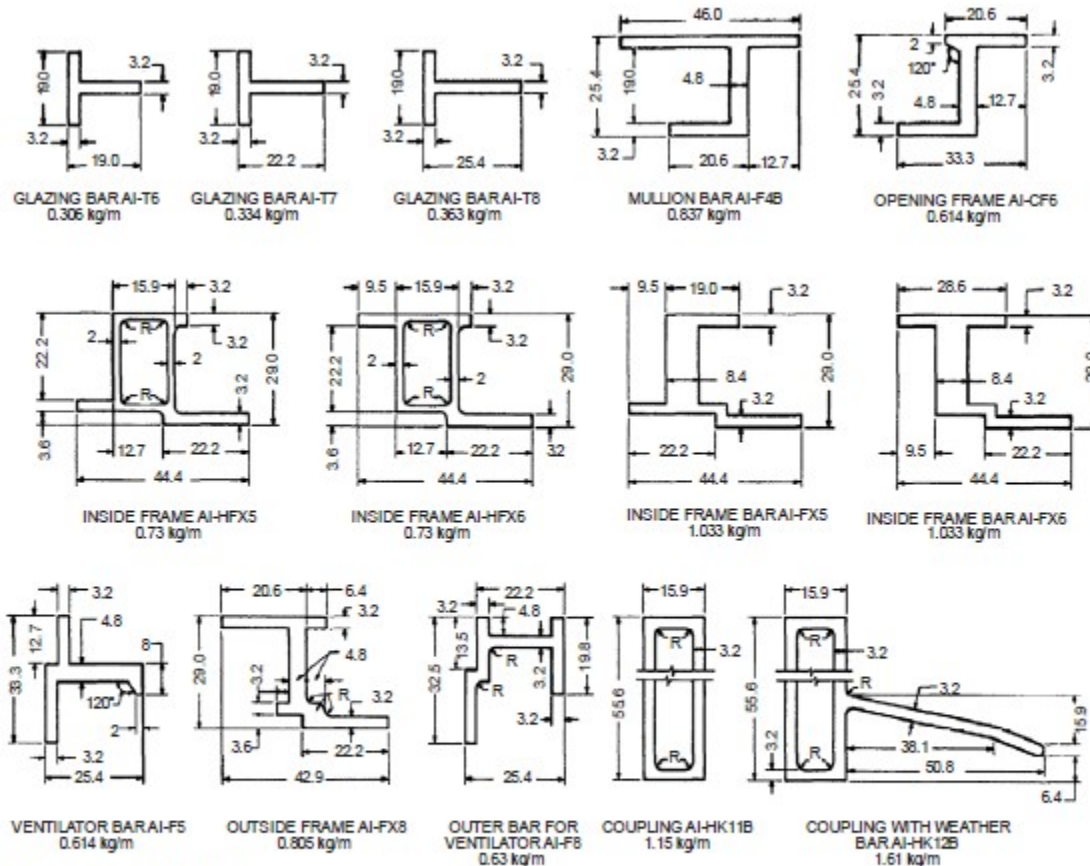


**Note : 1.** Windows without horizontal glazing bars shall be designated by 'N' in place of 'H' in the range shown.

**Note : 2.** Doors and side lights shall only be coupled with 12 module (117.5 cm) high windows.

All dimensions in centimetres

**Fig. 21.2 : Types and Size of Aluminium Doors, Windows and Ventilators**



Note 1 : All radii R = 1.6 mm

Note 2 : The weights of sections per metre length as indicated are nominal.

All dimensions in millimeters

**Fig. 21.3 : Extruded Aluminium Sections for Doors, Windows and Ventilators**

### 21.7.5 Glass Panes

Glass panes shall weigh at least  $7.5 \text{ kg/m}^2$  and shall be free from flaws, specks or bubbles. All panes shall have properly squared corners and straight edges. The sizes of glass panes for use in doors, windows and ventilators shall be as given in Table 21.6.

### 21.7.6 Screws

Screws threads of machine screws used in the fabrication of aluminium doors, windows and ventilators shall conform to IS 1362.

**TABLE 21.6**  
**Glass Sizes**(Clearance Allowed)  
(Clause 21.7.5)

Designation	Quantity	Glass size Width X Height cm
<b>No Glazing Bar Fixed Type</b>		
6NF6	1	53.0 x 53.0
10NF6	2	45.0 x 53.0
12NF6	2	55.0 x 53.0
15NF6	{2	45.0 x 53.0
	{1	47.5 x 53.0
18NF6	{2	55.0 x 53.0
	{1	57.5 x 53.0
6NF9	1	53.0 x 83.0
10NF9	2	45.0 x 83.0
12NF9	2	55.0 x 83.0
15NF9	{2	45.0 x 83.0
	{1	47.5 x 83.0
18NF9	{2	55.0 x 83.0
	{1	57.5 x 83.0
6NF12	1	53.0 x 113.0
10NF12	2	45.0 x 113.0
12NF12	2	55.0 x 113.0
15NF12	{2	45.0 x 113.0
	{1	47.5 x 113.0
18NF12	{2	55.0 x 113.0
	{1	57.5 x 113.0
6NF15	{1	53.0 x 27.0
	{1	53.0 x 113.0
10NF15	{2	45.0 x 27.0
	{2	45.0 x 113.0
12NF15	{2	55.0 x 27.0
	{2	55.0 x 113.0
15NF15	{2	45.0 x 27.0
	{1	47.5 x 27.0
	{2	45.0 x 113.0
	{1	47.5 x 113.0
18NF15	{2	55.0 x 27.0
	{1	57.5 x 27.0
	{2	55.0 x 113.0
	{1	57.5 x 113.0
8NF6	1	73.0 x 53.0
6NF21	{1	53.0 x 84.5
	{1	53.0 x 27.5
	{1	53.0 x 56.0
<b>No Glazing Bar Top-Hung Type</b>		
6NT6	1	50.0 x 50.0
10NT6	2	44.5 x 50.0
12NT6	2	54.5 x 50.0
15NT6	{2	45.0 x 53.0
	{1	45.5 x 50.0
18NT6	{2	55.0 x 53.0
	{1	54.5 x 50.0
8NT6	1	70.0 x 50.0
6NT9	{1	50.0 x 51.5
	{1	53.0 x 27.5

Designation	Quantity	Glass size Width X Height cm
<b>No Glazing Bar Centre-Hung Type</b>		
6NC6	1	46.0 x 46.0
10NC6	2	42.5 x 46.0
12NC6	2	52.5 x 46.0
15NC6	{2	45.0 x 53.0
	{1	43.5 x 46.0
18NC6	{2	55.0 x 53.0
	{1	53.5 x 46.0
8NC6	1	66.0 x 46.0
<b>No Glazing Bar Side-Hung Type</b>		
6NS9	1	50.0 x 80.0
10NS9	2	43.5 x 80.0
12NS9	2	52.5 x 80.0
15NS9	{2	43.5 x 80.0
	{1	47.5 x 83.0
18NS9	{2	52.5 x 80.0
	{1	57.5 x 83.0
6NS12	1	50.0 x 110.0
10NS12	2	43.5 x 110.0
12NS12	2	52.5 x 110.0
15NS12	{2	43.5 x 110.0
	{1	47.5 x 113.0
18NS12	{2	53.0 x 27.0
	{1	50.0 x 110.0
6NS15	{1	53.0 x 27.0
	{1	50.0 x 110.0
10NS15	{2	45.0 x 27.0
	{2	43.5 x 110.0
12NS15	{2	55.0 x 27.0
	{2	52.5 x 110.0
15NS15	{2	45.0 x 27.0
	{1	47.5 x 27.0
	{2	43.5 x 110.0
	{1	47.5 x 113.0
18NS15	{2	55.0 x 27.0
	{1	57.5 x 27.0
	{2	52.5 x 110.0
	{1	57.5 x 113.0
8NS21	{1	66.0 x 81.0
	{1	56.0 x 27.5
	{1	66.0 x 56.0
12NS21	{2	50.5 x 81.0
	{2	50.5 x 56.0
	{1	50.5 x 27.5
	{1	40.5 x 27.5

<i>Designation</i>	<i>Quantity</i>	<i>Glass size Width X Height cm</i>
<b>Horizontal Glazing Bar Fixed Type</b>		
6HF6	2	53.0 x 26.0
10HF6	4	45.0 x 26.0
12HF6	4	55.0 x 26.0
15HF6	{4	45.0 x 26.0
	{2	47.5 x 26.0
18HF6	{4	55.0 x 26.0
	{2	57.5 x 26.0
6HF9	{2	53.0 x 27.5
	{1	53.0 x 26.0
10HF9	{4	45.0 x 27.5
	{2	45.0 x 26.0
12HF9	{4	55.0 x 27.5
	{2	55.0 x 26.0
15HF9	{4	45.0 x 27.5
	{2	45.0 x 26.0
	{2	47.5 x 27.5
	{1	47.5 x 26.0
18HF9	{4	55.0 x 27.5
	{2	55.0 x 26.0
	{2	57.5 x 27.5
	{1	57.5 x 26.0
6HF12	4	53.0 x 27.5
10HF12	8	45.0 x 27.5
12HF12	8	55.0 x 27.5
15HF12	{8	45.0 x 27.5
	{4	47.5 x 27.5

<i>Designation</i>	<i>Quantity</i>	<i>Glass size Width X Height cm</i>
<b>Horizontal Glazing Bar Centre-Hung Type</b>		
6HC6	2	46.0 x 22.5
10HC6	4	42.5 x 22.5
12HC6	4	52.5 x 22.5
15HC6	{4	45.0 x 26.0
	{2	43.5 x 22.5
18HC6	{4	55.0 x 26.0
	{2	53.5 x 22.5
8HC6	2	66.0 x 22.5
<b>Horizontal Glazing Bar Side-Hung Type</b>		
6HS9	3	50.0 x 26.0
10HS9	6	43.5 x 26.0
12HS9	6	52.5 x 26.0
15HS9	{6	43.5 x 26.0
	{2	47.5 x 27.5
	{1	47.5 x 26.0
18HS9	{6	52.5 x 26.0
	{2	57.5 x 27.5
	{1	57.5 x 26.0
6HS12	{2	50.0 x 26.0
	{2	50.0 x 27.5
10HS12	{4	43.5 x 26.0
	{4	43.5 x 27.5
12HS12	{4	52.5 x 26.0
	{4	52.5 x 27.5
15HS12	{4	43.5 x 26.0

18HF12	{8 {4	55.0 x 27.5 57.5 x 27.5
6HF15	{1 {4	53.0 x 27.0 53.0 x 27.5
10HF15	{2 {8	45.0 x 27.0 45.0 x 27.5
12HF15	{2 {8	55.0 x 27.0 55.0 x 27.5
15HF15	{2 {1 {8 {4	45.0 x 27.0 47.5 x 27.0 45.0 x 27.5 47.5 x 27.5
18HF15	{2 {1 {8 {4	55.0 x 27.0 57.5 x 27.0 55.0 x 27.5 57.5 x 27.5
8HF6	2	73.0 x 26.0
6HF21	6	53.0 x 27.5
<b>Horizontal Glazing Bar Top-Hung Type</b>		
6HT6	2	50.0 x 24.5
10HT6	4	44.5 x 24.5
12HT6	4	54.5 x 24.5
15HT6	{4 {2	45.0 x 26.0 44.5 x 24.5
18HT6	{4 {2	55.0 x 26.0 54.5 x 24.5
6HT9	{1 {1 {1	50.0 x 26.0 50.0 x 24.5 53.0 x 27.5
8HT6	2	70.0 x 24.5

	{4 {4	43.5 x 27.5 47.5 x 27.5
18HS12	{4 {4 {4	52.5 x 26.0 52.5 x 27.5 57.5 x 27.5
6HS15	{1 {2 {2	53.0 x 27.0 50.0 x 26.0 50.0 x 27.5
10HS15	{2 {4 {4	45.0 x 27.0 43.5 x 26.0 43.5 x 27.5
12HS15	{2 {4 {4	55.0 x 27.0 52.5 x 26.0 52.5 x 27.5
15HS15	{2 {1 {4 {4 {4	45.0 x 27.0 47.5 x 27.0 43.5 x 26.0 43.5 x 27.5 47.5 x 27.5
18HS15	{2 {1 {4 {4 {4	55.0 x 27.0 57.5 x 27.0 52.5 x 26.0 52.5 x 27.5 57.5 x 27.5
8HS21	{1 {4 {1	66.0 x 24.0 66.0 x 27.5 56.0 x 27.5
12HS21	{2 {9 {1	50.5 x 24.0 50.5 x 27.5 40.5 x 27.5

### 21.7.7 Fabrication

**Frames:** Frames shall be square and flat, the corners of the frame being fabricated to a true right angle. Both the fixed and opening frames shall be constructed of sections which have been cut to length, mitered and welded at the corners. Where hollow sections are used with welded joints, argon-arc welding or flash butt welding shall be employed (gas welding or brazing not to be done). Subdividing bars of units shall be tenoned and riveted into the frame.

The location of the parts and details of construction of the doors, windows and ventilators are indicated in Fig. 21.4 to 21.11.

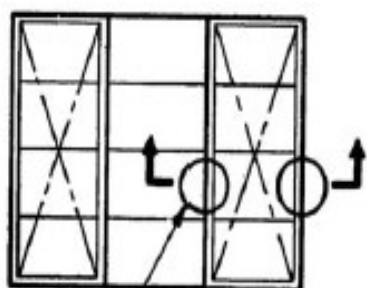


Fig. 21.4(a)

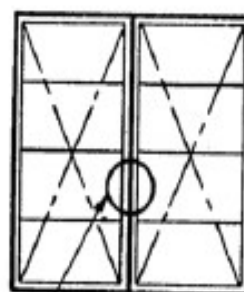


Fig. 21.4(b)

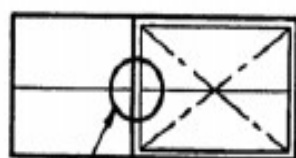


Fig. 21.4(c)



Fig. 21.4(d)



Type 6HF6/6HS12

Fig. 21.4 (e)



Fig. 21.4(f)

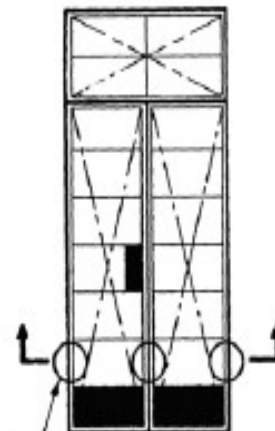


Fig. 21.4(g)

Fig. 21.4 : Location of Parts of Aluminium Doors, Windows and Ventilators for which Details are Shown

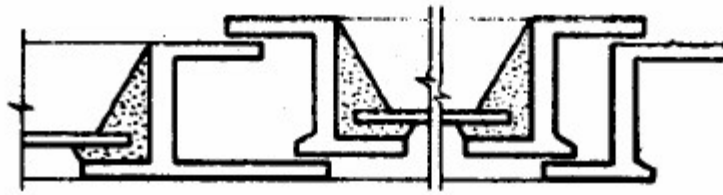


Fig 21.5 : Mullion with Fixed Glass on one Side and Side Hung on Other Side

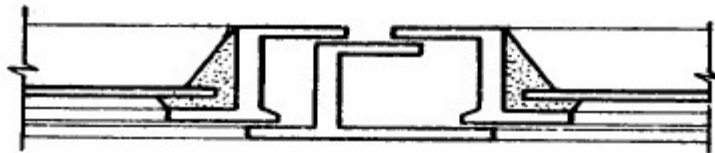


Fig 21.6 : Mullion with Side Hung Shutter Both Sides

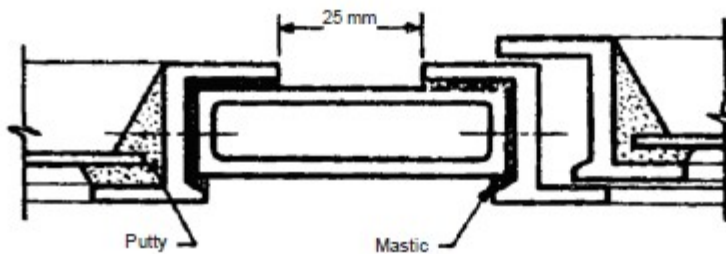


Fig 21.7 : Coupling Section Extruded for Coupling Windows Side by Side

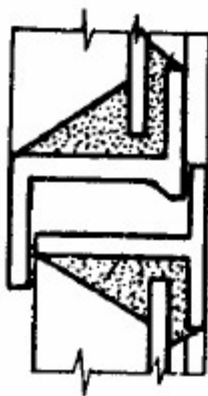


Fig 21.8 : Detail Through Bottom of Top-Hung Ventilator

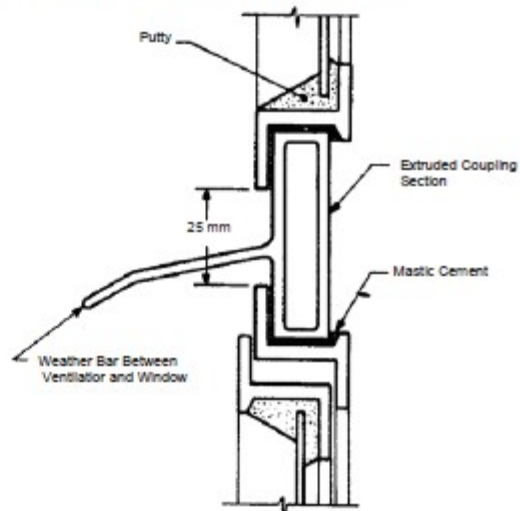


Fig 21.9 : Coupling Section Extruded having Weather Bar Fitted with Ventilators on top of Windows

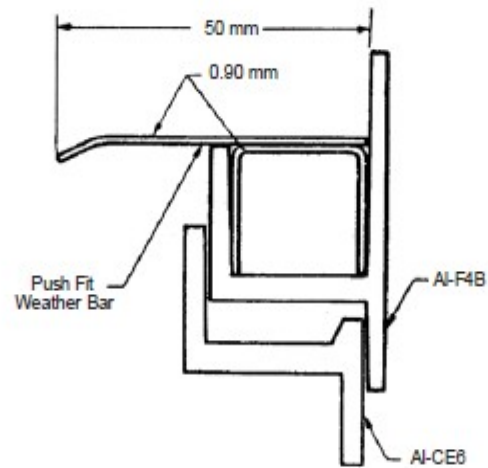


Fig 21.10 : Weather Bar over Extruded Opening Shutter with Fixed Light Above

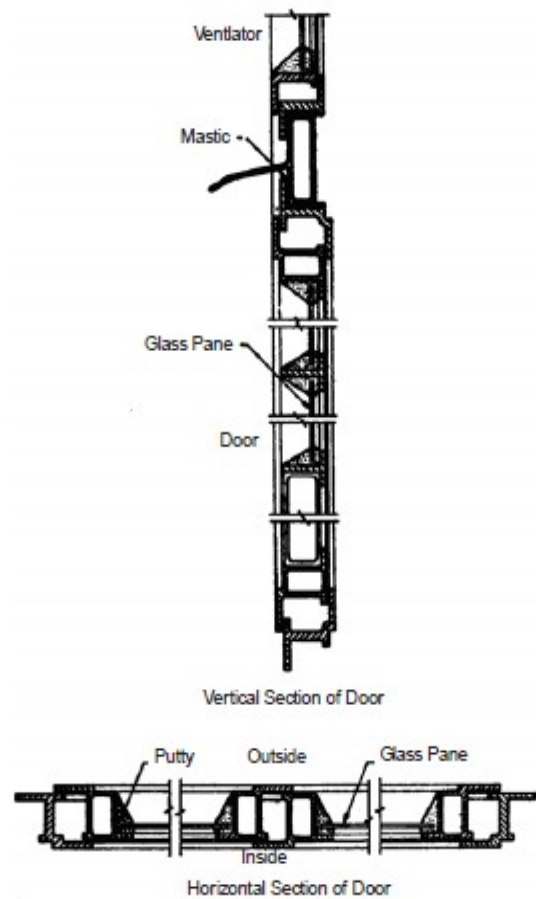


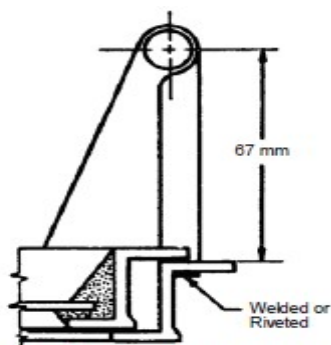
Fig 21.11 : Detail of Aluminium Double Shutter Door

### 21.7.8 Side-hung Shutters

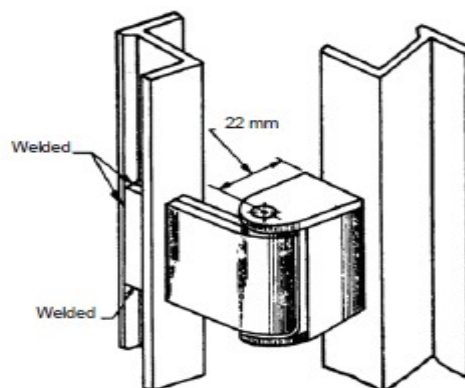
For fixing aluminium alloy hinges, slots shall be cut in the fixed frame and the hinges inserted inside and may be riveted to the frame. The hinges shall normally be of the projecting type 67 mm wide (Fig. 21.12). The aluminium alloy for cast hinges shall conform to IS Designation A-5-M of IS 617. Specification for Aluminium and Aluminium Alloy Ingots and Castings for General Engineering Purpose and for extruded section of hinges to IS Designation HE10-WP or HE30-WP of IS 733. The pins for hinges shall be of stainless steel of non-magnetic type or aluminium alloy HR30. Irrespective of hinges being anodized or not, the aluminium alloy pins shall be anodized to a minimum film thickness of 0.025 mm shall be sealed with oil, wax or lanolin. Non- projecting types of hinges may also be used where ever required. (Fig. 21.13).

Frictions hinges may be provided for side-hung shutter windows, in which case peg stay may not be required. The working principle of the friction hinges is illustrated in Fig. 21.14.

The handle for side- hung shutters shall be of cast aluminium conforming to IS Designation A-5-M of IS 617 and mounted on a handle plate welded or riveted to the opening frame in such a way that it could be fixed before the shutter is glazed. The handle should have anodized finish with minimum anodic film thickness of 0.015 mm. The handle shall have a two points nose which shall engage with an aluminium striking plate on the fixed frame in a slightly open position as well as in a fast position (Fig. 21.15). The height of the handles in each type of side-hung shutters shall be fixed in approximate position as indicated in Fig. 21.16.



**Fig. 21.12 : Typical Projecting Type Hinge for Side-Hung Shutters**



**Fig. 21.13 : Typical Non-Projecting Type Hinge for Side-Hung Shutters**



**Fig. 21.14 : Illustration Showing Working Principle of Friction Stay**

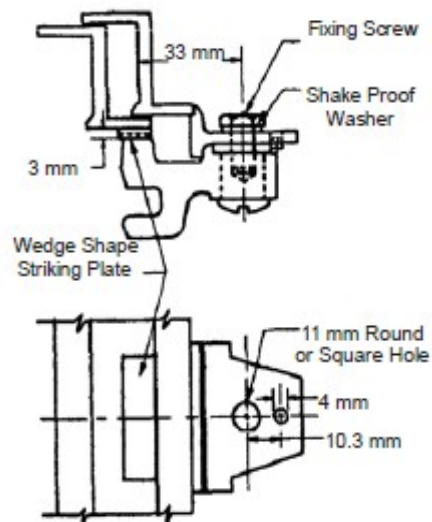


Fig. 21.15 : A Typical Handle for Side-Hung Shutter

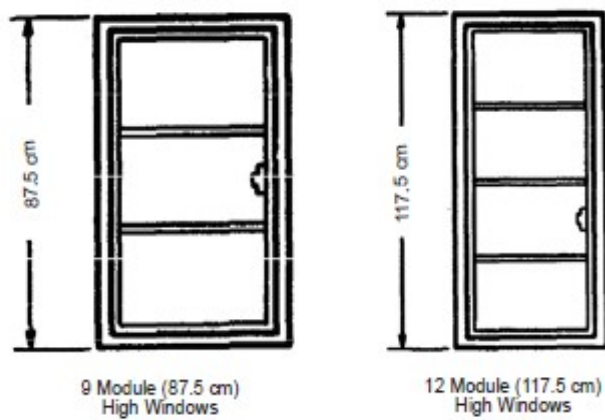


Fig. 21.16: Position of Handle Plates in Relation to Heights of 'HS' Type Windows

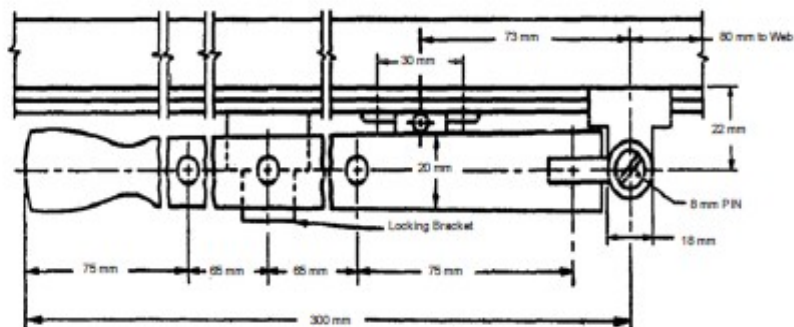
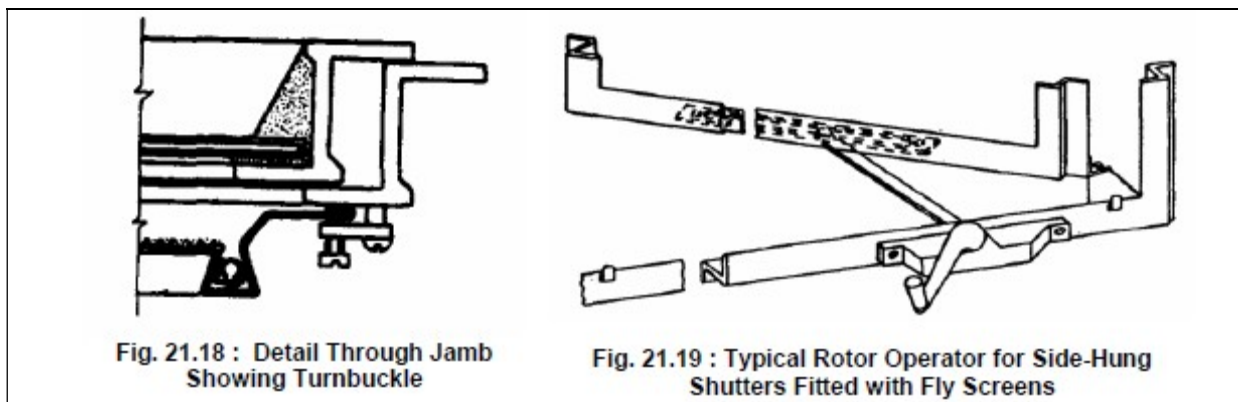


Fig. 21.17 : A Typical Peg-Stay for Side-Hung Shutters and Top-Hung Ventilators

The peg stay shall be either of cast aluminium conforming to IS 617 or folded from IS Designation NS4 aluminium alloy sheet conforming to IS:737 specification for wrought aluminium and aluminium alloys, Sheet and strip. It shall be 300 mm long, complete with peg and locking brackets (Fig. 21.17). The stay shall have holes for keeping the shutter open in three different positions. The peg and locking bracket shall be riveted or welded to the fixed frame.

Alternatively, and if specifically required by the purchaser, side- hung shutters may be fitted with an internal removable fly screen of 0.375 mm wire and equivalent to IS Sieve 100 in a 0.900 mm aluminium alloy sheet conforming to IS Designation NS3-1/2H of IS 737 applied to the outer frame of the shutter by case or extruded aluminium alloy turn-buckle at the jambs (Fig. 21.18) and by aluminium or plated bronze shoes at the sill to allow of the screen being readily removed, and with a rotor operator at the sill to permit the operation of the shutter through an angle of 90° (Fig. 21.19). On fly- screened shutters the peg stay is omitted and the normal handle shall be replaced by a locking handle to hold the shutter in the fast position.



### 21.7.9 Top-Hung Ventilators

The aluminium hinges for top- hung ventilators shall be either cast or fabricated out of extruded sections and shall be riveted to the fixed rail after cutting a slot in it. The aluminium alloy for cast hinges shall conform to IS Designation A-5-M of IS 617 and the extruded section of hinge to IS Designation HE10-WP or HE30\_WP of IS 733

The pegs stay shall be 300 mm long as in side-hung shutter (Fig. 21.17). The locking bracket shall be fixed to the fixed frame.

### 21.7.10 Centre-Hung Ventilators (Fig.21.20)

Centre hung ventilators shall be hung on two pairs of cup pivots of aluminium alloy to IS Designation NS-4 of IS 737 and IS Designation A-5- M of IS 617 or on brass or bronze cup pivots which should be either chromium or cadmium plated and riveted to the inner and outer frames of the ventilators to permit the ventilator to swing through an angle of approximately 85°. The opening portion of the ventilator shall be so balanced that it remains open at any desired angle under normal weather condition.

Cast aluminium conforming to IS Designation A-5-M of IS 617 or bronze which shall be either chromium-plated or cadmium-plated spring catch shall be fitted in the centre of the top bar of the ventilators for the operation of the ventilator. This spring catch shall be secured to the frame and shall close into aluminium catch plate riveted or welded to the outside of the outer ventilator frame bar (Fig. 21.21).



Fig. 21.20 : Detail of Horizontal Centre-Hung Ventilator

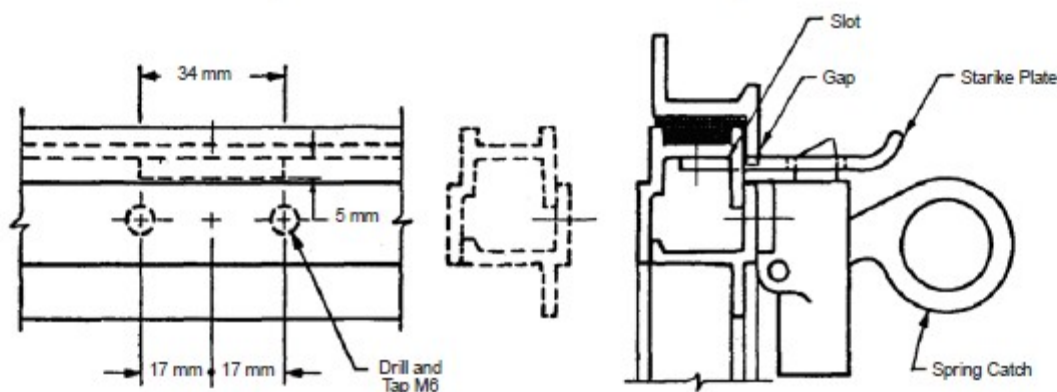


Fig. 21.21: Spring Catch for Centre-Hung Ventilator

Aluminium or cadmium plated brass cord pulley -wheel in an aluminium bracket shall be fitted at the sill of the ventilator with aluminium or galvanized or cadmium plated steel screw or, alternatively, welded together with an aluminium cord eye riveted or welded to the bottom inner frame bar of the ventilator in a position corresponding to that of pulley (Fig. 21.22).

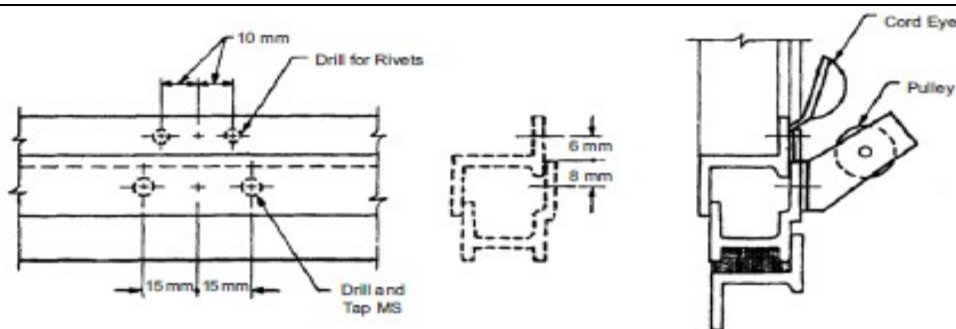


Fig. 21.22 : Cord Eye and Pulley Arrangement for Centre-Hung Ventilator

## 21.7.11 Doors

The outer fixed frame shall be of section A1-FX8. The shutter frame shall be of either hollow sections A1-HFX5 and A1-HFX6 (Fig. 21.3 and Fig. 21.11).

The kick panels shall be of 1.25 mm aluminium alloy sheet conforming to IS Designation NS3-1/2H of IS 737 specification for Wrought Aluminium and Aluminium Alloys, Sheet and strip and shall be screwed to the frame and the glazing bar.

**Hinges** –Cast of extruded aluminium alloy hinges for doors shall be of the same type as in the windows but of larger size. The hinges shall normally be of the 50 mm projecting type (Fig. 21.23). Non-projecting type of hinges may also be used (Fig. 21.24).

The handle for doors may be of the design indicated in Fig. 21.25.

A suitable lock for the door operable either from inside or outside shall be provided.

**Note:** From the point of view of security, the lock which is operable from only one side is better and in the case of such locks, a bolt shall be provided to make them inoperable from the other side.

In double shutter doors the first closing shutter shall have a concealed aluminium alloy bolt at top and bottom (Fig. 21.26). It shall be so constructed as not to work loose or drop by its own weight.

Single and double shutter doors may be provided with a three-way bolting device (Fig. 21.27). Where this is provided in the case of double shutter door, concealed aluminium bolts may not be provided.

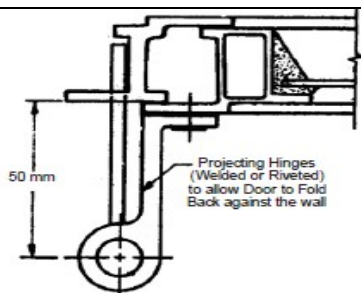


Fig. 21.23 : Typical Projecting Type Hinge for Door

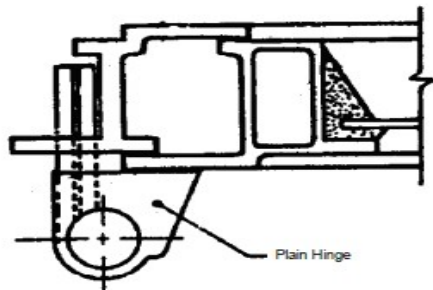


Fig. 21.24 : Typical Non-Projecting Type Hinge for Door

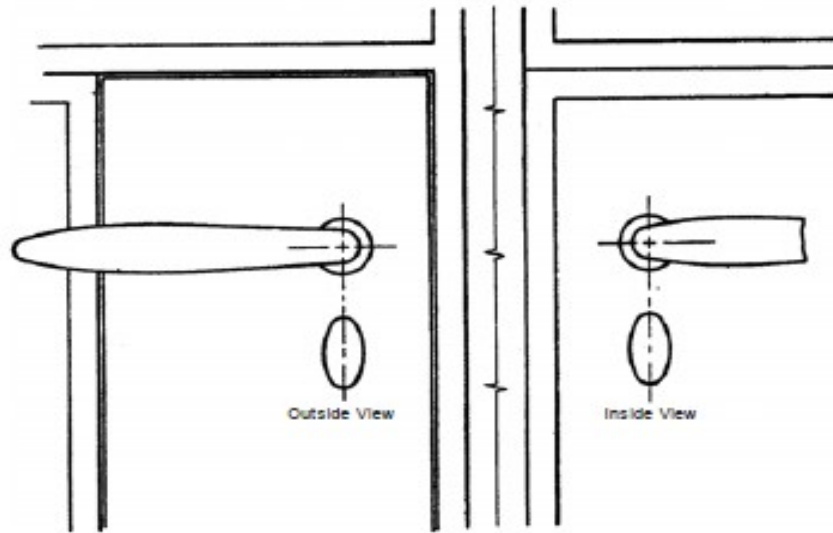


Fig. 21.25 Typical Door Handle

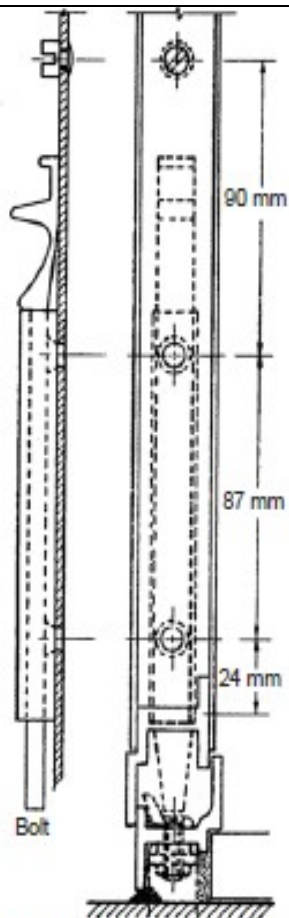
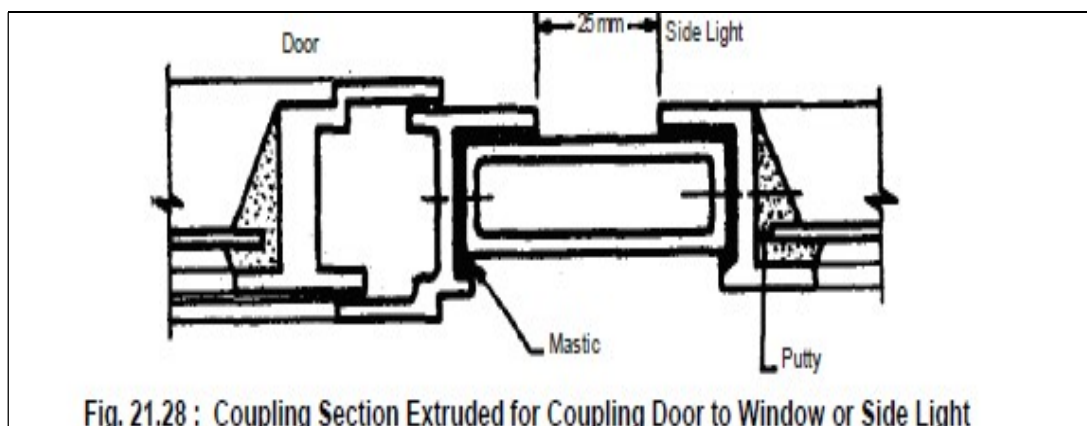
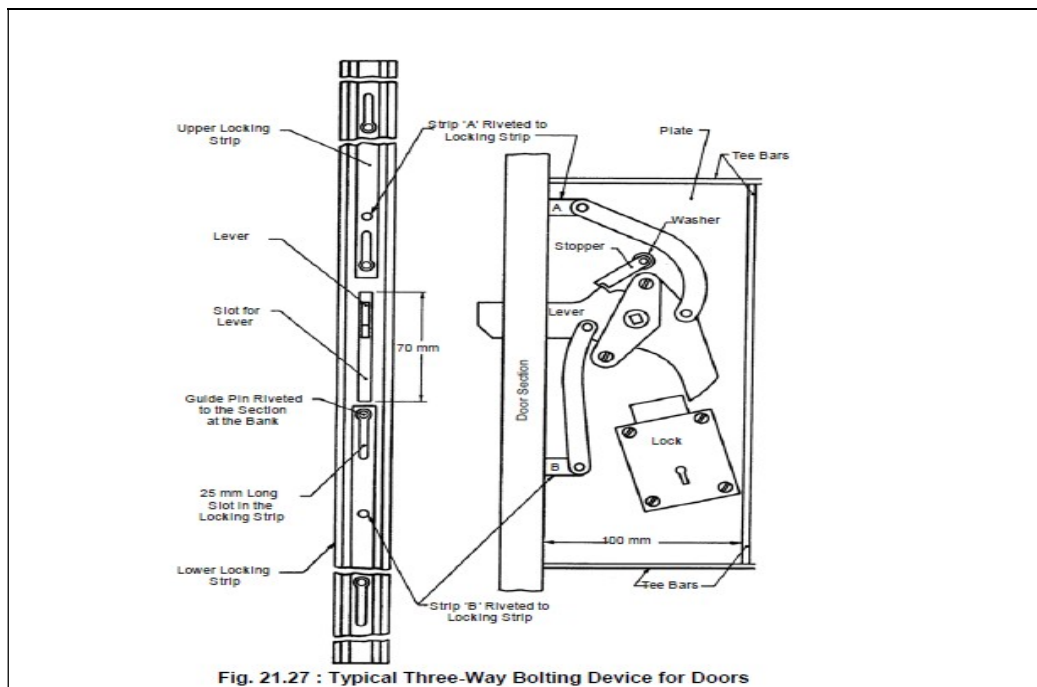


Fig. 21.26 : Typical Vertical Bolt for Double Shutter Door



### 21.7.12 Composite Units

The doors shall be coupled to windows or side-lights by extruded aluminium sections made from aluminium alloy conforming to IS Designation HE9-WP of IS 733. The coupling member should conform to the dimensions indicated in Fig. 21.28.

### 21.7.13 Weather Bar

Where a coupling member is fitted over an external opening shutter, the coupling member should incorporate an integrally extruded weather bar (Fig. 21.9).

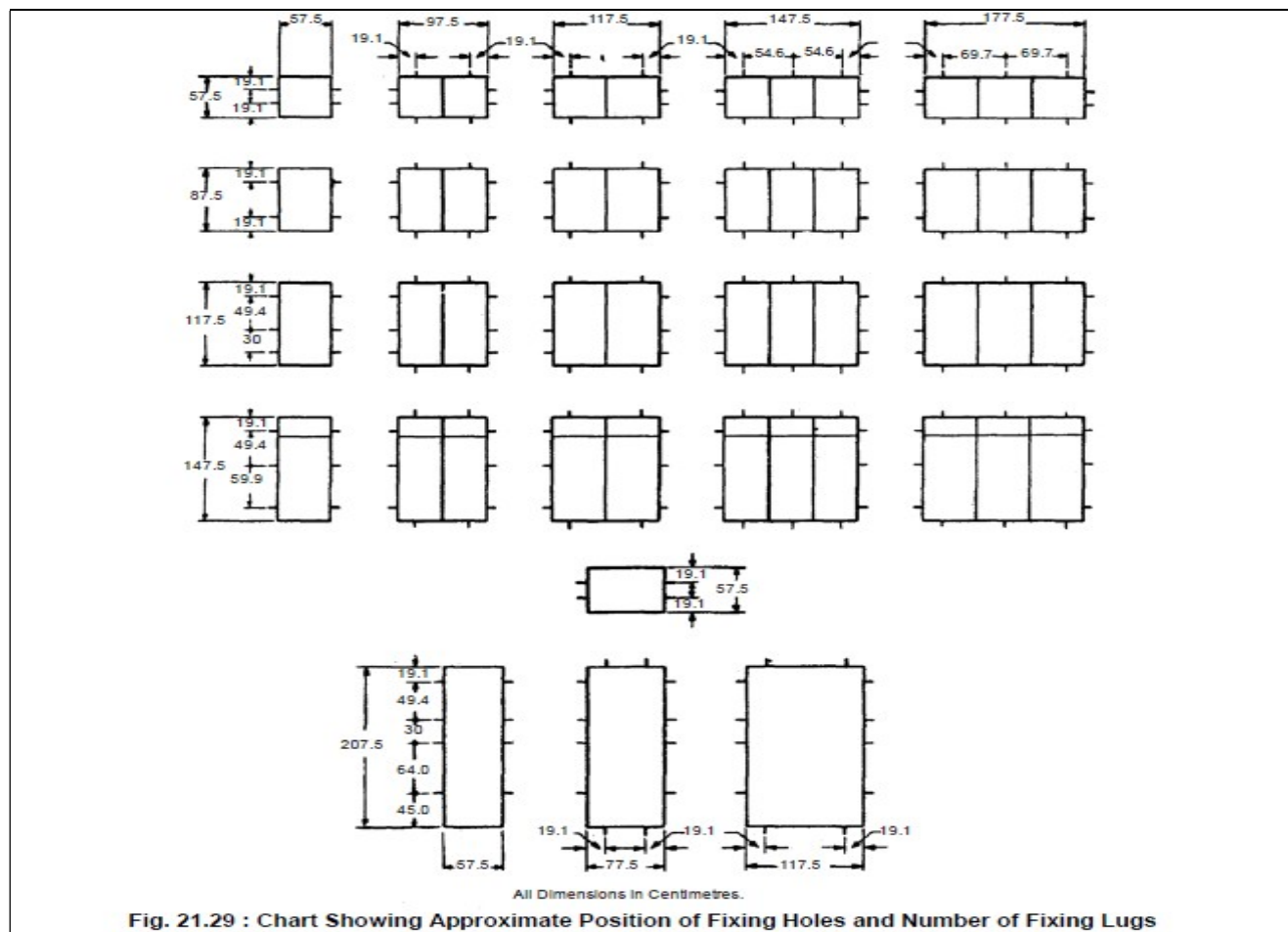
### 21.7.14 Position of Bolts, Fixing Screws and Lugs

Outer frames shall be provided with fixing holes centrally in the web of the sections in the position (Fig. 21.29). Moreover, any steel lugs coming in contact with aluminium should be either galvanized or given one coat of bituminous paint.

The fixing screws and lugs shall be as given in Table 21.7

TABLE 21.7

Sl. No.	Place of Fixing	Size of Screw or Lug
(i)	To wooden frames rebated on the outside	30 mm x No. 10 galvanized wood-screws.
(ii)	To plugs in concrete, stone or brick work rebated on the outside	-Do-
(iii)	To plugs in concrete, stone or brick work not rebated on the outside (that is plain or square jambs)	45 mm X No. galvanized wood-screws
(iv)	Direct to brick work or masonry (that is plain or square jambs)	Slotted steel adjustable lugs (natural finish) not less than 100 x 16 x 3 mm countersunk galvanized machine screws and nuts 19.0 X 6.3 mm
(v)	To steel work	Standard clips and 8 mm galvanized bolts with hexagonal nuts.



### 21.7.15 Finish

Aluminium doors, windows and ventilators may be supplied in either matt, scratch-brush or polished finish. They may, additionally, also be anodized, if so required by the Engineer-in-charge. If colour anodizing is to be done then only approved light-fast shades should be used.

A thick layer of clear transparent lacquer based on methacrylates or cellulose butyrate, shall be applied on aluminium doors, windows and ventilators by the supplier to protect the surface from wet cement during installation. This lacquer coating shall be removed after installation is completed.

#### **21.7.16 Glazing**

Glazing shall be provided on the outside of the frames

If required, glazing clips may be provided as extra fittings. Four glazing clips may be provided per glass pane, except for door type 8HS21 where the glazing clips shall be six per glass pane. In case of doors, windows and ventilators without horizontal glazing bars the glazing clips shall be spaced according to the slots in the vertical members, otherwise the spacing shall be 30 cm.

**Note:** Glazing clips are not usually provided for normal size glass panes. Where large size glass panes are required to be used or where the door or the window is located in heavily exposed situation, holes for glazing clips have to be drilled prior to fabrication and cannot be done at any later stage. Use of glazing clips, where necessary, shall be specified while placing the order.

#### **21.7.17 Packing**

All doors, windows and ventilators shall be dispatched with the opening parts suitably secured to preserve alignment when fixing and glazing.

Fixing lugs, coupling fittings and all hardware shall be dispatched separately.

Composite windows shall be dispatched uncoupled.

#### **21.7.18 Marking**

All doors, windows and ventilators shall be suitably marked on the frames with a mark identifying the manufacturer and the type.

The units may also be marked with the BIS Certification Mark.

### **21.8 FITTINGS**

#### **21.8.1 Stainless Steel Friction Stay**

The stainless steel friction stays of make approved by the Engineer-in-Charge shall be used. The SS friction stays shall be of grade AISI-304 and of sizes specified in nomenclature of item.

#### **21.8.2 Lockable Handles**

The lockable handle shall be of make approved by the Engineer-in-Charge and of required colour to match the colour of powder coated /anodized aluminium window sections.

### 21.8.3 Hydraulic Floor Spring

The hydraulic floor spring shall be heavy duty double action floor spring of make approved by the Engineer -in-Charge suitable for door leaf of weight minimum 100 kg. The top cover plate shall be of stainless steel, flushing with floor finish level. The contractor shall cut the floor properly with stone cutting machine to exact size & shape. The spindle of suitable length to accommodate the floor finish shall be used. The contractor shall give the guarantee duly supported by the company for proper functioning of floor spring at least for 10 years.

### 21.8.4 Tubular Handle

The tubular handle bar shall be aluminium polyester powder coated minimum 50 micron to required colour/anodized AC 15. Outer dia of tube shall be 32 mm, tube thickness 3.0 mm and centre to centre length 2115 mm  $\pm$  5 mm.

#### Measurements

If Item of Frame is paid to be paid separately, All the aluminium sections including snap beadings fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimeter. The weight calculated on the basis of actual average (average of five samples) weight of composite section in kilogram correct to the second place of decimal shall be taken for payment (weight shall be taken after anodizing). The weight of cleat shall be added for payment. Neither any deduction nor anything extra shall be paid for skew cuts. If item is complete with frame & Shutter then, it shall be paid as complete area of door/window/ventilator incl. frame & calculated on **One Sqm** basis nearest to 0.01 sqm.

#### Rate

The rate shall include the cost of all the materials, labour involved in all the operations as described in nomenclature of item and particular specification.

**Item No.03 Granite slab 18mm thick slab in risers of steps dedo and pillares laid 10mm thick cement 1:3(1-cement: 3 coarse sand) and jointed with grey cement slurry including rubbing,polishing etc complete.(Granite JAMS & SILL)**

#### 1.0. Materials

Water shall conform to M-1, Lime mortar shall conform to M-10, Cement mortar shall conform to M-11, Granite stone slab shall conform to M-52

#### 2.0. Workmanship

##### 2.1. Dressing of slabs :

Every stone shall be cut to required size and fine mirror polished to give a smooth and even surface on all sides to full depth. A straight edge laid along the sides of the stone shall be fully in contact with it grinding/ polishing shall also be done on top surface to remove any waviness. The sides and top surface of marble slabs shall be machine rubbed or table rubbed with coarse sand before using. All angles and edges of slabs shall be true, square and free from chipping.

**2.2.** The thickness of stone shall be 18 mm or as specified in the item. The allowable tolerance shall be 2 mm. allowable. The tolerance shall  $\pm 5$  mm. in length and breadth.

**2.3. Bedding :**

Bedding of Granite slabs shall either be lime mortar 1 : 1.5 (1 lime putty : 1.5 Coarse sand) or cement mortar 1 : 3 (1 Cement : 3 coarse sand) of average thickness 10 mm. thick as given in description of item. Minimum thickness at any place shall not be less than 10 mm.

**2.4. Laying :**

The surface of sub grade shall be cleared, wetted and mopped. Mortar of specified mix and thickness shall then be spread on an area sufficient to receive one marble slab. The slab be washed clean before laying. It shall be laid on top pressed and tapped gently to bring it in level with other slabs. It shall then be lifted and laid a side. The top surface of the mortar shall then be corrected by adding fresh mortar at hollows or depressions. The mortar shall then be gently placed in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slab. The joints shall be as fine as possible. Surplus cement on the surface of the slab shall be removed. The slab fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster skirting or dado. The junction between the walls and floors shall be finished neatly. The finished surface shall be true to level and slopes as directed.

**2.5. Curing :** The floor shall be cured for a minimum period of seven days.

**2.6. Polishing and finishing :**

Unevenness at the meeting edges of slab shall be removed by fine polishing.

**2.8. Grinding and finishing :**

**2.8.1.** Grinding and finishing shall be done either by hand or by machine. In case of manual grinding, the process of grinding shall begin after two days, while in case of machine grinding, the process shall be started after seven days, after completion of laying.

**2.8.2.** First grinding shall be done by carborundum stones of 60 grit size. The surface shall then be washed clean and grouted with a grout of cement or/and coloring matter in the same mix and proportion as the topping in order to fill any pin holes that appear. It shall be allowed to dry for 24 hours and wet cured for four days .

**2.8.3.** The second grinding shall be done with carborundum stone of 80 grit size. The surface shall then be prepared as after first grinding. The third grinding shall be done with carborundum stone of 120 to 150 grit. Size. The surface shall then be washed again and allowed to dry for 12 hours and wet cured for four days as before. The fourth grinding shall be done with carborundum stone of 320 to 400 grit size. The surface shall again be washed clean and rubbed hard with felt and slightly moistened oxalic acid powder @5 gms. Per sq. meter. Of floor surface. After the finishing work is over the surface shall be washed with dilute oxalic acid solution and dried floor polishing, machine fitted with felt or session bobs shall then be run over it until floor shines. In case wax polished surface is required, wax polished shall be applied on the surface with the help of soft linen over a clean and dry

surface. The polishing machine fitted with bobs shall be run over it, clean saw dust shall be spread over the floor surface and polishing machine again operated which will remove excess wax and leave glossy surface. Floor shall not be left slippery.

### **3.0. Mode of measurement and payment**

**3.1.** Granite stone flooring with various kinds of Granite shall be measured in sq. meter. The length and breadth shall be measured between the finished face of skirting or dedo or wall plaster. No deduction shall be made not extra shall be paid for any opening in the floor or area up to 0.05 sq. mt. Nothing extra shall be paid for laying stone at different levels in the same room. Treads and steps of stairs paved with Granite stone slabs shall be also be measured under flooring.

**3.2.** The rate shall be for a unit of one **sq. meter**.

## **Item No.4 Providing and fixing M.S. grills of required pattern to wooden frames of windows etc. with M.S. flats at required spacings and frame around, square or round bars with round headed bolts and nuts or by screws (A) Plain Grill.**

### **1.0. Materials**

The structural steel shall conform to M-22.

### **2.0. Workmanship**

**2.1.** The M.S. Grill shall be prepared as per the drawing or as directed for fixing to wooden frames of windows etc.

**2.2.** The grill shall be fabricated to the designs and patterns shown in the drawings and the weight shall be as directed, and the joints shall be reverted or welded as shown in the plan or as directed. The grill so formed shall be fixed into the frames of the windows etc. before they are erected in position. The outside strip frame of the grill shall be housed to its full thickness in to the frame with number of bolts and nuts or screws viz. bolt nut/screw per 30 cm. of the length of outer strip subject to minimum 2 nos. on each side of the frame or as indicated in the drawing or as directed.

**2.3.** The bolts and nuts or screws shall be counter sunk and shall be fixed with the top of their heads flush with the face of the frame strips.

### **3.0. Mode of measurements & Payment**

**3.1.** No. payment shall be made for weight of screws, bolts nuts etc. only weight of grill shall be paid.

**3.2.** The rate shall be for a completed item of Frame with grill on **One Kg**

## **Item No.5 Wall painting (two coats) with plastic emulsion paint of approved brand and manufacture on undecorated wall surface to give an even shade including thoroughly brushing the surface free from mortar droppings and other foreign matter and sand papered smooth.**

### **1.0. Materials**

Water shall be conform to M-1, The plastic emulsion shall conform to I.S. 5411-1969(Part-I)

## **2.0. Workmanship.**

**2.1. Scaffolding :** Wherever scaffolding is it shall be erected in such a way that as far as possible on part of scaffolding shall rest against the surface to be white or color washed. A properly secured strong and well tied suspended platform (Zoola) may be used for white washing. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the floors and walls. For white washing of ceilings, proper stage scaffolding shall be erected where necessary.

## **2.2. Preparation of surface :**

**2.2.1.** The undecorated surface to be Painted shall be thoroughly brushed from dust, dirt, grease, mortar dropping and other foreign matter and sand papered smooth. New plaster surface shall be allowed to dry for at least 2 months before applications of Paint..

**2.2.2.** All unnecessary nails shall be removed. Pitting in plaster shall be made good with plaster again with a line grade sand paper and made smooth. A coat of distemper shall be applied over the patches. The surface shall be allowed to dry thoroughly before the regular coat of Paint is allowed. The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with I.S. 2395-(Part-I)1966. Before applying distemping, any unevenness shall be made good by applying putty made of plaster of paris mixed with water on entire surface including filling up the undulation and then sand papering the same after it is dry.

## **2.3. Preparation of Mix :**

This shall be done as per manufacture's instructions. The thinning of emulsion is to be done with water and not with turpentine. The quantity of thinner to be added shall be as per manufacturer instructions.

## **2.4. Application :**

**2.4.1.** Before pouring into small containers for use, the paint shall be stirred thoroughly in item container. When applying also, the paint shall be continuously stirred in the smaller container, so that its consistency is kept uniform.

**2.4.2.** The paint shall be laid on evenly and smoothly by means of crossing and laying off the crossing and consist of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite direction two or three times and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of mouldings etc. shall be left on the work. The full process of crossing and laying off will constitute one coat.

**2.4.3.** The paint shall be applied with brush or rollers. For undecorated surfaces, the surface shall be treated with minimum two coats of cement water proofing paint. The second of subsequent coat shall not be started until the proceeding coat as become sufficiently hard to resist marking by brushing being used.

**2.4.4.** The surface on finishing shall present a flat velvety smooth finish. It shall be even and uniform in shade without patches, brush marks, paint drops etc.

## **2.5. Precautions :**

(a) Old brushes if they are to be used with emulsion paints, shall be completely dried of turpentine or oil pint by washing in warm soap water. Brushes shall be quickly washed in

water immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush.

(b) In the preparation of wall for plastic emulsion painting, no oil base paints shall be used in filling cracks holes etc.

(c) Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

(d) Washing of surfaces treated with emulsion paint shall not be done within 3 to 4 weeks of application.

## **2.6. Protective payment :**

The surfaces of doors, windows, floors, articles of furniture etc. and such other parts of the buildings as are not to be painted shall be protected from being splashed upon. Such surfaces shall be cleaned of distemper splashes if any.

## **3.0 Mode of measurements and payment.**

**3.1.** Priming coat of primer, scraping of surface spoiled by strunk soots, removal of oil and grease spots, treatment for infraction of effloresces., mould moss, fungi, algae and lichen and patch repairs to plaster shall be included in this item for which nothing extra shall be paid.

**3.2.** All the work shall be measured net in the decimal system as in place subject to the following limit unless otherwise stated hereinafter :

(a) Dimensions shall be measured to the nearest 0.01 m.

(b) Area in individual items shall be worked out to the nearest 0.01 sq. m. All work shall be made for ends of joints, beams posts etc., and openings, not exceeding 0.5 sq. mt. each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings not for around ends of joints, beams posts etc.

**3.3.** Deductions of openings exceeding 0.5 sq. mt. but not exceeding 3 sq. m. each shall be made as follows and net addition shall be made for reveals, jambs, soffits etc. of these openings :

(a) When both the faces of wall are provided with same finish, deductions shall be made for one face only.

(b) When each face of wall is provided with different finish, deduction shall be made for that side of frame for doors, windows etc. on which width of reveals is less than that of the other side but no deduction shall be made on the other side. Where the width of reveals on the both the faces of wall are equal, deduction of 50 % of area of opening on each face shall be made from area of finish.

(c) When only one face of wall is treated and the other face is not treated, full deductions shall be made if the width of the reveal on treated side is less than that on untreated side but if the width of the reveals is equal or more than that on untreated side neither deductions nor additions to be made for reveals, jambs, soffits, sills etc.

**3.4.** In case of openings of area exceeding 3 sq. mt. each deduction shall be made for openings but jambs sills and soffits shall be measured.

**3.5.** No deductions shall be made for attachments such as casings, conduits, pipes, electric wiring and the like.

**3.6.** Item includes removing nails, making good holes, patches with materials similar in composition of distemper.

**3.7.** The rate includes cost of all materials, labors, scaffolding, protective measures etc. involved in all the operations described above. This shall also includes conveyances, delivery, handling, unloading, storing work etc.

**3.8.** The rate shall be for a unit of one sq. meter.

**Extra over item No. 18.57 for every subsequent coat of wall painting with plastic emulsion paint of approved brand.**

**1.0. Materials & Workmanship.**

**1.1.** The relevant specifications of item No. 18.57 shall be followed except that the painting work shall be for subsequent coat of plastic emulsion paint.

**2.0 Mode of measurements and payment.**

**2.1.** The relevant specifications of item No. 18.57 shall be followed except that the extra payment shall be done on ceiling and sloping roofs

**2.2.** The rate shall be for a unit of one sq. meter.

**18.60. Extra over item No. 18.57 for painting with plastic emulsion paint of approved brand on ceiling and sloping roofs.**

**1.0. Materials & Workmanship.**

**1.1.** The relevant specifications of item No. 18.57 shall be followed except that the painting shall be on ceiling and sloping roofs.

**2.0 Mode of measurements and payment.**

**2.1.** The relevant specifications of item No. 18.57 shall be followed except that the extra payment shall be made for applying plastic emulsion paint on ceiling and sloping roofs over and the rate of item No. 18.57.

**2.2.** The rate shall be for a unit of one sq. meter.

**18.62. Extra over item 18.59 for paint ceiling and sloping roofs.**

**1.0. Materials & Workmanship.**

**1.1.** The relevant specifications of item No. 18.57 shall be followed except that the work for subsequent coat of plastic emulsion paint shall be carried out on ceiling and slopping roofs.

**2.0 Mode of measurements and payment.**

**2.1.** The relevant specifications of item No. 18.57 shall be followed except that the extra rate shall be paid for carrying out painting on sloping roofs and ceiling with plastic emulsion paint over and above the rate of item No. 18.59.

**2.2.** The rate shall be for a unit of one **sq. meter**.

**Item No.06** Finishing wall with weather proof exterior emulsion paint on wall surface (two coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remains of loose powdered materials.etc complete

**1.0. Materials**

**1.1.** The water shall conform to M-1, Exterior Emulsion weather proofing paint shall conform to I.S. 5410-1969.

**2.0. Workmanship.**

**2.1. Scaffolding :** The relevant specifications of item No. 45 shall be followed.

**2.2. Preparation of surface :**

The relevant specifications of item No. 45 shall be followed except that the word white wash color wash shall be substituted with water proofing Exterior Emulsion paint. The surface shall be thoroughly wetted with clean water before Exterior Emulsion water proofing paint is applied.

**2.3. Preparation of paint :** Portland Exterior Emulsion paint shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brush able consistency. Generally, equal volumes of paint powder and water make a satisfactory paint. In all cases, The manufacture's instructions shall be followed. The paint shall be mixed in such quantities as can be used up within an hour of mixing as otherwise the mixture will set and thicken, affecting flowing and finish. The lids of Exterior Emulsion paint drums shall be kept tightly when not in use.

**2.4. Application of Paint :**

**2.4.1.** No painting shall be done when the paint is likely to be exposed to a temperature of below 7° C within 48 hours after application.

**2.4.2.** When weather conditions are such as to cause it to be carried out in the shadow as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.

**2.4.3.** To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.

**2.4.4.** For undecorated surfaces, the surface shall be treated with minimum two coats of water proof Exterior Emulsion paint. Not less than 24 hours shall be allowed between two coats. Next coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the preceding coat shall be slightly moistened before applying the subsequent coat.

**2.4.5.** The finished surface shall be even and uniform in shade, without patches, brush marks, paint drops etc.

**2.4.6.** The Exterior Emulsion paint shall be applied with a brush with relatively short stiff hog or fiber bristles. The paint shall be brushed in uniform thickness and shall be free from excessively heavy brush marks. The lamps shall be brushed out.

**2.4.7.** Weather proof Exterior Emulsion paint shall not be applied on surface already treated with white wash, color wash, distemper dry or oil bound varnishes, paint etc. it shall not be applied on gypsum, wood and metal surfaces.

**2.5. Curing :** Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for at least two days following the final coat. The curing shall be started as soon as the paint has hardened so as not to be damaged by the sprinkling of water say about 12 hours after the application.

**2.6. Protective measurements :** The surfaces of doors, windows, floors, articles of furniture etc. and such other parts of the buildings as are not to be distempered shall be protected from being splashed upon. Such surfaces shall be cleaned of emulsion splashes if any.

### **3.0 Mode of measurements & payment**

**3.1.** Finishing wall with weather proof exterior emulsion paint shall be measured under this item.

**3.2.** All the work shall be measured net in the decimal system, as executed subject to the following limits unless otherwise stated here in after.

(a) Dimensions shall be measured to the nearest 0.01 meter.

(b) Areas shall be worked out to the nearest 0.01 sq. meter.

**3.3.** No deductions shall be made for openings not exceeding 0.5 sq. mt. each and no addition shall be made for painting to beddings, mouldings, edges, jambs, soffits, sills etc. of such openings.

**3.4.** In case of fabricated structural steel and iron work, priming coat of paint shall be included with fabrication. In case of trusses if measured in sq.m. compound girders, stanchions, lattices, grader and similar work, actual area shall be measured in sq. m. and extra shall be paid for painting on bolts heads nuts, washers etc. No addition shall be made to the weight calculated for the purpose of measurements of steel and iron works for paint applied on shop or at site.

**3.5.** The different surfaces shall be grouped into one general item, areas of uneven surface being converted into equivalent plain area in accordance with the table given as per Annexure – II for payment.

**3.6.** The rate shall be for a unit of one sq. meter.

#### **Item No.7 Providing and fixing P.V.C. Pipe 10kg F/sq.cm Rain water spout of 50mm dia.**

1.0. Materials : PVC type of 50 mm. dia. shall conform to M-56.

2.0. Workmanship

2.1. The PVC pipe of 50mm. Fixed as rain water pipe as directed. The pie shall be fixed about ¼ dia. below the floor level so as to make approach of water easy. The inlet of pipe shall be rounded off for easy entry of rain water pipe. The pipe shall be fixed in C.M. 1 : 3.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all labor and materials required for satisfactory completion of this item.

3.2. The rate shall be for a unit of one Rmt.

#### **Item No.8 Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low densidy, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(D) 40mm**

**1.0. Materials :**

**1.1.** The low density polythene pipe of specified diameter with 10 kg./sq.cm. working pressure shall conform to I.S.3076-1968. The specials and fittings required shall be of best quality.

## **2.0. Workmanship**

**2.1.** The U.P.V.C.pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid P.V.C. pipes, due allowance shall be made particularly in over ground pipe lines for any change in length of pipe line which may occur during installation or when pipe line is in service.

**2.2.** Above ground installation of rigid P.V.C. pipe should be undertaken after preparations are observed for their protection against direct sun rays and mechanical damage.

**2.3.** The rigid P.V.C. pipe lines should not be kept exposed above ground when it passes through public places, railway lines, road side and floor paths.

**2.4.** P.V.C. pipes shall be supported at the following intervals :

-20 mm. dia.          500 mm.      -25 mm. dia. 750 mm.      -32 mm. dia. 900 mm.

**2.5.** Closer support spacing shall be provided if recommended by the manufacture.

**2.6.** The guide lines indicated by the manufacturer regarding handling, transportation, storing, laying and jointing of pipes shall be kept in view during execution.

**2.7.** P.V.C. pipes shall be fixed on wall with wooden plugs and suitable plastic clamps.

## **2.8. Jointing the pipes :**

**2.8.1.** The pipes and sockets shall be accurately cut. The ends of the pipes and fittings should be absolutely free from dirt and dust. The outside surface of the pipes and the inside of the fittings shall then be roughened with emery paper, and then solvent cement joint. Since solvent cement is aggressive to P.V.C. care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped off after jointing. Empty solvent cement tins, brushes, rags, or paper unimpregnated with cement should not be buried in the trenches. They should be gathered not left scattered about, as they can prove to be a hazard to animals, which may chew them.

**2.8.2.** If any manufacturer recommends its own methods of jointing the same shall be adopted after necessary approval from the Engineer in charge.

## **2.9. Laying pipes in Trenches :**

**2.9.1.** The pipes shall be laid over uniform relatively soft fine grained soil found to be free of presence of hard object such as large flints, rocky projections, large tree roots etc. The width of the trenches shall be minimum width required for working.

**2.9.2.** The pipes laid underground shall not be less than one meter from the ground level. The pipe shall be positioned in the trenches so as to avoid any induced stress due to deflection. Any deviation required shall be obtained by using proper type of rubber ring joints.

## **3.0. Mode of measurements and payment**

**3.1.** The relevant specification of item 23.2(A) shall be followed except that the P.V.C. pipes of specified dia. shall be paid under this item.

**3.2.** The rate shall be for a unit of one running meter.

**Item No.9      Providing and fixing to wall ceiling and floor 6.0 Kg. F/Cm<sup>2</sup> working pressure polythene pipes of the following outside Dia. Low density, complete with**

**special flange compression type fittings, wall clip etc. including making good the wall ceiling and floor.(B) 25mm**

**1.0. Materials :**

**1.1.** The low density polythene pipe of specified diameter with 6 kg./sq.cm. working pressure shall conform to I.S.3076-1968. The specials and fittings required shall be of best quality.

**2.0. Workmanship**

**2.1.** The U.P.V.C.pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid P.V.C. pipes, due allowance shall be made particularly in over ground pipe lines for any change in length of pipe line which may occur during installation or when pipe line which any occur during installation or when pipe line is in service.

**2.2.** Above ground installation of rigid P.V.C. pipe should be undertaken after preparations are observed for their protection against direct sun rays and mechanical damage.

**2.3.** The rigid P.V.C. pipe lines should not be kept exposed above ground when it passes through public places, railway lines, road side and floor paths.

**2.4.** P.V.C. pipes shall be supported at the following intervals :

-20 mm. dia. 500 mm. -25 mm. dia. 750 mm. -32 mm. dia. 900 mm.

**2.5.** Closer support spacing shall be provided if recommended by the manufacture.

**2.6.** The guide lines indicated by the manufacturer regarding handling, transportation, storing, laying and jointing of pipes shall be kept in view during execution.

**2.7.** P.V.C. pipes shall be fixed on wall with wooden plugs and suitable plastic clamps.

**2.8. Jointing the pipes :**

**2.8.1.** The pipes and sockets shall be accurately cut. The ends of the pipes and fittings should be absolutely free from dirt and dust. The outside surface of the pipes and the inside of the fittings shall then be roughened with emery paper, and then solvent cement joint. Since solvent cement is aggressive to P.V.C. care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped off after jointing. Empty solvent cement tins, brushes, rags, or paper unimpregnated with cement should not be buried in the trenches. They should be gathered not left scattered about, as they can prove to be a hazard to animals, which may chew them.

**2.8.2.** If any manufacturer recommends its own methods of jointing the same shall be adopted after necessary approval from the Engineer in charge.

**2.9. Laying pipes in Trenches :**

**2.9.1.** The pipes shall be laid over uniform relatively soft fine grained soil found to be free of presence of hard object such as large flints, rocky projections, large tree roots etc. The width of the trenches shall be minimum width required for working.

**2.9.2.** The pipes laid underground shall not be less than one meter from the ground level. The pipe shall be positioned in the trenches so as to avoid any induced stress due to deflection. Any deviation required shall be obtained by using proper type of rubber ring joints.

**3.0. Mode of measurements and payment**

**3.1.** The relevant specification of item 23.2(A) shall be followed except that the P.V.C. pipes of specified dia. shall be paid under this item.

**3.2.** The rate shall be for a unit of one running meter.

**Item No.10** Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm<sup>2</sup> working pressure polythene pipes of the following outside Dia. Low density, complete with special flange compression type fittings, wall clip etc. including making good the wall ceiling and floor.(F) 75mm

**1.0. Materials :**

**1.1.** The low density polythene pipe of specified diameter with 10 kg./sq.cm. working pressure shall conform to I.S.3076-1968. The specials and fittings required shall be of best quality.

**2.0. Workmanship**

**2.1.** The U.P.V.C.pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid P.V.C. pipes, due allowance shall be made particularly in over ground pipe lines for any change in length of pipe line which may occur during installation or when pipe line which any occur during installation or when pipe line is in service.

**2.2.** Above ground installation of rigid P.V.C. pipe should be undertaken after preparations are observed for their protection against direct sun rays and mechanical damage.

**2.3.** The rigid P.V.C. pipe lines should not be kept exposed above ground when it passes through public places, railway lines, road side and floor paths.

**2.4.** P.V.C. pipes shall be supported at the following intervals :

-20 mm. dia. 500 mm. -25 mm. dia. 750 mm. -32 mm. dia. 900 mm.

**2.5.** Closer support spacing shall be provided if recommended by the manufacture.

**2.6.** The guide lines indicated by the manufacturer regarding handling, transportation, storing, laying and jointing of pipes shall be kept in view during execution.

**2.7.** P.V.C. pipes shall be fixed on wall with wooden plugs and suitable plastic clamps.

**2.8. Jointing the pipes :**

**2.8.1.** The pipes and sockets shall be accurately cut. The ends of the pipes and fittings should be absolutely free from dirt and dust. The outside surface of the pipes and the inside of the fittings shall then be roughened with emery paper, and then solvent cement joint. Since solvent cement is aggressive to P.V.C. care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped off after jointing. Empty solvent cement tins, brushes, rags, or paper impregnated with cement should not be buried in the trenches. They should be gathered not left scattered about, as they can prove to be a hazard to animals, which may chew them.

**2.8.2.** If any manufacturer recommends its own methods of jointing the same shall be adopted after necessary approval from the Engineer in charge.

**2.9. Laying pipes in Trenches :**

**2.9.1.** The pipes shall be laid over uniform relatively soft fine trained soil found to be free of presence of hard object such as large flints, rocky projections, large tree roots etc. The width of the trenches shall be minimum width required for working.

**2.9.2.** The pipes laid underground shall not be less than one meter from the ground level. The pipe shall be positioned in the trenches so as to avoid any undue stress due to

deflection. Any deviation required shall be obtained by using proper type of rubber ring joints.

**3.0. Mode of measurements and payment**

**3.1.** The relevant specification of item 23.2(A) shall be followed except that the P.V.C. pipes of specified dia. shall be paid under this item.

**3.2.** The rate shall be for a unit of one running meter.

**Item No.11]Providing and fixing Gun metal check or non-return fullway wheel valve.(C) 25mm dia.**

**1.0. Materials :** The gun metal check or not return fully way wheel valve or specified dial, shall conform to I.S : 778-1964. The non-return valve shall be tested quality.

**2.0. Workmanship**

**2.1.** The gun metal check or non return valve shall be fully cleared of all foreign matter before fixing. The fixing of shall be done by means of bolts nuts and 3 mm. rubber insertions with flags of spigot and socketed tail pieces, drilled to the same specifications as incase of socket and spigot flanges in case of flanged pipes. The joining shall be done leak proof.

**3.0. Mode of measurements and payment**

**3.1.** The rate includes all labors and materials, tools and plants etc.required for satisfactory completion of the item.

**3.2.** The rate shall be for a unit of one number.

**Item No.12]Providing and fixing Brass screws down bib tap chromium plated of 15 mm dia. (B) Brass Chromium plated screw down bib tap**

**1.0. Materials :** 15 mm. dia. brass screw down wth bright polished finished shall conform to I.S. 781-1977. The bib cock shall be best Indian make and quality.

**2.0. Workmanship**

**2.1.** The screw down bib cock 15 mm. as specified above shall be fixed as directed. The treaded portion shall be smeared with white or red lead and around with a few turns of fine spun yarn round the screwed and of the pipe. The bib cock shall be then screwed and fixed to water tight position.

**3.0. Mode of measurements and payment**

**3.1.** The rate includes cost of all labors and materials, tools and plants etc. required for satisfactory completion of the item.

**3.2.** The rate shall be for a unit of One number.

**Item No.13]Providing erecting and fixing double coated Syntex PVC. (ISI) water tank of required capacity No. with all necessary fittings and connection etc. complete on terrace.**

**1.0. Materials**

PVC tank and fixture shall of ISI make and brand as directed by Engineer In Charge

**2.0. Workmanship**

PVC tank should be placed and fixed as directed with necessary fixtures and accessories with required all materials and labour as directed by Engineer-in-Charge and tested for leakage and pressure strength by demonstration at site.

### **3.0. Mode of measurements & payment :**

**3.1.** The work done shall be measured in litre capacity of Tank incl. all related items including testing.

**3.2.** The rate shall be for a unit of one litre capacity of tank.

**Item No.14** Providing and laying broken china mosaic flooring for terrace using 12 mm to 20 mm broken pieces of glazed tiles to be laid over cement mortar 1:3 to plain or slope and to be tempered to bring mortar cream out up to surface using white cement including rounding off junctions and extending them up to 15 cm along the wall, clearing with water and oxalic acid etc. as directed.

### **1.0 GENERAL:**

The work shall be carried out as per general technical specification volume and as per National Building Code as amended from time to time.

### **2.0 MATERIALS:**

The water shall conform to M-2. The cement shall conform to M-3

The cement Mortar shall conform to M-22. The sand shall conform to M-6.

The glazed tiles to be of approved quality shall conform to M-55.

### **3.0 WORKMANSHIP:**

#### **3.2 PREPARATION OF SURFACE:**

First the **existing R.C.C. surface of slab shall be clean thoroughly then** the surface where this china mosaic water-proofing work is to be carried out shall be roughened manually. Thereafter first coat of cement slurry at a rate of **2.75 Kg/Sqmt** With water-proofing compound shall be admixed and shall be applied on the cleaned surface.

#### **3.2 PREPARATION OF BASE:**

The China Mosaic flooring shall be laid on 50 mm thick Cement concrete flooring 1:2:4 ( 2 cement, 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) by adding water proofing materials as directed and tiles shall be laid on neat cement slurry as directed.

The work so completed shall be cured for a period of minimum two days either by spreading wet gunny bags or preparing ponds. After completion of the curing the second layer of cement mortar 2:3 with admixing of water proofing materials shall be laid in proportion of 2.75 Kg/Sqmt. Required slope shall be maintained and tempered to bring mortar cream out up to surface using white cement incl. rounding off junctions and extending them up to 25.00 cm. Along with walls & slabs clearing with water and oxalic acid etc. as directed.

On completion of sub base work the china mosaic tiling work shall be carried out. The china mosaic tiles shall be in form of pieces of required size from glazed tiles be trowelled with white cement slurry.

#### **3.3 FINAL FINISHING:**

On completion of the entire work the whole terrace where work has been carried out shall be flooded with sufficient quantity of water for a period of at least two weeks of curing and for final test. All above operations to be done in order and as directed and specified by

the Engineer in charge.

#### **4.0 MODE OF MEASUREMENT AND PAYMENT**

The rate shall include the cost of all materials and labour involved in all operation described above. No deduction shall be made nor extra payment shall be made for any opening upto 0.2 Sq.Mt in area in the floor, nothing extra shall be paid for laying the floor at different levels in the same room on the court yard.

#### **5.0 Additional Performance Guarantee for china mosaic item:-**

The whole slab area in ceiling or wall above which china mosaic water proofing item is to be done shall not be leaked or shall not show any dampness for the period of three years from the date of completion of work.

Minimum three year guarantee bond should be submitted to the Executive Engineer, of the Division, by the contractor and 20% (Ten percent) of total amount for this item shall be withheld for three years from bills.

The said withheld amount shall be refunded only after satisfactory completion of the three year guarantee period. For any bad performance a notice will be given by concerned Deputy Executive Engineer and contractor has to rectify the defect within 25-days. In case of non-responsive to department's notice, necessary action will be taken by the deptt. at the risk and cost of contractor. A sample performance bond is shown on next page.

The Rate shall be paid per Sq.Mt. Basis.

#### **Item No.15 Providing water proofing water repellent compound on ceiling for waterproofing including cleaning the surface, removing dirt and other foreign materials etc**

2.1. The proportion of materials for the ceiling shall be mentioned with the specifications of that item. The quality of water proofing materials to be added and method of addition shall be as specified by manufacturers.

##### **2.2. Mixing**

2.2.1. The mixing of the water proofing materials in cement, water or concrete shall be done according to the specifications of the manufacture.

##### **3.0. Mode of measurements and payment**

3.1. The payment is extra over and above the rate of concrete for mixing water proofing proper.

3.2. The rate shall be for a unit of one liter or kg. per quintal of cement in which water proofing material

#### **Item No.16 Supplying and fixing total electrification work with concealed wiring including standard ISI mark modular switches, copper wire gauge minimum 3/20 & above, 8 nos of lighting point, 2 nos fans, 8**

**nos LED bulbs including electric accesseries like MCB with distribution box, Switch board & Exhaust fen as directed by Engineer - in -charge.**

## **SPECIFICATION FOR INTERNAL ELECTRICAL WORK**

### **CONTENTS**

Section 1. Technical Specifications – General

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Section 5. Technical Specifications- Electrical fittings, fixtures and fans.

Section 6. Technical Specifications- Circuit breakers, panel boards & distribution boards

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Section 8. Technical Specifications- Painting

Section 9. Testing

Section 10. Accepted makes of materials.

### **SECTION – 1**

#### **TECHNICAL SPECIFICATIONS – GENERAL**

1.1 These specifications indicate the General requirements for internal electrical work including wiring system, panel boards, cable laying, earthing protection and other related works.

1.2 These specifications are drawn to indicate essential requirements and precautions to be taken regarding internal electrical installation for ensuring efficient, safe, economical and practicable use of electrical materials and equipment, in conformity with statutory regulations and easy maintainability of the installations.

1.3 Complete work shall be carried out conforming to the provisions of Indian Electricity Act and relevant Indian standard Specifications (ISS). Wherever these regulations are supplemented by the State Electricity Dept., Electricity Undertakings/Boards, Factory inspector and the Safety Engineering Dept. of AI, the installation shall also comply with these requirements. Wherever the specifications given in this booklet differs from those of the statutory regulations, these specifications shall be followed.

1.4 On completion of works, wiring diagram for complete installation shall be prepared by the contractor and 4 copies of the same shall be supplied to AI.

1.5 All wiring diagrams shall indicate clearly in plan the main switch board, distribution fuse board, the runs of various mains and sub mains and the position of points with their classifications and controls. All circuits shall be indicated and numbered in wiring diagram and all points shall be given the same number as the circuit to which they are electrically connected. Distribution boards shall also be marked to indicate the circuit number controlled by them.

1.6 All materials issued by AI such as fans, equipments, cement etc. will be issued at the AI Stores and transportation to site will be contractor's responsibility. No separate payment will be made towards the transportation.

1.7 The Contractor shall prepare fabrication and detailed working drawings and obtain approval of Electrical Inspector, TAC and other local authorities before submitting them for approval of AI. All works shall be carried out only on approval of drawings. Approval of drawings, does not relieve the contractor of his responsibilities to meet the intents of specifications. Wherever service connections are to be obtained from the local supply company, the contractor shall process the application and obtain the power supply. All fees payable to the supply company and Electrical **Inspector** for such service connections will be paid by AI / reimbursed to the contractor as directed by EIC.

1.8 Location of panel boards, distribution boards, switch boards, light fittings, cable routes, conduit/ CTS wiring routes, earth pits etc. shall be marked at site and approval of Engineer-in-charge obtained before proceeding with the installation work.

1.9 Rated Power, Voltage and frequency of supply of current consuming devices and materials used in installation shall be suitable for the power and frequency of the supply to which these are to be connected.

#### 1.10 **Accepted make of materials:**

1.10.1 In section 10 Accepted makes of various materials are indicated. Materials of these brand names only shall be utilised for this work.

#### 1.11 **STANDARDS:**

For all materials and equipments Indian standard Specifications shall apply. In the absence of ISS, relevant British Standards shall be applicable. All Specifications, publications mean the latest edition. A list of IS Specifications applicable for internal electrical works is given at Section 15.

## **SECTION – 2**

### **TECHNICAL SPECIFICATIONS FOR CONDUIT WIRING**

2.1 For all industrial premises, conduit system of wiring shall be provided. In case of commercial and domestic premise, conduit system of wiring shall be provided wherever specified.

#### **2.2 Point Wiring:**

**2.2.1** Point wiring shall include all works necessary for complete wiring of a switch circuit of any length from the tapping point on the distribution circuit to the following through the switch.

- a) Ceiling rose or connector (in the case of ceiling/exhaust fan point).
- b) Ceiling rose (in the case of pendant except stiff pendant point).
- c) Back plate (in the case of stiff pendants and fittings with down rods)
- d) Socket and Outlets (in the case of socket outlets points)
- e) Lamp Holder (in the case of wall brackets, batten points, bulk head and similar fittings).
- f) Call Bell/ Buzzer (in this case the works Via the switch shall be red as " Via ceiling rose, socket outlet or bell push where no ceiling rose/socket outlets is provided").

2.2.2 The following shall be deemed to be included in the point wiring.

- a) Switch.
- b) Ceiling rose or connector as required
- c) Any special and suitable M. S. box for neatly housing the connector and covering the fan hook in case of fan point.
- d) Bushed conduit or porcelain where cable pas through walls, floors etc.
- e) Earth wire from the distribution boards to all current carrying apparatus through switch boards, M. S. Boxes etc.
- f) All metal blocks, boards, covers and M. S. Boxes, sunk or surface mounted including those required for mounting fan regulators but excluding those for fixing the distribution switch boards.
- g) All fixing accessories such as clips, nails, screws, phil plug, rawl plug etc. as required.
- h) Connection to ceiling rose, connector socket outlets, Lamp holders, switch, fan regulator etc.
- i) Looping in the same switch board and inter connections between points on the same circuit.

2.2.3 All points in the distribution system shall be measured under point wiring irrespective of length of circuit from the distribution board.

2.2.4 In case of point with more than one light point controlled by the same switch, the complete items shall be considered as separate point and the rate shall be quoted accordingly.

2.2.5 A light point controlled by 2 Nos. of control switches shall be measured as one point from the switch to either side of the appliance viz. total of two points.

2.2.6 In case of call bell/buzzer point where a single call bell/buzzer is controlled from more than one place with a ceiling rose and bell push, ceiling rose where socket outlets is not provided, the length of point shall be from the call bell/buzzer to the closest bell push. The additional bell-push and wiring on the same point shall be separately quoted for.

### **2.2.7 Sub-Main wiring**

2.2.8 The sub-main wiring shall mean the length of wiring from main building panel board/distribution switch board to another main/distribution switch board, measured along the run of wiring. Such wiring shall be measured on linear basis.

### **2.3 System of Wiring:**

2.3.1 The wiring shall be carried out as per the system specified in the tender Schedule. Power wiring shall be kept separate and distinct from lighting and fan wiring. All conductors shall run as far as possible along the walls and ceiling so as to be easily accessible and capable of being thoroughly inspected. In all types of wiring due consideration shall be given for neatness, good appearance and safety.

2.3.2 The balancing of circuits in 3 wires on poly phase installation shall be arranged to the satisfaction of Engineer-in-charge. In large/important rooms light fans and socket outlet points shall be distributed over more than one circuit as directed by the Engineer-in-charge.

## **2.4 Flexible Cable:**

2.4.1 Conductor of flexible cable shall be of copper. The minimum permissible size of conductor for flexible cable shall be  $16/0.2 \text{ mm}^2$ . Unless the flexible cables and conduits are protected by armour PVC sheaths, these shall not be used in workshops and other places where they are liable to mechanical damage.

2.4.1 Three core flexible cables shall be used for connecting single phase appliance.

## **2.5 Rating of lamps, fans etc. :**

2.5.1 For the purposes of connected load calculations, incandescent installations for residential and non residential building shall be rated at 100 W

2.5.2 Table fans shall be rated at 50/60W. Exhaust fans shall be rated according to their capacity.

2.5.3 5 Amp socket outlet point and 15 Amp socket outlet point shall be rated at 100W and 1000W respectively, unless the actual values of loads are known or specified.

## **2.6 Joints and loop back :**

2.6.1.1 Unless otherwise specified, the wiring shall be done in the 'Looping system'. Phase or light conductor shall be looped at the circuit box and neutral connected shall be looped from the light, fan or socket outlet. In non residential buildings neutral conductor and earth continuity wire shall be brought to each circuit board, circuit switch in rooms and halls. These shall be terminated inside the switch board and shall be of adequate sizes to accommodate minimum of 1 No. 5 Amps socket outlet and control switch in future.

2.6.2 Wherever wires are to be connected together, mechanical connector of adequate ratings shall be made use of. Under no circumstances twisted joints shall be allowed.

## **2.7 Control at point of entry of supply.**

2.7.1 There shall be a linked main switch gear with fuse on each light conductor of the supply mains at the points of entry. The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of linked switch gear.

2.7.2 The neutral shall be distinctly marked.

2.7.3 The main switch gear shall be situated as near as practical to the termination of service line and shall be easily accessible without the use of any external aid.

2.7.4 On the main switch gear, where the conductors include earth conductor of a 2 wire system or on earthed neutral conductor of a multi wire system or a conductor which is to be connected thereto, the permanent indication shall be provided to identify the earthed neutral conductor ( Rule 32 (i) of Indian Electricity Rules 1956 refers).

## **2.8 Switch Boards:**

2.8.1 Metal clad switch gear shall be mounted on wall, columns etc. by suitable mechanical means so as to ensure firm mechanical supports.

2.8.2 Hinged type boards shall consist of a box made of sheet metal clad, switch gear, distribution boards etc.

2.8.3 Hinged metal boards shall consist of a box made of sheet metal of 6 SWG gauge thick and shall be provided with hinged cover to enable board to be swung open for the examination of the wiring at the back. The joint shall be substantially welded.

2.8.4 All wires passing through metal boards shall be bushed.

2.8.5 No apparatus shall project beyond any edge of the panel. No fuse body shall be mounted within 2.5 cms of any edge of the panel.

2.8.6 Fixed type metal boards shall be provided for large switch boards where number of switch gears and/or higher capacity metal clad switch gears are to be mounted.

2.8.7 Fixed type metal boards shall consist of an angle or channel iron frame fixed on the wall or on the floor and supported on the wall at the top. There shall be a clear distance of one meter in front of the switch board. The working distance of one meter behind the switch board is preferable.

2.8.8 The detailed design and drawings for metal boards and angle iron frame work including the disposition of the various mounting, which shall be systematically and neatly arranged for arriving at the overall dimensions shall be prepared and submitted before hand for approval of the Engineer-in-charge.

2.8.9 In case of convenience power outlets in industrial premises of 15/30 Amps the boxes shall be made out of sheet metal 16 gauge and of size 300 x 250 mm. The socket outlet shall be of Reyrolle type two pin and earth. A 30 Amps switch, double pole metal clad shall be provided for the socket outlet. For the socket outlets, protective cover with connecting chain shall also be provided.

2.8.10 In case of commercial and residential buildings or wherever specifically indicated power outlets with flush type 15 Amps socket outlet and 15 Amps control switch shall be provided.

## **2.9 Marking of Apparatus:**

2.9.1 When a board is connected to voltage higher than 250 volts, all the terminals or leads of the apparatus mounted on it shall be marked in the following colours to indicate the different poles or phase to which apparatus or its different terminals may have been connected.

### **Alternating Current Direct Current**

Three phases-Red, Blue, yellow, Three Wire System 2 outer wires Neutral - Black  
Neutral - Black

2.9.2 Where a board has more than one switch gear, each such switch gear shall be marked to indicate which section of the installation it controls. The main switchgear shall also be suitably marked. Where there is more than one switch board in the building, each such switch board

shall be marked to indicate which section of the installation and building it controls.

2.9.3 All marking required under this rule shall be clear and permanent.

2.9.4 In the cable boxes for all the switchgears, the size and number of cables connected to it shall be suitably marked.

2.9.5 All distribution boards shall be marked 'lighting' or 'power' & essential lighting / power as the case may be and also marked with the pressure and number of phases

of the supply. Each distribution board shall be provided with a circuit list giving details of each circuit which it controls and the current rating of the circuit and size of the fuse element.

#### **2.9.6 Capacity of Circuits:**

2.9.7 Lights and fans may be wired on a common circuit. Such circuit shall not have more than a total of 8 points of light, fan and socket outlets or a load of 800 watts, whichever is less.

2.9.8 The power circuits shall be designed with one outlet per circuit unless otherwise specified, The circuits shall be designed based on the loading of the circuit. Where not specified, the load shall be taken as 2000 watts per circuit.

#### **2.10 Type and size of Conduit:**

2.10.1 Conduit pipe used in wiring system shall be of 16 gauge for sizes upto 32 mm and 14 gauge for sizes above 32 mm. Conduit pipes shall be solid drawn or formed by electric resistance welding (ERW) finished with galvanized or stove enameled surface. All conduit accessories shall be of thread type. Pin grip type or clamp grip type accessories shall not be used. The maximum number of PVC insulated 250 volts grade aluminium conductor cable that can be drawn in one conduit of

various sizes is given in Table I and the number of cables per conduit shall not exceed this. Steel conduit of size less than 19 mm in diameter shall not be used.

#### **2.11 Bunching of cables:**

2.11.1 Cables carrying direct current may be bunched whatever their polarity, but cable carrying alternating current, if installed in metal conduit shall always be bunched so that the outgoing and return cables are drawn into the same conduit.

#### **2.12 Conduit Joints:**

2.12.1 Conduit pipes shall be jointed by means of screwed – screwed accessories only. In long distance straight run of conduit, inspection type completes at reasonable intervals shall be provided. In the latter case the bare threaded portion shall be treated with anti-corrosive preservative. Threads on conduit pipe in all cases shall be between 13 mm to 19 mm long sufficient to accommodate pipes to full threaded portion of couplers or accessories. Cut ends of conduit pipes shall have no sharp edges nor any burrs left to avoid damage to the insulation or conductors while pulling them through such pipes. After laying of the conduit the bare threaded portion shall be treated with two coats anti-corrosive preservative.

#### **2.13 Protection of conduit against rust:**

2.13.1 All the conduit pipes including accessories shall be given 2 coats of duco paint of white colour or any other colour if specified so as to avoid damage to conduit due to rust. It will be ensured that no bare threaded portion of conduit is allowed to be energized unless they are treated with anti corrosive preservative and painted.

2.13.2 Conduit shall be laid at a minimum distance of 100 mm from the pipes of other non electrical device.

#### **2.14 Fixing of Conduit:**

2.14.1 Conduit run on surface shall be supported on M.S. Spacers 3 mm thick, painted with 2 coats of anticorrosive primer, which in turn are properly screwed to

the wall or ceiling. Rawl plugs or phil plug shall be used for fixing the spacers. Conduit pipes shall be fixed on the spacers using C. I. saddles of suitable size and heavy gauge (SWG). Saddles shall be at intervals of not more than 50 cm. Conduit shall be neatly run parallel or at right angle to the walls of the buildings.

2.14.2 Saddles shall not be less than 24 gauge for conduit upto 25 mm diameter and not less than 20 gauge for larger diameter.

2.14.3 Where conduit pipes are not to be laid along the trusses, steel joints etc., the same shall be secured by means of ordinary clips or girder clips as approved by the Engineer-in-charge. Where is not possible to drill holes in the truss members suitable clamps with bolts and nuts shall be used. The width and the thickness of the ordinary clips or girder clips and clamps shall be approved by the Engineer-in-charge.

### **2.15 Bends in Conduit:**

2.15.1 All necessary bends in the system including diversion shall be done by bending pipes or by inserting suitable solid or inspection type normal bends, elbows or similar fittings, or by fixing cast iron inspection boxes whichever is most suitable. Conduit fittings shall be avoided as far as possible on conduit system exposed to weather. Where necessary solid type fittings shall be used. Radius of bends in conduit pipes shall not be less than 7.5 cm.

### **2.16 Outlets:**

2.16.1 The switch or regulator boxes shall be made of metal on all sides. In case of office buildings Hylam sheets/bakelite sheets of 3 mm thickness and white colour finish may be used for the front side of the box. In Industrial buildings, the front side of the boxes shall also be of mild steel. In case of cast iron boxes, wall thickness shall be atleast 3 mm and in the case of welded mild steel sheet boxes the fabrication shall be carried out from 16 gauge sheet steel. The edges of the M.S. Boxes shall be folded inside to support bakelite/hylam sheet. In no case M. S. Boxes with corner pieces welded for supporting the hylam sheet shall be provided.

2.16.2 In case of M.S. Cover for the front side of the switch boards, all the four edges of these cover shall be folded inside for a depth of atleast 4 mm.

2.16.3 Clear depth of the box shall not be less than 50 mm and this shall be increased suitable to accommodate mounting of fans regulator in flush pattern.

2.16.4 Only a portion of the M.S. Boxes shall be sunk in the wall, the other portion being projected out for suitable entry of conduit pipes into the box.

2.16.5 Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in sheet steel boxed with cover plates as specified. Chromium plated brass screws shall be used for fixing of switches.

2.16.6 Power Point wiring shall be distinctly separated for light Point wiring. Conduits not less than 25 mm and wires not less than 6 sq. mm aluminium or equivalent copper shall be used for power wiring.

### **2.17 Earthing of Conduit:**

2.17.1 The conduit of each circuit or section shall be completed before conductors are drawn. The entire system of conduit after erection shall be tested for mechanical and electrical continuity throughout and permanently specified in earthing system.

2.17.2 Bare earth wire of size not less than 12 gauge aluminium shall be run with each conduit and clamped along the run and specifically across threaded joints using copper earth clamps.

2.17.3 Gas or water pipe shall not be used as earth medium.

2.17.4 If conduit pipes are liable to mechanical damage they shall be adequately protected. In a conduit system, pipe must be continuous when passing through walls or floors.

#### **2.18 Flexible steel conduit:**

2.18.1 Flexible conduit shall be used only where absolutely unavoidable. Flexible conduits shall be formed from the continuous length spiral antilocked strip steel with fused zinc coating on both sides. The conduit shall be terminated in brass adapters.

2.18.2 All unused conduit entries shall be blocked off in an approved manner and where conduits are terminated in adapter boxes, all removable box covers shall be firmly secured to provide complete enclosures.

#### **2.19 Recessed conduit wiring system:**

2.19.1 Recessed conduit wiring system shall comply with all the requirements of surface conduit wiring and in addition shall also comply with following requirements.

##### **2.19.2 Making of chase**

The chase in the wall shall be neatly made and of ample dimensions to permit the flexing of conduit pipe in an approved manner. In case of building under construction, conduit shall be buried in the wall before plastering and shall be finished neatly after erection of conduit. In case of exposed brick masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work. In case of new construction the scope of work under the electrical contractor shall be responsible for providing chase in the wall, fixing up the conduits and finishing of the wall complete. However, final painting after plastering will be carried out by the agency.

##### **2.19.3 Fixing of conduit in case:**

The conduit pipe shall be fixed by means of staples or by means of saddles not more than 60 cm apart. Fixing of standard bends or elbows shall be avoided as far as possible and all curves maintained by bending conduit pipe itself with long radius which will permit easy drawing of conductors. All threaded joints of conduit pipes shall be treated with approved 'preservative compound' to ensure protection against rust.

##### **2.19.4 Inspection boxes:**

Suitable inspection boxes to the barest minimum requirements shall be provided to permit periodical inspection to facilitate replacement of wires, if necessary. These shall be mounted flush with the suitable ventilating holes shall be provided in the inspection box covers.

##### **2.19.5 Types of accessories to be used:**

All outlets such as switches, wall sockets etc. may be either flush mounting type or surface mounting type as specified. The outlet box shall be efficiently earthed with conduit by an approved means of earth attachment.

To facilitate drawing of wire in the conduit G.I. fish wire of 10 SWG shall be provided along with laying of recessed conduit.

## 2.20 Wires:

2.20.1 All wires shall be PVC insulated single core copper or aluminium as specified and shall be any 660 volts grade.

2.20.2 Wires of single strand is permissible upto 2.5 sq. mm size. Beyond this size wires with stranded conductors only be used.

2.20.3 All wiring termination shall be with crimped lugs except in case of termination on piano type switches and piano type sockets outlets.

2.20.4 Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the Engineer-in-charge before the concrete is poured. Proper care shall be taken to ensure that the conduits are neither dislocated nor choked at the time of pouring the concrete. Suitable fish wires shall be drawn in all conduits before they are embedded.

2.20.5 No conduit shall be buried in concrete or plastered unless the work has been inspected and inspected and approved by the Engineer-in-charge.

### 2.21 Mode of Measurement:

2.21.1 Sub main wiring from main building panel or distribution panel to sub distribution panels shall be measured on linear basis and paid separately.

2.21.2 Wiring from distribution board to the ceiling rose or socket outlet through the switchboard shall be measured on point basis and shall include for all the items as indicated in the detailed specifications.

2.21.3 Socket outlets on the lighting distribution boards shall be measured and paid separately.

2.21.4 Building panel board, distribution boards, light fittings ceiling fans and exhaust fans shall also be measured and paid separately.

2.21.5 In case of power point, the point wiring shall include for the wiring from distribution board right upto the power outlet including isolating switch, socket outlet etc. all as specified.

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Table - I

## MAXIMUM PERMISSIBLE NUMBER OF 250 V GRADE SINGLE CORE CABLES THAT CAN BE DRAWN INTO RIGID STEEL CONDUITS

Size of Cable													
Nomiona l Cross Sectional Area mm2		Number of Diameter in mm of Wires		20		25		32		40		50	
1.5				S	B	S	B	S	B	S	B	S	B

2.5													
4													
6													
10								8	6				
16								7	6				
25								5	4	8	6	9	7
35								4	3	7	5	8	6
50								2		5	4	6	5
								2		5	4	6	5

\* For copper conductors only.

+ For aluminium conductors only.

**MAXIMUM PERMISSIBLE NUMBER OF 250 V GRADE SINGLE CORE CABLES THAT MAY BE DRAWN INTO RIGID NON METALLIC CONDUITS**

Size of Cable		Size of Conduit (mm)				
Nominal Cross Sectional Area mm <sup>2</sup>	Number & Diameter in mm of Wires	20	25	32	40	50
		(Number of Cables, Max)				
1.0	1/1.12*	7	13	20		
1.5	1/1.40	6	10	14		
2.5	1/1.80 3/1.06*	5	10	14		
4.0	1/2.24 7/0.85*	3	6	10	14	
6.0	1/2.80 7/1.06*	2	5	8	11	
10	1/3.55+ 7/1.40*		4	7	9	
16	7/1.70		2	4	5	12
25	7/2.24			2	2	6
35	7/2.50				2	5
50	7/3.00+ 19/1.80				2	3

\* For copper conductors only

+ For aluminium conductors only.

## **SECTION – 3**

### **TECHNICAL SPECIFICATIONS FOR CTS WIRING**

3.1 CTS wiring is not permitted for industrial and office buildings. However, in case of residential buildings CTS wiring may be allowed for internal wiring.

3.2 Sub-main wiring from the supply company cut-out to the main switch in each flat shall be carried out in surface / concealed conduits only.

3.3 Wires used in CTS wiring shall be white colour 250 volts grade PVC insulated PVC sheathed aluminium single core stranded wires of size as specified in Schedule of Quantities.

3.4 Teakwood battens used shall be of good quality 12 mm thick well polished and without any burrs. Wooden bends shall be used in all corners.

3.5 Tinned brass clips of 34 gauge thickness and of proper size shall be used.

3.6 Wooden battens shall be fixed to the wall with rawl plugs/ quick adhesive paste and G.I. plated wood screws of size not less than 40mm shall be used for fixing battens. Fixing screws shall be

provided at a distance of not more than 600 mm.

3.7 Wooden boards used shall be of good quality, workmanship and finish and varnished insided all polished outside. Full length hinges shall be used for the board. Clips for locking the board shall be of heavy design.

3.8 Rates quoted against point wiring shall include for switchboards of adequate size, complete wiring from main switch / D.B. as applicable, round blocks, ceiling rose, connector strips etc. all complete.

3.9 Twisted wires are not allowed for looping circuits. Mechanical connectors shall be used for this and the connectors will be fixed to the base of switch boards.

3.10 Earth leads of size as specified shall be used for the entire length of wiring.

..

3.11 Wherever wiring crosses walls/beams, PVC/Porcelain pipe sleeves shall be provided for the crossings.

3.12 Specifications laid down for conduit system of wiring shall be applicable for CTS wiring also in respect of layout, design of circuit, installation of switchboards etc.

3.13 In case of residential buildings, while laying out the wiring system care shall be taken to ensure that lighting circuits, junction of distribution boards are not located in areas where damages due to rain water, leakages from the bath rooms and toilets are likely to take place.

3.14 In case of stair case blocks, the junction boxes and control switches wherever provided shall be made flush with the wall.

3.15 Main switch board and meter boxes shall be located at the ground floor below the stair case or in a separate room as provided at site. While fixing the location of meter boxes care shall be taken to see that rain water does not flood the meter room during monsoon.

3.16 Wherever power supply is to be obtained from the supply company, provision of meter boxes shall be made as per requirements of local supply company.

3.17 For lighting point aluminium wires of 1.5 sq.mm or equivalent shall be used. For sub-main wiring sizes of wire shall be not less than 2.5 sq.mm. aluminium or equivalent copper. In case of power circuit 4 sq.mm aluminium shall be made use of. For specified applications like electrical heaters, geysers, cooking range, etc. proper size of conductor shall be selected taking in to consideration the load to be connected.

3.18 In case of residential flats where total connected loads exceeds 5 KW, 3 phases distribution board may be obtained depending upon the supply company regulations. In case where 3 phase power supply is obtained for residential premises, care shall be taken to ensure that the distribution of load among the 3 phases are more or less equal.

### 3.19 Mode of Measurements :

3.19.1 Sub main wiring from main building panel or distribution panel to sub distribution panels shall be measured on linear basis and paid separately.

3.19.2 Wiring from distribution board to the ceiling rose or socket outlet through the switch board shall be measured on linear basis and paid separately.

3.19.3 Socket outlets on the lighting distribution boards shall be measured ++and paid separately.

3.19.4 Building panel board, distribution boards, light fittings, ceiling fans and exhaust fans shall also be measured and separately.

3.19.5 In case of power point the point wiring shall include for the wiring from distribution board right upto the power outlet including isolating switch,socket outlet etc. all as specified.

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## SECTION – 4

## TECHNICAL SPECIFICATIONS FOR CABLE LAYING

4.1 All cable shall be PVC insulated, sheathed end steel armoured with an outer PVC protective sheath. Cables shall have high conductivity stranded aluminium conductors and cores shall be colour coded as per Indian Standards.

4.2 All cables shall be without any kinks or visible damage.

4.3 Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the contractor shall mark it out on the drawings and also on the basis of actual site measurements.

4.4 Cable laid directly in ground shall be at a depth of 60 cms for (L.T.Cables) and laid on a bedding of sifted earth sand. After the cables are laid over the sand bedding, burnt bricks shall be placed across the cables and for the entire length of cable. Laying of bricks along the cable shall not be accepted under any circumstances. In case of H.T. cables concrete tiles of approved design and with suitable markings shall be placed above the cables. Road crossings and concreted areas shall be negotiated through buried C.I. / RCC pipes. Cable shall be bent to a radius of not less than 8 diameters, leaving sufficient slack for soil subsidence and

loops at both ends. Loops shall be provided at both ends of the cable and near straight through joints as directed by the Engineer-in-Charge. Wherever more than one cable is buried in one trench, non-corroding identification tags shall be provided on each cable at 10 M intervals. In addition suitable galvanized cable markers shall be provided above ground over behinds, loops crossings at every 30 M interval on straight runs.

4.5 Cables shall have twin continuous aluminium/G.I. conductors as specified against each item along the entire length of cable for continuous earthing. Cables shall be earthed at both ends.

4.6 All cables shall be properly terminated with glands, tinned copper lugs and cables identification tags and shall be properly crimped or soldered with lugs as directed.

4.7 All the indoor cables shall be laid on walls, ceilings, inside shafts, with suitable supports. Distance between supports shall not be more than 50 cms.

4.8 Cables shall be laid indoors by using 3 mm thick M.S. spacers with G.I. saddles and screws.

4.9 Cables laid directly in existing trenches shall be properly supported by M.S. Clamps.

4.10 Straight through joints shall not be permitted where the route length does not exceed one full drum length. In case of routes where the length exceeds on full drum length, minimum number of straight through joints as approved by the Engineer-in-charge shall be provided. However, no separate payment will be made for such straight through joints.

4.11 Cables shall be tested before laying and after laying but definitely before connecting up to the switch gears.

4.12 After the cable installation is complete, the entire installation shall be tested with 500 V insulation resistance tester and following reading established.

(i) Continuity on all phases

(ii) Insulation resistances between conductors, conductors and ground.

All test readings shall be recorded and handed over to Engineer-in-Charge.

4.13 In case of High Tension cables the insulation test shall be carried out using 2000 V meggar. In addition to this pressure test shall be carried out on the H.R. Cables as specified in IS:1255– Code of Practice for installation & maintenance of paper insulated power cables.

#### **4.14 Mode of Measurements :**

4.14.1 All cabling shall be measured on the basis of unit length and the cost per unit length shall include cost of cable, cost of supports, clamps,labour for installations, testing & commissioning all complete.

4.14.2 In the case of cables laid in ground/duct, excavation sand cushioning, brick covering & back filling shall also form part of the cabling.

4.14.3 While all cable supporting clamps are to be included in the unit cost of cables, cable trays or cable racks wherever specifically indicated shall be paid extra on unit rates.

4.14.4 Cable terminations shall be measured per set and the cost shall include cost of tinned copper lugs, brass glands, all jointing materials, bolts and nuts, M.S. plate support labour and any other incidental items not specifically indicated above.

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## **SECTION – 5**

### **TECHNICAL SPECIFICATIONS FOR ELECTRICAL FITTINGS, FIXTURES AND FANS**

#### **5.1 Fluorescent Light Fittings :**

5.1.1 All fixtures shall be complete with accessories and fixing necessary for installation completed in all respects. Fixtures connected to emergency lighting systems shall have distinct red markings.

5.1.2 Fixtures shall be installed at mounting heights as detailed on the drawings or instructed at site by the Engineer-in-charge.

5.1.3 Fixtures and/or fixture outlets boxes shall be provided with hangars to adequately support the weight of the fixture. Design of hangars and method of fastening shall be as approved by Engineer-in-charge unless otherwise specified in the drawings and tender specifications.

5.1.4 Pendant fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Provision for adjustment of height during installation shall be made.

5.1.5 Flush mounted recessed fixture shall be installed so as to completely eliminate light leakage within the fixture & between the fixture and adjacent finished surface.

5.1.6 Fixture mounted on outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Extension pieces shall be installed where required to facilitate proper installation.

5.1.7 Fixture shall be completely wired and constructed so as to comply with the ISS and IE Regulations for Electric Light Fixtures. Fixtures shall bear manufacturer's name & the Factory Inspection Labels.

5.1.8 Wherever specific make of fixtures are indicated in the Tender Specifications, the entire fixture shall be Factory Assembled from the manufacturers. Locally assembled fittings with components from primary manufacturers shall not be accepted.

5.1.9 Wiring within the fixture and for connection to the branch circuit wiring shall be with wire of size not less than 1.5 sq.m. copper for 250 Volts applications. Insulation of the wire shall suite the temperature conditions inside the fixtures.

5.1.10 Sheet metal used for manufacturing of lighting fixtures shall not be less than 22 SWG or heavier if so required to comply with the specification or standards. Sheet Steel reflectors shall have a thickness of not less than 20 SWG. The parts of the fixtures shall be completely free from burrs and tool marks. Soldering shall not be used as mechanical fastening device on any part of the fixture.

5.1.11 Ferrous metal shall be given corrosion resistant phosphate treatment or other approved rust inhibiting primer coat to provide a rust-proof base before application of final coat of finish.

5.1.12 Non reflecting surface such as fixture, frame, etc. shall be finished with baked enamel paint.

5.1.13 Light reflecting surface shall be finished baked white enamel having a reflection factor of not less than 80%. All parts of reflector shall be completely covered by the baked enamel finish and shall be free from irregularities in surface. After the finish coat is applied and cured, it should be capable of withstanding a 6mm radius bend without showing signs of cracking, peeling or loosening from the base metal. Finished surface shall be capable of withstanding 72 hours exposure to an ultra-violet sun lamp placed 10 cm from the surface without discoloration, hardening or warping and retain the same reflection factor after exposure.

5.1.14 Fixtures with visible frames shall have concealed hinges and catches. Pendant fixtures and lamp holders shall be provided with ball type aligners or similar approved means for adjustments. Recessed fixture shall be constructed so as to fit an acoustic tile ceiling or plaster ceiling without distorting either the fixture or the ceiling. Plaster rings shall be provided for plaster ceilings. Fixtures with hinged diffuser doors shall be provided with spring clips or other retaining devices to prevent the diffuser from moving.

5.1.15 Detailed catalogue and technical data for all fixtures or wherever desired by the Engineer-in-charge, Sample fixtures shall be submitted for approval to the Engineer-in-charge before orders for the fixtures are placed. Shop drawings for non-standard fixture types shall be submitted for approval to the Engineer-in-charge.

5.1.16 Recessed fixtures shall be constructed so that all components are replaceable without removing housing from the ceiling.

5.1.17 Lamp shall be supplied and installed in all lighting fixtures provided under this contract. Lamps used for temporary lighting service shall not be used in the final lamping of fixtures. Lamps shall be of wattage and type as shown on the drawings. Wherever not shown, the details shall be ascertained from the Engineer-in-charge before procurement. Lamps for permanent installation shall not be placed in the fixtures until so directed by the Engineer-in-charge and this shall however be accomplished immediately before the building portions are ready for occupation.

5.1.18 Only single and or two lamp ballast shall be used in any one fixture. Ballasts shall be completely enclosed inside sheet steel casing, and shall have a corrosion resistant finish. Ballasts shall contain a thermosetting type compound not subject to softening or liquefying under any operating conditions or upon ballast failure. Compound shall not support combustion. All ballasts shall be copper wound and shall be of high power factor compensated to above 0.9 P.F. Ballast temperature and sound rating rise shall be specified by the manufacturer and guaranteed. Ballasts shall be for operation at the voltages and frequencies indicated and under temperature conditions

prevailing in the various locations of the premises.

5.1.19 All fluorescent fixtures shall be provided with separate wiring channel with cover plate and an earth terminal. All screws shall be chromium brass screws. Lamps and starter holders shall be out of tough mounted plastic with spring loaded rotor

type contactors rendered shock and vibration proof. Condensers shall be of low oil paper impregnated hermetically sealed type complying with ISS. Internal wiring is passing by the ballast in a suitable heat resistant barrier or sleeve shall be provided.

5.1.20 Surface mounted fixture longer than two feet shall have one additional point of support besides the outlet box fixture stud when installed individually. Pendants for individually mounted fixtures of 1.2m long and small shall be provided with twin stem/conduit hangars. Stems shall have ball aligners or similar devices and provision for a minimum of 25 mm vertical adjustment.

5.1.21 Stems shall be of appropriate length to suspend fixtures at required mounting height.

5.1.22 Lamps, starters and ballasts provided with each fittings shall match the lamp specified.

## 5.2 Incandescent Fittings :

5.2.1 Incandescent fittings shall be of the type specified in the drawings and schedule. Contractor shall submit samples to Engineer-in-charge and obtain approval in writing before procurement of fittings.

5.2.2 Incandescent fixtures shall be equipped with porcelain, ceiling rose and B.C. type sockets for lamps upto and including 200 watts and screw type base for lamps 300 watt and over.

5.2.3 Re-lamping the fixture shall be possible without removing the fixtures from its location.

5.2.4 Incandescent lamps shall be inside frosted or clear type as specified by the Engineer-in-charge.

## 5.3 Highbay/Street light fittings :

5.3.1 Highbay/street light fittings shall be with HPMV/SON/HALOGEN/MLL Lamps as specified in the schedule.

5.3.2 Rates quoted against light fittings shall include for the complete light fittings, control gear, bulb etc. all complete in factory wired and assembled condition. Locally assembled fittings and control gear shall not be accepted. Rate shall also include for fixing arrangement for the fittings and control gear. Fixing arrangements shall have prior approval from Engineer-in-charge.

5.3.3 In case of street light fittings, rates quoted against fittings will be excluded from the arm over the pole, but will include for lead wire from pole mounting box and all other hardware necessary to complete the work.

5.3.4 Street light poles shall be of M.S. ERW Type conforming to IS 2713- 1969. Pole size and other fixing arrangements shall be as per

Drawing No.CWP/STD/EM-48D, CWP/STD/EM-51B, CWP/STD/EM- 29C or CWP/STD/EM-50B whichever is applicable

5.3.5 Sample of the pole shall be submitted and approval of Engineer-in charge obtained in writing before order is placed for the full quantity....

5.3.6 Rate quoted against pole item shall include for excavation, concrete foundation, pole earthing studs, arm for fitting, fixing bracket for control gear, pole cap etc. all complete.

5.3.7 Poles shall be erected absolutely vertical.

5.3.8 All buried portions of the poles shall be given a primer coat and two coats of bituminous paint. All exposed portions shall be given one primer coat and two coats of aluminium paint before erection. In addition, one more coat of aluminium paint shall be given after the fittings are erected and work completed.

5.4 Fans, Regulators and Clamps :

5.4.1 Ceiling fans including their suspension shall conform to relevant ISS with secondary safety device incorporated against free fall of fans from their hooks.

5.4.2 All ceiling fans shall be wired to ceiling roses or to special connector boxes and suspended from hooks or shackles. There shall be no joints in the suspension rod.

5.4.3 In case of "I" beams, the suspension arrangements fabricated out of M.S. plates shall be shaped suitably to catch the flanges and shall be held together by means of laying bolts, nuts, check nut and split pin.

5.4.4 For concrete roofs, ceiling fans hooks shall be got buried in the concrete during construction.

5.4.5 Fan hooks made of M.S. rods of 15mm diameter shaped in 'U' form with their legs projecting horizontally on the top at least 19 cm on either side and tied over the top reinforcement of the roof shall be laid in the concrete slabs.

5.4.6 The suspension arrangement for the fans shall be so designed that the fans canopies shall completely hide suspension element.

5.4.7 Unless otherwise specified all ceiling fans shall be hung 2.75M above the floor.

5.4.8 In the case of measurement of extra down rod for ceiling fans including wiring, the same shall be measured in units of 10 cms & length less than 5 cm shall be ignored. The cost of wiring for extra down rod shall be paid as per supplying and drawing cable in existing

conduits.

5.4.9 Exhaust fans shall conform to relevant ISS.

5.4.10 Exhaust fans shall be erected at the places indicated by the Engineer in-charge. For fixing exhaust fans a circular opening shall be provided in the wall to suit the size of the frame, which would be fixed by means of rag bolts, embedded in the walls, opening shall be neatly plastered

to the original finish of the wall. The exhaust fan shall be wired as near to the opening as possible by means of flexible cord. Care being taken that the blades rotate in the proper direction.

5.4.11 The exhaust fan for installation in corrosive atmosphere shall be painted with special PVC paint or chlorinated rubber paint. Installation of exhaust fan in kitchen, dark room and such other special locations shall be carried out giving due consideration for the specific requirements.

5.4.12 The body of the ceiling fan, exhaust fan and fan regulator shall be connected to the earthing system by proper earth leads.

5.5 Mode of Measurements :

5.5.1 each lamp, fixtures, shall be measured as a unit complete with all accessories, lamps, mounting, wiring, connection, earthing etc. all complete.

5.5.2 Each street light pole shall be measured as a separate unit complete including excavation, erection of pole, pole cap, bracket etc. all as specified and in conformity with the drawing and specifications.

5.5.3 Exhaust fan and ceiling fans shall be measured as a complete unit including fixing up and connecting the fans, regulator, earthing arrangement, blanking opening in the wall, in case of exhaust fan etc.

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## **SECTION – 6**

### **TECHNICAL SPECIFICATIONS FOR CIRCUIT BREAKERS,PANEL BOARDS AND DISTRIBUTION BOARDS**

#### **6.1 Circuit Breakers :**

6.1.1 Circuit breakers shall preferably be air break horizontal type fully interlocked and meeting the requirements of IS:2516 or BS:3659. Breakers shall be rated for a medium voltage of 600 V and rated full load amperes as indicated on drawings. Breakers shall be capable of making and breaking system short circuits.

6.1.2 Breakers shall be manually operated complete with panel operating handle, isolating plug with safety shutters, mechanical ON/OFF indicator, silver plated arcing and main contact arc chutes and trip free operation. Breakers shall be capable of being racked out into 'Testing', 'Isolated' and 'Maintenance' positions and kept locked in any of the positions.

6.1.3 Over current releases shall be triple pole direct acting trips and all such tripping devices/shall be capable of discriminating with MCCB's down stream. External relays shall be with AC series trips and where shunt trips are incorporated necessary DC source power shall also be provided with associated charger, cabling etc. as forming part of the circuit breaker cost.

#### **6.2 Switch Fuse Units :**

6.2.1 Switch fuse units shall have quick-make, quick break silver plated preferably double break contacts with operating mechanism suitable for rotary operation in the case of cubicle mounting. All Switches shall be rated according to the Schedule of work or drawings and shall withstand the system fault current. Cam operated rotary switches with adequate terminal adaptors upto 25A are acceptable but for all higher rating switch fuse units shall be heavy duty type conforming to I.S.4047.

6.2.2 Fuses shall be HRC Cartridge type conforming to I.S.2208 with a breaking capacity corresponding to system fault level. Fuses shall be link type with visible indication. Screw type fuses are not acceptable for any ratings. Fuses shall be provided only in the phase conductors

even in case of double pole switches, Neutral, wherever provided, shall have suitable links only.

6.2.3 All disconnectors shall consists of switch units quick make, quick break type with silver plated contacts. The switches shall preferably have double breaks. All switches shall be mounted in steel sheet enclosure, which in turn is mounted on suitable angle iron frame work. All switches shall have cast iron enclosure except for ratings where manufacturers do not make switches with cast iron enclosure. For such

ratings switches with sheet steel enclosure, supplied by manufacturer as a complete unit shall be supplied. Dis connectors shall have a minimum breaking capacity of 5 KA at 415 volts.

### 6.3 Cubicle Boards :

6.3.1 All boards shall be combination 14 and 16 SWG sheet steel, free standing, extensible, totally enclosed, dust tight, vermin-proof cubicle, flush dead front and modular construction suitable for 3 phase 440 V 4 wire 50 Hertz system. All Boards shall be accessible from the front for the maintenance of switch fuses, bus bars, cable terminations, meters, etc. Cables shall be capable of entering the board both from top as well as bottom. All panels shall be machine pressed with punched openings for meter etc. All sheet steel be rust inhibited through a process of degreasing, acid pickling, phosphating etc. The panel shall be finished with two coats of red oxide primer and finished with two coats of synthetic enamel paint of approved shade. Engraved plastic labels shall be provided indicating the feeder details, capacity and danger signs.

6.3.2 The boards shall accommodate air insulated bus bars, circuit breakers, switch fuse units with HRC fuses, starters, necessary meters, relays, contactors etc. as required and shown on drawings

and arranged in suitable tiers.

6.3.3 The switch board shall be fully compartmentalized in vertical tiers housing the feeder switches in different totally enclosed independent compartments. Each compartment shall be self-sufficient with switch unit fuses, contactors, relays, indicating lamps and inter-locked door with facility for padlocking. Each feeder must terminate in an independent labelled terminal block. Strip type terminal block accommodating several feeders together is not acceptable. Pressure clamp type terminals suitable for aluminium wires may be used upto switches of 25 A and cable lugs for higher rating. All terminations shall be shrouded in an approved manner. The entire enclosure shall

meet with I.S. 2147. Feeder connections shall be out of solid insulated copper wires or strips with bimetallic clamps wherever required. Internal wiring, bus bar markings etc. shall conform to I.S.S.

375. Internal wiring shall have terminal ferrules. Main switch should be at easily accessible height and the highest switch operating handle should not be over 1.75 M from floor level. Cable glands shall not form part of the switch board, as the cost of glands will form part of the cable termination.

6.3.4 Bus bars shall be three phase and neutral and of tinned copper rated for a temperate rise of 35oC over the ambient temperature specified based on bare conductor ratings. Current density shall not exceed

130 Amp/Sq.cm for aluminium and 160 Amp/Sq.cm for copper. Neutral bars may be of one half the size of the phase bars. The main bus bars shall be of uniform cross section and rated for 50% above the incoming switch. The vertical bus bars for the feeder columns may be rated at 75% of aggregate feeder capacity and shall be uniform in size. Bus bars and inter-connections shall be taped with PVC colour coded tape to prevent bar to bar accidental shorts. Each bus bar shall be directly and easily accessible on removal of the front cover and shall be supported on non-hydroscopic insulator blocks to with-stand thermal and dynamic overloads during system short

circuits. An earth bus of 50% of the phase bar shall be provided subject to the following minima and maxima.

### **Copper Aluminium**

**Minimum** 6.5 sq.mm 10 sq.mm

**Maximum** 65 sq.mm 120 sq.mm

Individual switch components shall be connected with the earth bus through copper wire/ strips; size of connecting wire being as above.

All wire connections to bus bars shall be through lugs, bolts, and nuts and spring washers.

#### **6.4 Panel Boards :**

6.4.1 All the panels shall consist of ammeter, volt-meter of adequate ranges and indicating lamps.

6.4.2 Bus bar chamber shall have removable end covers and bus bars shall have bolt holes provided at both ends to enable future extension of panels on either side.

#### **6.5 Industrial Panel Boards :**

6.5.1 The frame shall be fabricated out of 50mmx 50mm x 6mm M.S. angles and horizontal supports of M.S. flats not less than 50mm x 6mm size. The frame shall be welded, and shall be floor mounting, self supporting type.

6.5.2 The bus bar chamber shall be of 14 SWG sheet steel, extensible, totally enclosed, dust tight, vermin proof cubicle, flush dead front and construction suitable for 3 phase 415 V 4 wire, 50 Hertz system. The bus bar chamber shall accommodate bus bars complying with the Technical Specifications given in this section.

6.5.3 The switches should be at easily accessible height and the highest switch operating handle should not be over 1.75 M from floor level.

6.5.4 All the interconnections shall be solid copper links and shall be taped properly as per the colour code.

6.5.5 Engraved plastic labels shall be provided indicating the feeder details, capacity and cable sizes.

6.5.6 'DANGER' sign board shall be fixed on the front cover.

6.5.7 The complete frame and bus bar shall be painted to match the switches.

6.5.8 Arrangements for terminating earth strip shall be provided on the frame.

6.5.9 Cable entry boxes shall be provided for all incoming and outgoing cables.

6.5.10 The panel shall be grouted in the floor with all the necessary hardware.

6.5.11 The sub-panels should be mounted on suitable M.S. frames and job includes grouting the same on the wall/ floor with all the necessary hardware.

6.5.12 Bus bar chamber shall be completely compartmentalized openings made at top and bottom for switches shall be blocked with bakelite sheets and bushed openings provided for interconnecting leads.

#### **6.6 Testing and Inspection :**

6.6.1 All switch boards shall be subject to factory inspection before finishing and despatch, unless inspection is waived by Engineer-in-Charge.

6.6.2 Certificates for all routine and type tests for circuits breakers in accordance with the I.S.S. 2516 shall be furnished. In addition, all panels shall be meggered phase to phase and phase to neutral using a 1000 V meggar with all switch gear in closed position. Meggar value should not be less than 2.5 megohms between phases and 1.5 megohms between phase and neutral.

6.6.3 All meters and relays shall be calibrated and tested at site by contractor before commissioning through secondary injection tests. Tests shall be carried out in the presence of Engineer-in-Charge or his authorized representative.

6.6.4 All secondary wiring and apparatus connected therewith shall withstand 2000 V for one minute.

6.6.5 All field tests shall be witnessed by Engineer-in-Charge and recorded.

## 6.7 DISTRIBUTION BARDS :

### 6.7.1 LIGHTING DISTRIBUTION BOARDS :

6.7.1.1 Lighting Distribution Boards shall be either 6, 8 10 outgoing ways or 12 ways as specified in the Schedule of Quantities with isolators.

6.7.1.2 The capacity of each way shall be 5/10/15 amps and only miniature circuit breaker shall be used.

6.7.1.3 30 amps single pole and neutral isolator shall be used at incoming point of lighting distribution boards.

6.7.1.4 The number of points per way shall not exceed eight or the total connected load per way shall not exceed 800 watts.

6.7.1.5 All the miniature circuit breakers, isolators shall be housed in a specially fabricated M.S. box of 16 gauge size. The front side shall have detachable flush type door. Box shall be painted with one coat of primer and two coats of DUCO paint of approved colour. Complete distribution boards shall be factory assembled by the manufacturer.

6.7.1.6 All the circuit wires shall be properly crimped with lugs and connected to terminals.

### 6.7.2 POWER DISTRIBUTION BOARDS :

6.7.2.1 The power distribution boards shall be suitable for 3 phase 440 volts supply 4 ways/ 6 way/ 8 way with 32 amps with neutral bar.

6.7.2.2 All the outlets shall be provided with HRC fuse links of 30 Amps capacity.

6.7.2.3 Main switch shall be of IC three phase and neutral.

6.7.2.4 The capacity of main switch shall be as follows :

For 4 way PDBS ..... 63 Amps

For 6/8 way PDBS ..... 100 Amps

6.7.2.5 All the interconnections between distribution board and the switch shall be of solid jumpers / stranded copper wire of suitable capacity.

6.7.2.6 All the circuit wires shall be properly crimped with lugs and terminated as per colour codes.

6.7.2.7 Only one outlet shall be connected per circuit.

6.7.2.8 All the phase strips and neutral links shall be housed in dust proof M.S. Boxes. Complete distribution board shall be factory assembled by Manufacturer.

### 6.7.3 MOUNTING :

6.7.3.1 Both lighting and power distribution boards shall be properly mounted on angle iron frame.

6.7.3.2 The angle iron frames shall be grouted on wall with suitable bolts.

6.7.3.3 All the distribution boards shall be clearly marked to indicate the various load locations and cable sizes.

### 6.8 MODE OF MEASUREMENTS :

6.8.1 Each panel complete with various components, earthing etc. shall be treated as one unit for purposes of measurement and payment.

6.8.2 Outgoing feeder termination will be paid for at unit rates separately under cable termination and hence cable glands need not be provided with switch boards unless otherwise specified.

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## **SECTION – 7.0**

### **TECHNICAL SPECIFICATION - FOR EARTHING**

#### **7.1 EARTHING :**

##### **7.1.1 Earthing Pits :**

An earthing pit of 1m x 1m x 2.5 m deep installed with galvanized cast iron plate of 600 mm x 6 mm thick shall be provided. Twin earth leads of G.I. size 25 mm x 3 mm shall be connected to the earth plate by means of tinned copper lugs and brass nuts and bolts. The plaster shall be covered with mixture of charcoal and salt for thickness of 15 cms all around and remaining area filled with general mix of sand & soil. G.I. pipe of 37 mm dia class 'C' shall be installed in the earth pit starting from 15 cms above the earth plate and brought to ground level and shall be provided with a manhole of brick masonry 12" x 12" x 9" (300 mm x 300 mm x 225 mm) around the pipe at ground level with hinged cast iron cover. A bolted and removable link connecting main earth bus outside the pit and portion leading to plates shall be accommodated in this manhole for testing.

7.1.2 Normally an earth pit shall not be situated less than 1.5 mtrs. from any building. Care shall be taken that the excavations for earthing may not affect the footing of the foundations of the buildings.

7.2 The earthing lead shall be securely bolted and soldered to plate. The lead shall be connected by means of cable socket with bolts & nuts.

7.3 The earthing lead shall be suitably protected from mechanical injury.

7.4 No earth electrodes installed shall have a greater ohmic resistance than one ohm as measured by an approved earth testing apparatus.

7.5 The twin strips of size 25 mm x 3 mm of aluminium or G.I. strip shall be connected from earth station to nearest switch gear.

7.6 The cost towards provision and erection of earth station shall include all labour for excavation in soft soil/ hard rock/ concrete apron, back filling of the excavated portion, resurfacing to the original finish including provision of all materials, sundries, consumables and test link.

7.7 The entire work shall be carried out conforming to IS 3043-1966.

7.8 all connections on the earthing system shall be by means of brass nuts and bolts.

7.9 The earth bus and individual earth connecting strips running inside the building shall be suitably supported on wall/columns/under ceiling with proper non-ferrous clamps spaced not more than 900 mm.

#### 7.10 SUB EARTHING :

7.10.1 From main panel, earthing conductor in twin shall be laid along with the cables for continuous earthing. Sizes of earth wire shall be as specified in the schedule of quantities upto the distribution board.

7.10.2 The earth conductors shall be earthed at both ends using properly sized lugs, either by crimping or soldering. Twisted joints are not allowed anywhere in the earthing system.

7.10.3 The earth conductors shall be properly fastened to the cables throughout the run.

7.10.4 All the conduits either surface or concealed shall be laid with 12 SWG bare aluminium earth conductors along the run of conduits.

7.10.5 The copper earthing clamps shall be fastened at threaded joints to ensure proper earthing and all the threaded joints shall be painted with black bituminous paint.

#### 7.11 EQUIPMENT EARTHING :

##### 7.11.1 Metallic Conduit :

Bare aluminium earth continuity conductor clamped at one metre intervals shall be provided throughout the length of conduit. Size of conductor shall be 12 SWG aluminium or equal and copper earth clamps shall be used for fixing. Binding wires are not acceptable.

##### 7.11.2 Non Metallic Conduit :

Same as above but with insulated wire drawn inside.

##### 7.11.3 Armoured cable :

Two distinct dearth connections to armouring at both ends of size equivalent to 50% of the phase conductor or minimum of No.8 SWG copper or maximum of 65 MM<sup>2</sup> copper or equivalent shall run throughout the length of cable.

##### 7.11.4 Three Ph. Power Panels and Distribution Boards :

Two distinct earth connections of same size as per cable sizes.

##### 7.11.5 Single phase DB's :

One earth connection of size shown or as per incoming cable sizes.

##### 7.11.6 Isolating Switch ( 3 Ph ) :

Two distinct earth connections of same size as per cable sizes.

##### 7.11.7 Isolating Switch ( 1 Ph ) :

One earth connection of size shown or as per incoming cables sizes.

##### 7.11.8 3 Ph Motors and other 3 Ph. Apparatus :

Two distinct earth connections of size 50% of connecting cable or No.

8 SWG/ copper or equivalent whichever is higher.

7.11.9 1 Ph. Motors, Light Fittings and other Apparatus :

One earth connection of 14 SWG copper or equivalent.

7.11.10 Street Lights :

As per detailed drawing.

7.12 Mode of Measurement :

7.12.1 Earthing pit shall be measured as a complete unit including provision of earth electrode (Pipe or plate), Earth leads upto the ground level, chamber, excavation refilling with coal and salt, water arrangements etc. all complete.

7.12.2 Earthing leads beyond the removable link from manhole chamber to the nearest main switch board shall be measured and paid separately on a unit length basis.

7.12.3 Earthing leads from power panel, distribution panels etc. shall be measured independently on length basis or measured along with cable or conduit lines depending upon the description given in the schedule of quantities.

7.12.4 Earthing connection to the various fixtures and appliances shall be included as part of the installation rate quoted for the concerned item.

No separate payment for earth connection to these appliances and fixtures shall be made.

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## **SECTION - 8.0**

### **TECHNICAL SPECIFICATION FOR PAINTING**

8.1 General : The scope of this section covers 'Painting' to be carried out at Site.

8.1.1 Paints : Paints, oils, varnishes etc. of approved make in original tin to the satisfaction of the Engineer-in-Charge shall only be used.

8.1.2 Preparation of the surface : The surface shall be thoroughly cleaned and dusted before painting is started. The proposed surface shall be inspected by the Engineer-in-Charge or his authorized agent and shall have received the approval before painting is commenced.

8.1.3 Application : Paint shall be applied with brush. The paint shall be spread as smooth and even as possible. Particular care shall be paid to rivets, nuts, bolts, and over lapping. Before drawing out, it shall be continuously stirred in the smaller containers with a smooth stick while it is being applied. Each coat shall be allowed to dry out sufficiently before a subsequent coat is applied.

8.1.4 Scope : Painting on old surface in indoor situations will not include primer coat except where specially mentioned in the Schedule of Work or Special Specification. However, where rust has formed on iron and steel surfaces the spots will be painted with one anti-rust primer coat.

8.1.5 Precautions : All furniture, fixtures, glazing, floors, etc. shall be protected by covering. All stains, smears, splashings, dropping of every kind shall be removed.

While painting of wiring etc., it shall be ensured that paintings of wall and ceiling etc. is not spoiled in any way.

#### 8.2 Painting of wiring on wood batten :

The wiring shall after erection be neatly painted with two coats of oil less non-cracking paint of suitable colour to match the surroundings to the satisfaction of the Engineer-in-charge.

#### 8.3 Painting of conduit and accessories :

After installation, all accessible surface of conduit pipes, fittings, switch and regulator boxes, etc. shall be painted with two coats of approved enamel paint or aluminium paint as required to match the finish of surrounding wall, trusses etc.

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### **SECTION 9.0**

#### **TECHNICAL SPECIFICATION FOR TESTING**

##### **9.1 General**

On completion of an installation the following tests shall be carried out:-

1. Insulation Resistance Test.
2. Polarity Test.
3. Earth continuity Test.
4. Earth Electrode Resistance Test.

##### **9.1.1 Insulation Resistance**

9.1.1.1 The insulation resistance shall be measured by applying between earth and the whole system of conductors of any section thereof with all fuses in place and all switches closed, and except in earthed concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it need not exceed 500 volts for medium voltage circuits. Where the supply is derived from the three wire D.C. or a poly phase A.C. system, the neutral pole of which is connected to earth either direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral.

9.1.1.2 The insulation resistance shall also be measured between all conductors connected to one pole or phase conductor of the supply and all the conductors connected to the neutral or to the other pole or phase conductors of the supply with all lamps in position and switches in 'off' position and its value shall not be less than that specified in sub-Clause 9.1.1.3.

9.1.1.3 The insulation resistance in Meg Ohms measured as above shall not be less than 50 Meg Ohms divided by the number of outlets or when PVC insulated cables are used for wiring 12.5 Meg Ohms divided by number of outlets outgoing circuits.

9.1.1.4 Where an entire installation is being tested, a lower value than that given by the formula, subject to a minimum of 1 Meg Ohm is acceptable.

9.1.1.5 A preliminary and similar test may be made before/lamps etc are installed , and in this event the insulation resistance to earth should be not less than 100 meg

ohms divided by the number of outlets or when PVC insulated cables are used for wiring 25 meg ohms divided by number of outlets.

9.1.1.6 The term "outlet" includes every point alongwith every switch except that a switch combined with a socket outlet, appliance or lighting fitting is regarded as one outlet.

9.1.1.7 Control rheostats, heating and power appliances and electric signs may, if required, be disconnected from the circuit during the test, but in that event the insulation resistance between the case or frame work, and all live parts of each rheostat, appliance and sign, shall be not less than that specified in the relevant India Standard Specification or where there is no such specification shall be not less than half a megohm.

### 9.1.2 **Polarity test of switch:**

9.1.2.1 In a two wire installation a test shall be made to verify that all switches in every circuit have been fitted in the same conductor throughout and such conductor shall be labelled or marked for connection to phase conductor or to the non earthed conductor of the supply.

9.1.2.2 In a three wire or a four wire installation a test shall be made to verify that every non linked single pole switch is fitted in a conductor which is labelled or marked for connection to one of the phase conductor of the supply.

9.1.2.3 The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp, one lead of which is connected to the earth. Glowing of test lamp to its full brilliance, when the switch is in "ON" position irrespective of appliance in position or not, shall indicate that the switch is connected to the right polarity.

### 9.1.3 Testing of earth continuity path :

9.1.3.1 The earth continuity conductor including metal conduits and metallic envelopes of cables in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance or earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

### 9.1.4 Measurement of earth electrode resistance :

9.1.4.1 Two auxiliary earth electrodes besides the test electrode are placed at suitable distance from the tests electrode (see figure). A measured current is passed between the electrode 'A' to be tested and an auxiliary current electrode 'C' and the potential difference between the electrode 'A' and auxiliary potential electrode 'B' is measured.

The resistance of the test electrode 'A' is then given by –

V

R = -----

I

Where,

**ACCEPTED MAKES OF MATERIALS**

-----  
-----  
Sr.No. Articles / Items Approved Makes  
-----  
-----

1. PVC Wires/ conductors Finolex, Polycab, Sundep
  - 2, Conduits VIMCO / BEC
  3. Cables Gloster, Asian, Polycab, CCI  
(until 95 sq.mm.)
  4. Switches, Sockets Standard, Anchor  
5 Amps / 15 Amps
  5. 15/30 Amps. ICDP switches Stanley, KEW
  6. I.C.T.P.N. Switches KEW, GE, L&T, Siemens
  7. Lighting Distribution Morarjee Dormans, Legrand  
Boards – MCB type
  8. Power Distribution Boards GE, Legrand
  9. All light fittings Crompton / GEC / Philips
  10. Any other item Sample to be sent for  
Approval of E.I.C
  11. Change over switches L&T, KEW
- -----

## **A P P E N D I X 'A'**

### **FORM OF COMPLETION CERTIFICATE**

I/We certify that the installation detailed below has been installed by me/us and tested and that to the best of my/our knowledge and belief, it complies with Indian Electricity Rules, 1956, as well as IS:732 – Code of practice of Electrical wiring Installations (system voltage not exceeding 650 volts)

Electrical Installation at \_\_\_\_\_

Voltage & system of supply \_\_\_\_\_

1. Particulars of Works :

(a) Internal Electrical Installation

No. Total Load Type of system

Of wiring

(i) Light point

(ii) Fan point

(iii) Plug point

(a) 3 pin 5 amp

(b) 3 pin 15 amp

(b) Others

Description HP / KW Type of starting

(a) Motors (i)

(ii)

(iii)

(b) Other plants :

...2

.. 2 ..

(c) If the work involves installation of over headline and/ or under ground cable.

[a] (i) Type & description of overhead line

(ii) Total length and No. of spans

(iii) No. of street light and its description.

[b] (i) Total length of underground cable & its size.

(ii) No. of joints End Joint :

Tea Joint :

St. through Joint :

Earthing :

(i) Description of earthing electrode

(ii) No. of earth electrodes.

(iii) Size of main earth lead.

Test Results :

(a) Insulation Resistance

(i) Insulation resistance of the whole system of conductors to earth .... Megohms

(ii) Insulation resistance between the phase

Conductor & neutral -

Between phase R and neutral .... Megohms

Between phase Y and neutral .... Megohms

Between phase B and neutral .... Megohms

(iii) Insulation resistance between the phase

Conductors in case of poly phase supply

Between phase R and phase Y .... Megohms

Between phase Y and phase B .... Megohms

Between phase B and phase R .... Megohms

(b) Polarity Test

Polarity of non linked single pole branch switches.

(c) Earth continuity test

Maximum resistance between any point in the earth continuity conductor

conductor including metal conduits and main earthing lead ..... Ohms

(d) Earth Electrode Resistance

(i) Ohms

(ii) Ohms

(iii) Ohms

(iv) Ohms

(e) Lighting Protective System

Resistance of the whole of lighting protective system to earth before any bonding is effected with earth electrode and met-1 in/on the structure ... Ohms

**Item No.17** Providing and Painting of typical Logo. Writing letter or figures on any surface with Thick White Paint Incl. stops, comas, hyphens etc as required) : Indian (Letters/figures). as per instruction of engg. In charge.

Providing and Painting of typical Logo. Writing letter or figures on any surface with Thick White Paint Incl. stops, comas, hyphens etc as required) : Indian (Letters/figures). as per instruction of engg. In charge.

Painting Specification As Per It.No.05

Rate includes carving the letters of scheme as directed for One No.as per LOGO

**Item No.18** Carrying out plinth treatment to post construction / existing structure by spraying chemical solution for termite control treatment including labour and material consistment with I.S.I specification. Using Chlordene and Chiorpurfiles 20 EC. As Per 6131\_paret- II Concentration Weight one percent is recommended i.e one litre 20 EC chemical emulsion with 19 liter give 1 % concntration inclusive of one litre chemical emulsion appication at the rate of 5 Litre chemical / Sqm of surface is recommended as per I.S

**1.0. Materials :** The chemicals used for the treatment shall be only one of the following with concentration shown against each in aqueous emulsion.

	<b>Chemicals</b>	<b>Concentration</b>
1.	Aldrin	0.50%(by weight)
2.	Heptachlor	0.50%(by weight)
3.	Chlordane	1.00%(by weight)

**2.0. Workmanship**

**2.1.** The chemicals barrier shall be complete and continuous under whole of the structure to be protected.

- 2.2.** The bottom and the sides of foundations up to a height of 30 cms. From the bottom excavation made for masonry foundation and for basement column pits shall be treated with the chemical emulsion at the rate 5 liters/ sq. meter. of the surface area.
- 2.3.** The chemical treatment, shall be carried out when the surfaces is quite dry. Chemical treatment shall not be carried out when it is raining or when the soil wet with rain or sub soil water.
- 2.4.** Once formed, treated soil barriers shall be not disturbed. If by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and compactness of the barrier system.
- 2.5.** The treatment against termite infection shall remain fully effective for a period not less than 10 years from date of issue of the final certificate to completion of work. If at any time during this period, any defects in treatment are revealed or any evidence of infection in any part of the building or structure is noticed, the contractor shall be rectify the concerned effects within 14 days. On receipt of notice from Engineer-in-charge. On contractor's failure to do the Engineer-in charge may get the same rectified through any other agency at contractor risk and cost. And decision of Engineer-in-charge as to the cost payable by contractor for the same shall be final and binding to the contractor.
- 2.6.** A guarantee bond on appropriately stamped paper shall be given by the contractor to the department in the manner and form prescribed below :

#### **FORM OF GUARANTEE BOND**

- I/We**.....(Contractor)hereby guarantee that work will remain unaffected and will not be in any way damaged by termite or any other germs of similar types, for a period for 10 years after completion of the work of anti termite as per the terms and conditions of the contract and or damage that might be caused on account of termite and or other similar type of germs and hereby Guarantees to make good any loss of damages suffered by the Government of Gujarat and further guarantee to redo effective work without claiming any extra cost."
- 2.7.** This guarantee shall remain in force for the period of 10 years from the completion of the work under the contract and it shall remain binding to the contractor for period of 10 years.
  - 2.8.** The deposit at the rate of 50 % of the cost of this item from the running and final bills shall be recovered and retained for the first one over after completion of the work and 10 % shall be retained for the balance of guarantee period and shall be refunded only after the completion of the guarantee period.

#### **3.0. Mode of measurements and payment**

- 3.1.** The length and breadth shall be measured correct to a cm. as per the dimensions of sanctioned plans. No deduction shall be made for extra paid for any opening for pipes etc up to 0.1 sq. mt. The rate shall include the cost of all labor and materials required for the operation involved for satisfactory completion of this item. The sides of the trenches 30 cms. Each side and bottom shall be measured under this item.
- 3.2.** The rate shall be for a unit of One square meter.

## **SPECIFICATION For Anti-Termite**

**Measures in Buildings, Part 2: Pre-constructional Chemical Treatment Measures [CED 13: Building Construction Practices including Painting, Varnishing and Allied Finishing]-**  
**Specifications shall apply as per IS 6313-2 (2001) ATTACHED**

**Item No.19** Carrying out wall treatment for termite control including spraying with chemical solution in oil base including labour and material Using Chlorpyrphos 20 ECAs per IS 6313 part - II (1% concentration by mass) is recommended i.e one litre chemical emulsion diluted with 19 liter oil base. Total solution will be 20 liters inclusive of one liter chemical emulsion application at the rate of 7.5 litre chemical / Sqm of surface is recommended as per I.S.

## **SPECIFICATION For Anti-Termite**

**Measures in Buildings, Part 2: Pre-constructional Chemical Treatment Measures [CED 13: Building Construction Practices including Painting, Varnishing and Allied Finishing]-**  
**Specifications shall apply as per IS 6313-2 (2001) ATTACHED**

**Item No.20** 20mm thick sand faced cement plaster on walls upto height 10 metres above ground level consisting of 12mm thick backing coat of C.M. 1:3 (1-cement : 3-sand) and 8mm thick finishing coat of C.M. 1:1 (1-cement : 1-sand) etc. complete.

### **1.0. Materials**

**1.1.** Water shall conform to M-1, Cement mortar shall conform to M-11.

### **2.0. Workmanship**

#### **Scaffolding :**

Wooden bullies, bamboos, planks trestles and other scaffolding shall be sound. These shall be properly examined before erection and use. Stage scaffolding shall be provided for ceiling plaster which shall be independent of the walls.

#### **2.2. Preparation of back ground :**

**2.2.1.** The surface shall be cleaned of all dust, loose mortar droppings, traces of algae, efflorescence and other foreign matter by water or by brushing if it is not hard and by hacking if it hard. In case of concrete surface, if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and the care shall be taken that none of the retarder is left on the surface. Trimming of projections on brick concrete surfaces where necessary shall be carried out to get an even surface.

**2.2.2.** Raking of joints in case of masonry where necessary shall be allowed to dry out for sufficient period before carrying out the plaster work.

**2.2.3.** The work shall not be soaked but only damped evenly before applying plaster. If the surface becomes dry such area shall be moistened again.

**2.2.4.** For external plaster, plastering operation shall be started from top floor and carried downwards. For internal plaster, the plastering operations may be started wherever the

building frame cladding work are ready and temporary supports of the ceiling resting on the wall of the floor have been removed . Ceiling plaster shall be completed before starting later to walls.

### **2.3. Application of plaster :**

**2.3.1.** The plaster about 15 x 15 cms. shall be first applied horizontally and vertically at not more than 2 meters intervals over the entire surface to serve as gauge. The surfaces of these gauges shall be truly in plane of the finished plastered surface. The mortar shall then be applied in uniform surface slightly more than the specified thickness, then brought to a true surface working a wooden straight edge reaching across the gauges with small upward and sideways movements at a time. Finally the surface shall be finished off trued with a trowel or wooden float according as a smooth or a smooth or a sandy granular texture is required. Excessive troweling or over working the float shall be avoided. All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering, corners, arises junctions etc. shall be carried out with proper templates to be size required.

**2.3.2.** Cement plaster shall be used within half an hour after addition of water. And mortar or plaster which is partially set shall be rejected and removed forthwith from the site.

**2.3.3.** In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically. When recommencing the plaster, the edges of the old work shall be scraped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and nearer than 15 cm. to any corners or arise. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakage. No portion of the surface shall be left out initially to be packed up later on.

**2.3.4.** Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficient. Soaking of walls shall be avoided side of building in hot air or dry weather shall be used, excessive evaporation on the sunny or windward side of building hot air or dry weather shall be prevented by hanging matting or gunny bags on the outside of the plaster and keeping them wet.

**2.1.** The work shall be carried out in the coats. The backing coat (base coat) shall be 12 mm. thick C.M. 1 :3. The relevant specifications of item No. 17.58(I shall be followed except that the thickness of back coat shall be 12 mm. average. Before the first coat hardens its surface shall be beaten up by edges of wooden tapers and close dents shall be made on the surface. The subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days. Depending upon the weather conditions. The surface shall not be allowed to dry during this period.

**2.2.** The second coat shall be completed to 8 mm. thickness in C.M. 1: 1 as described above including raising sand facing by bushing. The sample of sand face shall be got approved before the work is started. The whole work shall be carried out uniformly as per sample approved.

### **2.3. Curing :**

The curing shall be started overnight after finishing of plaster. The plaster shall be kept wet for a period 7 days. During this period, it shall be protected from all damages.

### **2.0. Mode of measurement and payment**

**3.1.** The rate shall include the cost of all materials, labor and scaffolding etc. involved in the operations described under workmanship.

- 3.2.** All plastering shall be measured in square meter unless otherwise specified. Length breadth or height shall be measured correct to a centimeter.
- 3.3.** Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooves or open joints in brick work, stone work etc. or space between laths. Thickness of plaster shall be average thickness with minimum 10 mm. at any point on this surface.
- 3.4.** The item includes plastering up to floor two level.
- 3.5.** The measurement of wall plastering shall be taken between the walls or partition(dimensions before plastering being taken)for length and from the top of floor or skirting to ceiling for height. Depth of cover of cornices if any shall be deducted.
- 3.6.** Soffits of stairs shall be measured as plastering on ceilings, following soffits shall be measured separately.
- 3.7.** For jambs, soffits, sills etc. for openings not exceeding 0.5 sq.mt. each in area for ends of joints beams, posts, girders, steps etc. not exceeding 0.5 sq. mt. each in area and for openings exceeding 0.5 sq. mt. and not exceeding 3.00 sq. mt. in each area deductions and additions shall be made in the following manners.
- (a) No deductions shall be made for ends of joints, beams, posts etc. and openings not exceeding 0.5 sq. mt. each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings, for finish to plaster around ends of joints, beams posts etc.
- (b) Deduction for openings exceeding 0.5 sq. mt. but not exceeding 3 sq. mt. each shall be made as follows and no addition shall be made for ravel, jambs, soffits, sills etc. of these openings.
- (i) When both faces of all wall are plastered with same plaster, deduction shall be made for one face only.
- (ii) When two faces of wall are plastered with different types of plasters or if one face is plastered and the other pointed, deductions shall be made from the plaster of pointing on the side of frame for door, window etc. on which width of reveals is less than that on the other side but no deductions shall be made on the other side. Where width of reveals on both faces of all are equal, deductions of 50 % of area of opening on each face shall be made from areas of plaster and/or pointing as the case may.
- 3.8.** For openings having door frames equal to or projecting beyond the thickness of wall, full deduction for opening shall be made from each plastered face of the wall.
- 3.9.** In case of openings of area above 3 sq. mt. each deduction shall be made for openings but jambs, soffits and sills shall be measured.
- 3.10.** The rate shall be for a unit of One sq. meter.
- 2.1.** The relevant specifications of item No. 17.58 shall be followed except that the sand face plaster on outside up to 10 m. above ground level shall be measured under this item.
- 2.2.** The rate shall be for a unit one sq. meter.

**Item No.21** Providing Septic tank of size 2.50mtr x 1.50mt x 1.50mt I/I dimension with 0.23mtr thick walls including plastering and filling with brick bats with top slab in CC 1:2:4 (1-cement:2-sand:4-coarse aggregate) including centreing and shuttering and reinforcement and etc complete.

1.0. Materials : Water shall conform to M-1, Cement mortar conform to M-11, Burnt Bricks shall conform to M-15, R.C.C. stone slab 0.12 mm. thick shall conform to M-48, Brick bat shall conform to M-14.

2.0. Workmanship

- 2.1. The excavation for soak pit shall be carried out as per relevant specification of item 4.00.1.(A) except that the size of soak pit such that the clear volume shall remain 2 cum. The diameter and depth shall be as directed.
  - 2.2. The periphery of the soak pit shall be provided with dry masonry wall with burnt brick in 23 cms. thick. The masonry wall shall be done with best workman like manner in true line and plumb.
  - 2.3. The soak pit shall be filled in with brick bats of burn brick 40 mm. nominal size in 45 cms. Height. The work of filling brick bats shall be done in such a way that no dry masonry shall be damaged during filling of brickbats.
  - 2.4. The top of the soak pit shall be covered with rough kotah stone slab 40 to 50 mm. thickness. The length of the stone shall be in single piece in length.
  - 2.5. The cement mortar 1 : 3 shall be used to fill up the joints and preparing vata as directed.
  - 2.6. The cement work shall be cured 4 days.
  - 3.0. Mode of measurements and payment
  - 3.1. The rate includes costs of all labor and material required for satisfactory completion of this item as described above.
  - 1.0. Materials and workmanship
- The relevant specifications of item 24.00.2(A) shall be followed except that the volume of soak pit shall be 5 cum. Clear.
- 3.0. Mode of measurements and payment
  - 2.1. The relevant specifications of item 24.00.2(A) shall be followed.
  - 2.2. The rate shall be for a unit of One number

**Item No.22 White Stone Bela masonry block in course in superstructure with stone of approved quality in Lime Mortar 1:5 (1-Cement :5- coarse sand) including packing the joints etc. complete.**

## **Materials**

The relevant specification of shall be followed except that the proportion of mortar shall be in C.M. 1 : 5 (1 cement : 5 coarse sand).

- 1.1. The stone or bela shall be white hard stone or block. The stone shall be sound hard rough and durable. It shall be free from skin. The thickness of bela or block shall not be less than 15 cms. or as directed. The mortar used shall consist. One part of lime putty and 1.5 parts of fine sand. Lime mortar shall conform to M-10.

## **2.0. Workmanship**

- 2.1. Dressing of stone :  
Stone shall be chiseled on all the side so that all six sides shall be in a rectangular shape and all the stones shall be so dressed that the bushing of the exposed face shall not be as per thickness of the wall to be constructed or as directed.
- 2.2. Laying :

All the stone shall be sufficiently wetted before laying to prevent absorption of water from mortar. All connected walls in a structure shall normally be raised up uniformly and regularly. The vertical joint shall not be allowed and also it shall not be more than 12 mm. in thickness.

**.3.** Proper bonding shall be made by laying bela or block side by side each other with lime mortar on bed as well as in between two bela or block vertically.

**.4.** Bond stones :

Bond stones or through stones running right across the thickness of the wall shall be provided in walls up to 450 mm. thick. In thicker walls two bela or blocks or laying each other by at least 150 mm. each other shall be provided across the thickness of the wall to bond stone. Such bond stone shall be at least one for every 1.0 sq. mt. area of the wall surface.

**.5. Joints :**

All the joints shall be completely filled up with mortar and their thickness shall not exceed by 12 mm. When plastering or pointing is not required to be done, the joints shall be struck flush and finished, simultaneously while laying the stone. Otherwise the joints shall be raked to a minimum depth of 20 mm. during process laying while mortar is still green.

**.6. Scaffolding :**

Single or double scaffolding shall be used. It shall be strong and sound. The holes left in masonry for supporting shall be made good before plastering.

**.7. Curing :**

Green work shall be cured for a period of 7 days continuously.

**3.0. Mode of measurement & Payment**

**3.1.** The work shall be measured on the basis of finished dimensions. No deduction shall be made nor extra payment shall be made for the following :

(a) Ends of joint, beams, posts, girders, rafters, purlins corbels etc., each up to 500 sq. cms. in section (b) Opening each up to 0.10 sq. m. (c) Small plates and bed plates, bearing or chhajjas and like up to 10 cms. depth (bearing or floor and roof shall be deducted from masonry). (d) Drain holes and recesses for cement concrete blocks to embedded hold fasts of one cubic meter.

**Item No.23** **Marble Slab Polished marble stone Rajnagar Makarana 20mm size 60 x 45 cms.**

**M-51 Marble Slab**

**51.1.** Marble slab shall be white or of other and of best quality as approved by the Engineer in charge.

**51.2.** Slabs shall be hard, close, uniform and homogeneous in texture. They shall have even crystalline grain and free from defects and cracks. The surface shall be machine polished to an even and perfect plane surface and edges machine cut true and square. The rear face shall be rough to provide key for the mortar.

**51.3.** Marble slabs with natural veins, if selected shall have to be laid as per the pattern given by the Engineer in charge. Size of the slab shall be minimum. 460 mm. x 450 mm. and preferably 600 mm. x 600 mm. However smaller sizes will be allowed to be used to the extent of maintaining required pattern.

**51.4.** The slab shall not be thinner than the specified thickness at its thinnest part. A few specimen of finished slab to be used shall be deposited by the Contractor in the officer for reference.

**51.5.** Except as above the marble slab shall conform to I.S. 1130-1969.

**51.6 Mode of measurements & payment.**

The rate shall include the cost of all materials and labor involved in all the operations described above.

The rate shall be for a unit of **one sq. meter**.

**\*\*\*\*\*THE END\*\*\*\*\***

# इंटरनेट

# मानक

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

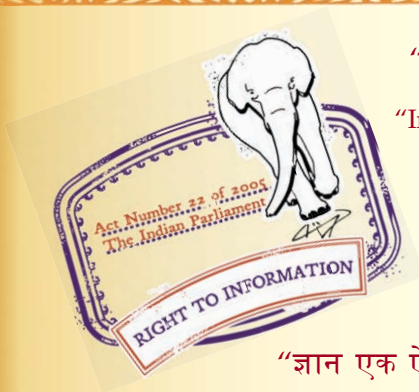
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 14587 (1998): Prelaminated medium density fibre board  
-Specification [CED 20: Wood and other Lignocellulosic  
products]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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Reaffirmed 2009

IS 14587 : 1998

**भारतीय मानक**

**मध्यम घनत्व के पूर्व-लेमिनेटिड  
फाइबर बोर्ड — विशिष्टि**

*Indian Standard*

**PRELAMINATED MEDIUM DENSITY FIBRE  
BOARD — SPECIFICATION**

ICS 79.060.20

© BIS 1998

**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

September 1998

Price Group 6

**AMENDMENT NO. 1 DECEMBER 1999**  
**TO**  
**IS 14587 : 1998 PRELAMINATED MEDIUM DENSITY**  
**FIBRE BOARD — SPECIFICATION**

[ *Page 4, Table 1, Sl No. (1.8)* ] — Substitute the following for the existing:

'1.8 Abrasion resistance ( *Min* ), in number of revolutions:

a) Type I	1 000	1 000
b) Type II	450	450
c) Type III	250	250
d) Type IV	75	75'

( CED 20 )

**AMENDMENT NO. 2 AUGUST 2000  
TO  
IS 14587 : 1998 PRELAMINATED MEDIUM DENSITY  
FIBRE BOARD — SPECIFICATION**

*( Page 2, clause 8 ) — Substitute 'IS 12406' for 'IS 12049'.*

*( Page 5, Annex A ) — Delete the following:*

*'IS 12049 : 1987 Dimensions and tolerances relating to wood based panels'.*

**( CED 20 )**

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**Reprography Unit, BIS, New Delhi, India**

**AMENDMENT NO. 3 MARCH 2005  
TO  
IS 14587 : 1998 PRELAMINATED  
MEDIUM DENSITY FIBRE BOARD —  
SPECIFICATION**

[ *Page 2, clause 9.2(e)* ] — Substitute the following for the existing:

- c) For Determination of Modulus of Rupture (MOR) and Modulus of Elasticity (MOE)*

Three test specimens each for MOR and MOE from each sample as specified in IS 2380 (Part 4)

( *Page 3, clause 10.6* ) — Substitute the following for the existing:

**10.6 Test for Modulus of Rupture and Modulus of Elasticity**

The modulus of rupture and modulus of elasticity shall be determined for each test specimen in accordance with the method prescribed in IS 2380 (Part 4) and the average and minimum individual values shall not be less than the requirements laid down in items 1.4 and 1.5 of Table 1.'

( *Page 4, clause 11.1* ) — Insert the following after 11.1(d):

- 'e) One side laminated (OSL) or both side laminated (BSL).'

**Amend No. 3 to IS 14587 : 1998**

[ Page 4, Table 1 (see also Amendment No. 1) ] — Substitute the following for the existing table:

**Table 1 Physical and Mechanical Properties**  
(Clauses 10.2, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9 and 10.10)

Properties	Requirements	
	Grade I	Grade II
1.1 Density variation ( <i>Max</i> ), percent	±10	±10
1.2 Water absorption ( <i>Max</i> ), percent:		
a) 2 h	6	9
b) 24 h	12	18
1.3 Thickness swelling ( <i>Max</i> ), percent, 2 h	4	7
1.4 Modulus of rupture ( <i>Min</i> ), N/mm <sup>2</sup> :		
a) Up to 20 mm thickness:		
Average	28	28
Minimum individual	25	25
b) Above 20 mm thickness:		
Average	25	25
Minimum individual	22	22
1.5 Modulus of elasticity, N/mm <sup>2</sup> :		
a) Up to 20 mm thickness:		
Average	2 800	2 800
Minimum individual	2 500	2 500
b) Above 20 mm thickness:		
Average	2 500	2 500
Minimum individual	2 300	2 300
1.6 Tensile strength perpendicular to surface, N/mm <sup>2</sup> :		
a) Up to 20 mm thickness:		
Average	0.9	0.8
Minimum individual	0.8	0.7
b) Above 20 mm thickness:		
Average	0.8	0.7
Minimum individual	0.7	0.6

Amend No. 3 to IS 14587 : 1998

1.7 Tensile strength perpendicular to surface, N/mm <sup>2</sup> : a) After cyclic test <sup>1)</sup> Average Minimum individual b) After accelerated water resistance <sup>2)</sup> Average Minimum individual	0.45 0.40  0.30 0.25	— —  — —
1.8 Screw withdrawal strength (Min), N: a) Face b) Edge	1 500 1 250	1 500 1 250
1.9 Abrasion resistance (Min), in number of revolutions: a) Type I b) Type II c) Type III d) Type IV	1 000 450 250 75	1 000 450 250 75
<sup>1)</sup> Cyclic Test — Specimens are immersed in water at 27 ± 2°C for a period of 72 h, followed by drying in air at 27 ± 2°C for 24 h and then heating in dry air at 70°C for 72 h. Three such cycles are to be followed and the specimens are tested for tensile strength perpendicular to the surface. <sup>2)</sup> Accelerated Water Resistance Test — Specimens are immersed in water at 27 ± 2°C and water is brought to boiling and kept at boiling temperature for 2 h. Specimens are then cooled in water to 27 ± 2°C and tested for tensile strength perpendicular to the surface.		

**AMENDMENT NO. 4 AUGUST 2005**  
**TO**  
**IS 14587 : 1998 PRELAMINATED MEDIUM DENSITY**  
**FIBRE BOARD — SPECIFICATION**

( *Second cover page, Foreword* ) — Insert the following matter after fourth para:

'A scheme of labelling environment friendly products to be known as ECO Mark has been introduced at the instance of the Ministry of Environment and Forests (MEF), Government of India. The ECO Mark shall be administered by the Bureau of Indian Standards (BIS) under *BIS Act*, 1986 as per the Resolution No. 71 dated 21 February 1991 and Resolution No. 425 dated 28 October 1992 published in the Gazette of the Government of India. For a product to be eligible for ECO Mark, it shall also carry the Standard Mark of the BIS besides meeting additional environment friendly requirements. For this purpose, the Standard Mark of BIS would be a single mark being a combination of the ISI Mark and the ECO Logo. Requirements to be satisfied for a product to qualify for BIS Standard Mark for Eco friendliness will be optional. Manufacturing units will be free to opt for ISI Mark alone also.

The Eco criteria is based on the Gazette Notification No. 170 dated 18 May 1996 for Wood Substitutes as Environment Friendly Products published in the Gazette of Government of India.'

( *Page 1, clause 5.1* ) — Insert the following at the end of the clause:

'For ECO Mark, the medium density fibre board shall also confirm to the requirement of ECO Mark specified in IS 12406.'

( *Page 4, clause 10.14* ) — Insert the following new clauses after 10.14 and renumber the subsequent clauses:

**'11 OPTIONAL REQUIREMENT FOR ECO MARK**

**11.1 General Requirement**

11.1.1 Prelaminated medium density fibre board shall confirm to the requirement of quality and performance as specified in this standard.

**Amend No. 4 to IS 14587 : 1998**

**11.1.2** The manufacturer shall produce to BIS environment consent clearance from State Pollution Control Board as per the provisions of the *Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Cess Act, 1977* along with the authorization, if required under the *Environment (Protection) Act, 1986* while applying for ECO Mark appropriate with enforced Rules and Regulations of Forest Department.

**11.2 Specific Requirement**

Prelaminated medium density fibre board shall confirm to the specific requirement given for ECO Mark under relevant clauses of the standard.

NOTE — The manufacturer shall provide documentary evidence by way of certificate or declaration to Bureau of Indian Standards, while applying for ECO Mark.'

[ Page 4, clause 11.1 (renumbered 12.1) ] — Insert the following at the end of the clause:

- 'e) The criteria for which the prelaminated medium density fibre board has been labelled as ECO Mark.'

( CED 20 )

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Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 5 SEPTEMBER 2006  
TO  
IS 14587 : 1998 PRELAMINATED MEDIUM  
DENSITY FIBRE BOARD —  
SPECIFICATION**

*[Page 4, clause 11, Title (see also Amendment No. 4)] — Substitute  
'ADDITIONAL' for 'OPTIONAL'.*

( CED 20 )

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Reprography Unit, BIS, New Delhi, India

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Wood Products Sectional Committee had been approved by the Civil Engineering Division Council.

As the prelaminated medium density fibre boards are being manufactured and extensively used in our country, the need for this standard was felt to guide the manufacturers and the users. Prelaminated medium density fibre board is a medium density fibre board laminated on both surfaces by synthetic resin impregnated base papers with or without impregnated overlay under the influence of heat and pressure.

This standard classifies a prelaminated medium density fibre board into two grades, namely, Grade I and Grade II for use in humid and dry locations respectively. Each grade consists of four types, Type I, Type II, Type III and Type IV depending upon the abrasion resistance of the prelaminated surface. Type I is useful for flooring application. Type II is useful for horizontal applications like cash counters and restaurant table tops. Type III is useful for normal horizontal applications like office table tops and domestic furniture tops. Type IV is useful for vertical applications like panelling and partitioning and for false ceilings.

In the formulation of this standard due weightage has been given to international coordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

The composition of technical committee responsible for the formulation of this standard is given at Annex G.

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.

## *Indian Standard*

# PRELAMINATED MEDIUM DENSITY FIBRE BOARD — SPECIFICATION

## 1 SCOPE

This standard covers the requirement of prelaminated medium density fibre board for general purposes and also for special applications.

## 2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this 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 agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

## 3 TERMINOLOGY

3.1 For the purpose of this standard, the following definitions shall apply, and for definitions other than those given below, reference may be made to IS 707.

### 3.2 Prelaminated Medium Density Fibre Board

A medium density fibre board laminated on both surfaces by synthetic resin impregnated base papers with or without impregnated overlay under the influence of heat and pressure.

### 3.3 Base Paper

A printed or plain coloured absorbant paper normally having a weight of 60-140 g/m<sup>2</sup>.

### 3.4 Impregnated Base Paper

A base paper, printed or plain coloured, impregnated in any suitable synthetic resin and dried to a volatile content of 4 to 8 percent.

### 3.5 Overlay Paper

A highly absorbant tissue paper having a weight of 18-40 g/m<sup>2</sup>.

### 3.6 Impregnated Overlay

An overlay paper impregnated in any suitable synthetic resin and dried to a volatile content of 4 to 8 percent.

## 4 GRADES AND TYPES

4.1 Prelaminated medium density fibre board shall be of two grades, namely Grade I and Grade II corresponding to IS 12406.

4.2 Each of the grades specified in 4.1 shall be of

four types, namely, Type I, II, III and IV classified by the surface abrasion characteristics specified in Item 1.8 of Table 1.

4.3 The grades and types of prelaminated medium density fibre boards shall be represented by symbols as follows:

Grade and Type		Designation
Grade I	Type I	PLMDF - 11
	Type II	PLMDF - 12
	Type III	PLMDF - 13
	Type IV	PLMDF - 14
Grade II	Type I	PLMDF - 21
	Type II	PLMDF - 22
	Type III	PLMDF - 23
	Type IV	PLMDF - 24

## 5 MATERIALS

### 5.1 Medium Density Fibre Board

Synthetic resin bonded medium density fibre board used for the manufacture of prelaminated medium density fibre board shall conform to IS 12406.

### 5.2 Impregnated Base Paper

Printed or plain coloured absorbant base paper having a weight of 60-140 g/m<sup>2</sup> impregnated in a suitable synthetic resin and dried to a volatile content of 4-8 percent shall be used for prelamination on both surfaces of medium density fibre board.

### 5.3 Impregnated Overlay

An absorbant tissue paper having a weight of 18-40 g/m<sup>2</sup> impregnated in a suitable synthetic resin and dried to a volatile content of 4-8 percent, shall be used for prelaminations on both surfaces of medium density fibre board.

## 6 MANUFACTURE

6.1 Medium density fibre board having a dense, compact, homogenous construction with super smooth surface is used for making prelaminated medium density fibre boards. Impregnated base papers rich in synthetic resin are placed on either side of the medium density fibre board and the assembly is taken inside a short cycle single opening lamination press or a multidaylight press. Under heat and pressure the resin flows and forms a permanent bond with the medium density fibre board.

The top surface of impregnated paper comes in contact with special surfaced chromium plates or steel caul

plates and takes the impression of surface finish of these cauls. Hot boards are extracted out of the short cycle press and cooled in air, whereas cooling of boards is done inside the press in multidaylight type. Care shall be taken to keep cycle times low in the press to avoid heat penetration to the centre of the board edge.

6.1.1 The impregnated overlay paper may be used by placing it over the impregnated base paper (IBP) on one surface while using a normal IBP on the other surface and pressed under the influence of heat and pressure. The impregnated overlay becomes transparent after pressing. Such boards are used for high surface abrasion applications.

## 7 FINISH

The finish of the paper overlaid board depends on the surface of caul plates used. Common surface finishes in use are glossy, matt textured (soft, swede, wood pore and leather), etc.

## 8 DIMENSIONS AND TOLERANCES

Dimensions and tolerances shall conform to IS 12049.

NOTE — Any other dimension as agreed to between the manufacturer and the purchaser may be used.

## 9 SAMPLING AND INSPECTION

### 9.1 Scale of Sampling

#### 9.1.1 Lot

In any consignment, all the prelamated medium density fibre boards of the same grade, type and dimensions, and manufactured under similar conditions of production, shall be grouped together to constitute a lot.

9.1.1.1 The conformity of a lot to the requirements of this specification shall be ascertained on the basis of tests of prelamated medium density fibre boards selected from it.

9.1.2 The number of prelamated medium density fibre boards to be selected from a lot shall be as follows:

Lot Size <i>N</i>	Number of Prelaminated Medium Density Fibre Boards to be Selected <i>n</i>
Up to 50	2
51 to 100	3
101 to 200	4
201 to 300	5
301 to 500	7
501 and above	10

9.1.2.1 These prelamated medium density fibre boards shall be selected at random (see IS 4905). In order to ensure randomness of selection, all the

prelamated medium density fibre boards in the lot may be arranged in a serial order and every *r*th prelamated medium density fibre board may be selected till the required number is obtained, *r* being the integral part of  $N/n$ , where *N* is the lot size and *n* is the sample size.

9.1.3 All boards selected as in 9.1.2.1, when tested as specified in IS 2380 (Part 2) for length, width, thickness, edge straightness and squareness, shall comply with the requirements specified under 8.

### 9.2 Test Specimens and Number of Tests

From each of the prelamated medium density fibre board selected as in 9.1.2.1 following test specimens shall be cut out from portions 150 mm away from the edges for tests as specified in 10 and conditioned as specified in IS 2380 (Part 1).

#### a) For Determination of Density

Three test specimens 75 mm wide and 150 mm long, in full thickness of board from each sample. Other sizes of specimens may be used when deemed necessary.

#### b) For Determination of Moisture Content

Three test specimens 75 mm wide and 150 mm long, in full thickness of board from each sample. Smaller specimens may be used when deemed necessary.

#### c) For Water Absorption Test

Three test specimens of size 300 mm × 300 mm in full thickness of board from each sample.

#### d) For Swelling in Water Test

Three test specimens of size 200 mm × 100 mm in full thickness of board from each sample.

#### e) For Determination of Modulus of Rupture

Three test specimens from each sample as specified in IS 2380 (Part 4).

#### f) For Determination of Tensile Strength Perpendicular to Surface

Three test specimens of size 50 mm × 50 mm in full thickness of board from each sample.

#### g) For Determination of Tensile Strength Perpendicular to Surface After Ageing Test

Three test specimens of size 50 mm × 50 mm in full thickness of board from each sample.

#### h) For Determination of Screw Withdrawal Strength

Three test specimens from each sample of size as specified in IS 2380 (Part 14).

#### j) For Determining the Resistance to Abrasion

Three test specimens of size about 130 mm

diameter or a square of about 120 mm with its corners rounded to give a diagonal of about 130 mm in full thickness of board from each sample.

- k) *For Determining the Resistance to Steam*  
Three test specimens of size 100 mm × 100 mm in full thickness of board from each sample.
- m) *For Determining the Resistance to Crack*  
Three test specimens of size 100 mm × 100 mm in full thickness of board from each sample.
- n) *For Determining the Resistance to Cigarette Burn*  
Three test specimens of size 200 mm × 100 mm in full thickness of board from each sample.
- p) *For Determining the Resistance to Stain*  
Three test specimens of size 75 mm × 25 mm in full thickness of board from each sample.

### 9.3 Criteria for Conformity

A lot shall be considered as conforming to the requirements of the specifications, if no group of test specimens for any of the characteristics fails to meet the conditions as prescribed in 8 and 10.

9.3.1 In case of a failure, double samples shall be taken from the lot for testing. The lot shall be considered to have passed if all these samples conform to the specified requirements.

## 10 TESTING OF SAMPLES

10.1 The test specimens shall be tested as given in 10.2 to 10.14 and shall conform to the requirements as prescribed in respective clauses.

### 10.2 Test for Density

The density of the board shall be determined for each test specimen in accordance with the method prescribed in IS 2380(Part 3), and the average value shall be between 500 and 900 kg/m<sup>3</sup> and the variations in the board shall comply with the requirements specified in Table 1.

### 10.3 Test for Moisture Content

The moisture content for each test specimen shall be determined in accordance with the method prescribed in IS 2380 (Part 3) and the average value shall lie between 5 percent and 15 percent.

### 10.4 Test for Water Absorption

The water absorption shall be determined for each test specimen in accordance with the method prescribed in IS 2380(Part 16) and the average value

shall not exceed the limits specified in Item 1.2 of Table 1.

### 10.5 Test for Swelling in Water

The swelling in thickness shall be determined for each test specimen in accordance with the method prescribed in IS 2380 (Part 17) for 2 hours soaking in water and the average value shall not exceed the limits specified in item 1.3 of Table 1.

### 10.6 Test for Modulus of Rupture

The modulus of rupture shall be determined for each test specimen in accordance with the method prescribed in IS 2380 (Part 4) and the average value shall not be less than the requirement laid down in Item 1.4 of Table 1.

### 10.7 Test for Tensile Strength Perpendicular to Surface

Tensile strength perpendicular to surface shall be determined for each test specimen in accordance with the method prescribed in IS 2380 (Part 5) and the average value shall not be less than the values specified in 1.5 of Table 1.

### 10.8 Test for Tensile Strength Perpendicular to Surface After Ageing

Tensile strength perpendicular to surface shall be determined for each test specimen in accordance with the method prescribed in IS 2380 (Part 5) after subjecting the specimens to the ageing test, namely, cyclic test or accelerated water resistance test as prescribed in Table 1. The average value shall not be less than the values specified in item 1.6 of Table 1.

### 10.9 Test for Screw Withdrawal Strength

The screw withdrawal strength shall be determined for each test specimen as prescribed in IS 2380 (Part 14). The average value shall not be less than the values specified in item 1.7 of Table 1.

### 10.10 Test for Surface Abrasion Resistance

The abrasion resistance shall be determined for each test specimen in accordance with the method prescribed in Annex B and shall comply with the requirements specified in item 1.8 of Table 1.

### 10.11 Test for Resistance to Steam

The resistance to steam shall be determined for each test specimen in accordance with the method prescribed in Annex C and the specimen shall not show any sign of blister, delamination or change in surface finish. There may be slight colour change in dark colours/patterns.

### 10.12 Test for Resistance to Crack

The resistance to crack shall be determined for each

test specimen in accordance with the method prescribed in Annex D and the specimen shall not show any sign of cracks or delamination.

10.13 Test for Resistance to Cigarette Burn

The resistance to cigarette burn shall be determined for each test specimen in accordance with the method prescribed in Annex E and the specimen shall not leave any mark or stain on the specimen after cleaning with water or solvent.

10.14 Test for Resistance to Stain

The resistance to stain shall be determined for each test specimen in accordance with the method prescribed in Annex F and the specimen shall not leave any stain on the specimen after cleaning with water, solvent or detergent.

11 MARKING

11.1 Each prelaminated medium density fibre board

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

- a) Name of the manufacturer or trade-mark,
- b) Grade and type of prelaminated medium density fibre board,
- c) Thickness, and
- d) Batch number and year of manufacture.

11.2 BIS Certification Marking

The prelaminated medium density fibre boards may also be marked with the Standard Mark.

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

Table 1 Physical and Mechanical Properties  
(Clauses 10.2, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9 and 10.10)

Properties	Requirements	
	Grade I	Grade II
1.1 Density variation ( <i>Max</i> ), percent	±10	±10
1.2 Water absorption ( <i>Max</i> ), percent:		
a) 2 hours	6	9
b) 24 hours	12	18
1.3 Thickness swelling ( <i>Max</i> ), percent, 2 hours	4	7
1.4 Modulus of rupture ( <i>Min</i> ), N/mm <sup>2</sup> :		
a) Up to 20 mm thickness	28	28
b) Above 20 mm thickness	25	25
1.5 Tensile strength perpendicular to surface ( <i>Min</i> ), N/mm <sup>2</sup> :		
a) Up to 20 mm thickness	0.8	0.7
b) Above 20 mm thickness	0.7	0.6
1.6 Tensile strength perpendicular to surface ( <i>Min</i> ), N/mm <sup>2</sup> :		
a) After cyclic test <sup>1)</sup>	0.4	—
b) After accelerated water resistance test <sup>2)</sup>	0.25	—
1.7 Screw withdrawal strength ( <i>Min</i> ), N:		
Face	1 500	1 500
Edge	1 250	1 250
1.8 Abrasion resistance ( <i>Min</i> ), in number of revolutions:		
a) Type I	450	450
b) Type II	250	250
c) Type III	80	80
d) Type IV	75	75

<sup>1)</sup>Cyclic Test — Specimens are immersed in water at 27 ± 2°C for a period of 72 hours, followed by drying in air at 27 ± 2°C for 24 hours and then heating in dry air at 70°C for 72 hours. Three such cycles are to be followed and then specimens are tested for tensile strength perpendicular to the surface.

<sup>2)</sup>Accelerated Water Resistance Test — Specimens are immersed in water at 27 ± 2°C and water is brought to boiling and kept at boiling temperature for 2 hours. Specimens are then cooled in water to 27 ± 2°C and tested for tensile strength perpendicular to the surface.

**ANNEX A**  
(Clause 2)  
**LIST OF REFERRED INDIAN STANDARDS**

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
324 : 1959	Ordinary denatured spirit ( <i>revised</i> )	(Part 5) : 1977	Determination of tensile strength perpendicular to surface ( <i>first revision</i> )
707 : 1976	Glossary of terms applicable to timber technology and utilization ( <i>second revision</i> )	(Part 14) : 1977	Screw and nail withdrawal test ( <i>first revision</i> )
1500 : 1983	Method for Brinell hardness test for metallic materials ( <i>second revision</i> )	(Part 16) : 1977	Determination of water absorption ( <i>first revision</i> )
2380	Methods of test for wood particle boards and boards from other lignocellulosic materials	(Part 17) : 1977	Determination of swelling in water ( <i>first revision</i> )
(Part 1) : 1977	Preparation and conditioning of test specimens ( <i>first revision</i> )	3400	Methods of test for vulcanized rubber : Part 2 Hardness ( <i>second revision</i> )
(Part 2) : 1977	Accuracy of dimensions of boards ( <i>first revision</i> )	(Part 2) : 1995	
(Part 3) : 1977	Determination of moisture content density ( <i>first revision</i> )	4905 : 1968	Methods for random sampling
(Part 4) : 1977	Determination of static bending strength (modulus of rupture and modulus of elasticity in bending) ( <i>first revision</i> )	12049 : 1987	Dimensions and tolerances relating to wood based panel materials
		12406 : 1988	Specification for medium density fibre boards for general purposes

**ANNEX B**  
(Clause 10.10)

**METHOD OF TEST FOR DETERMINING SURFACE ABRASION RESISTANCE**

**B-1 PRINCIPLE**

The test measures the ability of the decorative surface of the sheet under test to resist abrasive wear-through to the sublayer. Abrasion is achieved by rotating a specimen in contact with a pair of loaded cylindrical wheels covered with abrasive paper. The wheels are positioned so that their cylindrical faces are equidistant from the specimen's axis of rotation but not tangential to it. As they are turned by the rotating specimen, they abrade an annular track on the specimen's surface. The number of revolutions of the specimen required to cause a defined degree of abrasion is used as a measure of resistance to surface wear.

**B-2 MATERIALS**

**B-2.1 Calibration Plates of Rolled Zinc Sheet**

Calibration plates of rolled zinc plate shall have a thickness of  $0.8 \pm 0.1$  mm and a Brinell hardness of  $48 \pm 2$  BHN when tested in accordance with IS 1500 except that the ball diameter shall be 5 mm and the load 360 N.

**B-2.2 Abrasive Paper Strips**

Abrasive paper strips shall be of 12.7 mm width and

about 160 mm length, having the following composition:

- a) Paper of grammage 70 g/m<sup>2</sup> to 100 g/m<sup>2</sup>;
- b) Powdered aluminium oxide having a particle size that it will pass through a sieve of aperture 100  $\mu$ m and remain on a sieve having an aperture of 63  $\mu$ m; and
- c) Adhesive backing (optional).

**B-2.3 Double-Sided Adhesive Tape**

Double-sided adhesive tape shall be required only if the abrasive paper has no adhesive backing.

**B-3 APPARATUS**

**B-3.1 Testing Machine**

The testing machine shall be consisting of the items given in B-3.1.1 to B-3.1.5 (see Fig. 1).

**B-3.1.1 Specimen Holder**

The specimen holder shall be in the form of a disc (7) which rotates in a horizontal plane at a frequency of 58 rev/min to 62 rev/min and to which the test specimen (6) can be clamped flat (4/5).

**B-3.1.2 Abrasive Wheels (3)**

Abrasive wheels shall be two cylindrical rubber-covered wheels of 12.7 mm width and 50 mm diameter which rotate freely about a common axis. The curved surface of the wheels to a depth of 6 mm, shall be of rubber (2) of hardness 50 to 55 TRHD when tested according to IS 3400 (Part 2). The inside faces of the wheels shall be 50 mm to 55 mm apart, and their common axis shall be 20 mm from the vertical axis of the specimen holder. The wheels shall be positioned symmetrically in a plane containing the axis of the specimen holder.

**B-3.1.3 Holding and Lifting Device (8)**

Holding and lifting device for the abrasive wheels, shall be so constructed that each wheel exerts a force of  $5.4 \pm 0.2$  N on the test specimen.

**B-3.1.4 Revolution Counter****B-3.1.5 Suction Device**

Suction device shall be so fitted that two nozzles are over the abraded section of the specimen under test. One nozzle shall be situated between the wheels, the other diametrically opposite. The centres of the nozzles shall be 77 mm apart and 1 mm to 2 mm from the surface of the test specimen. When the nozzles are closed, there shall be a vacuum of  $1.5 \times 10^{-3}$  N/mm<sup>2</sup> to  $1.6 \times 10^{-3}$  N/mm<sup>2</sup>.

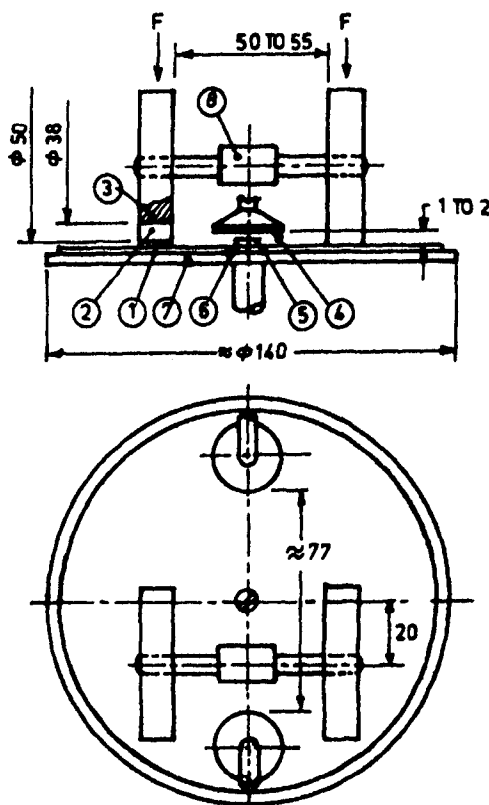


FIG. 1 TYPE OF APPARATUS FOR MEASURING ABRASION RESISTANCE

**B-3.2 Conditioning Chamber**

Conditioning chamber shall be capable of maintaining a standard atmosphere of  $27 \pm 2^\circ\text{C}$  and relative humidity of  $65 \pm 5$  percent.

**B-4 TEST SPECIMENS**

Each test specimen shall be a piece of the sheet under test, shaped to fit the type of clamping device used. It will usually be a disc of diameter about 130 mm, or a square of about 120 mm with its corners rounded to give a diagonal of about 130 mm and it will usually have a hole of diameter 6 mm in its centre. Three specimens shall be prepared.

**B-5 PREPARATION OF TEST SPECIMENS AND ABRASIVE PAPER**

Clean the surface of the test specimens with an organic solvent which is immiscible with water, for example, trichloroethane. Precondition the test specimens and the abrasive strips for at least 72 h in the conditioning atmosphere (see B-3.2) before testing.

**B-6 PROCEDURE****B-6.1 Preparation of Abrasive Wheels**

Bond a strip of preconditioned abrasive paper (see B-2.2) to each of the rubber-covered wheels using either the adhesive backing, if present, or the double-sided adhesive tape (see B-2.3), in such a way that the cylindrical surface is completely covered, but without any overlapping of the abrasive paper (see Fig. 1).

**B-6.2 Calibration of Abrasive Paper**

Prepare two abrasive wheels with unused strips of abrasive paper from the batch to be used for testing (see B-6.1).

Clamp a zinc plate (see B-2.1) in the specimen holder (see B-3.1.1), operate the suction device (see B-3.1.5), and abrade the zinc plate for 500 revolutions. Wipe the zinc plate clean and weigh to the nearest 1 mg. Replace the abrasive paper on the wheels with unused strips from the same batch, clamp the same zinc plate in the specimen holder, lower the abrasive wheels and operate the suction device. Abrade the zinc plate for a further 500 revolutions, then wipe it clean and reweigh it to the nearest 1 mg. Its loss in mass shall be  $130 \pm 20$  mg.

Any batch of abrasive paper which causes a loss in mass of the zinc plate outside this permitted range shall not be used for testing.

**B-6.3 Abrasion of Test Specimen**

Perform the test immediately after removal of the test specimen and calibrated abrasive paper from the preconditioning atmosphere.

Prepare sufficient abrasive wheels for the test using

previously unused abrasive paper. Fit two wheels to the machine and set the revolution counter to zero. Clamp the specimen in the holder, ensuring that its surface is flat. Lower the abrasive wheels on to the specimen, operate the suction device and allow the specimen to rotate. Examine the specimen for wear after each 25 revolutions and examine the abrasive paper for clogging with abraded particles. Replace the abrasive paper if becomes clogged, or after 500 revolutions, whichever happens first. Continue the test in this way until the final wear point is reached, that is, till the fibre board surface

is visible in 95 percent of the abraded area. Record the number of revolutions withstood by the specimen to reach the final point.

## **B-7 EXPRESSION OF RESULTS**

The wear resistance, expressed in revolutions, for each specimen shall be half the number of revolutions recorded for the final wear point.

The wear resistance of the sample under test shall be the average of the values obtained on the three test specimens, rounded to the nearest 25 revolutions.

## **ANNEX C** (Clause 10.11)

### **METHOD OF DETERMINING SURFACE RESISTANCE TO STEAM**

#### **C-0 GENERAL**

This test determines the surface resistance of prelaminated medium density fibre board against contact with steam atmospheric pressure.

#### **C-1 NUMBER OF TEST PIECES**

Three specimens shall be used for each test.

#### **C-2 SPECIMEN SIZE**

Specimen of size 100 mm × 100 mm in full thickness shall be used.

#### **C-3 PREPARATION OF SAMPLE**

The test specimen shall be cut to the required size from the sample board, 150 mm away from the corner of the edge. The specimens selected shall have compact edges with no loose core particles.

#### **C-4 APPARATUS**

This test requires very simple apparatus.

**C-4.1** Electric hot plate of size 200 mm diameter or 200 mm × 200 mm minimum.

**C-4.2** Glass Conical Flask, 250 ml.

**C-4.3** A Holding Clamp

#### **C-5 PREPARATION OF APPARATUS**

Place the conical flask filled with water up to 100 cc on the hot plate. Cover the mouth of the conical flask with the specimens such that the surface to be tested shall face downwards. Put the clamp to secure specimen from falling down.

#### **C-6 PROCEDURE**

**C-6.1** Start heating the water in the flask by putting on the electric heater. After sometime water will start boiling. Note the time and continuously heat for a total period of one hour. Steam will come in contact with the board surface and escape into the atmosphere.

**C-6.2** Observe the surface of the specimen closely and note down the remarks in the register.

**ANNEX D**  
(Clause 10.12)

**METHOD OF TEST FOR DETERMINING RESISTANCE TO  
CRACKING OF LAMINATION UNDER HEAT**

**D-0 GENERAL**

This test determines the surface resistance to cracking when the specimen is subjected to a temperature of 70-100°C of a definite time.

**D-1 NUMBER OF TEST PIECES**

Three specimens shall be used for each test.

**D-2 SPECIMEN SIZE**

Specimen of size 100 mm × 100 mm in full thickness of the board.

**D-3 PREPARATION OF SAMPLE**

The test specimen shall be cut in the required size

from the sample board, 150 mm away from the corner of the edge. The specimens selected shall have compact edges with no loose core particles.

**D-4 APPARATUS**

Electric oven of suitable size having temperature range of 50-150°C.

**D-5 PROCEDURE**

Keep the temperature stabilized at  $70 \pm 2^\circ\text{C}$ . Keep the specimens in the oven. Remove the specimens after 24 hours duration and observe of cracks on the lamination surface.

Then maintain a temperature of  $100 \pm 2^\circ\text{C}$  and keep the fresh specimens. Remove them after 2 hours and observe for surface cracks and blemishes.

**ANNEX E**  
(Clause 10.13)

**METHOD OF TEST FOR DETERMINING RESISTANCE TO CIGARETTE BURN**

**E-0 GENERAL**

This test is to check the effect of leaving a glowing cigarette on the lamination surface.

**E-1 NUMBER OF SAMPLES**

Three specimens shall be taken for the test.

**E-2 SPECIMEN SIZE**

Specimen of size 200 mm × 100 mm in full

thickness of the board.

**E-3 PROCEDURE**

Place a glowing cigarette horizontally on the specimen. Keep it for 60 s and remove it from the specimen as soon as 60 s are lapsed. This could be checked by a stop watch. Clean the area with water or a suitable solvent and observe if any blister has formed or the surface colour got changed.

## ANNEX F

### (Clause 10.14)

#### METHOD OF TEST FOR DETERMINING RESISTANCE TO STAIN

##### F-0 GENERAL

This test determines effect of staining materials on the lamination surface.

##### F-1 OUTLINE OF THE METHOD

Different staining materials are applied to separate test specimens of the decorative laminates, covered suitably and allowed to remain in contact for a specified period. The staining agent is washed off, cleaned with a domestic abrasive cleaner and the surface examined for the staining produced.

##### F-2 APPARATUS

Glass covers, one for each staining material to prevent evaporation.

NOTE — Watch glasses are suitable for this purpose.

##### F-3 STAINING MATERIALS

Coffee and acetic acid solution (10 percent concentration) are the staining materials to be used on the prelaminated medium density fibre board.

##### F-4 TEST SPECIMENS

F-4.1 Specimens to be cut from the sheet to be tested shall be 75 mm long and 25 mm wide.

F-4.2 The number of specimens for sheet shall be equal to twice the number of staining materials selected for test.

##### F-5 PROCEDURE

Apply each staining material to two test specimens at room temperature. Cover one of the two test specimens with a glass cover and allow them to stand for 24 hours. Wash each specimen with water containing a suitable wetting agent and then with denatured spirit (*see* IS 324). Allow the specimens to dry. After one hour place the specimens in horizontal position under overhead white fluorescent light having an intensity of 800 to 1100 lumens/m<sup>2</sup>. Exclude light from other sources. View the specimens at an angle of approximately 90° to the specimens where the staining agent is specifically applied. If any staining or discolouration is noticed attempt to remove it by gently rubbing with a mild domestic abrasive cleaner. Allow the specimens to dry and examine them again under conditions mentioned above.

##### F-6 EVALUATION

The material shall be deemed to have passed the test if no specimen shows blistering, staining or discolouration when finally examined. Specimen on which stains are removable by light rubbing with soap and water, or a mild abrasive domestic cleaner shall be considered acceptable.

**ANNEX G**  
**(Foreword)**

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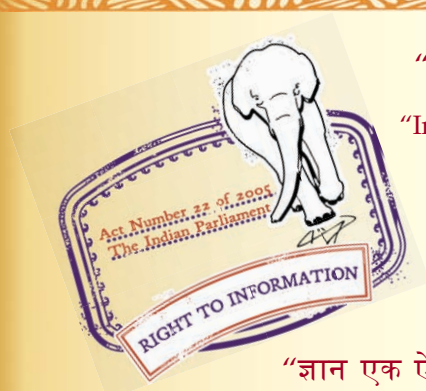
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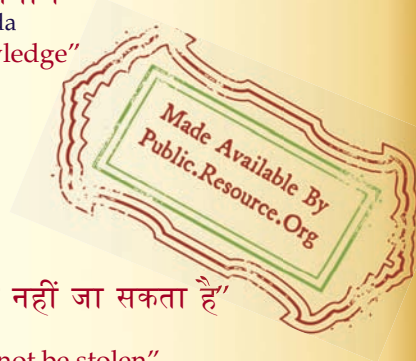
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भाग 2 निर्माण से पूर्व रासायनिक उपचार

( दूसरा पुनरीक्षण )

*Indian Standard*

# CODE OF PRACTICE FOR ANTI-TERMITE MEASURES IN BUILDINGS

**PART 2 PRE-CONSTRUCTIONAL CHEMICAL TREATMENT MEASURES**

*( Second Revision )*

ICS 91.12.01

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**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

## FOREWORD

This Indian Standard (Part 2) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

This standard (Part 2) was first published in 1971 and subsequently revised in 1981. In view of comments received and further knowledge that has become available, the Committee responsible for formulation of this standard decided to take up its revision. Considerable assistance has been provided by Central Building Research Institute, Roorkee in revising this standard. In this revision, apart from other changes, Chlorpyrifos and Lindane have been recommended for anti-termite treatment. Part 1 of this standard deals with constructional measures and Part 3 deals with treatment for existing buildings.

Termite control in buildings is very important as the damage likely to be caused by the termites is huge. Wood is one of the cellulosic materials which termites damage, cellulose forming their basic nutrient. They also damage materials of organic origin with a cellulosic base, household articles like furniture, furnishings, clothings, stationery, etc. Termites are also known to damage non-cellulosic substances in their search for food. Rubber, leather, plastics, neoprene as well as lead coating used for covering of underground cables are damaged by termites. The widespread damage by termites, high constructional cost of buildings have necessitated evolving suitable measures for preventing access of termites to buildings.

On the basis of their habitat, termites are divided into two types, namely (a) Subterranean or ground nesting termites, and (b) Non-subterranean or wood nesting termites having no contact with soil (*see* Annex A). The subterranean termites are most destructive and are mainly responsible for the damage caused in buildings. Typically, they form nests or colonies underground in the soil, near ground level in a stump or in other suitable piece of timber, and some species may construct a conical or dome shaped mound. These colonies may persist for many years and, as they mature, contain a population running into millions. All attacks by subterranean termites originate from the nest but timber either lying on or buried in the ground may be reached by means of shelter tubes constructed within, or over such materials or else by the erection of an independent, free standing mud structure. Chemical barriers which prevent the termites from reaching the super-structure of the building will protect the building and its contents. Treating the soil beneath the building and around the foundations with a soil insecticide is a good preventing measure which is attracting attention throughout the world. The purpose of this treatment is to create a chemical barrier between the ground from where the termites come and woodwork, cellulosic materials and other contents of the buildings which may form food for the termites. Timber which is seasoned and is naturally durable in heartwood may be used in the building structure. However, non-durable timbers and sapwood of all timbers should be treated to withstand the attack of drywood termites (*see* IS 401 and IS 1141).

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

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 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.

## *Indian Standard*

# CODE OF PRACTICE FOR ANTI-TERMITE MEASURES IN BUILDINGS

## PART 2 PRE-CONSTRUCTIONAL CHEMICAL TREATMENT MEASURES

### *(Second Revision)*

#### 1 SCOPE

This standard (Part 2) gives recommendations for the chemical treatment of soils for the protection of buildings from attack by subterranean termites. It includes reference to the chemicals to be used, lays down minimum rates of application for usage, and outlines procedures to be followed while the building is under construction.

#### 2 REFERENCES

The Indian Standards given in Annex B contain provisions, which through reference in this 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 agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated.

#### 3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

##### 3.1 Chemical Barrier

The layer of chemically treated soil in immediate contact with the foundation and floor structure of a building which kills or repels termites thus forming a barrier which is impervious to termite entry.

##### 3.2 Soil Treatment

The application of chemicals (toxicants) to the soil adjacent to and under a building to form a chemical barrier which is lethal or repellent to termites.

##### 3.3 Pre-Construction Soil Treatment

This is a process in which soil treatment is applied to a building during the early stages of its construction.

#### 4 SITE PREPARATION

**4.1** The removal of trees, stumps, logs or roots from a building site reduces the hazards from subterranean termites. Similarly, the sub floor area should be kept free from all debris in which new colonies of termites

might be established. In order to ensure uniform distribution of the treating solution and to assist penetration, some site preparation, may be necessary. The information given in 4.1.1 to 4.1.4 is for guidance in preparing a building site for chemical treatment.

##### 4.1.1 Heavy Soils and Sloping Sites

On clay and other heavy soils where penetration is likely to be slow and on sloping sites where run off of the treating solution is likely to occur, the surface of the soil should be scarified to a depth of at least 75 mm.

##### 4.1.2 Sandy or Porous Soils

On loose, sandy or porous soils where loss of treating solution through piping or excessive percolation is likely to occur, preliminary moistening to fill the capillary spaces in the soil is recommended.

##### 4.1.3 Levelling, Excavations and Filling

All sub floor levelling and grading should be completed; all cuttings, trenches and excavations should be completed with backfilling in place, borrowed fill must be free from organic debris and should be well compacted. If this is not done supplementary treatments should be made to complete the barrier.

##### 4.1.4 Concrete Formwork

All concrete formwork, levelling pegs, timber off-cuts and other builder's debris should be removed from the area to be treated.

#### 5 CHEMICALS AND RATE OF APPLICATION

##### 5.1 Basic Principle

Chemical toxic to subterranean termites may be used effectively to check termite infestation in the soil. These are useful in the treatment of new building sites and may also be used to eradicate existing infestation in buildings and to prevent reinfestation. The effectiveness and/or residual activity depend upon the choice of the chemicals, the dosages adopted and the thoroughness of application. The chemical solutions or emulsions are required to be dispersed uniformly in

the soil and of the required strength so as to form an effective chemical barrier which is lethal and repellent to termites.

### 5.2 Mound Treatment

If termite mounds are found within the plinth area of the buildings these should be destroyed by means of insecticides in the form of water suspension or emulsion which should be poured into the mounds at several places after breaking open the earthen structure and making holes with crow-bars. The quantity to be used will depend upon the size of the mound. For a mound volume of about  $1 \text{ m}^3$ , 4 litres of an emulsion in water of one percent Chlorpyrifos 20 EC or Lindane 20 EC may be used.

### 5.3 Soil Treatment

Treating the soil beneath the building and around the foundations with a soil insecticide is a preventive measure. The purpose of the treatment is to create a chemical barrier between the ground from where termites come and woodwork or other cellulosic materials in the buildings. The following chemicals conforming to relevant Indian Standard in water emulsion are effective when applied uniformly over the area to be treated.

<i>Chemical</i>	<i>Relevant Indian Standard</i>	<i>Concentration by Weight, percent (active ingredient)</i>
Chlorpyrifos 20 EC	IS 8944	1.0
Lindane 20 EC	IS 632	1.0

NOTE — The chemicals described in this code are insecticides with a persistent action and are regarded highly poisonous. These chemicals can have an adverse effect upon health when absorbed through the skin, inhaled as vapours or spray-mists or swallowed. Detailed precautions for the safe handling of these chemicals are given in Annex C. Persons carrying out chemical soil treatment in accordance with this code should familiarize themselves for these precautions and exercise due care when handling the chemical whether in concentrate or in diluted form. The use of the chemical should be avoided where there is any risk of wells or other water supplies becoming contaminated.

## 6 ESSENTIAL REQUIREMENTS FOR BARRIER AND METHOD OF APPLICATION

### 6.1 Conditions of Formation

Barrier shall be complete and continuous under the whole of the structure to be protected. All foundations shall be fully surrounded by and in close contact with the barrier or treated soil. Each part of the area treated shall receive the prescribed dosage of chemical.

### 6.2 Time of Application

Soil treatment should start when foundation trenches and pits are ready to take mass concrete in foundations. Laying of mass concrete should start when the

chemical emulsion has been absorbed by the soil and the surface is quite dry. Treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water. The foregoing requirements applies also in the case of treatment to the filled earth surface within the plinth area before laying the sub-grade for the floor.

### 6.3 Disturbance

Once formed, treated soil barriers shall not be disturbed. If, by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.

## 7 TREATMENT

### 7.1 Soil Treatment

The chemical emulsions described in 5.3 shall be applied uniformly at the prescribed rate in all the stages of the treatment. A suitable hand operated compressed air sprayer or watering can should be used to facilitate uniform disposal of the chemical emulsion. On large jobs, a power sprayer may be used to save labour and time.

7.1.1 In the event of waterlogging of foundation, the water shall be pumped out and the chemical emulsion applied when the soil is absorbent.

### 7.2 Treatment for Masonry Foundations and Basements

7.2.1 The bottom surface and the sides (upto a height of about 300 mm) of the excavations made from masonry foundations and basements shall be treated with the chemical at the rate of  $5 \text{ l/m}^2$  surface area (see Fig. 1).

7.2.2 After the masonry foundations and the retaining wall of the basements come up, the backfill in immediate contact with the foundation structure shall be treated at the rate of  $7.5 \text{ l/m}^2$  of the vertical surface of the sub-structure for each side. If water is used for ramming the earth fill, the chemical treatment shall be carried out after the ramming operation is done by rodding the earth at 150 mm centres close to parallel to the wall surface and spraying the chemical emulsion at the above dosage. After the treatment, the soil should be tamped in place. The earth is usually returned in layers and the treatment shall be carried out in similar stages. The chemical emulsion shall be directed towards the masonry surfaces so that the earth in contact with these surfaces is well treated with the chemical (see Fig. 2 and 3).

### 7.3 Treatment for RCC Foundations and Basement

7.3.1 The treatment described in 7.2.1 and 7.2.2 applies essentially to masonry foundations where there are voids in the joints through which termites are able to seek entry into buildings. Hence the

foundations require to be completely enveloped by a chemical barrier. In the case of RCC foundations, the concrete is dense being a 1:2:4 (cement: fine aggregates: coarse aggregates, by volume) mix or richer, the termites are unable to penetrate it, it is therefore, unnecessary to start the treatment from the bottom of excavations. The treatment shall start at a depth of 500 mm below the ground level except when such ground level is raised or lowered by filling or cutting after the foundations have been cast. In such cases, the depth of 500 mm shall be determined from the new soil level resulting from the filling or cutting mentioned above, and soil in immediate contact with the vertical surfaces of RCC foundations shall be treated at the rate of  $7.5 \text{ l/m}^2$ . The other details shall be as laid down in 7.2.2 (see Fig. 4).

#### 7.4 Treatment of Top Surface of Plinth Filling

The top surface of the consolidated earth within plinth walls shall be treated with chemical emulsion at the rate of  $5 \text{ l/m}^2$  of the surface before the sand bed or sub-grade is laid. If the filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes up to 50 to 75 mm deep at 150 mm centres both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion.

#### 7.5 Treatment at Junction of the Wall and the Floor

Special care shall be taken to establish continuity of the vertical chemical barrier on inner wall surface from ground level (where it had stopped with the treatment described in 7.2.2) up to the level of the filled earth surface. To achieve this, a small channel 30 mm  $\times$  30 mm shall be made at all the junctions of wall and columns with the floor (before laying the sub-grade) the rod holes made in the channel up to the ground level 150 mm apart and the iron rod moved backward and forward to break up the earth and chemical emulsion poured along the wall at the rate of  $7.5 \text{ l/m}^2$  of vertical wall or column surface so as to soak the soil right to the bottom. The soil should be tamped back into place after the operation.

#### 7.6 Treatment of Soil Along External Perimeter of Building

After the building is complete, the earth along the external perimeter of the building should be rodded at intervals of 150 mm and to a depth of 300 mm. The rods should be moved backward and forward parallel to the wall to break up the earth and chemical emulsion poured along the wall at the rate of  $7.5 \text{ l/m}^2$  of vertical surfaces. After the treatment, the earth should be tamped back into place. Should the earth outside the

building be graded on completion of building, this treatment should be carried out on completion of such grading.

**7.6.1** In the event of filling being more than 300 mm, the external perimeter treatment shall extend to the full depth of filling upto the ground level so as to ensure continuity of the chemical barrier.

#### 7.7 Treatment of Soil Under Apron Along External Perimeter of Building

Top surface of the consolidated earth over which the apron is to be laid shall be treated with chemical emulsion at the rate of  $5 \text{ l/m}^2$  of the surface before the apron is laid. If consolidated earth does not allow emulsion to seep through, holes up to 50 to 75 mm deep at 150 mm centres both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion (see Fig. 3).

#### 7.8 Treatment of Walls Retaining Soil Above Floor Level

Retaining walls like the basement walls or outer walls above the floor level retaining soil need to be protected by providing chemical barrier by treatment of retained soil in the immediate vicinity of the wall, so as to prevent entry of termites through the voids in masonry, cracks and crevices, etc above the floor level. The soil retained by the walls shall be treated at the rate of  $7.5 \text{ l/m}^2$  of the vertical surface so as to effect a continuous outer chemical barrier, in continuation with that of the one formed under 7.2.

#### 7.9 Treatment of Soil Surrounding Pipes, Wastes and Conduits

When pipes, wastes and conduits enter the soil inside the area of the foundations, soil surrounding the point of entry shall be loosened around each such pipe, waste or conduit for a distance of 150 mm and to a depth of 75 mm before treatment is commenced. When they enter the soil external to the foundations, they shall be similarly treated at a distance of over 300 mm unless they stand clear of the walls of the building by about 75 mm.

#### 7.10 Treatment for Expansion Joints

Expansion joints at ground floor level are one of the biggest hazards for termite infestation. The soil beneath these joints should receive special attention when the treatment under 7.4 is carried out. This treatment should be supplemented by treating through the expansion joint after the sub-grade has been laid, at the rate of 2 litres per linear metre.

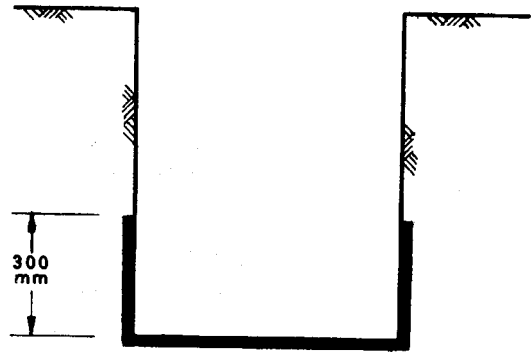
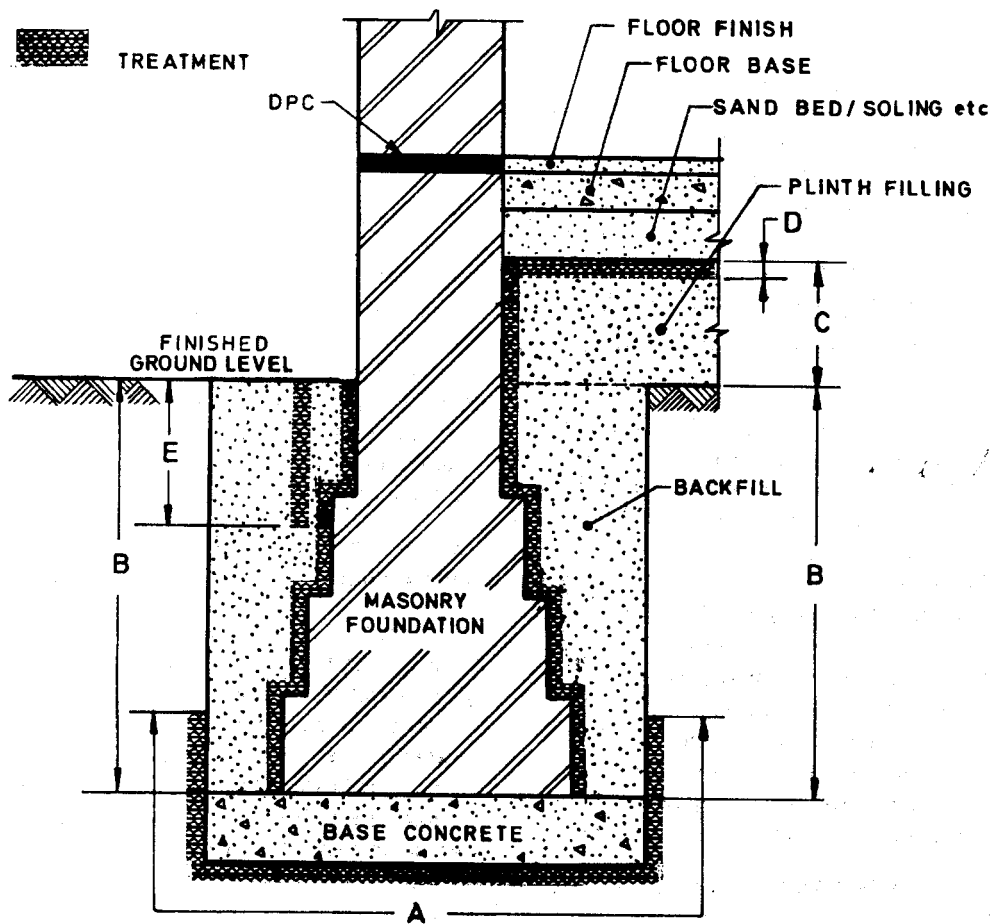


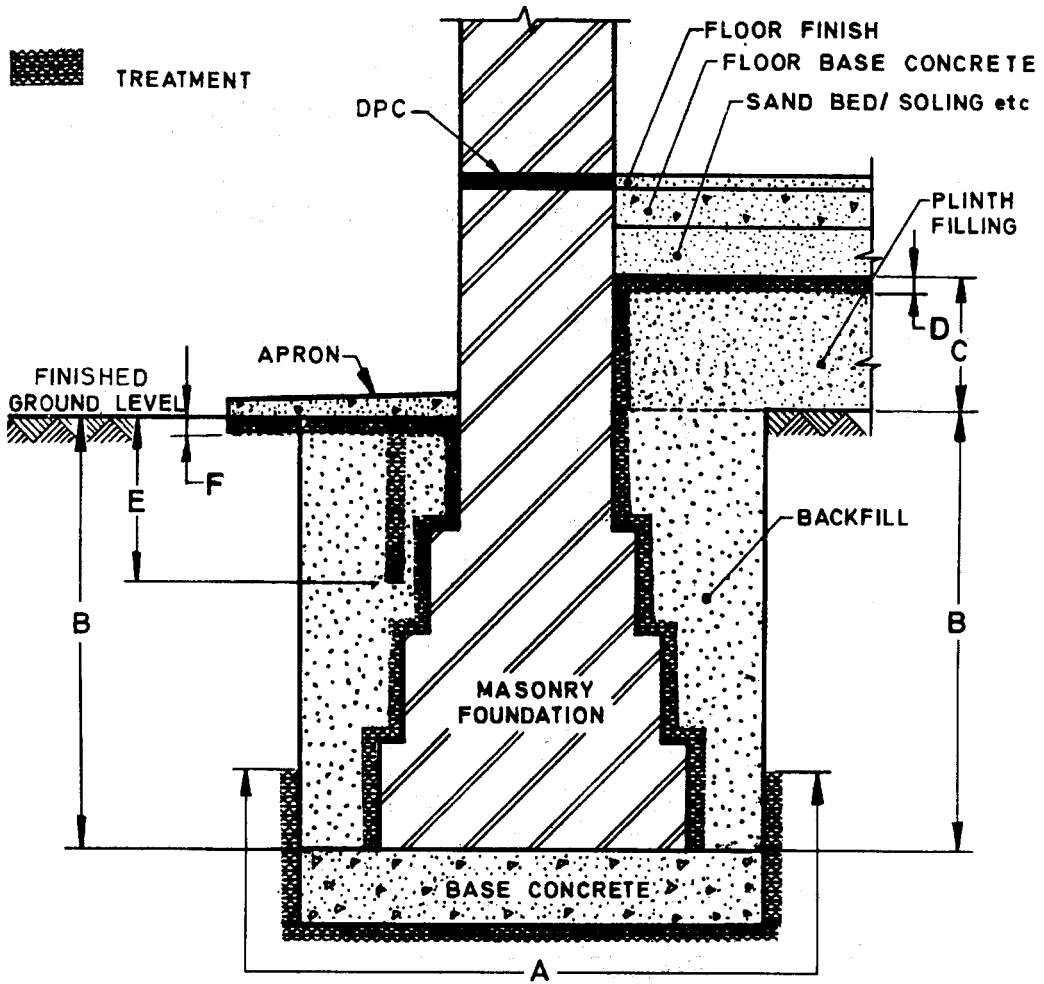
FIG. 1 TREATMENT OF TRENCH BOTTOM AND SIDES



*Stages of Treatment*

- A - Bottom and Sides of Trenches (see 7.2.1)
- B - Backfill in Immediate Contact with Foundation Walls (see 7.2.2)
- C - Junction of Wall and Floor (see 7.5)
- D - Top Surface of Plinth Filling (see 7.4)
- E - External Perimeter of Building (see 7.6)

FIG. 2 TREATMENT FOR MASONRY FOUNDATIONS WITHOUT APRON



*Stages of Treatment*

- A - Bottom and Sides of Trenches (see 7.2.1)
- B - Backfill in Immediate Contact with Foundation Walls (see 7.2.2)
- C - Junction of Wall and Floor (see 7.5)
- D - Top Surface of Plinth Filling (see 7.4)
- E - External Perimeter of Building (see 7.6)
- F - Soil Below Apron (see 7.7)

FIG. 3 TREATMENT FOR MASONRY FOUNDATIONS WITH APRON ALONG EXTERNAL PERIMETER

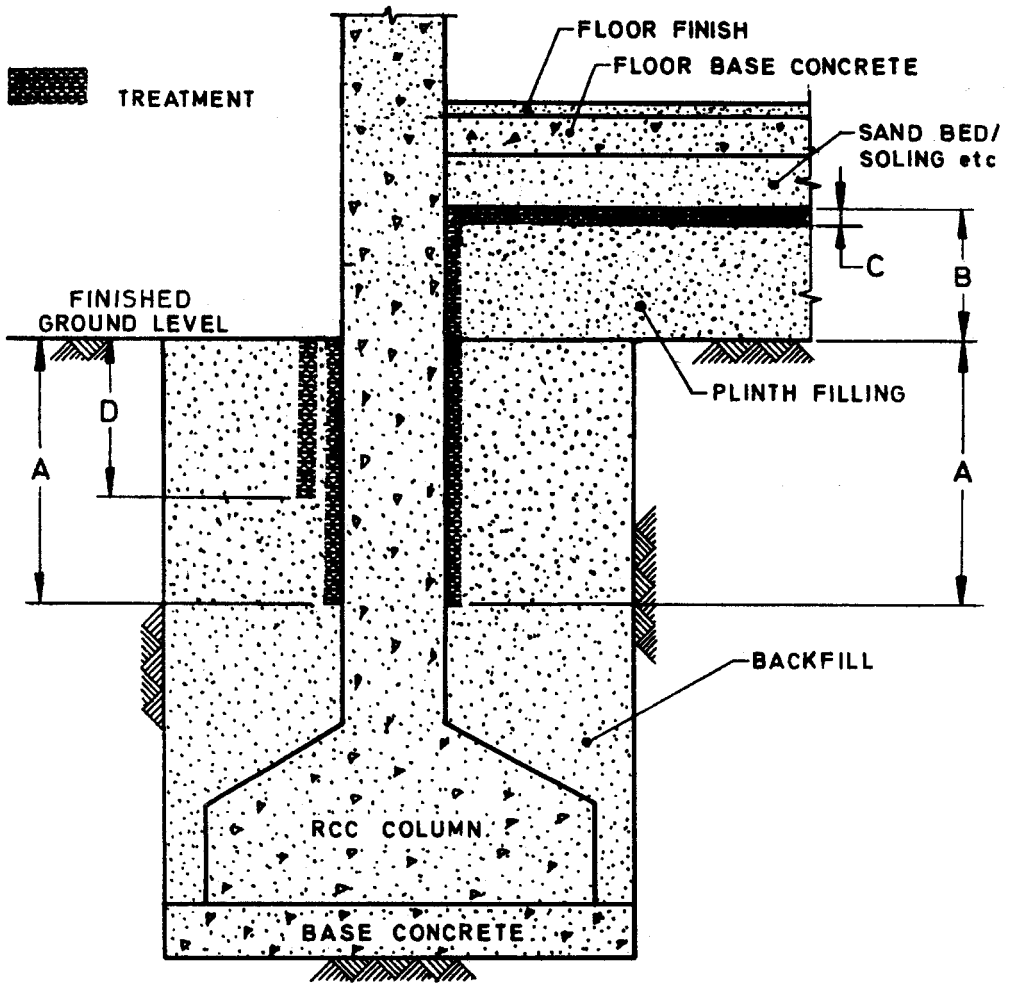


FIG. 4 TREATMENT FOR RCC FOUNDATIONS

## ANNEX A

## (Foreword)

## A SHORT NOTE ON TERMITES

## A-1 CLASSIFICATION

**A-1.1** Termites constitute a separate order of insects called 'ISEPTORA'. Although, they are commonly called white ants, they are not related to ants. The front pair of wings of the ants are longer than their hind pair whereas in termites, both pairs are equal. There are over 2 300 species of termites of which about 220 are found in India. All these species are not considered to be serious pests.

**A-1.2** According to their habits, termites can be divided into two well defined groups:

- a) Subterranean or ground nesting termites which build nests in the soil and live in them, and
- b) Non-subterranean or wood nesting termites which live in wood with no contact with soil.

**A-1.3** Subterranean termites require moisture to sustain their life. They normally need access to ground at all times. They build tunnels between their nest and source of food through covered runways. These covered tunnels provide humidity conditions thus preventing desiccation and protection against predators, darkness necessary for their movement and for maintaining contact with earth. The subterranean termites enter a building from ground level, under the foundation, working their way upwards through floors, destroying all before them. So little is seen of these termite operations that sometimes the structural member attacked is found to be merely a shell with the inside completely riddled and eaten away.

**A-1.4** The wood nesting species comprise drywood and dampwood termites. Drywood termites which predominate are able to live even in fairly drywood and with no contact with soil. These frequently construct nests within large dimensional timbers such as rafters, posts, door and window frames, etc, which they destroy, if not speedily exterminated. However, they are not as prevalent and common as subterranean termites, and are generally confined to coastal regions and interiors of eastern India.

**A-1.5** A termite colony consists of a pair of reproductives, the so-called king and queen and a large number of sterile workers, soldiers, and nymphs. If, however, the queen is lost or destroyed, her place taken by a number of supplementary reproductive in some group of termites; thus by removing the queen, the colony will not be destroyed. All the work of the colony is carried out by the workers. Guarding the colony is the work of the soldiers. The adult workers and soldiers are wingless. The workers are generally

greyish white in colour. The soldiers are generally darker than the workers and have a large head and longer mandibles. There are, however, other types of soldiers whose mandibles are small, degenerated and functionless; instead the frontal part of the head is prolonged to form a long nasus; they dispel the enemy by squirting out white poisonous fluid through the nasus. The reproductives, that is, the flying adults, have brown or black bodies and are provided with two pairs of long wings of almost equal size in contrast to the reproductives of ants which have two pair of wings of unequal size.

**A-1.6** The food of the termite is cellulosic material like timber, grass, stumps of dead trees, droppings of herbivorous animals, paper, etc. Once termites have found a suitable foot-hold in or near a building, they start spreading slowly from a central nest through underground and over-ground galleries in the case of subterranean termites, and galleries within the structural member. Once they get direct access to them in the case of drywood termites. In their search for food they by pass any obstacle like concrete or resistant timber to get a suitable food many metres away.

**A-1.7** In subterranean termite colony, the workers feed the reproductives, soldiers, winged adults and young nymphs. One of the habits of the termites which is of interest is the trophallaxis by means of which food and other material remain in circulation among different members of the colony. Workers are also in the habit of licking the secretions of exuding glands of the physogastric queen.

## A-2 DEVELOPMENT OF TERMITE COLONY

**A-2.1** At certain periods of the year, particularly after a few warm days followed by rain, emergence of winged adults on colonizing flights, occurs. This swarming, also called the nuptial flight, may take place any time during the monsoon or post-monsoon period. The fight is short and most of the adults perish due to one reason or the other. The surviving termites soon find their mates, shed their wings and establish a colony if circumstances are favourable. The female of the pair or queen produces a few eggs in the first year. The first batch of the brood comprises only of workers. The rate of reproduction however, increases rapidly after 2 to 3 years. Although a colony may increase in size comparatively rapidly, very little damage may occur in a period less than 8 to 10 years. Any serious damage that may occur in a short time is perhaps due to heavy infestation in the initial stages due to large

population of termites existing in the soil before the building is constructed.

### A-3 RECOGNIZING THE PRESENCE OF TERMITE INFESTATION IN BUILDING

**A-3.1** Swarms of winged reproductives flying from the soil or wood are the first indication of termite infestation in a building. Often the actual flight may not be observed but the presence of wings discarded by them will be a positive indication of a well established termite colony nearby. Termite damage is not always evident from the exterior in the case of subterranean termites, since they do not reduce wood to a powdery mass of particles like some of the wood borers or drywood termites. These termites are also

recognized by the presence of earth-like shelter tubes which afford them the runways between soil and their food.

**A-3.2** Drywood termites on the contrary may be recognized by their pellets of excreta. Non-subterranean termites excrete pellets of partly digested wood. These may be found in tunnels or on the floor underneath the member which they have attacked. These termites may further be noticed by blisters on wood surfaces due to their forming chambers close to the surface by eating away the wood and leaving only a thin film of wood on the surface. Also the hollow sound on tapping structural timber will indicate their destructive activity inside.

## ANNEX B

( Clause 2 )

### LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
401 : 1982	Code of practice for preservation of timber ( <i>third revision</i> )	2568 : 1978	Malathion dusting powder ( <i>second revision</i> )
632 : 1978	Gamma — BHC (Lindane) emulsifiable concentrates ( <i>fourth revision</i> )	4015 : 1998	Guide for handling cases of pesticides poisoning: Part 1 First aid measures ( <i>first revision</i> )
1141 : 1993	Seasoning of timber — Code of practice ( <i>second revision</i> )	8944 : 1978	Chlorpyrifos emulsifiable concentrates

## ANNEX C

( Clause 5.3 )

### SAFETY PRECAUTIONS

#### C-1 PRECAUTIONS FOR HEALTH HAZARDS AND SAFETY MEASURES

**C-1.1** All the chemicals mentioned in 5.3 are poisonous and hazardous to health. These chemicals can have an adverse affect upon health when absorbed through the skin, inhaled as vapours or spray mists or swallowed. Persons handling or using these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely sources of accidental poisoning. They should be cautioned to observe carefully the safety precautions given in C-1.2 to C-1.5 particularly when handling these chemicals in the form of concentrates.

**C-1.2** These chemicals are brought to the site in the form of emulsifiable concentrates. The containers should be clearly labelled and should be stored carefully so that children and pets cannot get at them. They should be kept securely closed.

**C-1.3** Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to

dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water specially before eating and smoking. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes they shall be flushed with plenty of soap and water and immediate medical attention should be sought.

**C-1.4** The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing.

**C-1.5** Care should be taken in the application of soil toxicants to see that they are not allowed to contaminate wells or springs which serve as sources of drinking water.

**C-1.6** In case of poisoning, suitable measures shall be taken for protection in accordance with IS 4015.

# ANNEX D

## (Foreword)

### COMMITTEE COMPOSITION

#### Building Construction Practices Sectional Committee, CED 13

##### *Organization*

In personal capacity (*D-6 Sector 55, Noida 201301*)  
Bhabha Atomic Research Centre, Mumbai,

Builders Association of India, Chennai  
Building Materials & Technology Promotion Council, New Delhi

Central Building Research Institute, Roorkee  
Central Public Works Department, New Delhi

Central Road Research Institute, New Delhi  
Central Vigilance Commission, New Delhi  
Delhi Development Authority, New Delhi

Engineer-in-Chief's Branch, New Delhi

Engineers India Limited, New Delhi

Forest Research Institute, Dehra Dun

Hindustan Prefab Ltd, New Delhi

Hindustan Steel Works Construction Ltd, Kolkata

Housing & Urban Development Corporation, New Delhi

Indian Institute of Architects, Mumbai

Indian Oil Corporation, Mathura

Indian Pest Control Association, New Delhi  
Life Insurance Corporation of India, New Delhi

Ministry of Railways, Lucknow

National Buildings Construction Corporation Ltd, New Delhi  
National Industrial Development Corporation Ltd, New Delhi

National Project Construction Corporation, New Delhi

Public Works Department, Government of Arunachal Pradesh, Itanagar  
Public Works Department, Government of Maharashtra, Mumbai

Public Works Department, Government of Punjab, Patiala

Public Works Department, Government of Rajasthan, Jaipur

Public Works Department, Government of Tamil Nadu, Chennai

• State Bank of India, New Delhi

Structural Engineering Research Centre, Chennai

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SHRIMATI RACHNA SEHGAL  
Deputy Director (Civ Engg), BIS

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Timber Engineering Subcommittee, CED 13 : 4

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Public Works Department, Government of Tamil Nadu, Chennai	JOINT CHIEF ENGINEER
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Structural Engineering Research Centre, Ghaziabad	SHRI P. C. SHARMA
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