

GENERAL TECHNICAL SPECIFICATIONS

FOR BUILDING WORKS

Name of Work- Construction of Gram Panchayat office (for Population from 5000- 10000) at Village Dedan, Tal.Khambha, Dist. Amreli

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SPECIFICATIONS

Item No.	Item of work	Item No.	Page No.
	General Technical Specifications	Attached	
1	Excavation for foundation upto 1.50 M.depth including sorting out &stacking of useful materials i.e. disposing the excavated stuff up to All lead (a) Loose or soft soil	Attached	
2	Excavation for foundation upto 1.50 M.depth including sorting out &stacking of useful materials i.e. disposing the excavated stuff up to All lead (a) Dense or Hard soil.	Attached	
3	Providing and laying cement concrete 1:4:8 (1 cement, 4sand, 8 Crushed stone aggregates 40 mm.Nominal size)and curing complete, excluding cost of formwork in(a) Foundation and Plinth	Attached	
4	Providing and laying ordinary cement concrete1:1:2 (1cement,1sand, 2 gradedstone aggregates 20 mm.Nominal size) and finishing smooth with curing etc. complete excluding cost of form work and reinforcement for reinforced cement concrete work in in A) Foundations, footings, base of columns and mass concrete	Attached	
5	Providing and laying ordinary cement concrete1:1.5:3 (1cement,1.5sand, 3 gradedstone aggregates 20 mm.Nominal size) and finishing smooth with curing etc. complete including the cost of formwork but excluding the cost of reinforcement of R.C.C. work in Column (iii) Having cross-sectional area more than 0.085 Sq.M. and up to 0.12Sq.M	Attached	
6	Brickwork using common burnt clay building brick shaving crushing strength not less than 35 Kg/Sqcm. in foundation and plinth in cement mortar 1:6(1 Cement ; 6 Fine sand) Conventional bricks	Attached	
7	Filling in plinth with sand under floors including ramming watering, consolidating and dressing etc complete	Attached	
8	Filling available excavated earth (excluding rock) in trenches plinth, sides of foundations etc in layers not exceeding 20 cm in depth consolidating each disposed layer by ramming and watering	Attached	
9	Brickwork using common burnt clay building brick shaving crushing strength not less than 35 Kg/Sqcm. in super structure for all floors. in cement mortar 1:6(1 Cement ;6 Fine sand)	Attached	
10	Providing and laying cement concrete1:1.5:3 (1cement, 1.5sand, 3 gradedstone aggregates20 mm.Nominal size) and curing complete, including cost of formwork in sill and sides (R.C.C. band) but excluding the cost of reinforcement for all Floor level	Attached	
11	Providing & laying ordinary C.C. 1:1 1/2:3 (1 cement ,1 1/2 course sand, 3 graded stone agg. of 20 mm nominal size)and for R.C.C. LINTELS incl. Finishing smooth with curring of formwork but excl. the cost of reinforcement.for above floor for all Floor level.	Attached	
12	Providing & laying cement concrete 1:11/2:3 (1 cement ,11/2 course sand,3graded stone agg.of 20 mm nominal size) for rein-forcement concrete CHHAJJAS not exceeding 10cm thickness for all Floor level incl. finishing the exposed surface with C.M. 1:3 (1 cement ,3 fine sand) to give a smooth and ever surface, centering, formwork and curring comp.Excl. the cost of reinforcement.above plinth for all Floor level.	Attached	
13	Providing & laying C.C. 1:11/2:3 (1 cement ,11/2 course sand,3 graded stone agg.of 20 mm nominal size) and finishing smooth with curring etc. comp. incl. the cost of formwork but excl. the cost of reinforcement for R.C.C. work in. (A) Beam :- Having cross sectional Area 0.085 to 0.12 Sqm for all Floor level	Attached	
14	Providing & laying ordinary cement concrete1:11/2:3 (1 cement ,11/2 course sand,3 graded stone agg.of 20 mm nominal size) exposed work with curring etc.comp. incl. the cost of formwork but excluding the cost of reinforce ment for R.C.C. work in. SLAB :- having more than 10cm and up to 13cm thickness for all Floor level	Attached	
15	Providing & laying ordinary cement concrete1:11/2:3 (1 cement ,11/2 course sand,3 graded stone agg.of 20 mm nominal size) exposed work with curring etc.comp. incl. the cost of formwork but excluding the cost of reinforce ment for R.C.C. work in. Staircases Excluding Landing up to all floor	Attached	
16	Thermo Mechanically treated bar F.F.415 Steel reinforcement for R.C.C. work including bending binding and placing in position complete for all Floor level	Attached	
17	Providing fixing of Polished Kotah stone frame for Doors & windows of 15cmx4 cm. Size including necessary holdfasts, holes for fixtures and fastenings incl. all labour & materials etc comp	Attached	
18	Providing and fixing 35mm. Thick Panelled,glazed orPanelled and glazed shutters for doors, windows and clearstory windows including anodised aluminium butt hinges with necessary screws and Indian TeakWood shutters with-(B) Partical board panells.12mm. thick including applying primer and two coats of oil painting etc. complete	Attached	
19	Providing 15mmthick cement plaster in single coat on fair side of Brick/concrete walls for interior plastering for all floor and finished even and smooth in (I)cement mortar 1:3 (1 cement:3 sand) for all floor	Attached	

Item No.	Item of work	Item No.	Page No.
20	Providing 10 mmthick cement plaster in single coat on fair side of Brick/concrete walls for interior plastering for all floor and finished even and smooth in (I)cement mortar 1:3 (1-cement:3 sand) .for all Floor level finished even & Smooth with floating coat of neat cement slurry	Attached	
21	Providing and laying 24" x 24" vitrified 8MM thick tile flooring over 20MM (average) base of cement mortar 1:6 (1- Cement : 6-Coarse Sand) on new surface or fixing on existing flooring by adhe-sive material including dismantling of existing flooring and jointed with colour cement slurry including finished with flush pointing and cleaning the surface etc.	Attached	
22	Providing and laying Ceramic tiles 6mm thick in flooring treads of steps and landing laid on a bed of 12mm thick cement mortar 1:3 (1-cement : 3-coarse sand) finishing with flush pointing in white cement	Attached	
23	Providing and laying Ceramic tiles 6mm thick in skirting risers of steps and dedo on 10mm thick cement plaster 1:3 (1-cement : 3-coarse sand) and jointed with white cement slurry	Attached	
24	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	
25	Distempering (Two coats) with oil bound distemper of approved brand and manufacture and of required shade on wall surface to give an even shade over and including a priming coat with distemper primer of approved brand and manufacture after thoroughly brushing the surface free from mortar dropping and other foreign matter and also including preparing	Attached	
26	Proving and fixing water closet squatting pan (Indian type W.C.Pan) size 580 mm. incl. 100mm. Size P trap & Foot rest(Earthwork, bed concrete,foot rests and trap to be measured and paid for separately) (A) Vitreous china (I) Long pattern white colour.	Attached	
27	Providing and fixing PVC SWR Nahni trap IS 14735 for drain - 100 mm diameter with jali of the following nominal diameter of self cleansing design with C.I scread down or hinged grating including the cost of cutting and making good the walls	Attached	
28	Proving and fixing cast iron spigot and socket soil, waste and ventilating pipes of the following nominal size.(C) 100 mm. Dia.	Attached	
29	Proving and fixing in position cowl vent to pipes(C) 100 mm. Dia.	Attached	
30	Providing and fixing S.W. gully trap with C.I. grating brick masonry chamber and water tight C.I. cover with frame of 300mm x 300mm size (inside) with standard weight.(i) Square mouth trans (A) 100mm x 100mm size P type	Attached	
31	Providing and fixing urinal of approved quality including connection with trap and with integral longitudinal flush pipe (A) White earthen ware flat back or corner type size 430mm x 260mm x 350mm	Attached	
32	Constructing brick masonry road gully chamber 450mm x 450mm x 775mm with vertical grating complete With C.I. Manhole Cover 450x600 mm size	Attached	
33	Providing and fixing wash basin with single hole for pillar tape with C.I. of M.S. brackets painted white including cutting holes and making good the same but excluding fittings (A) Stainless steel Acrysil or Equivalent make- Flat back wash basin 550mm x 400mm size with CP brass couplin, padastal matching the shade, waste pipe etc comp	Attached	
34	Providing, laying and jointing in true line and level 110 diametre U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp of the size 110 mm diametre x 149 mm length x 145 mm heigh at every 2000 mm center to center or shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials.	Attached	
35	Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete ID132mm	Attached	
36	Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete ID120mm	Attached	
37	Proving and fixing screw down bib taps of following size.(A) Brass screw downbib tap polished bright (I) 15 mm Dia	Attached	
38	Proving sock pit of 5.0 Cumt. Volume including excavating and filling brick bats with dry masonry work at top for 45 cm. Height including covering the top with stone including providing vatas in c.m. 1:3 with finishing curing etc. complete as directed	Attached	
39	Providing and Fixing double coated Syntex or Equivalent PVC (ISI) mark water tank of required capacity each with all necessary fittings and connection etc. comp on terrace or as directed by Engineer - in- charge	Attached	

Item No.	Item of work	Item No.	Page No.
40	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 creme out upto surface using white cement including rounding off junctions and extending them upto 15 cm along the wall,clearing with water	Attached	
41	Pro. /Fix. with windows with 40x40x5mm. Iron angle & frame 30x30x4 mm size in Double Shutter with B.G. 20 Gauge Sheet plates with , Hold fasts ,Iron hinges handles,stopper ,and locking arrangement etc. comp. Steel welded is built up section cutting hoisiting , finishing in two coats of oil painting over coat of primer coat etc. comp.	Attached	
42	Providing and fixing M.S. Grills of required pattern to wooden frames of Pipe / Angles etc.including Priming coat of approved primer and Two coats of Oil painting etc. complete Ordinary grill	Attached	
43	Providing and laying polished kota stone slab flooring over 20mm (average) thick base of cement mortar 1:6 (1 cement : 6 coarse sand) or L.M. 1:1.5 laid and jointed with grey cement slurry including rubbing and polishing etc. complete 25mm Thick	Attached	
44	Providing and fixing 30mm thick FACTORY MADE SOLID PANEL PVC DOOR SHUTTER consisting of frame made out of M.S. tubes of 19 gauge thickness and size of 19mm x 19mm for stiles and 15mm x 15 mm for top and bottom rails. M.S. frame shall have a coat of steel primers of approved make and manufacture, M.S. frame shall be covered with 5 mm thick heat moulded PVC 'C' channel of size 30 x 50 mm forming stiles, and 5mm thick 75mm wide PVC sheets for top rail, lock rail and bottom rail on either side, and 10mm (5mm x 2) thick, 20mm wide cross PVC sheet as gap insert for top rail and bottom rail, Panelling of 5 stiles and rails with 30mm wide x 5mm thick PVC sheet beading on either side, and joined together with solvent cement adhesive,. An additional 5mm thick PVC strip of 20mm width is to be stulk on the interior side of the 'c' channel using PVC solvent cement adhesive etc. complete as per direction of Engineer in charge, manufacture's specification and drawing.	Attached	
45	Providing & Fixing Acrylic sheet name board size 2.00 mt x 0.60 sqm. With painting letters Indicating Gram panchayat office / Village/ Taluka/ Dist. Etc. as directed by Adm. Department etc with all required material & Labour comp	Attached	
46	Providing & Fixing 4.50 Kg Co2 type Fire Extinguisher with all required equipment & Labour comp	Attached	
47	Providing & Fixing 6.00 Kg ABC type Fire Extinguisher with all required equipment & Labour comp	Attached	
48	Point wiring for Light / Bell with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in/ on surface on wall/ceiling complete with 6A Modular type switch / bell push & accessories and earth continuity of following type, erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected, with necessary Lamp holder/ceiling rose / H.D.Connector as directed.	Attached	
49	Point wiring for FAN with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV Grade FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in / flushed on wall/ceiling complete with 6A Modular type switch and hum free EME four or more step type electronic fan regulator with separately mounted and accessories with earth continuity of following type erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected. with necessary ceiling rose / H.D.Connector as directed.	Attached	
50	Point wiring for Looped Plug with 6A Modular type switch & 5 pin socket erected on PVC / Metallic box, single mounting base frame covered with textured / metallic front plate modules erected on / in wall / ceiling with following type accessories Cat- III	Attached	
51	Point wiring for individual Plug with & Earth wire of FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in / surface of wall/ceiling complete with Modular type switch and 5 Pin plug erected on PVC/ Metallic box covered with appropriate front plate modules erected on / in wall/ ceiling as per pipe erected with following type of (I) For 6A Plug with 2-1.5 Sq.mm Cu. wire	Attached	
52	Providing & erecting Switch board for Computer or electric apparatus consisting of following items in single board erected on PVC / Metal board with 3 mm thick PC (Polycarbonate) / Acrylic sheet erected as directed 1 no. 6A/16A universal plug-switch combined. 4 nos. 6A Switch 4 nos. 6A 5 pin Plug	Attached	
53	Decorative call bell Ting-tong box type 250 volts complete erected	Attached	

Item No.	Item of work	Item No.	Page No.
54	Supplying and erecting led lamps with following wattage capacity of 220 to 240 voltage minimum 15000 burning hours life, 500 V in built-surge protection, Polycarbonate diffuser mounting suitable for E14 / E27 / B22 lamp holders, pf >= 0.5 (A) LED Lamps integral type with PC diffuser suitable LAMP holder (iii) 10 to 15 watts	Attached	
55	Miniature circuit breaker single pole 6A to 25A suitable to operate on 240 V A.C. system and having breaking capacity 10 KA to be erected in existing box. confirming to IS 8828/1996 with ISI Mark Cat-III	Attached	
56	Providing & erecting 240 V MCB double pole switch for lighting load (B Curve) having 10 KA breaking capacity & Confirming to IS :8828 in Existing box , having capacity (B) 40 Amp.- Cat-III	Attached	
57	Providing and erecting Sheet Steel powder coated MCB distribution board - flush / surface mounted fitted with busbar, neutral link, earth bar and DIN rail, confirming to IS 13032 and BS 5486-1986 without MCB to house appropriate nos. of MCBs.(The DBs should be used of same company of MCB to be used)	Attached	
58	Providing & erecting Approved make Ceiling Fan with double ball bearing ISI mark with Condenser 230 volt A.C. 50 c/s, 1200 mm sweep complete having 3blades with aluminium blades with , canopy & 30 cms. down rod erected on existing hook or Clamp with 24/ 0.2, 3 core flexible wire with earthing.	Attached	
59	Pipe type earthing having 150 cms.long and 2.5 cms. dia. Galvanised iron pipe with coupling and buch buried in specially prepared earth pit complete with necessary 8 SWG earth wire. For using salt and charcoal / coke as required for pipe type earthing.	Attached	

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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 of 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 kankar 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 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	by Designation	I.S. Sieve 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 e 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 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.	-	-	-
	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 than 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 be of 1.63 mm. or 1.22 mm. (16 to 18 gauge) diameter and shall conform to 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 or 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 ballies 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 got inspected by and got approved from the Engineer in charge, before the reinforcement bars are placed in position.

26.4. The props shall consist to 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 jerking 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 of 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 provides 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. thickness 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. or 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, loose 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 shall be free from rot 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 painting 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 aggregate area of such knots shall 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 or cluster knots, flows, shakes, warps, bends or any other defects. It 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 testi 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 ± 1.2 mm. In Nominal height ± 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 thin boards 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, smokes 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 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. Resign 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 surfaces 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 made 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 curdling, 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 ± 1 mm. tolerance of thickness shall be ± 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 form 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 or 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 ± 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 dedo, 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 ± 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 ± 0.15 mm.

(b) Length or Width

(1) 300 mm. Sqr. Tiles ± 0.20 mm. (3) 900 mm. Sqr. Tiles ± 0.60 mm.

(2) 600 mm. Sqr. tiles ± 0.40 mm. (4) Sheets and roll ± 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 ±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 to 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 a 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 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 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 rubble 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 be of 1st 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 sq. to their axis.

68.3. The size 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	Excluding ears
			1.5 m. long	1.8 m. long.	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. Nanhhi Trap

69.1. Nahni 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 nahni trap shall be specified and shall be of self cleaning design.

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

69.3. The Nahni 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 $1/12^{\text{th}}$ 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 ± 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.1 Excavation for foundation upto 1.50 M.depth including sorting out & stacking of useful materials i.e. disposing the excavated stuff up to All lead (a) Loose or soft soil

1.0. General

1.1. Any soil which generally yields to the application of pick axes and shovels, phawaras rakes or any such ordinary excavating implement or organic soil, gravel silt, sand turf, clay peat etc. fall under this category.

2.0. Clearing the site

2.1. The site on which the structure is to be built shall be cleared and all obstructions loose stone materials and rubbish of all kind, bush wood and trees shall be removal as directed. The materials so obtained shall be property of the Government and shall be conveyed and stacked as directed within 50 m. lead. The roots of the trees coming in the sides shall be cut and coated with a hot asphalt.

2.2. The rate of side clearance is deemed to be included in the rate of earth work for which no extra will be paid.

3.0. Setting out

After clearing the site the centers lines will be given by the Engineer in charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all parts of the work. Contractor shall supply labours materials etc. required for setting out the reference marks and bench marks and shall maintain them as long as required and directed.

4.0. Excavation

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown I the drawings or as directed. The contractor shall do the necessary shoring and shuttering or providing necessary slopes to a safe angle, at his own cost. The payment for precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be leveled both longitudinally and transferely as directed by removing and watering as required no earth filling will be allowed for bringing it to level. If by mistake or any excavation is made deeper or wider than that shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation up to 1.5 m. depth shall be measured under this item.

5.0. Disposal of the excavated stuff

5.1. The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers including ramming and watering etc.

5.2. The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead up to 50 M. and all lift.

6.0. Mode of measurements & payment

6.1. The measurement of excavation in trenches for foundation shall be made according to the section of trench shown on the drawing or as per sections given by the Engineer in

charge. No payment shall be made for surplus excavation made in excess of above requirements or due to stopping and sloping back as found necessary on account of conditions of soil and requirements safety.

6.2. The rate shall be for a unit of one cubic meter.

Item No.2 **Excavation for foundation up to 1.5 M. depth including sorting out and stacking of useful materials and disposing of the excavated stuff up to all lead in dense or hard soil.**

1.0. Dense or Hard Soil

Any soil which generally require close application of picks or jumpers or sacrifier to loosen it stiff clay gravel and stone etc. fall under this category.

2.0. Workmanship

The excavation work shall be carried out in dense or hard soil.

1.0. General

1.1. Any soil which generally yields to the application of pick axes and shovels, phawaras rakes or any such ordinary excavating implement or organic soil, gravel silt, sand turf, clay peat etc. fall under this category.

2.0. Clearing the site

2.1. The site on which the structure is to be built shall be cleared and all obstructions loose stone materials and rubbish of all kind, bush wood and trees shall be removal as directed. The materials so obtained shall be property of the Government and shall be conveyed and stacked as directed within 50 m. lead. The roots of the trees coming in the sides shall be cut and coated with a hot asphalt.

2.2. The rate of side clearance is deemed to be included in the rate of earth work for which no extra will be paid.

3.0. Setting out

After clearing the site the centers lines will be given by the Engineer in charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all parts of the work. Contractor shall supply labours materials etc. required for setting out the reference marks and bench marks and shall maintain them as long as required and directed.

4.0. Excavation

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown I the drawings or as directed. The contractor shall do the necessary shoring and shuttering or providing necessary slopes to a safe angle, at his own cost. The payment for precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be leveled both longitudinally and transferely as directed by removing and watering as required no earth filling will be allowed for bringing it to level. If by mistake or any excavation is made deeper or wider than that shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation up to 1.5 m. depth shall be measured under this item.

5.0. Disposal of the excavated stuff

5.1. The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers including ramming and watering etc.

5.2. The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead up to 50 M. and all lift.

6.0. Mode of measurements & payment

6.1. The measurement of excavation in trenches for foundation shall be made according to the section of trench shown on the drawing or as per sections given by the Engineer in charge. No payment shall be made for surplus excavation made in excess of above requirements or due to stopping and sloping back as found necessary on account of conditions of soil and requirements safety.

3.2. The rate shall be for unit of one cubic meter.

Item No.3 Providing and laying cement concrete 1:4:8 (1 cement, 4sand,8 Crushed stone aggregates 40 mm.Nominal size)and curing complete, excluding cost of formwork in(a) Foundation and Plinth .

1.0. Materials

1.1. Water shall conform to M-1, cement shall conform to M-3, sand shall conform to M-6, Stones aggregate 40 mm. nominal size shall conform to M-12.

2.0. Workmanship**2.1. General**

2.1.1. Before stating concrete the bed of foundation trenches shall be cleared of all loose materials, leveled watered and rammed as directed.

2.2. Proportion of Mix :

2.2.1. The proportion of cement, sand and coarse aggregate shall be one part of cement 4 parts of sand and 8 parts of stone aggregates and shall be measured **by volume**.

2.2.2 The proportion of cement concrete shall be mixed in the preparation of 1 :4 :8 by volume.

2.3. Mixing :

2.3.1. The concrete shall be mixed in a mechanical mixer at the site of work. Hand mixing may however be allowed for smaller quantity of work if approved by the Engineer Inc charge. When hand mixing is permitted by the Engineer in charge in case of break down of machineries and in the interest of the work, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in color and consistency. However in such case 10 % more cement than otherwise period 1 ½ to 2 minutes. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose.

2.4. Transporting & Placing the Concrete :

2.4.1. The concrete shall be handed from the place of mixing to the final position in not more than 15 min. by the method as directed and shall be placed in to its final position,

compacted and finished within 30 min. of mixing with water i.e. before the setting commences.

2.4.2. The concrete shall be laid in layers of 15 cms. To 20 cms.

2.5.1. The concrete shall be rammed with heavy iron rammers and rapidly to get the required compaction and to allow all the interstices to be filled with mortar

2.6. Curing :

2.6.1. After the final set, the concrete shall be kept continuously wet if required by pounding for a period of not less than 7 days from the date of placement.

2.7. Mode of Measurement & Payment :

2.7.1. The concrete shall be measured for its length breadth and depth limiting dimensions to those specification on plan or as directed.

2.7.2. The rate shall be for a unit of one cubic metre.

Item No.4 Providing and laying ordinary cement concrete 1:1:2 (1 cement, 1 sand, 2 graded stone aggregates 20 mm. Nominal size) and finishing smooth with curing etc. complete excluding cost of form work and reinforcement for reinforced cement concrete work in in A) Foundations, footings, base of columns and mass concrete.

1.0. Materials

Water shall conform to M-1, cement shall conform to M-3, sand shall conform to M-6, Grit shall conform to M-8, Graded stone aggregate 20 mm. nominal size shall conform to M-12.

2.0. General

2.1. The concrete mix is not required to be designed by preliminary testes. The proportion of the concrete mix shall be 1:2:4 (1 cement : 2 coarse sand : 4 graded stones aggregate 20 mm. nominal size) by volume concrete shall have exposed concrete surface or as specified in the item.

2.2. The designation ordinary M-100, M-150, M-200, M-250 specified as per I.S. correspond approximate to 1:3:6, 1:2:4, 1:1 ½ : 3 and 1:1:2 nominal mix of ordinary concrete by volume respectively..

2.3. The ingredients required for ordinary concrete containing one bag of cement of 50 kg. by weight (0.0342 Cu. M.) for different proportions of mix shall be as under.

Grade of concrete.	Total quantity of dry aggregate by volume per 50 kgs. Of cement to be taken as the sum of individual volume of fine and coarse aggregates, maximum	Proportion of fine aggregate to coarse aggregate	Quantity of water per 50 kgs. Of cement maximum.
1	2	3	4
M-100(1:3:6)	300 Liters	Generally 1 : 2 for line aggregate	34 Liters
M-150(1:2:4)	220 Liters	To coarse aggregate by vol.	32 Liters
M-200(1 : 1 ½ 3)		160 but subject to an upper limit	30 Liters
M-250(1:1:2)	100 Liters	Of 1 : 1 ½ and lower limit	1:327 Liters

2.4. The water cement ratios shall not be more than specified in the above table. The cement content of mix specified in the table shall be increased if the quantity of water in mix has to be increased to overcome the difficulties of placements and compaction so that the water cement ratio specified in the table is not exceeded.

2.5. Workability of the concrete shall be controlled by maintaining a water cement ratio that is found to give a concrete mix which is just sufficient wet to be placed and compacted without difficulty with the measure available.

2.6. The max. size of coarse aggregate shall be as large as possible within the limits specified but in no case greater than one forth of the minimum thickness of the member provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and to fill the corners of the form.

2.7. For reinforced concrete work, coarse aggregates having a nominal size of 20 mm. are generally considered satisfactory.

2.8. For heavily reinforced concrete members as in the case of ribs of main beams, the nominal max. size of coarse aggregate should usually be restricted to 5 mm. less than the min. clear distance between the main bars, or 5 mm. less than the min. cover to the reinforcement whichever is smaller.

2.9. Where the reinforcement is widely spaced as in solid slabs, limitations of size of the aggregate may not be so important, and the nominal max. size may some times be as great as or greater than min. cover.

2.10. Admixture may be used in concrete only with approval of Engineer in charge based upon the evidence that with passage of time neither the compressive strength of concrete is reduced nor are other requisite qualities of concrete and steel impaired by the use of such admixture.

3.0. Workmanship

3.1. Proportioning : Proportioning shall be done by volume, except which shall be measured in item of bags of 50 kg. weight, the volume of one such bag being taken as 0.0342 cu. Meter. Boxes of suitable size shall be used for measuring sand aggregate. The size of boxes (internal) shall be 35x25 cms. And 40cms. Deep while measuring the aggregate and sand the boxes shall be filled without shaking ramming or hammering. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand, allowances for bulk age shall be made.

3.2. Mixing :

3.2.1. For all work, concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Measured quantity of aggregate, sand and cement required for each batch shall be poured into the drum of the mechanical mixer while it is continuously running. After half a minute of dry mixing measured quantity of water require for each batch of concrete mix shall be added gradually and mixing continued for another one and a half minute. Mixing shall be continued till materials are uniformly distributed and uniform color of the entire mass is obtained and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case shall mixing be done for less than 2 minutes after all ingredients have been put into the mixer.

3.2.2. When hand mixing is permitted by the Engineer in charge for small jobs or for certain other reasons, it shall be done on the smooth water tight platform large enough to allow efficient turning over the ingredients of concrete before and after adding water flow out. Cement in required number of bags shall be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly be turning over to get a mixture to uniform color. Specified quantity water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 percent above that specified.

3.2.3. Mixers which have been out of use for more than 30 minutes shall thoroughly cleaned before putting in a new batch. Unless otherwise agreed to by the Engineer in charge the first batch of concrete from the mixture shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

3.3. Consistency :

3.3.1. The degree of consistency which shall depend upon the nature of the work methods of vibration of concrete, shall be determined by regular slump tests in accordance with I.S. 1199-1939. The slump of 10 mm. to 25 mm. shall be adopted when vibrators are used and 80 mm. when vibrators are not used.

3.4. Inspection :

3.4.1. Contractor shall give the Engineer in charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength, alignment and general fitness but such inspection shall not relieve the contractor of his responsibility for the safety of men machinery, materials and for results obtained. Immediately before concreting all form shall be thoroughly cleaned.

3.4.2. Centering design and its erection shall be got approved from the engineer in charge. One carpenter with helper shall invariably be kept present throughout the period of concreting. Movement of labor and other persons shall be totally prohibited for reinforcement laid in position. For access to different parts suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapachi or metal pieces shall not be used for this purpose.

3.5. Transporting and laying :

3.5.1. The method of transporting and placing concrete shall be as approved. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All form work shall be cleaned and made free from sanding water dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the engineer in charge has been obtained.

3.5.2. Concreting shall proceed continuously over the area between construction joints. Fresh concrete proper contraction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer. Except where otherwise agreed to by the engineer in charge, concrete shall be deposited in horizontal layers to compacted

depth of not more than 0.45 meter when internal vibrators are used and not exceeding 0.30 meter in all other cases.

3.5.3. Unless otherwise agreed to by the Engineer in charge concrete shall be dropped in to place from height exceeding 2 meters. When trucking or chutes are used they shall be kept close and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept clean, the concrete mix itself. The 13 mm. layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13 mm. layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all lateness shall be removed by scrubbing the wet surface with wire be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete too be placed on this surface shall not exceed 150 mm. in thickness and shall be well rammed against old work, particular attention being given to corners and close spots.

3.5.4. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators unless otherwise permitted by the Engineer in charge for exceptional cases, such as concreting under water, where vibrators cannot be used. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipemet is always available in the even of breakdowns. Concrete shall be judged to be compacted when the mortar fills the spaces between the coarse aggregate and begins to cream up to form and even surface. Compaction shall be completed before the initial setting sats i.e. within 30 min. of addition of water to dry mixture. During compaction it shall be observed that needle vibrators are not applied on reinforcement which is likely to destroy the bond between concrete and reinforcement.

3.6. Curing.

Immediately after compaction, concrete weather including rain, running water, shocks vibration traffic rapid temperatures changes, frost and drying out process. It shall be covered with wet sacking has Sian or other similar absorbent material approved, soon after the initial set and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonry work over foundation concrete may be started after 48 hours of its laying but curing of concrete shall be continued for a minimum period of 14 days.

3.7. Sampling and testing of Concrete :

3.7.1. Samples from fresh concrete shall be taken as per I.S. 1199-1959 and cubes shall be made, cured and tested at 7 days of 28 days as per requirements in accordance with I.S. 526-1959. A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and cover all mixing units. The minimum frequency of sampling of concrete of each grade shall be in accordance with following:

Qty. of concrete in the work	No. of Samples	Qty. of concrete in the work	No. of Samples
1-5 cmt.	1	16-30 cmt.	3
6-15 cmt.	2	31-50 cmt.	4
51 and above	4± one additional for each additional 50 mm. or part thereof.		

Note : At least one sample shall be taken from each shift. Ten test specimens shall be made from each sample, five for testing at 7 days and remaining five at 28 days. The samples of concrete shall be taken on each day of concreting as per above frequency. The number of specimens may be suitable increased as deemed necessary by the Engineer in charge when procedure of test given reveals a poor quality of concrete and in other special cases.

3.7.2. The average of the group of cubes cast for each day shall not be less than the specified cube strength of 150 kg./Cm² at 28 days 20 % of the cubes cast for each day may have value less than the specified strength provided the lowest value is not less than 85 % of the specified strength. If the concrete made in accordance with the proportions given for a particular grade does not yield the specified strength, such concrete shall be classified as belonging to the appropriate lower grade. Concrete made in accordance with the proportions given for a particular grade shall not, however be placed in a higher grade on the ground that the test strength are higher than the min. specified.

FOR CONCRETE WORKS IN BEAM/ COLUMN/ SLAB/ STAIR STINGER ARE TO BE TESTED FOR FOLLOWING TEST IN PRESENCE OF ENGINEER IN CHARGE.

9.11 Rebound hammer test

The rebound hammer of a spring controlled mass that slides on a plunger within a tubular housing. the impact energy required for rebound hammers for different application is given in Table

Sl.No.	Application	Approximate Impact Energy Required for the rebound Hammers (Nm)
i)	For Testing normal weight concrete	2.25
ii)	For Light-weight concrete or small and impact sensitive parts of concrete.	0.75
iii)	For test mass concrete for example in road, air fields pavement and hydraulic structures	30.00

Ultrasonic pulse velocity test (UPV)

The apparatus for Ultrasonic pulse velocity measurement shall consist of following:

- Electrical pulse generator,
- Transducer-one pair,
- Amplifier, and
- Electronic timing device

Acceptance criteria for concrete quality grading

Sl.No.	Pulse velocity by cross probing (kg/Sec)	Cement concrete quality grading
1	Above 4.5	Excellent
2	3.5 to 4.5	Good
3	3.0 to 3.5	Medium
4	Below 3.0	Doubtful

Note: In case of "doubtful" quality it may be necessary to carried out further tests of core test.

Core test

The points from which cores are to be taken and number of cores required shall be at the discretion of the engineer-in-charge and shall be representative of the whole of concrete concerned. In no case, however, shall fewer than three cores be tested.

Cores shall be prepared and tested as described in IS 516.

Concrete in the member represented by a core test shall be considered acceptable if the average equivalent cube strength of the cores is equal to at least 85 percent of the cube strength of the grade of concrete specified for the corresponding age and no individual core has a strength less than 75 percent.

3.8. Stripping :

3.8.1. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike the form work. While fixing the time of removal of formwork, due consideration shall be given to local conditions, character of the structure, the weather and other conditions that influence the setting of concrete and of the materials used in the mix. In normal circumstance (generally where temperatures are above 20 ° C) and where ordinary concrete is used, forms may be struck after expire or periods specified in item No. 9.1.(A) for respective item of form work.

3.8.2. All formwork shall be removed without causing any shock or vibration as would damage the concrete. Before the soft and struts are removed, the concrete surface shall be gradually exposed, where necessary in order to ascertain that concrete to take stresses due to its own weight uniformly and gradually and uniformly lowered in such a manner as to permit the or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25mm. cover to the finished concrete surface. Where it is intended to reuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer in charge. After removal of form work and shuttering the Executive Engineer shall inspect the work and satisfy by random checks that concrete produced is of good quality.

3.8.3. Immediately after the removal of forms, all exposed bolts etc. passing through the cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at least 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints all cavities produced by the removal of form tiles and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in proportions used in the grade of concrete that is being furnished and of as dry consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surface which are pointed shall be kept moist for period of 25 hours. If rock pockets/honeycombs in the opinion of the Engineer in charge are of such an extent or character as to effect strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of structure affected.

4.0. Mode of measurement & Payment

4.1. The consolidated cubical contents of concrete work as specified in item shall be measured. NO deduction shall be made for (a) Ends of dissimilar materials such as joints, beams, posts, girders, girders, purling trusses, corbels and steps etc. up to 500 sq. cm. in section.

4.2. The rate includes cost of all materials labor, tools and plant required for mixing, placing in position vibrating and compacting, finishing, as directed, curing and all other incidental expenses for producing concrete of specified strength. The rate excludes the cost of formwork.

4.3. The rate shall be for a unit of one cubic meter

Item No.5 Providing and laying ordinary cement concrete 1:1.5:3 (1 cement, 1.5 sand, 3 graded stone aggregates 20 mm. Nominal size) and finishing smooth with curing etc. complete including the cost of formwork but excluding the cost of reinforcement of R.C.C. work in Column (iii) Having cross-sectional area more than 0.085 Sq.M. and up to 0.12 Sq.M

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.4 R.C.C. WORK M-20 IN COLUMNS

Item No.7. Filling in plinth with sand under floors including ramming watering, consolidating and dressing etc. complete.

1.0. Workmanship

1.1. The earth to be used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken.

1.2. As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, bricks bats, mortar dropping etc. and filled with earth in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid. The earth shall be rammed with iron rammers where feasible and with the but ends of crow-bars where rammer cannot be used.

1.3. The plinth shall be similarly filled with earth in layers not exceeding 20 Cms. Adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finished level the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

1.4. The finished level of filling shall be kept to shape intended to be given to floor.

1.5. In case of large heavy duty flooring like factory flooring, the consolidation may be done by power rollers where so specified. The extent of consolidation required shall also be as specified.

1.6. The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

2.0. Mode of Measurements & Payment

2.1. The payment shall be made for filling plinth and trenches. No deduction shall be made for shrinkage or voids, if consolidated as instructed above.

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

1.0. Materials

1.1. Sand shall conform to M 6.

2.0. Workmanship

The relevant specifications of **This item above** shall be followed except that sand shall be filled in under floors including watering, ramming, consolidating and dressing etc., complete.

3.0. Mode of measurements & Payment

3.1. The relevant specifications of **This item above** shall be followed.

3.2. The rate includes cost of collecting carting sand with all lead and labor for filling the same in plinth under floors.

3.3 The rate shall be for a unit of one cubic meter

Item No.6 Brickwork using common burnt clay building brick shaving crushing strength not less than 35 Kg/Sqcm. in foundation and plinth in cement mortar 1:6(1 Cement ; 6 Fine sand) Conventional bricks

1.0. Materials

Water shall conform to M-1, Cement shall conform to M-3, sand shall conform to M-6, Brick shall conform to M-15, Cement mortar shall conform to M-11.

1.0. Workmanship

2.1 Proportion :

2.1.1. The proportion of cement mortar shall be 1:6 or 1 : 5 (1 cement : 5 fine sand) by volume.as specified

2.2. Wetting of bricks :

2.2.1. The bricks required for masonry shall be thoroughly wetted with clean water for about two hours before use or as directed. The cessation of bubbles, when the bricks are wetted with water is as indication of through wetting of bricks.

2.3. Laying :

2.3.1. Bricks shall be laid in English bond unless directed otherwise. Half or cut bricks shall not be used except when necessary to complete to bond ; closures in such case shall be cut to required size and used near the ends of walls.

2.3.2. A layer of mortar shall be spread on full width for suitable length of the lower course. Each bricks shall first be property bedded and set some by gently tapping with handle of trowel or wooden mallet. Its inside face shall be flushed with

mortar before the next brick is laid and pressed against it. On completion of course the vertical joints shall be fully filled from the top with mortar.

- 2.3.3.** The walls shall be taken up truly in plumb. All courses shall be laid truly horizontal and all vertical joint shall be truly vertical. Vertical joints in alternate course shall generally be directly one over the other. The thickness of brick course shall be kept uniform.
- 2.3.4.** The brick shall be laid with frog up wards. A set of tools comprising of wooden straight edges, man son's spirit level, square half meter rub, and pins string and plumb shall be kept on the site of work for frequent checking during the progress of work.
- 2.3.5.** Both the faces of walls of thickness greater than 23 cms. Shall be kept in proper place. All the connected brick work shall be kept not more than one meter over the rest of the work. Where this is not possible, the work shall be raked back according to bond(and not left toothed)at an angle not steeper than 45 degrees.
- 2.3.6.** All futures, pipes, outlets of water, hold fasts of doors and window etc. which are require to be built in wall shall be embedded in cement mortar.

2.4. Joints

2.4.1. Bricks shall be so laid that all joints are quite flush with mortar. Thickness of joints shall not exposed 12 mm. The face joints shall be raked out as directed by raking tools daily during the progress of work, when the mortar is still in green so as to provide key for plaster of pointing to done.

2.4.2. The face of brick shall be cleaned the very day on which the work is laid and all mortar dropping removed.

2.5. Curing :

2.5.1. Green work shall be protected from rain suitable. Masonry work shall be kept moist on all the faces for a period of seven days. The top of masonry work shall be kept well wetted at the close of the day.

2.6. Preparation of foundation bed :

2.6.1. If the foundation is to be laid directly on the excavated bed, the shall be leveled, cleared of all loose materials, cleaned and wetted before stating masonry, if masonry is to be laid on concrete footing, the top of concrete shall be cleaned and moistened. The contractor shall obtain the engineer's approval for the foundation bed before foundation masonry is started. When pucca flooring is to be provided flush with the top to plinth, the inside plinth offset shall be kept lower than the outside plinth top by the thickness of the flooring.

3.0. Mode of measurement & Payment.

- 3.1.** The measurement of this item shall betaken for the brick masonry fully completed I foundation up to plinth the limiting dimensions not exceeding those shown on the plinths or as directed shall be final. Battered tapered and curved portions shall be measured net.
- 3.2.** No deduction shall be made from the quantity of brick work, for any extra payment made for embedding in masonry of making holes in respect of following items :
- (1) Ends of joists, beams, posts, girders, purlins, trusses, corbel, steps etc. where cross sectional area does not exceed 500 sq. Cm.

- (2) Openings not exceeding 1000 Sq. Cm.
- (3) Wall plates and bed plates, bearing of slabs, chhajas and the like whose thickness does not exceed 10 Cms. And the bearing does not extend to the full thickness of wall.
- (4) Drainage holes, and recesses for cement concrete blocks to embed hold fasts for doors, windows etc.
- (5) Iron fixtures, pipes up to 300 m. dia; hold fasts, and doors and windows built into masonry and pipes etc. for concealed wiring.
- (6) Forming chases of section not exceeding 350 Sq. Cm. in masonry
- 3.3.** Apertures for fire place shall not be deducted or shall be paid for separately.
- 3.4.** The rate shall be for a unit of one cubic meter.

Item No.7. Filling in plinth with sand under floors including ramming watering, consolidating and dressing etc. complete.

1.0. Workmanship

1.1. The earth to be used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken.

1.2. As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, bricks bats, mortar dropping etc. and filled with earth in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid. The earth shall be rammed with iron rammers where feasible and with the but ends of crow-bars where rammer cannot be used.

1.3. The plinth shall be similarly filled with earth in layers not exceeding 20 Cms. Adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finished level the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

1.4. The finished level of filling shall be kept to shape intended to be given to floor.

1.5. In case off large heavy duty flooring like factory flooring, the consolidation may be done by power rollers where so specified. The extent of consolidation required shall also be as specified.

1.6. The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

2.0. Mode of Measurements & Payment

2.1. The payment shall be made for filling I plinth and trenches. No deduction shall be made for shrinkage or voids, if consolidated as instructed above.

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

1.0. Materials

1.1. Sand shall conform to M 6.

2.0. Workmanship

The relevant specifications of item No. 4.12 shall be followed except that sand shall be filled in under floors including watering, ramming, consolidating and dressing etc., complete.

3.0. Mode of measurements & Payment

3.1. The relevant specifications of item no. 4.12 shall be followed.

3.2. The rate includes cost of collecting carting sand with all lead and labor for filling the same in plinth under floors.

3.3 The rate shall be for a unit of one cubic meter

Item No.8 Filling available excavated earth (excluding rock) in trenches plinth, sides of foundations etc. in layers not exceeding 20 cm in depth consolidating each disposed layer by ramming and watering.

1.0. Workmanship

1.1. The earth to be used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken.

1.2. As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, bricks bats, mortar dropping etc. and filled with earth in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid. The earth shall be rammed with iron rammers where feasible and with the but ends of crow-bars where rammer cannot be used.

1.3. The plinth shall be similarly filled with earth in layers not exceeding 20 Cms. Adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finished level the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

1.4. The finished level of filling shall be kept to shape intended to be given to floor.

1.5. In case off large heavy duty flooring like factory flooring, the consolidation may be done by power rollers where so specified. The extent of consolidation required shall also be as specified.

1.6. The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

Item No.9 Brickwork using common burnt clay building brick shaving crushing strength not less than 35 Kg/Sqcm. in super structure for all floors in cement mortar 1:6(1 Cement ;6 Fine sand)

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.6 FOR SUPER STRUCTURE

Item No.10 Providing and laying cement concrete 1:1.5:3 (1 cement, 1.5 sand, 3 graded stone aggregates 20 mm. Nominal size) and curing complete, including cost of formwork in sill and sides (R.C.C. band) but excluding the cost of reinforcement for all Floor level.

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.4 R.C.C. WORK M-20 IN R.C.C BAND

Item No.11 Providing & laying ordinary C.C. 1:1 1/2:3 (1 cement ,1 1/2 course sand, 3 graded stone agg. of 20 mm nominal size)and for R.C.C. LINTELS incl. Finishing smooth with curring of formwork but excl. the cost of reinforcement.for above floor for all Floor level.

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.4 R.C.C. WORK M-20 IN LINTEL

Item No.12 Providing & laying cement concrete 1:1 1/2:3 (1 cement ,1 1/2 course sand, 3 graded stone agg. of 20 mm nominal size) for reinforcement concrete CHHAJJAS not exceeding 10cm. thickness for all Floor level incl. finishing the exposed surface with C.M. 1:3 (1 cement ,3 fine sand) to give a smooth and even surface, centering, formwork and curring comp. Excl. the cost of reinforcement. above plinth for all Floor level.

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.4 R.C.C. WORK M-20 FOR CHHAJA

Item No.13 Providing & laying C.C. 1:1 1/2:3 (1 cement ,1 1/2 course sand, 3 graded stone agg. of 20 mm nominal size) and finishing smooth with curring etc. comp. incl. the cost of formwork but excl. the cost of reinforcement for R.C.C. work in. (A) Beam :- Having cross sectional Area 0.085 to 0.12 Sqm. for all Floor level

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.4 R.C.C. WORK M-20 FOR BEAM

Item No.14 Providing & laying ordinary cement concrete 1:11/2:3 (1 cement, 11/2 course sand, 3 graded stone agg. of 20 mm nominal size) exposed work with curring etc. comp. incl. the cost of formwork but excluding the cost of reinforcement for R.C.C. work in. SLAB :- having more than 10cm. and end upto 13cm. thickness upto floor two level

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.4 R.C.C. WORK M-20 FOR SLAB

Item No.15 Providing & laying ordinary cement concrete 1:11/2:3 (1 cement, 11/2 course sand, 3 graded stone agg. of 20 mm nominal size) exposed work with curring etc. comp. incl. the cost of formwork but excluding the cost of reinforcement for R.C.C. work in. Staircases Excluding Landing up to all floor

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.4 R.C.C. WORK M-20 FOR STAIRCASE

Item No.16 Thermo Mechanically treated bar F.F.415 Steel reinforcement for R.C.C. work including bending, binding and placing in position complete for all Floor level.

DESCRIPTION

This work shall consist of furnishing and placing coated or uncoated mild steel or high strength deformed reinforcement bars (un tensioned) of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer.

MATERIALS

Steel for reinforcement shall meet with the requirements of Section 1000.

TABLE 1000 – 3

Grade Designation	Bar type conforming to governing IS Specification	Characteristic Strength Mpa	Elastic Modulus GPa
S 240	IS : 432 Part I Mild Steel Bar	240	200
S 415	IS : 1786 High Yield Strength Deformed Bars (HYSD)/TMT	415	200

Reinforcements may be either mild steel/medium tensile steel or high strength deformed bars/ TMT. They may be uncoated or coated with epoxy or with approved protective coatings.

PROTECTION OF REINFORCEMENT

Uncoated reinforcing steel shall be protected from rusting or chloride contamination. Reinforcements shall be free from rust, mortar, loose mill scale, grease, oil or paints. This may be ensured either by using reinforcement fresh from the factory or thoroughly cleaning

all reinforcement to remove rust using any suitable method such as sand blasting, mechanical wire brushing, etc., as directed by the Engineer. Reinforcements shall be stored on blocks, racks or platforms and above the ground in a clean and dry condition and shall be suitably marked to facilitate inspection and identification.

Portions of uncoated reinforcing steel and dowels projecting from concrete, shall be protected within one week after initial placing of concrete with a brush coat of neat cement mixed with water to a consistency of thick paint. This coating shall be removed by lightly tapping with a hammer or other tool not more than one week before placing of the adjacent pour of concrete. Coated reinforcing steel shall be protected against damage to the coating. If the coating on the bars is damaged during transportation or handling and cannot be repaired, the same shall be rejected.

BENDING OF REINFORCEMENT

Bar bending schedule shall be furnished by the Contractor and got approved by the Engineer before start of work.

Reinforcing steel shall conform to the dimensions and shapes given in the approved Bar Bending Schedules.

Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer using a proper bar bender, operated by hand or power to obtain the correct radii of bends and shape.

Bars shall not be bent or straightened in a manner that will damage the parent material or the coating.

Bars bent during transport or handling shall be straightened before being used on work and shall not be heated to facilitate straightening.

PLACING OF REINFORCEMENT

a) The reinforcement cage should generally be fabricated in the yard at ground level and then shifted and placed in position. The reinforcement shall be placed strictly in accordance with the drawings and shall be assembled in position only when the structure is otherwise ready for placing of concrete. Prolonged time gap between assembling of reinforcements and casting of concrete, which may result in rust formation on the surface, shall not be permitted.

b) Reinforcement bars shall be placed accurately in position as shown on the drawings. The bars, crossing one another shall be tied together at every intersection with binding wire (annealed), conforming to IS:280 to make the skeleton of the reinforcement rigid such that the reinforcement does not get displaced during placing of concrete, or any other operation. The diameter of binding wire shall not be less than 1 mm.

c) Bars shall be kept in position usually by the following methods:

(i) In case of beam and slab construction, industrially produced polymer cover blocks of thickness equal to the specified cover shall be placed between the bars and formwork subject to satisfactory evidence that the polymer composition is not harmful to concrete and reinforcement. Cover blocks made of concrete may be permitted by the Engineer, provided they have the same strength and specification as those of the member.

(ii) In case of dowels for columns and walls, the vertical reinforcement shall be kept in position by means of timber templates with slots cut in them accurately, or with cover blocks tied to the reinforcement. Timber templates shall be removed after the concreting has progressed upto a level just below their location.

(iii) Layers of reinforcements shall be separated by spacer bar at approximately one metre intervals. The minimum diameter of spacer bars shall be 12 mm or equal to maximum size of main reinforcement or maximum size of coarse aggregate, whichever is greater.

Horizontal reinforcement shall not be allowed to sag between supports.

(iv) Necessary stays, blocks, metal chairs, spacers, metal hangers, supporting wires etc, or other subsidiary reinforcement shall be provided to fix the reinforcements firmly in its correct position.

(v) Use of pebbles, broken stone, metal pipe, brick, mortar or wooden blocks etc., as devices for positioning reinforcement shall not be permitted.

d) Bars coated with epoxy or any other approved protective coating shall be placed on supports that do not damage the coating. Supports shall be installed in a manner such that planes of weakness are not created in hardened concrete. The coated reinforcing steel shall be held in place by use of plastic or plastic coated binding wires especially manufactured for the purpose. Reference shall be made to Section 1000 for other requirements.

e) Placing and fixing of reinforcement shall be inspected and approved by the Engineer before concrete is deposited.

BAR SPLICES

1. Lapping

All reinforcement shall be furnished in full lengths as indicated on the drawing. No splicing of bars, except where shown on the drawing, will be permitted without approval of the Engineer. The lengths of the splice shall be as indicated on drawing or as approved by the Engineer. Where practicable, overlapping bars shall not touch each other, and shall be kept apart by 25 mm or 1 I/. . times the maximum size of coarse aggregate, whichever is greater. If this is not feasible, overlapping bars shall be bound with annealed steel binding wire, not less than 1 mm diameter and twisted tight in such a manner as to maintain minimum clear cover to the reinforcement from the concrete surface. Lapped splices shall be staggered or located at points, along the span where stresses are low.

2. Welding

.2.1. Splicing by welding of reinforcement will be permitted only if detailed on the drawing or approved by the Engineer. Weld shall develop an ultimate strength equal to or greater than that of the bars connected.

.2.2. While welding may be permitted for mild steel reinforcing bars conforming to IS: 432, welding of deformed bars conforming to IS: 1786 shall in general be prohibited. Welding may be permitted in case of bars of other than S, 240 grade including special welding grade of S 415 grade bars conforming to IS: 1786, for which necessary chemical analysis has been secured and the carbon equivalent (CE) calculated from the chemical composition using the formula

$$CE = C + \frac{Mn}{6} + \frac{Cr+Mg+V}{5} + \frac{Ni+Cu}{15}$$

is 0.4 or less.

2.3. The method of welding shall conform to IS:2751 and 15:9417 and to any supplemental specifications to the satisfaction of the Engineer. Welding may be carried out by metal arc welding process. Oxy- acetylene welding shall not be permissible. Any other process may be used subject to the approval of the Engineer and necessary additional requirements to ensure satisfactory joint performance. Precautions on over heating, choice of electrode, selection of correct current in arc welding etc., should be strictly observed.

All bars shall be butt welded except for smaller diameter bars (diameter of less than 20 mm) which may be lap welded. Single-V or Double- V butt joints may generally be used. For vertical bars single bevel or double bevel joints may be used.

Welded joints shall be located well away from bends and not less than twice the bar diameter away from a bend.

Generally, shop welding in controlled conditions is to be preferred, where feasible. Site welding where necessary shall, however, be permitted when the facilities, equipment, process, consumables, operators, welding procedure are adequate to produce and maintain uniform quality at par with that attainable in shop welding to the satisfaction of the Engineer.

Joint welding procedures which are to be employed shall invariably be established by a procedure specification. All welders and welding operators to be employed shall have to be qualified by tests prescribed in IS: 2751. Inspection of welds shall conform to IS: 822 and destructive or non-destructive testing may be undertaken when deemed necessary. Joints with weld defects detected by visual inspection or dimensional check inspection shall not be accepted.

Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding. When welding is done in 2 or 3 stages, previous surface shall be cleaned properly. Bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before carrying out welding. Only competent and experienced welders shall be employed on the work with the approval of the Engineer. No welding shall be done on coated bars.

2.4 M.S. electrodes used for welding shall conform to IS: 814. 1606.2.4. Welded joints shall preferably be located at points where steel will not be subject to more than 75 per cent of the maximum permissible stresses and welds so staggered that at any one section, not more than 20 per cent of the bars are welded.

2.5. Welded pieces of reinforcement shall be tested. Specimens shall be taken from the site and the number and frequency of tests shall be as directed by the Engineer.

3. Mechanical Coupling of Bars

Bars may be joined with approved patented mechanical devices as indicated on the drawing or as approved by the Engineer e.g. by special grade steel sleeves swagged on to bars in end to end contact or by screwed couplers. In case such devices are permitted by the Engineer, they shall develop at least 125 per cent of the characteristic strength of the reinforcement bar.

TESTING AND ACCEPTANCE

The material shall be tested in accordance with relevant IS specifications and necessary test certificates shall be furnished. Additional tests, if required, will be got carried out by the Contractor at his own cost.

The fabrication, furnishing and placing of reinforcement shall be in accordance with these specifications and shall be checked and accepted by the Engineer.

MEASUREMENTS FOR PAYMENT

Reinforcement shall be measured in length including hooks, if any, separately for different diameters as actually used in work, excluding overlaps. From the length so measured, the weight of reinforcement shall be calculated in tonnes on the basis of IS: 1732. Wastage, overlaps, couplings, welded joints, spacer bars, chairs, stays, hangers and annealed steel wire or other methods for binding and placing shall not be measured and cost

of these items shall be deemed to be included in the rates for reinforcement.

RATE

The contract unit rate for coated/uncoated reinforcement shall cover the cost of material, fabricating, transporting, storing, bending, placing, binding and fixing in position as shown on the drawings as per these specifications and as directed by the Engineer, including all labour, equipment, supplies, incidentals, sampling, testing and supervision.

The unit rate for coated reinforcement shall be deemed to also include cost of all material, labour, tools and plant, royalty, transportation and expertise required to carry out the work. . The rate shall also cover sampling, testing and supervision required for the work.

Item No.17 Providing fixing of Polished Kotah stone frame for Doors & wIndows of 15cmx4 cm. Size including necessary holdfasts, holes for fixtures and fastenings incl. all labour & materials etc. comp

1.0. Materials

Kotah stone in frames shall conform to M-49.

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 dedo, skirting, sink, veneering, sills, steps etc. where machine polishing after the stones are fixed in situ is not possible shall be double polished.

2.0. Workmanship

2.1. The item covers the requirement of Kotah stone frames for doors, windows, clerestory windows, their supply and fixing.

2.2. Frames

2.2.1. All members of frames shall be exactly at right angles. The right angle shall be checked from inside surfaces of the frames of the respective members.

2.2.2. All members of frames shall be straight without any warp of bow and shall have smooth surfaces well planed on the three sides exposed at right angles to each other. The surfaces touching the wall may not be planed unless it is required in order to straighten up the member or to obtain the overall sizes within tolerances as specified.

2.2.3. Frame shall have dovetail joints. When clerestory windows included, it shall be provided by having full length one piece post for door or windows and clerestory window extending the frame on top at the head to the required extent. Horns shall not be provided in the head of the frame. When no sills are provided, the vertical posts of the frame in the ground floor shall be embedded in the sill masonry for 10 cm. on upper floors, the vertical posts shall be fixed in the floor or masonry by forming notches 1- mm. deep. Slight adjustment of spacing as necessary shall be done to have the hold fasts in the joints of masonry course. The frame shall be erected in position and held plum with strong support from north sides and built in masonry as it is being built. The transom shall be through tenoned into the mortises of the jamb post to the full width of the jamb post and the thickness of the tenon shall be not less than 15 mm.

2.3. Tolerance :

Unless specially mentioned otherwise tolerance of +1.5mm. shall be allowed for each wrought face.

2.4. The tenons shall be closely fitting into the mortises and suitably pinned with wood dowels not less than 10 mm. dia. Meter. The depth of rebates for housing the shutter shall be as shown in the detailed drawing or as directed.

2.5. The concrete surface of tenon and mortise shall be treated before putting together with an adhesive of approved make.

2.6. Minimum number of three hold fasts shall be fixed on each side of door and windows frames, one at the center point and the other two at 30 mm. from the top and bottom of the frames. In case of windows and ventilators frames. The size of each hold fast shall be 300 x 25 x 6 mm. and of mild steel with split end. The hold fasts shall be fixed with screws to frames.

2.7. Mild steel hold fasts shall be protected with a coating of coal asphalt tar. The surface of frame abutting the masonry or concrete faces shall be properly treated by applying a coat of approved coating.

3.0. Mode of Measurement and payment

3.1. The linear dimensions shall be measured correct up to 1 cm. The quantity shall be worked out correct to places of decimals of cu.m.

3.2. The rate shall be for a unit of One sqm.

Item No.18 Providing and fixing 35mm. Thick Panelled, glazed or Panelled and glazed shutters for doors, windows and clerestory windows including anodised aluminium butt hinges with necessary screws and Indian Teak Wood shutters with-
(B) Partical board panells. 12mm. thick including applying primer and two coats of oil painting etc. complete

1.0. Materials

1.1. Wood in frames shall conform to M-29. 2. Glass shall conform to M-38. 3. Anodized aluminum butt hinges shall conform to M-43.

1.0. Materials and workmanship

1.0. The relevant specification of item No. 10.23 shall be followed except that the hinges shall be of black enameled M.S. butt hinges instead of anodized aluminum butt hinges and shutter with (A) Plywood (B) Particle (C) Hard Board panels, (D) Asbestos sheet panels.

2.0. Workmanship

1.0. The item covers the requirement of preparation of shutters for doors, windows, clerestory windows, their supply and fixing.

1.0. Shutters :

2.2.1. Paneled shutters shall be constructed in the form of timber frame work of styles and rails with panel inserted of type as specified in the detailed drawings. Panel shall be fixed by providing grooves in the style and rails. The styles and rails shall be joined to each other by mortise and tenon joints at right angles.

2.2.2. All members of the shutters shall be straight without any warp or bow and shall have smooth, well planed faces at right angles to each other.

2.2.3. The size of styles and rails shall be as per drawings or as directed. Tyles and rails of shutters shall be made of one piece only.

2.0. Timber paneling :

2.3.1. Thickness of the panel shall be as specified in the item as shown in the drawing or as directed. If the panel is made from more than one piece the pieces shall be finished as

shown in the detailed drawings and shall be joined with continuous groove with specified size. The end pieces of the panel and the top and bottom of the panel shall be provided with continuous tongue to frame into groove of the frame shutter. An air space of 1.5 mm. shall be left in the groove of frame of shutter while framing the panels in it.

2.3.2. The faces of the panel as well as various pieces of the panel shall be closely fitted to the sizes of the grooves.

2.3.3. Finishing of the corners of raised panel edges shall be done as shown in drawings or as directed.

2.3.4. The thickness specified shall be finished thickness and no tolerance will be permitted.

2.5. Fixture and Fastenings ;

2.5.1. The rate shall include anodized butt hinges including fixing with iron screws. The size and number of hinges shall be as per table given in annexure -1.

3.0. Mode of measurements and payment

3.1. The rate for shutter includes cost of providing block and cleat for keeping the shutter in open position if directed.

3.2. The dimension of the shutter shall be measured clear size of the shutter in close position between the grooves of the frame.

3.3. The rate shall be for a unit of one sq. Meter.

Item No.19 Providing 15mmthick cement plaster in single coat on fair side of Brick/concrete walls for interior plastering for all floor and finished even and smooth in (I)cement mortar 1:3 (1 cement:3 sand) .for all floor.

1.0. Materials

Water shall conform to M-1, The cement mortar of proportion 1 : 3 shall conform to M-13.

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.

3.0. Mode of measurements & 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.

Item No.21 Providing 10 mm thick cement plaster in single coat on fair side of Brick/concrete walls for interior plastering for all floor and finished even and smooth in (I) cement mortar 1:3 (1 cement:3 sand) for all floor level finished even & smooth with floating coat of neat cement slurry.

1.0. Materials

Water shall conform to M-1, The cement mortar of proportion 1 : 3 shall conform to M-13.

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 is 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 is 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.

3.0. Mode of measurements & 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 reveals, 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.

Extra over item 51 to 65 for finishing with a floating coat of neat cement slurry.

1.0. Materials & Workmanship.

1.1. The relevant specifications of item No. 17.58 and 17.61 shall be followed for materials and workmanship except that this work is only providing smooth cement finish with floating coat of neat cement slurry.

1.2. The coat of cement and fine sand mortar of proportion 1 : 1 (1.5 mm. thick about) shall be applied to the plastered surface with a trowel to provide uniform texture while the base coat is still plastic.

1.3. In any continuous face of wall the finishing treatment should be carried out continuously and day to day breaks made to coincide with architectural breaks in order to avoid unsightly junctions.

1.4. Curing : All the plaster work shall be kept damp continuously for a period of 7 days.

2.0. Mode of measurement and payment

2.1. The payment shall be made for a unit of 1.0. sq. mt. of work done over and above the finishing of work of base coat.

2.2. The relevant specifications of item of base coat shall be followed for measurements and payment.

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

Item No.21 Providing and laying 24" x 24" vitrified 8MM thick tile flooring over 20MM (average) base of cement mortar 1:6 (1- Cement : 6-Coarse Sand) on new surface or fixing on existing flooring by adhesive material including dismantling of existing flooring and jointed with colour cement slurry including finished with flush pointing and cleaning the surface etc. complete. For Light shade.

SPECIFICATION FOR FLOORING

1 Scope

1.1 This specification covers providing, laying, finishing, curing, testing, protection, maintenance till handing over various types of floor finishes and allied items of work as listed below:

- a) Ironite/IPS/Granolithic floor finish
- b) Ceramic tile finish
- c) Kotah stone floor finish
- d) Vitrified floor tile finish
- e) Mastic Floor Finish
- f) Rubble soling

2 General

2.1 Base: The base to receive the finish either formed concrete sub-base or floor slab covered under other relevant specifications.

2.2 Commencement, scheduling and sequence of the finishing works shall be planned in detail and must be specifically approved by the Engineer-In-Charge, keeping in view the activities of other agencies working in the area. However, the contractor shall remain fully responsible for all normal precautions and vigilance to prevent any damage whatsoever till handing over.

2.3 Only workers specially experienced in particular items of finishing work shall be engaged; where such workers are not readily available, with the Engineer-In-Charge's permission, experienced supervisors recommended by the manufacturer shall be engaged. In particular cases where the Consultant so desire, the Contractor shall get the finishing items installed by the manufacturer.

2.4 The surface to be treated shall be thoroughly examined by the Contractor. Any rectification necessary shall be brought to the notice of the Consultant and his approval shall be obtained regarding method and extent of such rectification work. For all types of flooring, skirting, dado and similar works the base to receive the finish shall be adequately roughened by chipping, raking out joints and cleaning thoroughly all dirt, grease etc., with water and hard brush and (detergent if required, unless otherwise directed by the manufacturer of any special finishing treatment, the base shall be thoroughly soaked with water and all excess water mopped up. The surface shall be done dry where adhesive are used for fixing the finishes. Prior to commencement of actual finishing the approval of the Engineer-In-Charge shall be taken as to the acceptability of the surface.

3 Codes and Standards

3.1 All applicable standards, acts and codes of practice referred to shall be the latest editions including all applicable official amendments and revisions. A complete set of all these documents shall generally be available at site, with the Contractor.

Some of the applicable Indian standards, Codes, etc. are referred to here

IS 13630:1993 Method of test for ceramic tile

IS 15622:2006 Specification for pressed ceramic tile.

IS : 13753:1993 Specification for dust pressed ceramic tiles with water absorption

General

Flooring in any Structure may have to be done in discontinuous strips or areas to suit the equipment erection. The flooring shall be done in close co-ordination with other agencies and shall keep pace with the requirements of erection.

4 Materials

4.1 Materials required for individual finishing items are specified under respective items. In general, all such materials shall be as per relevant IS Codes where available. In all cases these materials shall be of the best quality available indigenously unless specified otherwise.

4.2 The materials for finishing items must be procured from well-reputed specified manufacturers and on the basis of approval of samples by the MMCI/HPCL Engineer-In-Charge. The materials shall be ordered, procured and stored well in advance to avoid compulsion to use substandard items to maintain the construction schedule.

6 Ceramic Tile

6.1 Ceramic Tiles for flooring

The tiles shall be of approved make and shall generally conform to IS:15622. They shall be flat and true to shape and free from blisters, crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested in accordance with IS:13630. The tiles shall be square or rectangular of nominal size such as 150 x 150 mm, 200 x 200 mm, 300 x 300 mm or as directed by the Engineer-In-Charge. The thickness of the tiles shall be 7 mm as specified

Tolerance in Size

The length of all four sides shall be measured correct to 0.1 mm and average length / breadth shall not vary more than ± 0.8 mm from the specified dimension. The variation of individual dimension from average value of length/breadth shall not exceed ± 0.5 mm. Tolerance in thickness shall be ± 0.4 mm.

NOTE :

The actual size of tiles supplied shall be 1 mm less so that with 1 mm joint, the tile when laid shall conform to the nominal size.

The top surface of the tiles shall be glazed and the glaze shall be either glossy or matt as specified. The underside of the tiles shall not have glaze on more than 5% of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze. However, any glaze if unavoidable, shall be permissible on only upto 50 per cent of the surface area of the edges.

6.2 Preparation of Surface and Laying

Base concrete or the RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tile shall be with cement mortar 1:4 (1 cement : 4 coarse sand) or as specified. The average thickness of the bedding shall be 10 mm while the thickness under any portion of the tiles shall not be less than 5 mm.

Mortar shall be spread, tamped and corrected to proper levels and allowed to harden sufficiently to offer a fairly rigid cushion for the tiles to be set and to enable the mason to place wooden plank across and squat on it.

Over this mortar bedding neat grey cement slurry of honey like consistency shall be spread at the rate of 3.3 kg of cement per square metre over such an area as would accommodate about twenty tiles. Tiles shall be soaked in water washed clean and shall be fixed in this grout one after another, each tile gently being tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern.

The surface of the flooring during laying shall be frequently checked with a straight edge about 2 m long, so as to obtain a true surface with the required slope.

Where full size tiles cannot be fixed these shall be cut (sawn) to the required size, and their edge rubbed smooth to ensure straight and true joints.

Tiles which are fixed in the floor adjoining the wall shall enter not less than 10 mm under the plaster, skirting or dado.

After tiles have been laid surplus cement slurry shall be cleaned off.

6.3 Pointing and Finishing

The joints shall be cleaned off the grey cement slurry with wire/coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigment if required to match the colour of tiles. The floor shall then be kept wet for 7 days. After curing, the surface shall be washed and finished clean.

6.4 Acceptance Criteria

The finished floor shall not sound hollow when tapped with a wooden mallet.

No loose tiles shall be accepted. Joints cannot be too wide and too narrow, and shall be in straight lines or as per the layout drawing. Joints shall be parallel to wall and orthogonal.

7 Ceramic Tiles in Skirting and Dado

The tiles shall be of approved make and shall generally conform to IS:15622. The tiles shall be of earthenware covered by a glaze thoroughly matured and fitted to the body. The tiles shall be sound, true to shape, flat and free from flaws and other manufacturing defects affecting their utility.

7.1 Preparation of Surfaces

The joints shall be raked out to a depth of at least 10 mm in masonry walls.

In case of concrete walls, the surface shall be hacked and roughened with wire brushes. The surface shall be cleaned thoroughly, washed with water and kept wet before skirting is commenced.

7.2 Laying

12 mm thick plaster of cement mortar 1:4 (1 cement : 4 coarse sand) mix or as specified shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonally at close intervals.

The tiles shall be soaked in water for one day, washed clean, and a coat of buttery cement slurry applied liberally at the back of the tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines.

The tiles shall be set in the required pattern and jointed. The joints shall be as fine as possible.

Top of skirting or dado shall be truly horizontal and joints truly vertical except where otherwise indicated.

Skirting and dado shall rest on the top of the flooring. Where full size tiles cannot be fixed these shall be cut (sawn) to the required size and their edges rubbed smooth.

7.3 Curing and Finishing

The joints shall be cleaned off the grey cement grout with wire/coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigments if required to match the colour of tiles. The work shall then be kept wet for 7 days.

7.4 Acceptance Criteria

After curing, the surface shall be washed and finished clean. The finished work shall not sound hollow when tapped with a wooden mallet, shall be in true level and plain. Joints shall be straight, not too wide, too narrow etc. Tiles shall be laid as per slope indicated. Slope shall be uniform if indicated.

10 Vitrified Tile Flooring Dado / Skirting / Facia

10.1 Materials

Vitrified Tiles: The tiles shall be of approved make like Marbonite / Granamite or equivalent and shall generally conform to the approved standards. They shall be flat and true to shape, free from cracks, crazing spots, chipped edges and corners. Unless otherwise specified, the nominal sizes of tiles shall be as under:

The tiles shall be square or rectangular of nominal sizes such as: 600 x 600 mm; 900 x 900 mm or as per tender schedule / drawings or as directed by the Engineer-in-Charge. Thickness shall be as per recommendations of the approved manufacturers.

Technical specifications of the tiles shall be generally conforming to the following standards:

TECHNICAL SPECIFICATIONS FOR VITRIFIED TILES (TABLE)**NO PROPERTY EXPECTED STANDARDS**

- 1 Deviation in length (+/-) 0.6%
- 2 Straightness of sides (+/-) 0.5%
- 3 Rectangularity (+/-) 0.6%
- 4 Surface flatness (+/-) 0.5%
- 5 Water absorption < 0.50%
- 6 Mohs. hardness >6
- 7 Flexural strength > 27 N / mm²
- 8 Abrasion resistance < 204 mm²
- 9 Skid resistance (friction coefficient) >0.4
- 10 Glossiness Min. 85% reflection

The tiles shall conform to the relevant standards in all respects. Samples of tiles shall be got approved from the Engineer-in-charge before bulk procurement for incorporation in the work.

10.2 Preparation of Surface for Flooring

Following procedure shall be followed:

Sub grade concrete or RCC slab or side brick wall / or plastered surfaces on which tiles are to be laid shall be cleaned, wetted and mopped.

Mortar and bedding: Cement mortar for bedding shall be prepared of mix 1:4 or as specified in the schedule of items, to a consistent paste and shall conform to the specification for materials, preparations etc. as specified under cement mortar. The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned off all dirt, scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified proportion and thickness shall then be evenly and smoothly spread over the base by use of screed battens to proper level or slope. Once the mix is prepared, no further water be added and the same shall be used within one hour of adding water. Apply on an average 20 mm thick bedding of mortar over an area of 1 sqm. at a time over surface of the area for laying tiles, in proper level and allowed to harden sufficiently to offer a fairly good cushion for the tiles to set.

Laying of Tiles for Flooring

The tiling work shall be done as per the pattern shown in the drawing or as directed by the Engineer-in-Charge. As a general practice laying of tiles shall be commenced from the centre of the area and advanced towards the walls. Cut tiles, if any, shall be laid along wall with necessary border pattern as shown / directed by the Engineer-in-Charge.

Tiling work shall be completed by pressing tiles firmly into place along the wall / floor. A white cement slurry to the back of the tile to be applied to ensure proper and full bedding. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles. Tiles, which are fixed on the flooring adjoining the wall, shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado.

Press gently the tile with wooden mallet for even adherence at the back of the tile. Do not use an iron hammer or some heavy material to press the tile.

The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints.

The joints shall be kept as close as possible and in straight line. Unless otherwise specified, joint less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1 mm. in width. The joint shall be grouted with white / matching colour cement slurry.

After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with wet sand and allowed undisturbed for 14 days.

10.3 Fixing Tiles for Dado & Skirting / Facia

The fixing of tiles on wall surfaces shall be done only after completing fixing of the tiles on the floor. Following procedure shall be followed;

The back of tiles shall be cleaned off and covered with layer of approved adhesive like BALENDURA or equivalent with proper towelling as per manufacturer's recommendations.

The edges of the tiles shall be smeared with the adhesive and fixed on the wall one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly fixed in level with the adjoining tiles. There shall be no hollows on the back or in joints. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall not exceed 1 mm. in width. The joint shall be grouted with approved

adhesive. The joints shall be kept in straight line or as per the approved pattern While fixing tiles in dado / skirting work, care shall be taken to break the joints vertically. The top line shall be touched up neatly with the rest of the plaster above. If doors, windows or other openings are located within the dado area, the corners, sills, jambs etc, shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required. The fixing shall be done from bottom of wall to upward without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. All tiles faces shall be in one vertical plane.

10.4 Grouting of Joints in Floor / Skirting / Dado

The joints, if specified, shall be cleaned off and all dust and loose particles removed. Joints shall then be filled with approved adhesive like BAL-ENDURA or equivalent grouts. After finishing the grouting process, after 15 minute, wipe off excess grout with a damp sponge and polish the tiles with a soft & dry cloth for a clean surface. The Finished work shall not sound hollow when tapped with a wooden mallet.

10.5 Cleaning

As directed by the MMCI/HPCL Engineer-in-Charge, the tiles shall be cleaned by mild acid (However, Hydrofluoric acid and its derivatives should not be used). After the tiles have been laid in a room or the days fixing work is completed, the surplus cement grout / adhesive that may have come out of the joints shall be cleaned off before it sets. The dado / skirting shall be thoroughly cleaned. In the case of flooring, once the floor has set, the floor shall be carefully washed clean and dried. When drying, the floor shall be covered with oil free dry sawdust. It shall be removed only after completion of the construction work and just before the floor is used.

10.6 Mode of Measurement and Rate

Dado / flooring / skirting shall be measured in sq. m. correct to two places of decimal. Length and breadth shall be measured correct to 1 cm between the exposed surfaces of skirting or dado.

No deductions shall be made nor extra paid for any opening of area up to 0.1 sq. m. The rate shall include all the cost of labour and materials involved.

10.7 Cleaning Agents for Vitrified Tiles

Vitrified tiles are resistant to all chemicals (except hydrofluoric acid and its derivatives), hence commercially available detergents and cleaning agents can also be used for regular

maintenance. Any spills and stains must be removed immediately. If left dry they may leave stains, which may be difficult to remove completely.

10.8 Cleaning Agents for Vitrified Tiles

STAINS CLEANING AGENT

Robin Blue Household detergent / Warm water
 Marker ink Turpentine / Acetone / Trichloroethylene
 Pen ink Acetone / Isopropyl alcohol
 Methylene blue Isopropyl alcohol / Acetone
 Sauce Ammonia solution
 Cement Turpentine / Acetone / Trichloroethylene / Cone. HCL
 Tea Hydrochloric acid / Bleaching powder
 Coffee Sodium hydroxide / Potassium hydroxide
 Beer Sodium hydroxide / Potassium hydroxide
 Diesel Acetone / Petrol
 Lab indicator Acetone / Isopropyl alcohol
 Cement and grouting Hydrochloric acid
 Pencil mark Benzene or Toluene or Xylene
 Plaster of Paris (POP) Ammonium sulphate solution
 Iodine (Tincture iodine) Sodium hydroxide / Potassium hydroxide
 Hair dye Per chloric acid
 Paan Lemon juice or citric acid
 Marker pen Acetone

Item No.22 Providing and laying Ceramic tiles 6mm thick in flooring treads of steps and landing laid on a bed of 12mm thick cement mortar 1:3 (1-cement : 3-coarse sand) finishing with flush pointing in white cement.

SPACIFICATION SHALL APPLY AS ITENM NO.20ABOVE- CERAMIC TILES FLOORING

Item No.23 Providing and laying Ceramic tiles 6mm thick in skirting risers of steps and dedo on 10mm thick cement plaster 1:3 (1-cement : 3-coarse sand) and jointed with white cement slurry

SPACIFICATION SHALL APPLY AS ITENM NO.21 ABOVE- CERAMIC TILES DADO

Item No.24 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 water proofing paint shall conform to I.S. 5410-1969.

2.0. Workmanship.

2.1. Scaffolding : Where scaffolding is required it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be distempered. A properly secured and well tied suspended platform(Joola) may be used for distempering. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary.

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 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 proceeding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the proceeding 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. Water 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.25 Distempering (Two coats) with oil bound distemper of approved brand and manufacture and of required shade on wall surface to give an even shade over and including a priming coat with distemper primer of approved brand and manufacture after thoroughly brushing the surface free from mortar dropping and other foreign matter and also including preparing the surface even and papered smooth.

1.0. Materials

1.1. Oil bound washable distemper and primer shall be of approved brand and manufacture. The distemper shall be of required color and shade and the same shall conform to I.S. 428-1969.

2.0. Workmanship.**2.1. Scaffolding**

Where scaffolding is required it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be distempered. A properly secured and well tied suspended platform(Joola) may be used for distempering. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary.

2.2. Preparation of surface :

2.2.1. The undecorated surface to be distempered 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 distemper.

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 distemper is allowed. The surface affected by moulds, moss, fungi, algee linchens, efflorescence etc. shall be treated in accordance with I.S. 2395-(Part-I)1966. Before applying distempering, any unevenness shall be made good by applying putty made of plaster of pairs mixed with water on entire surface including filling up the undulation and then sand papering the same after it is dry :

2.3. Priming coat :

2.3.1. A priming coat of distemper primer of approved manufacture and shade shall be applied over the papered surface in case of new work on undecorated surface. If the distemper priming is done after the wall surface dries completely the distemper primer shall be applied.

2.3.2. Application of primer shall be done as under : The primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours before oil bound distemper or paint is applied.

2.3.3. Oil bound distemper is not recommended to be applied within six months of the completion of wall plaster.

2.4. Preparation of oil bound distemper :

2.4.1. The distemper shall be diluted with water or any other prescribed thinner in manner recommended by the manufacturer only. Sufficient quantity of distemper required for a days work shall be prepared.

2.5. Application of Distemper coat :

2.5.1. For undecorated surfaces, after the primer coat is dried for at least 48 hours, the surface shall be lightly sand papered to make smooth for receiving the distemper, taking care not to rub out priming coat. All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed immediately by vertical strokes which together shall constitute one coat. The subsequent coats shall be applied after a time interval of at least 24 hours between consecutive coats to permit proper drying of the proceeding coat. The finished surface shall be even and uniform without patches, brush marks, distemper drops etc.

2.5.2. Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room which can not be completed on the same day.

2.5.3. 15 cm. double bristled distemper brush shall be used. After day's work brushed shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

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 distemper splashes if any.

3.0 Mode of measurements & payment

3.1. Priming coat of distemper 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.

Item No.26 Proving and fixing water closet squatting pan (Indian type W.C.Pan) size 580 mm. incl. 100mm. Size P trap & Foot rest(Earthwork, bed concrete,foot rests and trap to be measured and paid for separately) (A) Vitreous china (I) Long pattern white colour.

Indian	Type	W.C.
1.0. Materials		:
1.1.	Water closet squatting pan (Indian type W.C. Pan)shall conform to M-62, Cement mortar shall conform to M-11.	
2.0. Workmanship		
2.1.	The pan shall be sunk into the floor and embedded in cushion of average 15 cm. cement concrete 1:5:10(1 cement:5 fine graded sand:10 graded stone aggregate or brick aggregate 40 mm. nominal size) or and its bed concrete. the floor should be left 15 mm. below the to level of the pan so as to allow for flooring and its bed concrete. The floor should be suitably stopped so that the waste water is drained into the pan. The shall be provided with 100 mm. 'P' or 'S' trap as specified in the item , with approximately 50 mm. seal. The joints between the pan and the trap shall be made leak proof with cement mortar 1 : 1 (1 cement:1 fine sand).	

'P' or 'S' Trap

- 1.0. **Materials :** The 100 mm. size 'P' or 'S' trap for water closet shall conform to M-62. Cement mortar shall conform M-11.
- 2.0. **Workmanship**
- 2.1. The 'P' or 'S' trap shall be fixed with pan cast iron pipe C.M. 1 :1 . The pan shall be provided with a 100 mm. 'P' or 'S' trap as specified in the item with an approximately 50 mm. seal. The joint between the pan and the shall be made leak proof with cement 1 : 1 (1 cement :1 fine sand)

Flush GI Inlet connection

- 1.0. **Materials :**
- 1.1. The G.I. inlet connection for flush pipe shall conform to M-56.
- 2.0. **Workmanship**
- 2.1. The flush pipe from the cistern shall be connected to the closet by means of cement of red lead.
- 3.0. **Mode of measurements and payment**
- 3.1. The rate shall include the cost of all materials and labors involved in the operations described under workmanship.
- 3.2. The rate shall be for a unit of One number of all required Items as specified above.

Item No.27 Providing and fixing PVC SWR Nahni trap IS 14735 for drain - 100 mm diameter with jali of the following nominal diameter of self cleansing design with C.I scread down or hinged grating including the cost of cutting and making good the walls.

- 1.0. **Materials :**
- 1.1. The SWR-PVC(spun) Nahni trap shall conform to IS 14735:1999. The C.I. hinged or screwed down cover shall be of best quality.
- 2.0. **Workmanship**
- 2.1. The Nahni trap with 100 mm. dia inlet and 50 mm. dia outlet shall be fixed as per Table following or as directed.
- 2.2. **The Nahni trap** shall be jointed with SWR- PVC. Pipe, 75 mm. dia. with lead joints. The lead joints shall be done in conformation with I.S. 14735:1999.
- 3.0. **Mode of measurements and payment**
- 3.1. The rate includes cost of all labor, materials, tools and plants etc. required for satisfactory completion of this item including lead, jointing and testing.
- 3.2. The rate shall be for a unit of One number.

Item No.28 Proving and fixing cast iron spigot and socket soil, waste and ventilating pipes of the following nominal size.(C) 100 mm. Dia.

- 1.0. **Materials :**
- 1.1. The specified dia. C.I. Spigot and socket soil or waste pipe shall conform M-68.
- 2.0. **Workmanship**
- 2.1. The fixing of C.I. spigot and sockets soil, waste and ventilating pipe shall carried out as per relevant specification of item 15.93(B) except the C.I. spigot and socket shall be fixed. The joints shall be filled with cement mortar 1:2(1 cement : 2 sand) span sun yarn.

The joints shall be filled with cement mortar 1:2(1 cement : 2 sand) and spurn yarn. The pipes without care shall be fixed to wall with M.S. clamps. the pipes will earns shall be secured with 40 mm. before steel or iron barrel distance pieces or boils and stout galvanized iron nails 10 cms. long into hand wool plug fixed in walls. Access doors to fittings shall be provided with 3 mm. rubber insertion packing and secured without screws to made air and water tight.

2.2. All soil pipes shall be carried up above the roof and shall have a wire balloon guarded or a cowl.

2.3. The ventilating pipe or shaft shall be carried out to height of at least one meter above the outer covering of the roof of the building or in the case of windows in a gable wall or a dormer windows, it shall be carried up to ridge of the roof or at least two meter above the to of the windows. In case of flat roof to which access for use is provided it shall be carried out up to height of at least on meter above the parapet or two meter measured vertically form the top of any windows or opening which any exist up to a horizontal distance of five meter from the vent pipe into such building and in no case shall be carried out to a height less then three meters.

2.4. Where ventilating pipes are carried in pipe shafts, the shaft shall be ofa minimum size of one meter. If the shafts are also used to give light and air to rooms, the ventilating pipes must be carried out to a horizontal distance at roof level not less than five meter from the site of the shaft.

2.5. The sand cast iron pipes above parapet shall be fixed with M.S. clamps and stays. The clamps shall be made from 1.5 mm. thick M.S. flat or 3 mm. width band to the required shape and size to fit tightly one the sockets when tightened with screw bolt. It shall be formed of two semi circular pieces with flanged ends on both sides, with holes to fit in the screw bolts and nuts 40 mm. dia. M.S. bars. one end of the stay shall be bent to form a hook to be fixed with clamps by means of bolts and the other end shall be bend for embedding in cement concrete block of size 200 mm. x 100 mm. x 100 mm. in 1:2:4 mix. The concrete shall be finished to match the surrounding surfaces.

2.6. The connection between the main pipe and branch pipes shall be made by using branches and bends with access doors for cleaning.

2.7. The waste from lavatories, kitchens basins sinks, baths and other floor traps shall be separately connected to respective stacks of upper floor. The waste stack of lavatories shall be connected directly to main hole while the waste stack of other shall be separately discharged over gulley trap.

3.0. Mode of measurements and payment

3.1. The length of pipe shall be measured including all fittings along its length in running meter correct to centimeter. No allowance shall be made for the portion of pipe length entered in the sockets of the adjacent pipe of fittings.

3.2. The rate includes all labor, and materials tools and plant etc. required for satisfactory completion of this item.

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

Item No.29 Proving and fixing in position cowl vent to pipes(C) 100 mm. Dia.

1.0. Materials :

1.1. The cast iron (spun) Nahni trap shall conform to M-69. The C.I. hinged or screwed down cover shall be of best quality.

2.0. Workmanship

2.1. The Nahni trap with 100 mm. dia inlet and 50 mm. dia outlet shall be fixed as per drawing or as directed.

2.2. The Nahni trap shall be jointed with C.I. Pipe, 75 mm. dia. with lead joints. The lead joints shall be done in conformation with I.S. 782-1976.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all labor, materials, tools and plants etc. required for satisfactory completion of this item including lead, jointing and testing.

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

Item No.30 Providing and fixing S.W. gully trap with C.I. grating brick masonry chamber and water tight C.I. cover with frame of 300mm x 300mm size (inside) with standard weight. (i) Square mouth traps. (A) 100mm x 100mm size P type.

1.0. Materials :

(i) Water shall conform to M-1(2) cement mortar of proportion 1:5 shall conform to M-11.
(3) Burnt brick shall conform to M-15.(4) The S.W. Galley trap of 100 mm. x 100 mm. size shall conform to M-70.

2.0. Workmanship

2.1. Excavation for gulley trap shall be done true to dimensions and levels as indicated on plans or as directed. The excavation work shall generally be done as per relevant specifications of item 4.0.0. of earth work.

2.2. Fixing :

2.2.1. The gully trap shall be fixed over cement concrete 1 : 5 ; 10(1 cement : 5 fine sand : 10 graded stone aggregate 40 mm. nominal size) foundation 650 square and 100 mm. thick. The depth of concrete below the ground level shall be 675 mm. The jointing of gulley outlet to the branch drain shall be done similar to jointing of S.W. pipe as described in item No. 24.1.(A).

2.3. Brick masonry chamber : After fixing and testing gulley and branch drain, a brick masonry 300 mm. x 300 mm. inside with bricks in C.M. 1 : 5 (1 cement : 5 sand) shall be built with a 100 mm. brick work round the gulley trap from the top of bed concrete up to ground level. The space between the chamber walls and the trap shall be filled with cement concrete 1 : 5 ; 10. The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside with cement mortar 1 : 3 (1 cement : 3 sand) finished with floating coat of neat cement. The comers and bottom of the chamber shall be rounded of so as to slope towards the grating.

2.4. C.I. cover with frame 300 mm. x 300 mm. size (Inside)size shall then be fixed on the top of the brick masonry with C.C. 1 : 2 ; 4(1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size)40 mm. thick and rendered smooth. The finished top of the cover shall be left about 40 mm. above the adjoining ground level so as to exclude the surface water from entering the gulley trap.

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 number basis.

Item No.31 Providing and fixing urinal of approved quality including connection with trap and with integral longitudinal flush pipe (A) White earthen ware flat back or corner type size 430mm x 260mm x 350mm

1.0. Materials : The white earth ware flat back or corner type urinal of size 430 mm. x 260 mm. x 350 mm. shall conform to M-64.

2.0. Workmanship

2.1. The urinals shall be fixed in position by using wooden plugs and screws and shall be a height 65 cms. From the floor level to the top of the lip of urinal, unless otherwise directed. The wooden plugs shall be of 50 mm. x 50 mm. at base lapping to 38 mm. x 38 mm. at top 50 mm. in length shall be fixed in wall in steel waste pipe which shall discharge in the channel or floor a tap. The connection between the urinal and flush or waste pipe shall be made by means of putty or white lead mixed with chopped hemp.

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.32 Constructing brick masonry road gully chamber 450mm x 450mm x 775mm with vertical grating complete With C.I. Manhole Cover 450x600 mm size

1.0. Materials : Water shall conform to M-1, Cement shall conform to M-3, Sand shall conform to M-6, Brick shall conform to M-15, C.I. Grating of 500 x 450 mm. size of standard make shall be of approved quality. Stone aggregate 40 mm. nominal size shall conform to M-12. Coal tar shall conform to relevant M-5.

2.0. Workmanship

2.1. The Chamber shall be of size 500 mm. x 450 mm. internal clear dimensions between the masonry wall faces. The height of 500 mm. shall be measured from the top of the bed concrete to the top of the C.I. frame. The size of grating indicate the clear internal dimensions of the C.I. frame of grating.

2.2. The excavation shall be done to true dimensions and levels.

2.3. The foundation concrete shall consist of 150 cms. X 100 cms. X 15 cms. Thick C.C. 1 : 5 : 10 (1 cement : 5 coarse sand : 10 graded stoned aggregate 40 mm. nominal size).

2.4. The wall of the chamber shall be constructed in brick work C.M. 1 : 5 and 23 cms. Thick as per relevant specification of item 6.12 (B)

2.5. The walls and the bed concrete of chamber shall be plastered inside with 12 mm. thick cement plaster 1 : 3 (1 cement : 3 coarse sand) finished smooth.

2.6. The gully grating cover shall be hinged to frame to facilitate its opening for cleaning and repairs. The frames of the gully grating shall be fixed on the top of masonry wall of the chamber in 15 cms. Thick C.C. 1 : 2 : 4 (1 cement : 2 coarse sand : 4 graded stoned aggregate 20 mm. nominal size) laid over the full thickness of walls.

2.7. The chamber shall have connection pie, the length of which in meter between the road gully chamber and the manhole of the drain shall not be less than 1/40 times the nominal diameter of the pipe in MM. i.e. for 150 mm. connection pipe the length shall not be cement plaster on the bed concrete.

2.8. Painting : After the completion of the work of exposed surface of the grating of the frame shall be painted with a thick coat of coal tar.

3.0. Mode of measurements and payment

2.1. The cost of connection pipes is not included in the item and shall be paid separately. However, fixing the connection pipes in the walls of gully chamber is included in the rate for gully chambers and nothing the extra shall be paid for this separately.

2.2. The rate shall be for a unit of One number.

24.42. Constructing brick masonry road gully chamber 1100 mm. x 500 mm. x 775 mm. including 500 mm. x 450 mm. C.I. horizontal grating with frame and vertical grating complete.

1.0. Materials and workmanship: The relevant specifications of item 24.40 shall be followed except size of road gully chamber is 1100 mm. x 500 mm. x 775 mm. with vertical grating complete.

2.0. Workmanship

2.1. The Chamber shall be of size 450 mm. x 450 mm. internal clear dimensions between the masonry wall faces. The height of 775 mm. shall be measured from the top of the bed concrete to the top of the C.I. frame. The size of grating indicate the clear internal dimensions of the C.I. frame of grating.

2.2. The excavation shall be done to true dimensions and levels.

2.3. The foundation concrete shall consist of 150 cms. X 100 cms. X 15 cms. Thick C.C. 1 : 5 : 10 (1 cement : 5 coarse sand : 10 graded stoned aggregate 40 mm. nominal size).

2.4. The wall of the chamber shall be constructed in brick work C.M. 1 : 5 and 23 cms. Thick as per relevant specification of item 6.12 (B)

2.5. The walls and the bed concrete of chamber shall be plastered inside with 12 mm. thick cement plaster 1 : 3 (1 cement : 3 coarse sand) finished smooth.

2.6. The gully grating cover shall be hinged to frame to facilitate its opening for cleaning and repairs. The frames of the gully grating shall be fixed on the top of masonry wall of the chamber in 15 cms. Thick C.C. 1 : 2 : 4 (1 cement : 2 coarse sand : 4 graded stoned aggregate 20 mm. nominal size) laid over the full thickness of walls.

2.7. The chamber shall have connection pie, the length of which in meter between the road gully chamber and the manhole of the drain shall not be less than 1/40 times the nominal diameter of the pipe in MM. i.e. for 150 mm. connection pipe the length shall not be cement plaster on the bed concrete.

2.8. Painting : After the completion of the work of exposed surface of the grating of the frame shall be painted with a thick coat of coal tar.

3.0. Mode of measurements and payment

2.1. The cost of connection pipes is not included in the item and shall be paid separately. However, fixing the connection pipes in the walls of gully chamber is included in the rate for gully chambers and nothing the extra shall be paid for this separately.

2.2. The rate shall be for a unit of One number.

Item No.33 Providing and fixing wash basin with single hole for pillar tape with C.I. of M.S. brackets painted white including cutting holes and making good the same but excluding fittings (A) Stainless steel Acrysil or Equivalent make- Flat back wash basin 550mm x 400mm size with CP brass couplin, padastal matching the shade, waste pipe etc comp

1.0. Materials :

1.1. The white glazed earthen ware wash basin shall be 550 mm. x 400 mm. of 1 st quality and make as approved by the Engineer in charge. The wash basin shall conform to M-59.

2.0. Workmanship

- 2.1.** The washbasin shall be fixed on the wall as and where directed. The wash basin shall be supported on a pair of M.S. or C.I. brackets fixed in C.M. 1:3(1 cement : 3 fine sand). The bracket shall conform to I.S. : 775-1962. The wall plaster on the rear shall be cut to rest the top edge of the washbasin. After fixing the basin, plaster shall be made good and surface finished to match the existing one.
- 2.2.** The brackets shall be painted white with ready mixed paint.
- 2.3.** The C.I. brass trap and union shall discharge into an open drain leading to a gully trap or direct in to gully trap on the ground floor and shall be connected to a waste pipe through a floor trap on the upper floors. C.P. brass trap and union may not be provided where the surface drain or a floor trap is placed directly under the basin and the waste is discharged in to vertical.
- 2.4.** The height of the front edge to the wash basin from the floor level shall be 80 cms.
- 2.5.** The necessary inlet, outlet connections and fittings such as pillar cocks, C.P. dress waste trap waste pipe, stop cock, chain wish rubber plug etc. shall be fixed.
- 2.6.** The payment of fittings shall be made separately under separate items.

3.0. Mode of measurements and payment

- 3.1.** The rate shall includes cost of all materials and labor involved install the operations described under workmanship.
- 3.2.** The rate shall be for a unit of One number.

C.P.Brass waste trap

1.0. Materials :

- 1.1.** The C.I. brass trap and unions shall be of 32 mm. dia and of best quality and make as approved by the Engineer in charge.

2.0. Workmanship

- 2.1.** C.P. brass waste trap and union shall be connected to 32 mm. dia. waste pipe which shall be suitably bent towards the wall which shall discharge into drain through a floor trap. The C.P. brass waste trap shall be provided for wash basin or sink as the case may be.

M.I.Union

1.0. Materials :

- 1.1.** The 32 mm. dia. M-1. Fisher union shall be of best quality and made as approved by the Engineer-in-charge.

2.0. Workmanship

- 2.1.** The 32 mm. dia. M.I. Fisher union shall be fixed to wash basin or sink in best workman like manner.

Pillar tap

- 1.0. Materials :** The capstan head pillar tap of specified dia. of C.P. over brass shall be best quality and shall conform to I.S. : 1975-1961. The pillar taps shall be tested quality.

2.0. Workmanship

- 2.1.** The capstan head pillar tap of specified dia. shall be fixed as directed with required washer of selected leather or rubber asbestos composition or of plastic as directed. The cock

shall fixed with pipe line white Zink end spun yarn, to make joint water tight. The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

3.1. The rate shall includes cost of all materials and labor involved install the operations described under workmanship.

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

Item No.34 Providing, laying and jointing in true line and level 110 diametre U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp of the size 110 mm diametre x 149 mm length x 145 mm heigh at every 2000 mm center to center or shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials.

12.1 Applicable code:

The laying of PVC-U pipes and fittings / specials shall comply with all currently applicable statutes, regulations, standards and codes. In particular the following standards, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the standards/codes shall be referred to. Other IS:Codes not specifically mentioned here but pertaining to the use of PVC-U pipes, fittings & specials shall be part of this Specification.

I.S. Number Title

IS : 15328 : 2003	Unplasticized Non-Pressure Polyvinyl Chloride (PVC-U) Pipes for use in underground drainage and sewerage system.
IS : 7634 (PT-3) : 2003	Code of practice for plastics pipes selection, Handling, Storage and installation for potable Water Supply.
IS: 14182 : 1994	Solvent Cement for use with unplasticized polyvinyl chloride pipe and fittings.
EN 13476-1	Plastics piping Systems for non-pressure underground drainage and sewerage- Structured-wall piping systems of Polyethylene
(PE) Part 1 :	General requirements and performance characteristics
EN 13476-3	Plastics piping Systems for non-pressure underground drainage and sewerage- Structured-wall piping systems of Polyethylene
(PE) Part 3 :	Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B

12.2 Specification for Unplasticized Non-Pressure, Polyvinyl Chloride (PVC-U) Pipes

12.2.1 Scope:

12.2.1.1 Integral sockets for either solvent-cement welding or for jointing with elastomeric sealing rings pipes made of unplasticized polyvinyl chloride (PVCU) of nominal outside diameters ranging from 110 mm up to and including 630 mm, intended for underground (buried) non-pressure gravity drain and sewer applications for transportation of soil and waste discharge of domestic origin, surface water (storm water).

12.3 Terminology:

- 12.3.1 Nominal size (DN)- The numerical designation for the size of a pipe, other than a pipe designated by thread size, which is a convenient round number approximately equal to the manufacturing dimension in millimeters.
- 12.3.2 Nominal outside Diameter (dn) The specified outside diameter in millimeters assigned to the nominal size.
- 12.3.3 Outside Diameter at Any point (de)- The value of the measurement of the Outside diameter of a pipe through its cross-section at any point of the pipe, rounded off to the next higher 0.1 mm
- 12.3.4 Mean outside Diameter (dem) - The quotient of the outer circumference of a pipe-section, rounded off to the next higher 0.1 mm.
- 12.3.5 Minimum Mean outside Diameter (dem,min)- The minimum value of the mean outside diameter as specified for a given nominal size.
- 12.3.6 Maximum Mean outside Diameter (dem,max)- The maximum value of the mean outside diameter as specified for a given nominal size.
- 12.3.7 Inside Diameter of a socket (ds) the value of the measurement of the inside diameter of the socket at any point in any cross-section of the socket.
- 12.3.8 Mean Inside Diameter of a socket (dsm) The arithmetical mean of four measurements, taken at 45° to each other, of the inside diameter of the socket in the same cross-section of the socket.
- 12.3.9 Nominal wall thickness (en) A numerical designation of the wall thickness of a component which is a convenient round number, approximately equal to the manufacturing dimensions in millimeters.
- 12.3.10 Wall thickness at any point (e) the value of the measurement of wall Thickness at any point around the circumference of a pipe, rounded off to the next higher 0.1 mm.
- 12.3.11 Minimum wall thickness at any point (emin) The minimum value for the wall thickness at any point around the circumference of a pipe, rounded off to the next higher 0.1 mm.
- 12.3.12 Maximum wall thickness at any point (emax) The maximum value for the wall thickness at any point round the circumference of a pipe, rounded off to the next higher 0.1 mm.
- 12.3.13 Mean wall thickness (em) The arithmetical mean of at least four measurements regularly spaced around the circumference and in the same cross-section of a pipe, including the measured minimum and the measured maximum values of the wall thickness in the cross-section, rounded off to the next higher 0.1 mm.
- 12.3.14 Maximum mean wall thickness (em, max) The maximum value for the mean wall thickness around the circumference of a component, as specified.
- 12.3.15 Tolerance The permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value.

12.4 Dimensions of Pipes:

- 12.4.1 Mean outside diameter- The mean outside diameter, outside diameter at any point and tolerances shall be as given in table 1 of IS 15328 and shall be measured according to the method given in IS: 12235 (part-1).
- 12.4.2 Wall thickness- The nominal wall thickness, e, shall be in accordance with table 2 of IS 15328. Tolerances in outside diameters shall be those given in IS 4985
- 12.4.3 Length of pipes:

- 12.4.3.1 Effective length (Le) of pipe with sockets is considered to be the distance between ends minus the socket depth. The length may be supplied as agreed to between the purchaser and the manufacturer.
- 12.4.4 Dimensions of Integral Sockets and Spigots ends: The Basic dimensions shall be in accordance with Tables 3 and 4.
- 12.4.4.1 Wall Thickness of Sockets: $e_2 \text{ min} = 0.9e$ and $e_3 \text{ min} = 0.75e$
- 12.4.4.2 $e_3 \text{ min}$ applies only to those parts of the sealing ring zone where the fluid contained within the pipe comes into contact with the fluid, that is beyond the designated ring seal point, walls thinner than e_3 are permitted.
- 12.4.4.3 If retaining caps or rings are provided, they can be made to other designs or from polymers other than unplasticized polyvinyl chloride, provided that the finished joint conforms to the same functional test requirements.
- 12.4.4.4 When a sealing ring is retained by means of a retaining ring or cap, the wall thickness of the area shall be calculated by addition of the wall thickness at the corresponding places of the socket and the retaining ring or cap.
- 12.5 Physical characteristic**
- 12.5.1 Colour- The colour of the pipes shall be dark (any shade of brown). The pipe shall be uniformly coloured throughout the entire wall. Slight variations in the appearance of the colour are permitted.
- 12.6 Marking**
- 12.6.1 Each pipe shall be clearly and indelibly marked in ink/paint or hot embossed on white base at intervals of not more than 3 m. but at least once per pipe, in the colour so that it differs from the basic color of the pipe.
- 12.6.2 The marking shall be legible without magnification. The marking shall not initiate cracks or other types of defects which adversely influence the performance of the pipe. Marking by indentation reducing the wall thickness not more than 0.15 mm shall be deemed to conform to this clause without infringing the requirements for the wall thickness.
- 12.6.3 The marking shall show the following:
- Identification of the source of manufacturer.
 - Outside diameter,
 - Stiffness class, and
 - Batch or Lot number.
- 12.6.4 BIS Certification Marking
- 12.6.4.1 Each pipe may also be marked with the standard Mark.
- 12.7 Solvent cement jointing**
- 12.7.1 PVC solvent cement is quick drying, therefore it shall be applied as quickly and carefully as possibly and in consistence with good workmanship. For larger sizes, it is advisable for two workers to work simultaneously on the pipe and socket.
- 12.7.2 Solvent cement shall conform to IS:14182.
- 12.7.3 Dip the applicator brush in the solvent cement and apply a liberal coat of cement to the end of the pipe up to the insertion depth.
- 12.7.4 Apply a uniform thin coat of cement inside the socket, working axially from the inside of the socket to the outside. Do not apply any cement on the shoulders of the socket (socket-to-pipe transition area). Care should be taken not to apply excess cement inside the socket. Excess cement in the socket will be pushed further into the pipe during assembly and cause the pipe to soften and weaken

at that point. Hot and dry climates generally require slightly thicker coatings of solvent cement.

- 12.7.5 In climates with large differences between day and night temperatures, it is advisable to make joints early in the morning or in the evening when it is cooler. Thus, the joints are prevented from being pulled apart if the pipes contract.
 - 12.7.6 For pipe installation solvent glued spigot is inserted in the socket up to the shoulder and then after a quarter (90°) turn is given to evenly distribute the cement over the treated surface.
 - 12.7.7 Within 20 second after the last application of solvent cement, insert the pipe in to socket in a single steady and every controlled but forceful action. Press it in fully until it bottoms. No. hammer blows should be used. If there is any sign of drying of the cement coat before insertion; the surface should be re-coated, avoiding application of excess cement in the socket. Once the insertion is complete, hold in place for 1 min without shifting the pipe in the socket.
 - 12.7.8 Immediately after assembly, wipe the excess solvent cement from the pipe at the end of the socket. A properly made joint will have a uniform bead around its entire perimeter. Any gaps in this bead may be indicative of an improper joint due to insufficient cement or the use of a lighter-bodied cement than the onerecommended.
- 12.8 Trench:-**
- 12.8.1 Location: Drinking water pipelines should not be located below sewerage pipelines. Where a pipeline runs parallel to other pipelines or cables, the distance between them should not be less than 0.4 m.
 - 12.8.2 At points of congestion, a distance of 0.2 m should be maintained unless steps are taken to prevent direct contact.
 - 12.8.3 Width: Trenches should be of adequate width to allow the burial of pipe, while being as narrow as practical. If expansion and contraction are not problems and snaking of pipe is not required, minimum trench widths may be obtained by jointing the pipe outside the trench and then lowering the piping into the trench after the testing. A trench width of two or three times the pipe diameter is a good rule of thumb. Narrow (unsupported) trench width and supported trench width shall be as given under:

Table No.12.2

Nominal pipe size (Diameter in mm)	Unsupported Narrow Trench Width (Minimum)		Supported Trench Width, (Minimum)	
	Number of pipe Diameter	Width (mm)	Number of pipe Diameter	Width (mm)
90	5.0	450	10.0	900
110	4.0	450	8.2	900
125	4.0	500	7.2	900
140	3.9	550	6.4	900
160	3.5	560	5.6	900
180	3.2	580	5.0	900
200	3.0	600	4.5	900

12.8.4 Where necessary to prevent cave-ins, trench excavations in unstable soil shall be adequately supported. As backfill is placed and sheeting withdrawn, the void left by the withdrawn sheeting shall be filled and compacted before withdrawing the next increment.

12.9 **Trench Bottom**

12.9.1 The trench bottom shall be constructed to provide a firm, stable and uniform support for the full length of the pipeline. There should be no sharp objects that may cause point loading.

12.9.2 Any large rocks, hard pan, or stones larger than 20 mm should be removed to permit a minimum bedding thickness of 100-150 mm under the pipe.

12.9.3 For pipes of diameters 100 mm or greater, bell holes in the bedding, under each socket joint, shall be provided by removing some of the bedding material, to accommodate the larger diameter of the joint and to permit the joint to be made properly.

12.9.4 Excavated material should be deposited at a sufficient distance from the trench so that damage is not caused to the pipe line through falling stones/debris.

12.9.5 Prepare the bedding by laying on soft soil and alternatively compacting and watering sparingly until an effective thickness of 100 to 150 mm is achieved.

12.10 **Laying**

12.10.1 Lay the pipe in the trench after ensuring that bell holes have been provided for at the appropriate places in the bedding (Pipes of diameter 110 mm or less, with no live load application, do not require bell holes in the trench bottom).

12.10.2 These have to be refilled carefully after testing of the pipeline and prior to complete backfilling of the trench.

12.10.3 Though not essential, the pipes should be laid with the spigots entered into the sockets in the same directions as the intended flow of water.

12.11 **Minimum cover:**

12.11.1 A minimum cover of 0.9 m when truck traffic is expected.

12.11.2 A minimum cover of 1.8 m when heavy truck /locomotive traffic is expected.

12.11.3 **If due to the side conditions deep burial of the pipe is not possible and heavy traffic is expected over the pipe, it is advisable to use steel or reinforced concrete casing (sleeve) to prevent damage to the pipe.**

12.12 Anchoring

- 12.12.1 The purpose of the anchor block is to transfer the total thrust to the trench sides. It is therefore important to take account of the load-bearing capacity of the surrounding ground.
- 12.12.2 Recommended mixture for concrete is one part cement, two parts washed sand and two parts gravel.
- 12.12.3 Where concrete would be in direct contact with the pipe or fittings, these should be wrapped with a compressible material, for example rubber sheet or foamed polyethylene sheet.

12.13 Back-filling

- 12.13.1 The first side fill or hunching layer should be placed by hand and compacted in layers under the lower quadrants of the pipe up to the spring level (half the vertical diameter) of the pipe.
- 12.13.2 Compaction can be done by careful trampling with the feet or with trampling tool.
- 12.13.3 Care should be taken to leave adequate area around the joint free of backfill to allow for inspection during testing of the pipeline.
- 12.13.4 Successive layers of backfill of 75 mm thickness may then be placed over and compacted to a height above the crown of not less than 150 mm. Light vibrating machinery may be used, but not directly above the pipe.
- 12.13.5 On completion of the surround to the pipe, suitable excavated material may be then replaced as backfill in 250 mm compacted layers up to the top of the trench.
- 12.13.6 No heavy compaction equipment to be employed until there is at least 300mm of fill above the crown of the pipe.

12.14 Performance requirement of solvent cement joints-

- 12.14.1 Internal Hydrostatic Pressure- when assembled according to the joint shall withstand an internal pressure of upto and including 0.05 MPa (0.5 bar) for a minimum period of 15 min without leakage.
- 12.14.2 Internal Negative Hydrostatic Pressure (Internal Vacuum)- when assembled on, the joint shall withstand an internal negative pressure (internal vacuum) of up to and including 0.03 MPa (0.3 bar) for a minimum period of 15 min without leakage.
- 12.14.3 Leak tightness of Elastomeric sealing Ring Type socket joints : The method of testing of joints under positive internal pressure and with Angular deflection is given in detail in Annexure-A.

12.15 Measurements:

- The lengths of pipe shall be measured in the running meters nearest to a cm as laid, lowered and jointed from in side of one manhole to the inside of the other manhole. The length shall be taken along the centre line of the pipes.
- 12.15.1 All fittings such as bends, junction, etc., which shall not be measured separately. excavation, refilling, shoring and timbering in trenches and cement concreting where ever required shall be measured separately under relevant item of work.
- 12.15.2 Security money for testing should be kept at 10 % of the value of the Item. After testing of the complete sewerage system to the satisfaction of the engineer in-charge the same shall be released.

12.16 Rate

12.16.1 The rate shall include the cost of material and labour involved in all the operation described above including the cost of concrete which shall be paid separately.

Item No. 35 Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete. [D] 32mm.

18.9 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPES (IS:15778:2007 ATTACHED.(CODE CPVC PIPES) separately

18.9.1 CPVC pipes & fittings used in hot & cold potable water distribution system shall conform to requirement of IS 15778. The material from which the pipe is produced shall consist of chlorinated polyvinyl chlorides. The polymer from which the pipe compounds are to be manufactured shall have chlorine content not less than 66.5%.

The internal and external surfaces of the pipe shall be smooth, clean and free from grooving and other defects. The pipes shall not have any detrimental effect on the composition of the water flowing through it.

Diameter and wall thickness of CPVC pipes are as per given in Table 18.16 below

TABLE 18.16

Sl. No.	Nominal Size	Nominal Outside Diameter	Mean Outside Diameter		Outside Diameter at any point		Wall thickness					
							Class 1, SDR 11			Class 3, SDR 17		
			Min	Max	Min	Max	Avg. Max	Min	Max	Avg. Max	Min	Max
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(i)	15	15.9	15.8	16.0	15.8	16.0	2.2	1.7	2.2	-	-	-
(ii)	20	22.2	22.1	22.3	22.0	22.4	2.5	2.0	2.5	-	-	-
(iii)	25	28.6	28.5	28.7	28.4	28.8	3.1	2.6	3.1	-	-	-
(iv)	32	34.9	34.8	35.0	34.7	35.1	3.7	3.2	3.7	-	-	-
(v)	40	41.3	41.2	41.4	41.1	41.5	4.3	3.8	4.3	-	-	-
(vi)	50	54.0	53.9	54.1	53.7	54.3	5.5	4.9	5.5	-	-	-
(vii)	65	73.0	72.8	73.2	72.2	73.8	-	-	-	4.8	4.3	4.8
(viii)	80	88.9	88.7	89.1	88.1	89.7	-	-	-	5.9	5.2	5.9
(ix)	100	114.3	114.1	114.5	113.5	115.1	-	-	-	7.5	6.7	7.5
(x)	150	168.3	168.0	168.6	166.5	170.1	-	-	-	11.1	9.9	11.1

Notes

For CPVC pipes SDR is calculated by dividing the average outer diameter of the pipe in mm by the minimum wall thickness in mm. If the wall thickness calculated by this formula is less than 1.52 mm, it shall be increased to 1.52 mm. The SDR values shall be rounded to the nearest 0.5.

18.9.2 Dimensions of Pipes

The outside diameter, outside diameter at any point and wall thickness shall be as given in Table 18.16.

Diameter : The outside diameter and outside diameter at any point as given in Table 18.16 shall be measured according to the method given in IS 12235 (part 1).

Diameter at any point : The difference between the measured maximum outside diameter and measured minimum outside diameter in the same cross-section of pipe (also called tolerance on ovality) shall not exceed the greater of the following two values:

- (a) 0.5 mm, and
- (b) $0.012 d_n$ rounded off to the next higher 0.1 mm.

Wall Thickness : The wall thickness of the pipes shall be as given in Table 18.16. Wall thickness shall be measured by any of the three methods given in IS 12235 (part 1). To check the conformity of the wall thickness of the pipe throughout its entire length, it is necessary to measure the wall thickness of the pipe at any point along its length. This shall be done by cutting the pipe at any point along its length and measuring the wall thickness as above. Alternatively, to avoid destruction of the pipe, non destructive testing methods such as the use of ultrasonic wall thickness measurement gauges shall be used at any four points along the length of the pipe.

Tolerance on Wall Thickness

For pipes of minimum wall thickness 6 mm or less, the permissible variation between the minimum wall thickness (e_{Min}) and the wall thickness at any point (e), ($e - e_{Min}$) shall be positive in the form of $+y$, where $y = 0.1 e_{Min} + 0.2$ mm.

For pipes of minimum wall thickness greater than 6mm, the permissible variation of wall thickness shall again be positive in the form of $+y$, where y would be applied in two parts.

The average wall thickness shall be determined by taking at least six measurements of wall thickness round the pipe and including both the absolute minimum and absolute maximum measured values. The tolerance applied to this average wall thickness from these measurements shall be within the range $0.1 e_{Min} + 0.2$ mm (see Table 18.16).

The maximum wall thickness at any point shall be within the range $0.15e_{Min}$ (see Table 18.16).

The results of these calculations for checking tolerance shall be rounded off to the next higher 0.1 mm.

18.9.2.4 Effective Length (L_e) : If the length of a pipe is specified, the effective length shall not be less than that specified. The preferred effective length of pipes shall be 3, 5 or 6 m. The pipes may be supplied in other lengths where so agreed upon between the manufacturer and the purchaser.

18.9.3 Pipe Ends

The ends of the pipes meant for solvent cementing shall be cleanly cut and shall be reasonably square to the axis of the pipe or may be chamfered at the plain end.

18.9.4 Physical and Chemical Characteristics

18.9.4.1 Visual Appearance : The colour of the pipes shall be off-white. Slight variations in the appearance of the colour are permitted.

The internal and external surface of the pipe shall be smooth, clean and free from grooving and other defects.

Opacity : The wall of the plain pipe shall not transmit more than 0.1 per cent of the visible light falling on it when tested in accordance with IS 12235 (Part 3).

Effect on Water : The pipes shall not have any determinate effect on the composition of the water flowing through them, when tested as per 10.3 of IS 4985.

Reversion Test : When tested by the method prescribed in IS 12235 (Part 5/ Sec 1 and Sec 2), a length of pipe 200 ± 20 mm long shall not alter in length by more than 5 per cent.

Vicat Softening Temperature : When tested by the method prescribed in IS 12235 (part 2), the Vicat softening temperature of the specimen shall not be less than 110°C .

Density : When tested in accordance with IS 12235 (Part 14), the density of the pipes shall be between 1450kg/m³ and 1650kg/m³.

18.9.5 Mechanical Properties

18.9.5.1 Hydrostatic Characteristics : When subject to internal hydrostatic pressure test in accordance with the procedure given in IS 12235 (part 8/Sec 1), the pipe shall not fail during the prescribed test duration. The temperatures, duration and hydrostatic (hoop) stress for the test shall conform to the requirements given in Table 18.17. The test shall be carried out not earlier than 24 h after the pipes have been manufactured.

TABLE 18.17
Requirements of Pipes for Internal Hydrostatic Pressure Test
(Clause 18.9.5.1)

Sl. No.	Test	Test Temperature Min	Test Period	Hydrostatic (Hoop) Stress
		°C	h	MPa
(1)	(2)	(3)	(4)	(5)
(i)	Acceptance	20	1	43.0
(ii)	Type	95	165	5.6
(iii)	Type	95	1000	4.6
(iv)	Type	95	8760	3.6 (Test for thermal stability)

Thermal Stability by Hydrostatic Pressure Testing : When subject to internal hydrostatic pressure test in accordance with the procedure given in IS 12235 (Part 8/Sec 1) and as per requirement given in Table 18.17, Sl. No. (iv), the pipe shall not burst or leak during the prescribed test duration.

Resistance to External Blow at 0°C : When tested by the method prescribed in IS 4985, with classified striker mass and drop height as given in Table 18.18, the pipe shall have a true impact rate of not more than 10 per cent.

TABLE 18.18
Classified Striker Mass and Drop Height Conditions for the Falling Weight Impact Test
(Clause 18.9.5.3)

Sl. No.	Nominal Pipe Size mm	Mass of Fallin Weight Kg	Falling Height mm
(1)	(2)	(3)	(4)
(i)	15	0.5±0.5%	300±10
(ii)	20	0.5±0.5%	400±10
(iii)	25	0.5±0.5%	500±10
(iv)	32	0.5±0.5%	600±10
(v)	40	0.5±0.5%	800±10
(vi)	50	0.5±0.5%	1000± 10
(vii)	65	0.8±0.5%	1000±10
(viii)	80	0.8±0.5%	1200±10
(ix)	100	1.0±0.5%	1600±10
(x)	150	1.6±0.5%	2000±10

Flattening Test : When tested by the method prescribed in IS 12235 (part 19), pipe shall show no signs of cracking, splitting and breaking.

Tensile Strength : When tested by the method prescribed in IS 12235 (Part 19), the tensile strength at yield shall not be less than 50 MPa at 27 ± 2°C.

18.9.6 Sampling and Criteria for Conformity

The sampling procedure and criteria for conformity shall be as given in Annexure F.

APPENDIX F
SAMPLING AND CRITERIA FOR CONFORMITY OF CPVC PIPES
(Clause 18.9.6)

F-1 ACCEPTANCE TESTS

F-1.1 Acceptance test are carried out on samples selected from a lot for the purpose of acceptance of the lot.

F-1.2 Lot

All CPVC pipes in a single consignment of the same class, same size and manufactured under essentially similar conditions shall constitute a lot.

F-1.3 For ascertaining conformity of the lot to the requirements of the specification, samples shall be tested from each lot separately.

F-1.4 Visual and Dimensional Requirements

F-1.4.1 The number of test samples to be taken from a lot shall depend on the size of the lot and the outside diameter of the pipe, and shall be in accordance with Table F-1.

TABLE F-1
Scale of Sampling of Visual Appearance and Dimensional Requirements
(Clause F-1.4.1 and F-1.4.3)

Sl. No.	Number of pipes in the lot	Sample number	Sample size	Cumulative sample size	Acceptance number	Rejection number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(i)	Up to 1000	First	13	13	0	2
		Second	13	26	1	2
(ii)	1001 to 3000	First	20	20	0	2
		Second	20	40	1	2
(iii)	3001 to 10000	First	32	32	0	3
		Second	32	64	3	4
(iv)	10001 & above	First	50	50	1	4
		Second	50	100	4	5

F-1.4.2 These pipes shall be selected at random from the lot and in order to ensure the randomness of selection, a random number table shall be used. For guidance and use of random number tables, IS-4905 may be referred to. In the absence of a random number table, the following procedure may be adopted:

Starting from any pipe in the lot, count them as 1, 2, 3, etc, up to r and so on, where r is the integral part of N/n , N being the number of pipes in the lot, and n the number of pipes in the sample. Every rth pipe so counted shall be withdrawn so as to constitute the required sample size.

F-1.4.3 The number of pipes given for the first sample in col. 4 of Table F-1, shall be taken from the lot and examined for visual and dimensional requirements given in Table 18.16 and 18.9.4.1. A pipe failing to satisfy any of these requirements shall be considered as defective. The lot shall be deemed to have satisfied these requirements, if the number of defectives found in the first sample is less than or equal to the corresponding acceptance number given in col. 6 of Table F-1. The lot shall be deemed not to have met these requirements, if the number of defectives found in the first sample is greater than or equal to the corresponding rejection number given in col. 7 of Table F-1. If, however, the number of defectives found in the first sample lies between the corresponding acceptance and rejection numbers given in cols. 6 and 7, a second sample of the size given in col. 4 shall be taken and examined for the

requirements. The lot shall be considered to have satisfied these requirements. The lot shall be considered to have satisfied these requirements if the cumulative sample is less than or equal to the corresponding acceptance number given in col. 6, otherwise not.

F-1.5 Reversion Test

F-1.5.1 The lot, having satisfied visual and dimensional requirements, shall be tested for reversion as given in 18.9.4.4.

F-1.5.2 For this purpose, the number of pipes given for the first sample in col. 4 of Table F-2 shall be taken from the lot. The sample pipe failing the reversion test shall be considered as defective. The lot shall be deemed to have met the requirements given in this specification for the reversion test, if the number of defectives found in the first sample is less than or equal to the corresponding acceptance number given in col. 6. This lot shall be deemed not to have met these requirements, if the number of defectives found in the first sample is greater than or equal to the corresponding rejection number given in col. 7 if, however, the number of defectives in the first sample lies between the corresponding acceptance and rejection numbers given in col. 6 and col. 7, a second sample of size given in col. 4 shall be taken and examined for the requirements. The lot shall be considered to have satisfied the requirements, if the number of defectives found in the cumulative sample is less than or equal to the corresponding acceptance number given in col. 6, otherwise not.

TABLE F-2

Scale of Sampling for Reversion, Vicat Softening Temperature and Density Test

(Clause F-1.5.2, F-1.6.2 and F-1.7.2)

Sl. No.	Number of pipes in the lot	Sample number	Sample size	Cumulative sample size	Acceptance number	Rejection number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(i)	Up to 1000	First	5	5	0	2
		Second	5	10	1	2
(ii)	1001 to 3000	First	8	8	0	2
		Second	8	16	1	2
(iii)	3001 to 10000	First	13	13	0	2
		Second	13	26	1	2
(iv)	10001 & above	First	20	20	0	3
		Second	20	40	3	4

F-1.6 Vicat Softening Test

F-1.6.1 The lot, having satisfied visual and dimensional requirements shall be tested for Vicat softening temperature as given in 18.9.4.5.

F-1.6.2 For this purpose, the procedure adopted for sampling and criteria for conformity shall be the same as that for reversion under F-1.5.2 using Table F-2.

F-1.7 Density

F-1.7.1 The lot, having satisfied the visual and dimensional requirements, shall be tested for density as given in 18.9.4.6.

F-1.7.2 For this purpose, the procedure adopted for sampling and criteria for conformity shall be the same as that for reversion under F-1.5.2 using Table F-2.

F-1.8 Resistance to External Blow at 0°C

F-1.8.1 The lot, having been found satisfactory according to F-1.4, F-1.5, F-1.6 and F-1.7 shall be tested for resistance to external blow at 0°C as given in 18.9.5.3.

F-1.8.2 For this purpose, the procedure adopted for sampling and criteria for conformity shall be as specified in Table 18.18 and Table F-3.

TABLE F-3
Scale of Sampling for Resistance to External Blow at 0°C

<i>Sl. No.</i>	<i>Number of pipes in the lot</i>	<i>Sample number</i>	<i>Sample size</i>	<i>Cumulative sample size</i>	<i>Acceptance number</i>	<i>Rejection number</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(i)	Up to 3000	First	3	3	0	2
		Second	3	6	1	2
(ii)	3001 to 10000	First	3	5	0	2
		Second	5	10	1	2
(iii)	10000 & above	First	8	8	0	2
		Second	8	10	1	2

F-1.9 Internal Hydrostatic Pressure Test (Acceptance Test)

F-1.9.1 The lot having been found satisfactory according to F-1.4, F-1.5, F-1.6, F-1.7 and F-1.8 shall be subjected to the requirements of the acceptance test for internal hydrostatic pressure as given in 18.9.5.1 and Table 18.17 Sl. No. (i). The number of pipes to be taken from the lot shall depend on the size of the lot and shall be according to Table F-4.

TABLE F-4
Scale of Sampling for Internal Hydrostatic Test
(Clause F-1.9.1 and F-1.9.3)

<i>Sl. No.</i>	<i>Number of pipes in the lot</i>	<i>Sample size</i>	<i>Acceptance number</i>
(1)	(2)	(3)	(4)
(i)	Up to 3000	2	0
(ii)	3001 to 10000	3	0
(iii)	10000 & above	5	0

F-1.9.2 The pipes shall be taken at random from the lot. In order to ensure the randomness of selection, procedures given in IS 4905 may be followed.

F-1.9.3 Number of Tests and Criteria for Conformity

The number of test samples shall be as given in Table F-4. The lot shall be considered to have satisfied the requirements for this test, if the number of test samples failing in this requirement is equal to the corresponding acceptance number given in column 4 of Table F-4.

F-2 TYPE TESTS

F-2.1 Type tests are intended to prove the suitability and performance of a new composition or a new size of pipe. Such tests, therefore, need to be applied only when a change is made in polymer composition or when a new size of pipe is to be introduced. Type test for compliance with 18.9.4.2, 18.9.4.3, 18.9.5.1 (Type test only) and 18.9.5.4 shall be carried out.

F-2.1.1 Verification of Malfunction Temperature T_{mal}

For this test, the manufacturer to the testing authority one assembly, selected preferably from a regular production lot.

F-2.1.2 Opacity

For this test, the manufacturer or the supplier shall furnish to the testing authority one sample of the pipe of the thinnest wall section, selected preferably from a regular production lot.

F- 2.1.2.1 The sample so selected shall be tested for compliance with requirements for opacity as given in 18.9.4.2.

F-2.1.2.2 If the sample passes the requirements of the opacity test, the type of the pipe under consideration shall be considered to be eligible for approval, which shall be valid for a period of one year.

F-2.1.2.3 In case the sample fails in the test, the testing authority, at its discretion, may call for a fresh sample and subject the same to the opacity test. If the sample passes the repeat test, the type of pipe under consideration shall be considered eligible for approval. If the sample fails in the repeat test, the type of pipe shall not be approved. The manufacturer or the supplier may be asked to improve the design and re-submit the product for type approval.

F-2.1.2.4 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for a fresh sample for opacity test for the purpose of type approval.

F-2.1.3 Test for Effect on Water

For this type test, the manufacturer or the supplier shall furnish to the testing authority three samples of the smallest size of pipe taken from each machine (selected preferably from a regular production lot).

F-2.1.3.1 Three samples so selected shall be tested for compliance with the requirements for effect on water as given in 18.9.4.3.

F-2.1.3.2 If all three samples pass the requirements for effect on water, the type test of the pipe under consideration shall be considered to be eligible for approval, which shall be normally valid for a period of one year.

F-2.1.3.3 In case any of the samples fails in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number, and subject them to the test for effect on water. If, in the repeat test, no single failure occurs, the type of pipe under consideration shall be considered eligible for type approval. If any of the samples fails in the repeat test, the type of pipe shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

F-2.1.3.4 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for fresh samples for effect on water test for the purpose of type approval.

F-2.1.4 Internal Hydrostatic Pressure Test (Type Test) and thermal Stability

For this type test, the manufacturer or the supplier shall furnish to the testing authority, three samples of pipes of different diameters and different classes (selected preferably from a regular production lot).

F-2.1.4.1 Three samples so selected shall be tested for compliance with the requirements of type test given in Table 18.9.4.3.

F-2.1.4.2 If all the three samples pass the requirements of the quality test, the type of pipe under consideration shall be considered to be eligible for type approval which shall be normally valid for a period of one year.

F-2.1.4.3 In case any of the samples fail in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number and subject them to the type test. If, in the repeat test, no single failure occurs, the type of pipe shall be considered for type approval. If any of the samples fails in the repeat tests, the type of pipe shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

F-2.1.4.4 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for fresh samples for type test for the purpose of type approval.

F-2.1.5 Tensile Strength Test (Type Test)

For this type test, the manufacturer or the supplier shall furnish to the testing authority, five samples of pipe of different diameters and different class (selected preferably from a regular production lot).

F-2.1.5.1 Five samples so selected shall be tested for compliance with the requirements of type test given in 18.9.5.4.

F-2.1.5.2 If all the five samples pass the requirement of the quality test, the type test of pipe under consideration shall be considered to be eligible for type approval which shall be normally valid for a period of one year.

F-2.1.5.3 In case any of the samples fails in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original numbers and subject them to the type test. If, in the repeat test no single failure occurs, the type of pipe shall be considered for type approval. If any of the samples fail in the repeat tests, the type of pipe shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

F-2.1.5.4 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for fresh samples for type test for the purpose of type approval.

18.9.7. Marking

18.9.7.1 Each pipe shall be clearly and indelibly marked in ink/paint or hot embossed on white base at intervals of not more than 3 m. The marking shall show the following:

Manufacturer's name or trade-mark
Outside diameter,
Class of pipe and pressure rating, and
Batch or lot number

BIS Certification Marking : Each pipe may also be marked with the Standard Mark.

18.9.8 Fittings

The fittings shall be as follows:

Plain CPVC solvent cement fittings from size 15 mm to 160 mm.

Brass threaded fittings.

Valve from size 15 mm to 160 mm

Brass Threaded Fittings: All types of one end brass threaded male/female adaptors in various fittings like coupler, socket, elbow, tee are available for transition to other plastic/metal piping and for fixing of CP fittings. Ball, Gate valves in CPVC are available in all dimensions. All fittings shall carry the following information:

Manufacturer's name/trade mark.
Size of fitting

Piping Installation Support and Spacing

Concealed Piping: Pipes can be concealed in chases. The pipes and fitting are to be pressure tested prior to concealing the chases. To maintain alignment of CP fittings while joining, all alignment of fittings and pipe shall be done correctly. DO NOT USE NAILS FOR HOLDING OF PIPES IN THE CASES.

External Installations: For pipes fixed in the shafts, ducts etc. there should be sufficient space to work on the pipes. Pipes sleeves shall be fixed at a place the pipe is passing through a wall or floor so as to allow freedom for expansion and contraction. Clamping of the pipe is done to support it while allowing the freedom for movement.

All pipes exposed to sunlight shall be painted with a water based acrylic paint emulsion to enhance UV protection. Pipes in trenching shall be laid in accordance to the Good Plumbing practices followed for Metal piping.

Recommended Support Spacing (Distance between Pipe Clamps Horizontal Support)

Pipe Size	Horizontal Support (In meters)			
	Temperature			
	23°C	38°C	60°C	82°C
16 mm (1/2")	1.22	1.22	1.07	0.92
20 mm (3/4")	1.53	1.37	1.22	0.92
25 mm (1/0")	1.68	1.3	1.37	0.92
32 mm (1 1/4")	1.83	1.68	1.53	1.22
40 mm (1 1/2")	1.98	1.83	1.68	1.22
50 mm (2")	2.29	2.14	1.98	1.22

18.9.9.3 Expansion LOOP: CPVC systems, like all piping materials, expand and contract with changes in temperatures. CPVC pipes shall expand 7.5 cm per 30 m length for a 40°C temperature change.

Expansion does not vary with Pipe size. Thermal expansion can be generally be accommodated at changes in direction. On a long straight run, an offset or loop based on the following chart is required.

Nominal Pipe Size	Length of Run (Meter), Loop length in cms.				
	6 metre	12 metre	18 metre	24 metre	30 metre
15 mm	43	56	69	79	86
20 mm	48	66	81	91	104
25 mm	53	74	91	104	117
32 mm	58	81	102	117	130
40 mm	63	89	109	127	142
50 mm	71	102	124	145	163

18.9.10 Testing

All water supply systems shall be tested to hydrostatic pressure test. The pressure tests are similar to the test pressure used for other plastic/metal pipes. System may be tested in sections and such section shall be entirely checked on completion of connection to the overhead tank or pumping system or mains.

18.9.11 Measurements

The net length of pipes as laid or fixed shall be measured in running meters correct to a cm for the finished work, which shall include CPVC pipe and fittings including plain and Brass threaded fittings and jointing solvent cement.

Item No.36 Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete. [B] 20mm.

SPECIFICATION FOR ITEM SHALL APPLY AS PER ITEM NO.35 ABOVE FOR 20 MM DIA. CPVC PIPES

Item No.37 Proving and fixing screw down bib taps of following size.(A) Brass screw down bib tap polished bright. (I) 15 mm. Dia.

1.0. Materials and workmanship

1.0. Materials : 15 mm. dia. brass screw down with 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 end 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.38 Proving sock pit of 5.0 Cumt. Volume including excavating and filling brick bats with dry masonry work at top for 45 cm. Height including covering the top with stone including providing vatas in c.m. 1;3 with finishing,curing etc. complete as directed.

1.0. Materials : Water shall conform to M-1, Cement mortar conform to M-11, Burnt Bricks shall conform to M-15, Rough stone slab 40 x 50 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 ,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 of Brick masonry 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 of Brick masonry shall be followed.

2.2. The rate shall be for a unit of One number.

Item No.39 Providing and Fixing double coated Syntex or Equivalent PVC (ISI) mark water tank of required capacity each with all necessary fittings and connection etc. comp on terrace or as directed by Engineer - in- charge.

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 nad labour as diredcted 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.40 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 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.

1.0 GENERAL:

The work shall be carried out us per general technical specification volume and as per National Building Code as amended form 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 (2cement,;2coarse 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 crême out up to surface using white cement incl. rounding off junctions and extending them upto 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.

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

Item No.41 Pro. /Fix. with windows with 40x40x5mm. Iron angle & frame 30x30x4 mm size in Double Shutter with B.G. 20 Gauge Sheet plates with , Hold fasts ,Iron hinges handles,stopper ,and locking arrangement etc. comp. Steel welded is built up section cutting hoisiting , finishing in two coats of oil painting over coat of primer coat etc. comp.

1.0. Materials

The structured steel work shall conform to M-22, Red lead paint shall conform to I.S. 102-1962.

2.0. Workmanship

2.1. The steel sections as specified or required shall be cut, square and to correct lengths, as per drawings and design. The cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make up the required length of member except as indicated in the drawing or as directed. All straightening and shaping to form shall be done by application of pressure and not by hammering. Any bending or cutting shall be carried out in such a manner as not to impair the strength of the metal. All operations shall be done in cold state unless otherwise directed/permitted.

2.2. Steel riveted or bolted in built up sections, frame work.

2.2.1. The steel structure as shown in the drawings or as per direction of the Engineer in charge shall be laid out on a level platform to full scale and to full size in parts. A steel tape shall be used for measurements to ensure max. accuracy.

2.2.2. Wooden templates 12 mm. to 19 mm. thick or metal sheet template shall be made to correspond to each connecting gussets plate and rivet holes shall be accurately marked on them and drilled. The templates shall be laid on the steel members and holes of the steel members and holes of the steel members shall also be marked for curing. The base of steel column and the position of Anchor bolts shall be carefully set out.

2.2.3. All stiffeners shall be formed by pressure and where practicable, the metal shall not to be cut and welded in making these. In major works or where so specified shop drawings giving complete details and in formations for the fabrication of the component parts of the structure. Including location type size length and details or rivets, bolts or weld shall be prepared in advance of the actual fabrication and as distinctly marked or stenciled with paint with the identification mark as given in the stop drawings. The bars shall be thickened at the ends, so as to provide for screwed threaded and gradually tapered off to meet their normal section.

Great accuracy shall be observed in fabrication of various member, so that these can be assembled without being unduly packed, stained or forced into the position and when build up shall be true and free from twists brinks buckles or open joints.

Before making holes in individual members for fabrication the steel work intended to be riveted or bolted together shall be as embed or clamped properly and tightly so as to ensure close abutting or lapping or the surfaces of the different members. All stiffeners shall bear tightly both at top and bottom without being drawn or caulked. The abutting joints shall be cut or crossed true and straight and fitted close together. Web splice plates and fillers under stiffeners shall be cut to fit within 3 mm. or flange Angles Web plates of girders shall have no cover. Plates shall have their ends flush with the top of angles forming the flanges unless otherwise required. The web plates when spiced shall have clearance of not more than 6 mm.

The erection, clearance for cleated ends of members connecting steel shall preferably be not greater than 1.5 mm. The erection, clearance at the ends of beams without web cleats shall

not be more than 3 mm. at each end but where for a practical reason greater clearance is necessary suitably designed seating shall be provided.

Pains and rollers shall be accurately tuned to gauge. These straight and smooth and free from flows. The roller bearing shall be provided with adequate arrangements for holding the girders or truss resting on it. In column caps and bases the ends of ships together with the attached gussets. Angles, channels etc. after riveting together shall be accurately mechanized so that the parts connected butt against each other over the entire surfaces of contact connecting angles or channels shall be fabricated and placed in position with greater accuracy so that they are not unduly reduced in thickness by machining. The ends of bearing stiffeners shall be mechanized or ground to fit tightly both at the top and bottom. All holes shall generally be drilled to the required size and at required. Position. Sub punching shall be permitted provided it is done 3 mm. or less in diameter and reamed thereafter to the required size. The holes for rivets and bolts shall be larger by 0.4 to 6 mm. than the nominal diameter of rivets or black bolts depending upon the diameter of rivets. Holes shall have their axis perpendicular to the surface bored through. The drilling or remarrying shall be free from butts, and the holes should be clean and accurate holes for counter shrunk bolts shall be made in such a manner that their heads fit flush with the surface after fixing. The fabrication work shall be completed in workshop as far as it is practicable to do so. Site joints shall be done with rivets and fitted bolts or black bolts, as shown in the drawings or as directed. Generally the following principles shall govern the use of rivets turned and fitted bolts and block bolts.

(i) Rivets and turned and fitted bolts shall be used where the connection is such that slip under load has to be avoided.

(ii) Black bolts may be used very sparingly where a force is carried through a connection without impact vibration or reversal or stresses.

2.2.4. Riveting :

The parts assembled for riveting shall be in close contact with each other and the bearing stiffeners shall bear tightly bolt at top and bottom without being drawn or caulked. Member to be riveted shall be properly pinned or bolted and rigidly held to gather while riveting. Drifting of holes shall not be permitted except to draw the parts together and the drifting tools so used shall have max. diameter not exceeding the nominal diameter of rivets or bolts. Drifting done during assembling shall not distort the metal or enlarge the holes.

The shanks of rivets shall project beyond the plate surface sufficiently so as to fill hole thoroughly and form the required head after riveting.

The riveting shall be done by hydraulic or pneumatic process. However where such facilities are not temperature of heating so as not to but the steel. Rivers of diameter less than 10 mm. may be fitted cold. Rivets shall be of heat finish with heads full and of equal size. All those burnt or badly formed reverts with concentric or deficient heads shall be cut out and replaced. The heads of rivets shall be central to shanks and shall grip the assembled member firmly. In cutting out rivets, care shall be taken so as not be injure assembled members, caulking or reequipping shall not be permitted.

For testing rivets, a hammer weighing approximately 0.25 kg. shall be used. Both heads of the rivets shall be tapped, stack rivets will give a hollow sound an a jar.

All rivet heads shall be painted with red lead paint within a week of their fixing.

2.2.5. All bolt heads and nuts shall be hexagonal of equal size unless specified otherwise. The screwed heads shall conform to I.S. 1363-1960 and the threaded surface shall not be tapered. the bolts shall be of such length so as to project two clear threads beyond the nuts when fixed in position and these shall fit in the holes without any shakes. The nut shall be fit in the threaded ends of bolts properly.

Where turned and fitted bolts are required to be used in place of rivets shall be provided with washers not less than 6 mm. thick so that the nut when tightened shall not bear on the unthreaded body of the bolt. Tapered washers shall be provided for all heads and nuts bearing on leveled surfaces. The threaded portion of the bolt shall not be within the thickness of the parts bolted together the faces of the bolt heads and nuts abutting against steel members shall be machine finished. Where there is a risk of the nut being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of locknuts, spring washers, cross cutting or hammering down of threads as directed.

Bolts nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. The whole steel work shall be painted with a coat of priming coat of red lead, as per relevant specification of painting.

3.0. Mode of measurements & payments

3.1. The steel work shall be measured in general as under.

- (a) All work shall be measured on the basis of finished dimensions as fixed at site and measured net unless specified otherwise.
- (b) The weight of steel sections, steel rods, and steel strips in finished work shall be calculated from standard weight on the same basis on which steel is supplied to contractor by department or those given in relevant I.S. if steel is arranged by the contractor.
- (c) The weight of steel plates and strips shall be taken from relevant I.S. based on 6.85 kg/sq. meter for every millimeter sheet thickness if steel is supplied to the contractor by department.
- (d) Unless otherwise specified, weight of cleats, brackets, packing pieces, bolts nuts washers distance pieces, separators, diaphragm gusset (taking overall squared dimensions) fish plates etc. shall be added to the weight of respective items.
- (e) In riveted work allowance is to be made for weight of rivet hands. No deductions shall be made for rivet or bolt holes excluding holes for anchor or holding down bolts.
- (f) For forged steel and steel casting, weight shall be calculated on the basis of 7850 kg./cum.
- (g) Unless otherwise specified, no allowance shall be made for weld metal in case of welded steel structure.
- (h) Dimensions other than cross sections and thickness of plates shall be measured to nearest 0.001 m.
- (i) Mill tolerance shall be ignored when weight is determined by calculation.

3.2. The rate includes cost of all material, labor, erection, hoisting scaffolding protective measured required for proper completion of the item of work. This shall also include conveyance and delivery handling loading, unloading storing etc. required for completing the item described above including necessary wastage involved.

For Shutters

1.0. Materials

M.S. steel shutters shall be fabricated of M.S. component as given in the description of item M.S. sheets 1 mm. thick shall be fixed to the frame with rivets or weld as approved. The shutters shall be provided with top and bottom Angles. The frame shall be riveted and/or welded and wherever riveting shall be done 3.15 mm. gussets plates shall be provided at the junctions.

2.0. Workmanship

2.1. The shutters shall be single or double leaf shutters as specified. The guide rails shall be sufficiently long and continued along the wall on the both ends so that the steel shutters can rest against walls, leaving full opening when so required.

2.2. The guide rails shall be fixed to the floor by means of anchor bolts embedded in the cement concrete floor. The steel section at the top shall be suitably supported from the walls. Two channel section shall suitably be fixed vertically below the extreme clamps in the wall and floor to avoid the shutters from going out of the supports at the top and bottom. A suitable clamping arrangement will be provided at either end of the opening to avoid the shutters from rolling back into opening.

2.2. All the adjoining work damaged while fixing shall be made good to match the existing work.

2.3. All members of the steel shutter including T-iron shall be thoroughly cleaned of rust scales dust etc. and given a priming coat of red lead before fixing them in position.

3.0. Mode of measurements & payment.

3.1. The steel doors shall be measured on sq. meter. The height of the shutters shall be measured from outside to outside of Angle and width outside to outside of shutters including vertical channels in sides. The rate includes providing handles, stoppers and locking arrangements etc. complete.

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

Item No.42 Providing and fixing M.S. Grills of required pattern to wooden frames of Pipe / Angles etc.including Priming coat of approved primer and Two coats of Oil painting etc. complete Ordinary 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 into 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.43 Providing and laying polished kota stone slab flooring over 20mm (average) thick base of cement mortar 1:6 (1 cement : 6 coarse sand) or L.M. 1:1.5 laid and jointed with grey cement slurry including rubbing and polishing etc. complete 25mm Thick

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 dedo, skirting, sink, veneering, sills, steps etc. where machine polishing after the stones are fixed in situ is not possible shall be double polished.

1.0. Materials

Water shall conform to M-1, Lime mortar shall conform to M-10, Exterior mortar shall conform to M-11, Polished kota stone shall conform to M-49.

2.0. Workmanship

2.1. Each slab shall be cut to the required size and shape and fine chisel dressed at all the edges. The sides must be dressed shall have a full contract if a straight edge is laid along. The sides shall be table rubbed with coarse sand before paving. All angles and edges of the slabs shall be true square and free from chippings and giving a plane surface. The thickness shall be 25 mm. (Average) as specified in the item but not less than 20 mm. at any place of the slab.

2.2. Bedding for Kota stone slabs shall be of Exterior mortar 1: 6 (1 Exterior : 6 coarse sand) or L.M. 1 : 1.5 of average thickness 20 mm. given in the description of the item. Sub grade shall be cleaned, wetted and mopped. Mortar of specified mix and thickness shall then be spread on an area sufficient to receive one kota stone slab. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped gently to bring it in level with other slabs. It shall then be lifted and laid aside. Top surface of the mortar shall then be corrected by adding fresh mortar at hollows or depressions. The mortar shall then be allowed to harden bit. Over this surface, Exterior slurry of honey like consistency shall be applied. The slab shall then be gently placed in position and tapped with wooden mallet till it properly padded in level with and close to the adjoining slab. The joint shall be as fine as possible. The slabs fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster, skirting or dedo. The junction between the wall and floor shall be finished neatly. The finished surface shall be true to levels and slopes as directed.

2.3. The floor shall be kept wet for a min. period of 7 days so that bedding and joints set properly.

2.4. Polishing shall be normally commenced after 14 days of laying the stone slab. First polishing shall be done with carborundum stone of 220 to 350 grade grit fitted in heavy machine. Water shall be Engineer in charge wax polish of approved quality shall be applied on the surface with the help of soft cloth over a clean and dry surface. Then the polishing machine fitted with bobs shall be run over it.

2.5. The holes required for nalni traps, pipes and any other fittings shall be made without any extra cost.

3.0. Measurement & Payment

3.1. The rate shall include the cost of all materials and labor involved in all the operations described above. The kota stone flooring shall be measured in square meters correct to two place decimal length and breadth shall be measured correct to a centimeter and between the

finished face of skirting dedo or wall plaster and no deduction shall be made not extra paid for any opening in floor of areas up to 0.1 sq. mt.

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

Item No.44 Providing and fixing 30mm thick FACTORY MADE SOLID PANEL PVC DOOR SHUTTER consisting of frame made out of M.S. tubes of 19 gauge thickness and size of 19mm x 19mm for stiles and 15mm x 15 mm for top and bottom rails. M.S. frame shall have a coat of steel primers of approved make and manufacture, M.S. frame shall be covered with 5 mm thick heat moulded PVC 'C' channel of size 30 x 50 mm forming stiles, and 5mm thick 75mm wide PVC sheets for top rail, lock rail and bottom rail on either side, and 10mm (5mm x 2) thick, 20mm wide cross PVC sheet as gap insert for top rail and bottom rail, Panelling of 5 stiles and rails with 30mm wide x 5mm thick PVC sheet beading on either side, and joined together with solvent cement adhesive,. An additional 5mm thick PVC strip of 20mm width is to be stulk on the interior side of the 'c' channel using PVC solvent cement adhesive etc. complete as per direction of Engineer in charge, manufacture's specification and drawing.

9.20 PVC DOOR FRAME

The shutters shall be fabricated at factory as per nomenclature of the item and directions of Engineer-in-Charge. Shutter shall be made of PVC material conforming to IS 10151

9.20.1 Solid PVC Door Frames consisting of section 50 x 47 mm shall be fabricated from 5 mm PVC sheet having density of 600 kg./cum. The sheet used may be in plain colour, printed design or prelam veneer shade as approved by the Engineer-in-Charge. The weight per running metre of the door frame including reinforcement should be a minimum of 1.5 kg./sq. mtr. The depth of the rebate of door frame shall be 10 mm. Frames shall have smooth surface, without any warping or bending in any member. All the parts of the door frame are to be joined to each other using solvent adhesive conforming to IS 14182. A tolerance of + 3 mm shall be permitted in the specified dimension of PVC section in the door frames. (Fig. 9.21)

The solid PVC door frames shall be fabricated in factory as per nomenclature of the item and directions of the Engineer-in-charge.

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 for separately

9.21 PANEL PVC DOOR SHUTTER

9.21.1 Panel PVC Shutters are factory made shutter and shall be brought to site fully assembled. The Solid Panel PVC Door shall be fabricated from 5 mm PVC sheet. The sheets used may be in plain colour, printed design or prelam veneer shade as approved by the Engineer-in-Charge. The shutters shall be fabricated at factory as per nomenclature of the item and directions of the Engineer-in-charge.

(a) 30 mm thick panel PVC door shutters (Figure 9.22).

30 mm THICK PANEL PVC DOOR SHUTTER

Sub Head : Wood Work and PVC Work
Clause : 9.21.1(a)

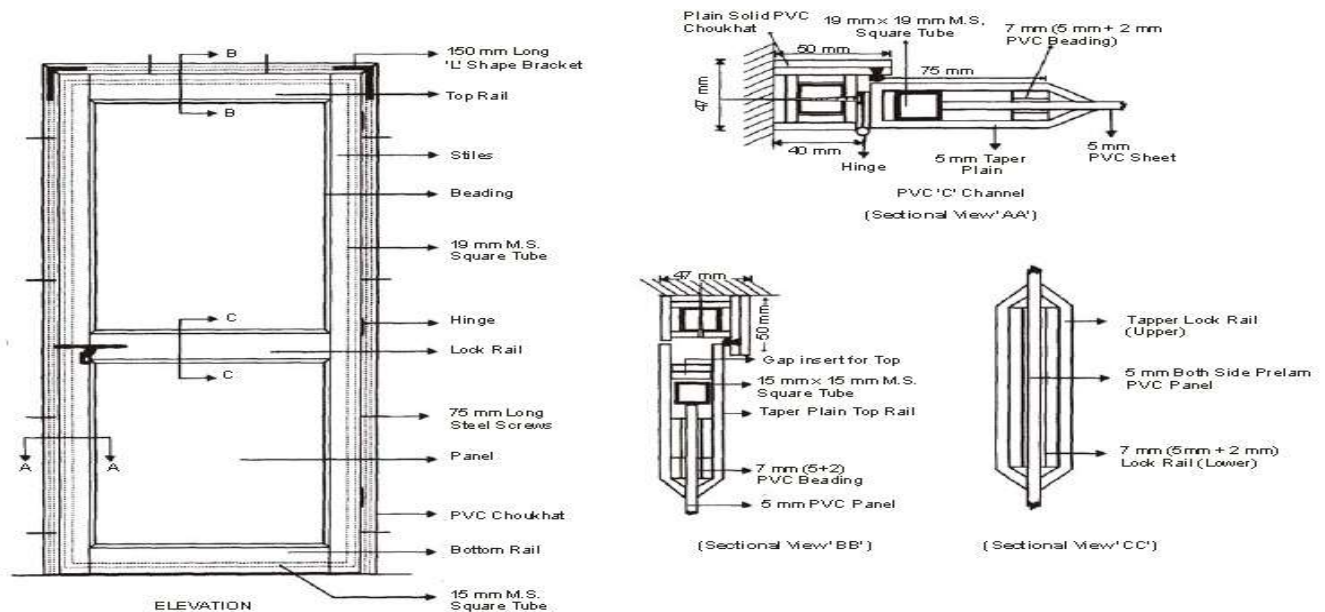


Fig. 9.22 : 30 mm Thick Panel PVC Door Shutter

(b) 9.21.2 Sampling and Criteria for Conformity

9.19.3.1 General Precautions

9.19.3.1.1 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.

9.19.3.1.2 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

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

9.19.3.2.2 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.

9.19.3.2.3 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>
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.

(a) 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.

© 9.21.3 Tests

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

(a) *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 + 5 mm. The door shutter shall not deviate by more than 1 mm on a length of 500 mm. The thickness of the door shutter shall be uniform throughout with the permissible variation of not more than 0.8 mm between any two points. The nominal thickness of the shutter shall be within a limit of + 1.5 mm.

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

(c) *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.

(d) *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.

(e) *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.

- (f) *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.
- (g) *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.
- (h) *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.
- (i) *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.
- (j) *Screw Holding Test* : Door shutters, when tested in accordance with IS 4020- Part 16, the load shall not be less than 1000 N.

(D) 9.21.4 Fixing of Shutters

PVC 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. In addition, it may be ensured that while fixing hinges the screws pass through the two opposites surfaces of the M.S. reinforcement.

(E)9.21.5 Tolerance

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

(F)9.21.6 Fittings

Fittings shall be provided as per schedule of fittings decided by Engineer-in-Charge.

In moisture prone areas M.S. fittings and screws should not be used. Hardware such as handles, tower bolt, stopper, buffer etc. should be directly screwed (not pre-drilled) and fitted on the door.

(G) 9.21.7 Measurements

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.

(H) 9.21.8 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.

Item No.45 Providing & Fixing Acrylic sheet name board size 2.00 mt x 0.60 sqm. With painting letters Indicating Gram panchayat office / Village/ Taluka/ Dist. Etc. as directed by Adm. Department etc. with all required material & Labour comp.

M-51 - Slab/ Acrylic plate

51.1. - Acrylic plate shall be white or of other and of best quality as approved by the Engineer in charge.

51.2. Acrylic plates 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. - Acrylic plates with natural veins, if selected shall have to be laid as per the pattern given by the Engineer in charge. Size of the Acrylic plate 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 Acrylic plate shall not be thinner than the specified thickness at its thinnest part. A few specimen of finished Acrylic plate to be used shall be deposited by the Contractor in the officer for reference.

51.5. Except as above the - Acrylic plate shall conform to I.S. 1130-1969.

51.6 Rate includes carving the letters of scheme as directed for One No. as per prescribed LOGO of Nandghar.

Item No.46 Providing & Fixing 4.50 Kg Co2 type Fire Extinguisher with all required equipment & Labour comp.

The item itself specifies the requirement for Co2 type Fire Extinguisher 4.50kg and shall be supplied to store or directed by Engineer in charge.

Co2 type Fire Extinguisher 4.50kg, CO2 Fire Extinguisher 4.5 KG are mainly used for electrical fire risks and are usually the main fire extinguisher type provided in computer server rooms. They also put out Class B fires. CO2 extinguishers suffocate fires by displacing the oxygen the fire needs to burn. This type of extinguisher has a black label. place near to the source of the fire risk or near the fire exits such as offices, kitchens, server rooms and premises with electrical appliances and equipment.

- ISI, ISO and CE Certified Product and Multipurpose Uses Co2 Type fire extinguisher 4.50 Kg.
- Package Contents-1 Fire Extinguisher, 1 Wall Hook, 1 Discharge Pipe.

Product Type	:	Fire Extinguishers
Fire Type	:	Type Co2
Capacity	:	4500g
Hazardous Material	:	No
Flammability	:	Not Flammable
Storage Category	:	Normal Storage
Storage Temperature Limit (in Degree Celsius)	:	Normal Warehouse Temperature

The necessary vouchers bill for purchase of Co2 type Fire Extinguisher 4.50kg shall be produced if demanded by Engineer in charge.

The payment shall be made on No. basis.



Co2 type Fire Extinguisher 4.50kg

Item No.47 Providing & Fixing 6.00 Kg ABC type Fire Extinguisher with all required equipment & Labour comp.

The item itself specifies the requirement for ABC type powder Fire Extinguisher 6kg and shall be supplied to store or directed by Engineer in charge.

ABC type powder Fire Extinguisher 6kg, ABC Types Fire extinguishers are effective for all types of fire like Class A, B and C types of fires as well as Electrical fires and also ABC Powder Type (Stored Pressure) Fire Extinguisher, Multipurpose uses

- ISI, ISO and CE Certified Product and Multipurpose Uses ABC Type fire extinguisher 6 Kg.
- Package Contents-1 Fire Extinguisher,1 Wall Hook, 1 Discharge Pipe.

Product Type	:	Fire Extinguishers
Fire Type	:	Type ABC and ABC Powder
Capacity	:	6000g
Hazardous Material	:	No
Flammability	:	Not Flammable
Storage Category	:	Normal Storage
Storage Temperature Limit (in Degree Celsius)	:	Normal Warehouse Temperature
Dimensions		

Height	25 cm
Length	15 cm
Width	20 cm
Net Weight	7 kg

The necessary vouchers bill for purchase of ABC type powder Fire Extinguisher 6kg shall be produced if demanded by Engineer in charge.

The payment shall be made on No. basis.



ABC type powder Fire Extinguisher 6kg

Item No.48 Point wiring for Light / Bell with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in/ on surface on wall/ceiling complete with 6A Modular type switch / bell push & accessories and earth continuity of following type, erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected, with necessary Lamp holder/ceiling rose / H.D.Connector as directed.

(f) with medium class Rigid PVC pipe and accessories Cat- III

SPECIFICATION FOR INTERNAL ELECTRICAL WORK

CONTENTS

- Section 1. Technical Specifications – General
- Section 2. Technical Specifications- Conduit Wiring
- Section 3. Technical Specifications – CTS wiring
- Section 4. Technical Specifications- Cable laying
- Section 5. Technical Specifications- Electrical fittings, fixtures and fans.
- Section 6. Technical Specifications- Circuit breakers, panel boards & distribution boards
- Section 7. Technical Specifications- Earthing
- 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 mm \square -mm². 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 alongwith 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-incharge.

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.

Table – I

MAXIMUM PERMISSIBLE NUMBER OF 250 V GRADE SINGLE CORE CABLES THAT CAN BE DRAWN INTO RIGID STEEL CONDUITS

Size of Cable

Nominal Cross Sectional Area mm ²	20		25		32		40		50	
Number of Diameter in mm of Wires	S	B	S	B	S	B	S	B	S	B
1.5										
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	Number & Diameter in mm of Wires	20	25	32	40	50
Cross Sectional Area mm2		(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	5	10	14		
	3/1.06*					
4.0	1/2.24	3	6	10	14	
	7/0.85*					
6.0	1/2.80	2	5	8	11	
	7/1.06*					
10	1/3.55+		4	7	9	
	7/1.40*					
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+				2	3
	19/1.80					

* 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.

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 bends, 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.

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 35°C 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 50mm x 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 circuit 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 megger with all switch gear in closed position. Megger 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 MM2 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 pert of the installation rate quoted for the concerned item.

No separate payment for earth connection to these appliances and fixtures shall be made.

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.

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 along with 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

$$R = \frac{1}{2}$$

I

Where,

R - Resistance of the test electrode in ohms.

V - Reading of the voltmeter in volts.

I - Reading of the ammeter in amps.

CURRENT ☐ *SOURCE*

////////////////////////////////////

$$X + 1 \text{ m}$$

A B C

TEST POTENTIAL CURRENT

ELECTRODE ELECTRODE ELECTRODE

9.1.4.2 (a) Stray currents flowing in the soil may produce serious errors in measurement of earth resistance. To eliminate this, hand driven generator is used.

(b) If the frequency of the supply of hand driven generator coincides with the frequency of stray current there will be wandering of instrument pointer. An increase or decrease of generator speed will cause this to disappear.

9.1.4.3 At the time of test, the test electrode shall be separated from the earthing system.

9.1.4.4 The auxiliary electrodes shall be of 13 mm diameter mild steel rod driven upto 1 m into the ground.

9.1.4.5 All the three electrodes shall be so placed that they will be independent of the resistance area of each other.

9.1.4.6 If the test electrode is in the form of rod, pipe or plate, the auxiliary current electrode "C" shall be placed at least 30m away from it and the auxiliary potential electrode 'B' shall be placed mid way between them.

9.1.4.7 Unless three consecutive readings of test electrode resistance agree the test shall be repeated by increasing the distance between electrodes A and C upto 50 m and each time placing the electrode 'B' midway between them.

9.1.4.8 On these principles "Megger Earth Tester" containing a direct reading ohm meter, a hand driven generator and auxiliary electrodes are manufactured for direct reading on earth resistance of electrodes.

9.1.5 On completion of an electric installation (or an extension to an installation) a certificate shall be furnished by the contractor countersigned by the certified supervisor under whose direct

supervision the installation was carried out. This certificate shall be in the prescribed form as given in Appendix 'A', in addition to the test certificate required by the local Electric Supply Authorities.

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SECTION 10.0

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
-

APPENDIX '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 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

Signature of the Supervisor Signature of Contractor

Name and address Name and address

Item No.49 Point wiring for FAN with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (Green) both are of .ISI marked 1.1 KV Grade FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in / flushed on wall/ceiling complete with 6A Modular type switch and hum free EME four or more step type electronic fan regulator with separately mounted and accessories with earth continuity of following type erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected. with necessary ceiling rose / H.D.Connector as directed.

(f) with medium class Rigid PVC pipe and accessories Cat- III

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.50 Point wiring for Looped Plug with 6A Modular type switch & 5 pin socket erected on PVC / Metallic box, single mounting base frame covered with textured / metallic front plate modules erected on / in wall / ceiling with following type accessories Cat- III

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.51 Point wiring for individual Plug with & Earth wire of FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in / surface of wall/ceiling complete with Modular type switch and 5 Pin plug erected on PVC/ Metallic box covered with appropriate front plate modules erected on / in wall/ ceiling as per pipe erected with following type of

(I) For 6A Plug with 2-1.5 Sq.mm Cu. wire

(f) With medium class rigid PVC Pipe and accessories - Cat_III

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.52 Providing & erecting Switch board for Computer or electric apparatus consisting of following items in single board erected on PVC / Metal board with 3 mm thick PC (Polycarbonate) / Acrylic sheet erected as directed

1 no. 6A/16A universal plug-switch combined.

4 nos. 6A Switch

4 nos. 6A 5 pin Plug

[B] For Modular Type Accessories Cat. III

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.53 Decorative call bell Ting-tong box type 250 volts complete erected

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.54 Supplying and erecting led lamps with following wattage capacity of 220 to 240 voltage, minimum 15000 burning hours life, 500 V in built-surge protection, Polycarbonate diffuser, mounting suitable for E14 / E27 / B22 lamp holders, pf ≥ 0.5 (A) LED Lamps integral type, with PC diffuser suitable LAMP holder (iii) 10 to 15 watts

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.55 Miniature circuit breaker single pole 6A to 25A suitable to operate on 240 V A.C. system and having breaking capacity 10 KA to be erected in existing box. confirming to IS 8828/1996 with ISI Mark
Cat-III

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.56 Providing & erecting 240 V MCB double pole switch for lighting load (B Curve) having 10 KA breaking capacity & Confirming to IS :8828 in Existing box , having capacity
(B) 40 Amp.- Cat-III

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.57 Providing and erecting Sheet Steel powder coated MCB distribution board - flush / surface mounted fitted with busbar, neutral link, earth bar and DIN rail, confirming to IS 13032 and BS 5486-1986 without MCB to house appropriate nos. of MCBs.(The DBs should be used of same company of MCB to be used)
(A) Single phase 12 way SS double door

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.58 Providing & erecting Approved make Ceiling Fan with double ball bearing ISI mark with Condenser 230 volt A.C. 50 c/s, 1200 mm sweep complete having 3 blades with aluminium blades with , canopy & 30 cms. down rod erected on existing hook or Clamp with 24/ 0.2, 3 core flexible wire with earthing.
(Make shall be approved by Engineer in charge)

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

Item No.59 Pipe type earthing having 150 cms.long and 2.5 cms. dia. Galvanised iron pipe with coupling and buch buried in specially prepared earth pit complete with necessary 8 SWG earth wire. For using salt and charcoal / coke as required for pipe type earthing.

SPECIFICATION SHALL APPLY AS PER ABOVE ITEM NO.48

*******THE END*******