Tender for Extension of wing in Block E at PDEU campus, Gandhinagar

Part – A

General & Technical Specifications

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PART - A
GCC, SCC, General and Technical specifications
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Applicable Standards
For
Civil & Plumbing Works

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1	Conversion factors	IS:786
2	Method of measurement of building works	IS:1200
3	Code of practice for measurement of civil engineering works	IS:3385
4	Materials and workmanship for earthwork and excavation	IS:1200 (PART I)
5	Safety code for blasting and related drilling operations	IS:4081
6	Safety code for excavation work	IS:3764
7	Moisture content in sand for filling	IS:2720
8	Determination of moisture content	IS:2720 (PART II)
9	Determination of moisture content & dry density relation using light compaction	IS: 2720 (PART VIII)
10	Determination of dry density of soils in-place by the sand replacement method	IS:2720(PART XXVIII)
11	Determination of dry density of soils in-place by the core cutter method	IS:2720 (PART XXIX)
12	Anti termite treatment	IS:6313(PARTI TO III)
13	Construction water	IS:456
14	Methods of sampling and test (physical and chemical water used in industry)	IS:3025
15	Ordinary (33 grade)/low heat Portland cement	IS:269
16	Ordinary Portland cement (43 grade)	IS:8112
17	Ordinary Portland cement (53 grade)	IS:12269
18	White Portland cement	IS:8042-E
19	Portland pozzolana cement	IS:1489
20	Rapid hardening Portland cement	IS:8041, IS:269
21	Portland(blast furnace) slag cement	IS:455
22	Hydrophobic cement	IS:8043
23	High alumina cement	IS:6452
24	Super sulphated cement	IS:6909
25	Oil well cement	IS:8229E
26	Standard for testing of cement	IS:650
27	Methods of physical tests for hydraulic cement	IS:4031
28	Specification for standard sand for testing of cement	IS:650
29	Coarse and fine aggregates for concrete	IS:383, IS:515
30	Gradation of coarse aggregates	IS:383(TABLEII)
31	Gradation of fine aggregates	IS:383 (TABLE III)
32	All-in-aggregates	IS:383 (TABLE IV)
33	Method of tests for aggregates for concrete	IS:2386 (PART I TO VIII)
34	Methods of determination the maximum qty. of deleterious materials in aggregate	IS:2386 (PART II)
35	Limiting values of the maximum quantities of deleterious materials in aggregate	IS:383 (TABLE I)
36	Flakiness index of aggregates	IS:2396 (PART I), IS:5640
37	Moisture content test for aggregates	IS:2386 (PART III)
38	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.	IS:432 (PART I & II)
39	Specification for plain hard drawn steel wire fabric for cement concrete	IS:1566
40	Specification for cold twisted steel bars for concrete reinforcement	IS:1786
41	Specifications for hot rolled mild steel and medium tensile steel deformed bars	IS:1139, IS:1739
42	Code of practice for bending and fixing of bars for concrete reinforcement	IS:2502
43	Mild steel binding wire	IS:280
44	Code of practice for welding of mild steel bars used for RCC	IS:2751
45	Code of practice for plain and reinforced concrete	IS:456
46	Code of practice for general construction of plain and RCC for dams	IS:457
47	Testing of reinforced cement concrete	IS:516
48	Method of tests for strength of concrete	IS:516
49	Methods of sampling & analysis of concrete	IS:1199
50	Code of practice for concrete structures for storage of liquids	IS:3370 (PART I TO IV)
51	Code of practice for composite construction	IS:3935
52	Code of practice for construction of reinforced concrete shell roof	IS:2204
53	Criteria for the design of RCC shell structures and folded plates	IS:2210
54	Specification for batch type concrete mixers	IS:1791
55	Specification for portable swing weigh batchers for concrete	IS:2722
56	Specification for roller pan mixer	IS:2438
57	Specification for concrete vibrators immersion type	IS:2505

58	Specification for screed board concrete vibrators	IS:2506
59	Specification for concrete vibrating tables	IS:2514
60	Specification for pan vibrators	IS:3366
61	Specification for form vibrators for concrete	IS:4656
62	Code of practice for use of immersion vibrators for consolidated concrete	IS:3558
63	Air entraining agent	ASTM:6260
64	Criteria for design and construction of precast concrete trusses	IS:3201
65	Prestressed concrete	IS:1343
66	Specification for high tensile steel bars used in code of practice for pre-stressed concrete	IS:2090
67	Specification for plain hard drawn steel wire for pre-stressed concrete	IS:1785 (PART I)
68	Specification for plywood for concrete	
69	Shuttering work	IS:4990
70	Code of practice for steel tubular scaffolding	IS:4014 (PART I & II)
71	Specification for steel scaffolding	IS:2750
72	Safety code for scaffolds and ladders	IS:3696
73	Common burnt clay building bricks	IS:1077
74	Classification of burnt clay bricks	IS:3102
75	Burnt clay building bricks, heavy duty	IS:2180
76	Burnt clay facing bricks	IS:2691,IS:1077
77	Method of sampling and testing clay building bricks	IS:3495 (PART I - IV)
78	Mortar for brick work	IS:2250
79	Code of practice for brick work	IS:2221
80	Masonry works	IS:3466
81	Structural safety etc. Of building masonry walls	IS:1905
82	Load bearing hollow concrete blocks	IS:2185
83	Lime - cement - cinder hollow concrete blocks	IS:5498
84	Lime - cement - cinder solid blocks	IS:3115
85	Code of practice for construction of stone masonry	IS:1597 (PART I)
86	Stone tests	IS:1124
87	Code of practice for design and installation of joints in buildings	IS:3414
88	Joint sealing compound	IS:834
89	Pre-molded bituminous joint filler	IS:1838
90	Timber door, window and ventilator frames	IS:4021
91	Material & workmanship for wood work	IS:883, IS:4021
92	Wooden flush door shutters (solid core type)	IS:2202 (PART I)
93	Timber paneled and glazed shutters	IS:1003 (PART I & II)
94	Method of tests for wooden flush doors, type tests	IS:4020
95	Plywood & tests	IS:303
96	General tests for wood work	IS:1659
97	Red lead for wood knot	IS:103
98	Oil type wood preservative	IS:218
99	Particle board	IS:3087
100	Transparent sheet glass for glazing & framing purposes	IS:1761
101	Resin bonded fiber glass	IS:3144
102	Putty for glazing	IS:420
103	Steel door frames	IS:4351
104	Steel window	IS:1361
105	Steel doors	IS:1038
106	Steel ventilators	IS:1081
107	Rolling shutters	IS:6248
108	Primer for steel doors, windows & ventilators	IS:102
109	Aluminum alloy for door/window frames	IS DSGN. HEA-WP OF IS:733
110	Sections	IS:1948
111	Anodizing	BS:1616
112	Hydraulic lime & storage	IS:712
113	General tests for lime	IS:6932 (PART I TO X)
114	Field tests for lime	IS:1624

115	Lime mortar preparation	IS:1625
116	Slacked lime	IS:1639
117	Surkhi	IS:1344
118	Code of practice for application of lime plaster finish	IS:2394
119	Rough cast plaster	IS:1661(CLAUSE-165)
120	Specification for integral cement water proofing compounds	IS:2645
121	Water proofing asphalt/maxphalt	IS:702
122	Bitumen saturated layer	IS:1322
123	Bitumen felt	IS:1322
124	Bitumen	IS:702
125	Code of practice for laying and finishing of cement concrete flooring tiles	IS:1443
126	Material & workmanship for flooring	IS:1197, IS:1344
127	Code of practice for laying in situ terrazzo floor finish	IS:2114
128	Code of practice for laying in-situ cement concrete flooring	IS:2571
129	Mosaic tiles	IS:1237
130	Glazed earthenware tiles	IS:777
131	Marble chips & marble mosaic terrazzo	IS:2114
132	Plain cement tiles & tests	IS:1237
133	Marble mosaic tiles	IS:1237
134	Marble slab	IS:1130
135	PVC flooring tiles & sheets	IS:3461,IS:3462
136	Broken marble mosaic tiles	IS:1257
137	Oxy-chloride	IS:658
138	Magnesium chloride	IS:657
139	C.I. grid tiles	IS:210
140	Pigment for terrazzo flooring	IS:459
141	Rivets	IS:1148
142	Electrodes for welding	IS:814
143	Code of practice for use of electric arc welding for general construction in steel	IS:813
144	Tests for welding works	IS:1181
145	Welding works	IS:816
146	Bolts and nuts	IS:1367
147	Tests for bolts and nuts	IS:1608
148	Structural steel sections & tests	IS:226
149	Structural steel plates	IS:2062
150	Defects in structural steel	IS:229
151	Dimension & properties of steel section	IS:808
152	Structural steel work	IS:226, IS:4948
154	Expanded metal steel sheet	IS:412
155	Mild steel wire gauze jali	IS:280
156	Welding procedure & edge preparation	IS:823
157	Washers	IS:2016
158	Storage of welding wire & electrodes	IS:816
159	Primer to structural surface for bolts	IS:2074
160	Checkered plates	IS:3502
161	Code of practice for painting of ferrous metal in building and allied finishes	IS:1477 (PART I & II)
162	Distemper and dry colour	IS:427
163	Code of practice for painting concrete, masonry and plaster surfaces	IS:2395
164	Distemper and oil emulsion	IS:428
165	Enamel paints	IS:2933
170	Coat of zinc chromate	IS:104
171	French spirit polish	IS:348
172	GI sheets	IS:227
173	Ac sheets	IS:459
174	Ac sheet fixing	IS:730
175	Mangalore pattern tiles	IS:654
176	Fiber glass reinforced polyester	IS:4154

177	Galvanized steel for barbed wire	IS:278
178	Insulation of hot water pipes, tanks & heat exchanger	BS:476
179	GI pipes & MS tubes	IS:1239 (PART I)
180	Screw down bib cocks & stop cocks	IS:781
181	Vitreous sanitary fixtures(general)	IS:2556 (PART I)
182	Gun metal wheel, globe, check, gate & non return valves	IS:778
183	Wash basin	IS:2556 (PART IV), IS:771
184	European W.C.	IS:2556, IS:771
185	Solid plastic seat & cover	IS:2548
186	Orissa pan W.C.	IS:2556 (PART III)
187	Squatting pans & traps	IS:2556 (PART III)
188	Indian W.C. (wash down W.C.)	IS:2556 (PART II), IS:771
189	Urinals	IS:2556 (PART VI)
190	Half round channels	IS:2556 (PART VII)
191	Specific requirements of siphonic wash down W.C.	IS:2556 (PART VIII)
192	Ss sink/C.I./flushing tank brackets	IS:775
193	C.I. siphonic flushing cistern	IS:774
194	Lead pipes	IS:404 (PART I)
195	Sand cast pipes & fittings	IS:1729
196	C.I. spun soil pipes & fittings	IS:3939
197	Gully trap	IS:651
198	Glazed stone ware pipes & fittings	IS:651
199	Ac pipe	IS:1626,IS:1626 (PART I)
200	High pressure/crydon ball valve	IS:1703
201	C.I. sluice valve	IS:780
202	Capstan head	IS:1795
203	Malleable iron fittings	IS:1879 (PART I TO X)
204	C.I. pipes	IS:1536, IS:1537
205	Molten (pig)lead	IS:782
206	C.I. manhole frames & covers	IS:1726
207	Concrete pipes	IS:458
208	Threads for screwed pipes	IS:554
209	Lead jointing	IS:718
210	Carbon steel for pipes	IS:9161
211	Low level ceramic cistern	IS:774
212	Bowl pattern flat back urinals	IS:2556 (PART IV)
213	Showers	IS:2064
214	Heavy C.I. pipes	IS:1729
215	Concrete mix design	IS:10262
216	Code of practice for construction of floor and roof with joists and filler blocks	IS:6061 (PART I)
217	Code of practice for construction of light weight concrete block masonry	IS:6042
218	Specification for load bearing light weight concrete blocks	IS:3590
219	Code of practice for construction of hollow concrete block masonry	IS:2572
220	Specification for concrete masonry units (hollow and solid concrete blocks)	IS:2185 (PART I)
221	Chemical composition of ordinary Portland cement	IS:4032
222	Sulphate resistant cement	BS:4027 & ASTMC-150 TYPE II
223	Specifications for circular hollow sections	IS:1161
224	Properties of rectangular & square hollow sections	IS:4923
225	Cold formed welded & seamless carbon steel structural tubing	ASTMA 500
226	Cold but not formed welded & seamless carbon steel structural tubing	ASTMA 501
227	Hot formed welded & seamless high strength low alloy tubing	ASTMA 618
228	Hot rolled structural steel hollow section	BS:4848/

Note : For the reference of all Codes and Standards, the latest version of the above specified Standards shall be followed, Wherever, such Standards are not specified for the construction materials, equipment and method, the relevant Indian Standard Codes of Practice shall be followed, in the absence of Indian Standards corresponding British Standard Codes of Practice or relevant American Standards shall be followed.

List of Approved Makes
for
Civil Work

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1	Ordinary Portland Cement	Ultratech, J.K.Laxmi,Ambuja,ACC,Birla,Lafarge
1a	Pozzolanic Portland Cement	Ambuja, Ultratech
2	White Cement	Birla, J.K.
3	TMT Fe-500 or Fe- 500 D Ribbed bars	Tata, RINL.(VIZAG). SAIL
4	Structural Rolled Steel sections-beams, channels, tee, flats, angles, bars(round, square, hexagonal)	Tata, SAIL, RINL.,Jindal
5	Structural Hollow steel sections (Square & Rectangular)	Tata, Asian, Jindal,
6	Structural tubular(round) sections	Tata, Asian, Jindal.
7	Coarse Aggregates (machine cut)	Approved quarry from Sevalia or nearby
	6mm to 40mm sizes (Hard black trap stone)	
8	Stone /Rubbles & Gravels (Hard black trap stone)	Approved quarry from Sevalia or nearby
9	Shuttering plywood	Kitply, Anchor, Green, Pragati, Mayur.
10	Water proof/ Marine grade plywood as per – IS – 710 (BWP)	Greenply, Archid, Kitply, Anchor, Uniply.
11	Commercial Plywood – IS – 303 (BWR)	Greenply, Archid, Kitply, Anchor, Uniply.
12	Decorative ply (Veneer)	Greenply, Durian, Century, Archid.
13	MDF	Nuwood, Duratuff (exterior grade only)
14	Prelam particle board	Novapan,Merino, Bhutan. (exterior grade only)
15	Laminate sheet	Formica, Greenlam, Alfa-ica, Decolam, Sundeck, Bloom, merino.
16	Cement bonded particle board	Shera ,NCL (Bison board), Everest (Eternite).
17	Gypsum plaster Board.	Saint Gobain (India Gypsum), USG Boral, Knoff.
18	Flush door – decorative / non decorative	KIT, Anchor, Greenply, Uniply.
19	Compact sheet	Alfiaca, Sundek, Vir, Bloom, Formica, merino.
20	Dead Locks/ Mortise locks	Kich, Dorma, Dorset,
21	Float Glass / wired Glass, Mirror	Modi guard, Saint Gobain, Asahi, HNG
22	Reflective Glass	Saint Gobain, PPG, Asahi, Emirates, Pilkington.
23	Paver block – Machine Pressed	Vyara, Super, Nishu & Alcock
24	MS Rolling shutter	Gandhi,Avian,Spanker,BG Engitech
24a	Automatic Rolling shutter	Gandhi, Avian,Spanker
25	Precast terrazo tiles & skirting (Mosaic)	Royal (rajkot) ,Alcock, Vyara, Nitco.
26	Glazed tiles	Asian, Johnson, Somany, Kajaria, Nitco,Cera,RAK
27	Ceramic tiles	Asian.Johnson, Somani, Nitco, Kajaria, ,Cera,RAK
28	Vitrified tiles	Restile Johnson, Asian, RAK, Nitco, Kajaria, Somani
29	Non-metallic floor hardener	Ironite, BASF, Sika,FOSROC,,CICO,Contech
30	Glass mosaic	Bisazza, Palladio, Italica
31	Construction chemicals	BASF, Fosroc, Sikka, Pidilite, Ultratech, Endura
	Plasticisers, Bonding agents, SBR latex, micro concrete	
32	**Water proofing chemicals**	
	Chemical Water proofing & Integral water proofing compound	Cico, BASF, Fosroc, Sikka, pidilite
	Crystalline water proofing	Penetron or Kryton

33	Silicon sealant/ Silicon paint	Wacker, Dowcorning, GE, Soudal, Bostik
	Polysulphide sealant	Pidilite, Chawksey
	P.U sealant/ Fire rated PU	Sikka (Exterior grade - UV resistant)
34	Pre-coated steel roofing/ walling sheets 550 Mpa	Tata bluescope, Interarch, Nippon Dendro (poly steel) Shree Precoated (Meta color), Shree Prefab, Everest
35	Polypropylene fibers/Glass Fibres	Nina concrete, Reliance, Kasturi Fibers, GSFC
36	Paint, primer, putty	Asian, Berger, ICI, Birla (putty), JK (Putty), Jotun, Serwinn Williams
37	Liquor /Melamine /PU polish	MRF, Asian, ICI, Taralac
38	PVC Water stop/Water bar	Arti Cables Baroda, Fixopan, Maruti.
39	Door Window Hardware,	Kich, Dorma, EPPW, Palladium, Magnum, Dorset,Haffele,Ozone
40	Floor spring	Dorma, Yale, Hafle,Geze
41	Door closer	Dorma, Yale, Hafle, Geze
42	Adhesives	
	Wooden Adhesives	Fevicol, Blue coat, Araldite.
	Tile adhesives & grouting material	BAL, Laticrete, Kerakoll, Ultratech
43	Oil & water finish	Double boiled CAT brand linseed oil & MTO of reliance
44	Fire door	Shaktimat, AGEW, Radiant.
45	Aluminum sections	Jindal, Hindalco (Indal), Banco, Royal touch, Sapa aluminium, Bhoruka, Pankaj, Alufit, Gulf extrusion.
46	Aluminum finish	
	Interior works pure polyester for Super durable powder coated finish	Akzonobel, Jotun, Fuller AG, Sapa Aluminium
	For Façade exteriors for PVDF Finish	Jotun, Valspar, PPG, Akzonobel,
	Non visible surface	Chromatizing.
47	Aluminum Window locks , handle , friction stays, corner cleat, butt hinges	Alualpha, Securestyle, Giessee, Roto, Geze, Savio, Frikstay, Lavaal, Comunello, Costwold
48	EPDM or silicone Gasket of infill panel for Aluminum	Amee rubber, gold seal, Osaka rubber, Maharashtra polymer, Maharashtra tyre & rubber industries.
49	Anchor Fasteners	Hilti, Fischer, Mungo, Corroshield, ITW, Buildex, Dewalt
50	Spandrel Insulation	Glass wool, Rockwool of UP Twinga
51	Wool felt/weather strip	Anand, reddiplex ltd.
52	Rust converter	Feovert (Krishna Conchem), Roff Rust Clear (Pidilite Industries)
53	Non-shrink general purpose grout	Fosroc, BASF & Sikka
54	Anchoring chemical for rebar dowell bar	Hilti, Fischer, ITW
55	Roll down/sliding mosquito curtain (Soft close)	Netmos, windoor marketing
56	Baker Rod, Expansion joint pre-moulded filler board	Supreme.
57	SS clamps for cladding	Hilti, Axel.
58	Aluminium operable Louvers	Technal, Domal, Sai Aluminium work
59	Spacer tape	Norton, tremco, bow.
60	Anodising	Bhoruka alum, Alufit alum, Alufin, Sapa

61	Glass Processor	Bulletproof, DGU, Toughness, lamination etc.
	For HS/HT,	Impact safety, sejal, Glasstech, GSC, Asahi, FG Glass, Goldplus, Emirates, Jazoo Glass, shreerang
62	Smoke seal Intumecent	Hilti/3M.
63	Elevator	Schindler, Otis(not trio), Mitsubishi, Thysun Crup
64	Metal Grid Ceiling	Saint Gobain, ESG, Armstrong, Metallium
65	Autoclaved Aerated Concrete Blocks	Ultratech, Eco Green, Build Tech, Siporex, brixo, satyam
66	Polycarbonate Domes	Argus, Tuflite, Krishna fibre glass
67	Toilet Partition	Merino, trespa, sundeck, greelam
68	Expansion Joint	Kantaflex, 3R, Ztech India, Sanfield
69	Multi point Lock for windows	Alualpha, Geze, Laval
70	Water proofing PVC membrane	BASF, FOSROC & SIKKA
71	Nitrile Rubber	Armacell
72	Standing Seam Roofing System	Kalzip, Kingspan
73	Sliding/folding partion system	Hafele, Dorma, Lotus

Note:
All the Materials/Makes listed above and other than as specified above shall be ordered and used after obtaining prior approval from the Architect/Engineer-in-charge.

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Cement Consumption

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Item	Ration/ Grade	Consumption	
A. CEMENT CONCRETE			
BBCC	1:6:12	2.30	Bags/m^3.
	1:5:10	2.60	Bags/m^3.
	1:4:8	3.40	Bags/m^3.
PCC	1:6:12	2.30	Bags/m^3.
	1:5:10	2.60	Bags/m^3.
	1:4:8	3.40	Bags/m^3.
RCC			
	1:3:6	4.30	Bags/m^3.
	1:2:4	6.40	Bags/m^3.
	1:1.5:3	8.00	Bags/m^3.
	1:1:2	12.2	Bags/m^3.
	1:2:5	5.40	Bags/m^3.
	1:2.5:5	5.10	Bags/m^3.
B. MORTARS			
Cement and Sand mortar			
	1:1	20.4	Bags/m^3.
	1:2	13.6	Bags/m^3.
	1:3	10.2	Bags/m^3.
	1:4	7.60	Bags/m^3.
	1:5	6.2	Bags/m^3.
	1:6	5.0	Bags/m^3.
	1:8	4.0	Bags/m^3.
Gauged mortar (Cement Lime and Sand mortar)			
	1:1:6	4.90	Bags/m3.
	1:1:8	3.80	Bags/m3.
	1:2:09	3.30	Bags/m3.
	1:5:10	2.95	Bags/m3.
	1:6:12	2.40	Bags/m3.
C. MASONRY WORK			
Brickwork in Cement sand mortar	**Conventional**		
	1:3	2.55	Bags/m^3.
	1:4	1.900	Bags/m^3.
	1:5	1.56	Bags/m^3.
	1:6	1.27	Bags/m^3.
	1:8	0.95	Bags/m^3.
Brickwork in Gauge Mortar			
	1:1:6	1.21	Bags/m^3.
	1:1:8	0.96	Bags/m^3.
	1:2:09	0.81	Bags/m^3.
Stone masonry, Uncoursed Random Rubble walling			
	1:3	2.95	Bags/m^3.
	1:4	2.29	Bags/m^3.
	1:6	1.51	Bags/m^3.
	1:8	1.18	Bags/m^3.

Stone masonry in Gauged Mortar	1:1:6	1.48	Bags/m^3.
	1:1:8	1.14	Bags/m^3.
	1:2:09	0.99	Bags/m^3.
Half Brick work	1:4	0.19	Bags/m².
D. PLASTERING			
12 mm. thick plaster in Cement mortar, on Brick masonry			
	1:2	0.24	Bags/m².
	1:3	0.17	Bags/m².
	1:4	0.14	Bags/m².
	1:5	0.10	Bags/m².
	1:6	0.09	Bags/m².
12 mm. thick plaster in Gauged mortar, on Brick masonry			
	1:1:8	0.07	Bags/m².
	1:2:09	0.60	Bags/m².
12 mm. thick plaster in Cement mortar, on Stone masonry			
	1:2	0.31	Bags/m².
	1:3	0.22	Bags/m².
	1:4	0.17	Bags/m².
	1:6	0.11	Bags/m².
12 mm. thick plaster in Gauged mortar, on Stone masonry			
	1:1:8	0.80	Bags/m².
	1:2:09	0.07	Bags/m².
20 mm. thick plaster in Cement mortar, on Brick masonry			
	1:2	0.34	Bags/m².
	1:3	0.24	Bags/m².
	1:4	0.19	Bags/m².
	1:5	0.13	Bags/m².
	1:6	0.12	Bags/m².
20 mm. thick plaster in Gauged mortar, on Brick masonry			
	1:1:8	0.10	Bags/m².
	1:2:09	0.80	Bags/m².
20 mm. thick plaster in Cement mortar, on Stone masonry			
	1:2	0.41	Bags/m².
	1:3	0.29	Bags/m².
	1:4	0.22	Bags/m².
	1:6	0.14	Bags/m².
20 mm. thick plaster in Gauged mortar, on Stone masonry			
	1:1:8	0.11	Bags/m².
	1:2:09	0.09	Bags/m².
20 mm. thick Sand Face plaster		0.20	Bags/m².
12 mm. thick Water Proof plaster in 1:4 Cement mortar		0.15	Bags/m².
Neat Cement finishing		0.44	Bags/m².
E. POINTING			
Flush, Grooved or Struck in Cement Brick masonry			
	1:1	0.600	Bags/m².
	1:2	0.50	Bags/m².
	1:3	0.30	Bags/m².
	1:4	0.28	Bags/m².
Flush, Grooved or Struck in Cement Random Stone masonry			
	1:2	0.10	Bags/m².
	1:3	0.80	Bags/m².
	1:4	0.60	Bags/m².

F. FLOORING			
Precast Mosaic Tiles in cement mortar		0.20	Bags/m².
Precast Mosaic Tiles dado in cement mortar		0.23	Bags/m².
Green and Brown Kotah Stone in flooring, skirting & dado		0.30	Bags/m².
Green Kotah Stone in Risers and Treads		0.30	Bags/m².
Double Polished Kotah Stone		0.30	Bags/m².
Rough Kotah Stone		0.30	Bags/m².
Glazed Tiles		0.20	Bags/m².
Spartek Tiles		0.20	Bags/m².
China mosaic		0.22	Bags/m².
Marble Slab		0.25	Bags/m².
Granite Slab		0.25	Bags/m².
Jesalmer		0.25	Bags/m².
Red Mandana		0.35	Bags/m².
I.P.S,	40 mm. thick	0.35	Bags/m².
	50 mm. thick	0.40	Bags/m².
Pinkish White Dholpur		0.15	Bags/m².
Red Dholpur		0.15	Bags/m².
Brick-on-edge		0.31	Bags/m².
Terrazzo		0.17	Bags/m².
G. STEEL WORK			
Fixing Windows in C.C Blocks 15 x 10 x 10 cm. in C.C	1:3:6	0.3	Bags/m².
Fixing Holdfasts in C.C Blocks			
15 x 15 x 30 cm. in C.C	1:3:6	3.3	Bags/100 nos.
23 x 25 x 30 cm. in C.C	1:3:6	7.76	Bags/100 nos.
30 x 30 x 45 cm. in C.C	1:3:6	19.8	Bags/100 nos.
H. MISCELLANEOUS			
Filling Zaris with			
C.M.	1:3	5.0	Bags/100 nos.
C.C	1:2:4	3.2	Bags/100 nos.
BBCC 1:5:10 Blocks, 30 x 30 x 50 cm. for Wire fencing		5.1	Bags/100 nos.
C.C Blocks for Flooring, 30 x 30 x 30 cm.	1:4:8	5.0	Bags/100 m².
I. ROADWORK			
Precast Curbs of P.C.C	1:2:4	21.5	Bags/100 m.
J. SANITARY WORK			
R.C.C Hume pipes jointed with Cement mortar 1:1			
	600 mm. dia.	6.4	Bags/100 m.
	450 mm. dia.	4.8	Bags/100 m.
	300 mm. dia.	2.2	Bags/100 m.
	230 mm. dia.	1.8	Bags/100 m.
	150 mm. dia.	1.2	Bags/100 m.
	100 mm. dia.	1.0	Bags/100 m.
SW pipes jointed with Cement mortar 1:1			
	300 mm. dia.	12.94	Bags/100 m.
	230 mm. dia.	9.74	Bags/100 m.
	150 mm. dia.	6.56	Bags/100 m.
	100 mm. dia.	4.34	Bags/100 m.

C.I Waste water line, concealed including filling the zari with Cement mortar 1:4 and joints in Cement mortar 1:1	75 mm. dia.	8.6	Bags/100 m.
	100 mm. dia.	10.88	Bags/100 m.
C.I Soil pipe/Rain water pipe, concealed, including filling the zari with C.M. 1:4 and joints in Cement mortar 1:1	100 mm. dia.	10.88	Bags/100 m.
	150 mm. dia.	14.66	Bags/100 m.
Fixing European type WC		0.1	Bag/no.
Fixing Orissa pan			
Fixing Urinal/s.		0.2	Bag/no.
Fixing Wash Hand Basin		0.3	Bag/no.
Fixing S.S Sink		0.5	Bag/no.
Brick Masonry Chambern 300 x 300 x 610 mm.		1.7	Bag/no.
Half Round Channel 100 mm.		15.86	Bags/100 m.
Fixing 100 mm. dia. SW Gully Trap		0.5	Bag/no.
K. STORM WATER DRAINAGE & CULVERTS			
R.C.C. pipe NP - 2			
	230 mm. dia.	1.8	Bags/100 m.
	300 mm. dia.	2.4	Bags/100 m.
	450 mm. dia.	5.4	Bags/100 m.
	900 mm. dia.	9.8	Bags/100 m.
Storm water Gully Chamber		6.0	Bag/no.

Material Specifications
for
Civil Works

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IV. MATERIALS SPECIFICATIONS – CIVIL

M-1 Water:

1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalies salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in RCC container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in IS : 456.

1.2 If required by the Engineer-in-charge and Architects it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in IS : 269. Any indication of unsounding change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar prepared with water sample when compared with the 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 or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

1.4 Hard and bitter water shall generally be found unsuitable for curing mortar or concrete.

1.5 Potable water shall be generally found suitable for curing mortar and concrete.

Testing Standards :

A. Chemical Analysis:-
Sampling: Test shall be carried out only once for one particular source.
Results:
a) TDS - 3000 mg/lit.e) Carbonic contents - 200 mg/lit.
b) Sulphates - 5000 mg/lit. f) Non-carbonic contents - 3000 mg/lit.
c) pH values - 6 to 8
d) Chlorides
P.P.C - 2000 mg/lit.
R.C.C - 1000 mg/lit.

M-2 Lime :

2.1 Lime shall be hydraulic lime as per IS : 712. Necessary test shall be carried out as per IS : 6932 (Parts I to X) .

2.2 The following fields tests for limes 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 colour, lime in form of Porous lumps of dirty white colour indicates quick lime, and solid lumps are the unburnt lime stone.

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

2.3 Storage shall comply with IS : 712. 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 IS : 1624 to show the acceptability of materials.

M-3 Cement :

3.1 Cement shall be ordinary Portland slag cement, grade 33, as per IS : 269, grade 43, as per IS : 8112 and grade 53, as per IS : 12269 or Portland slag cement as per IS : 455.

Testing Standards :

A. Setting time :
Sampling :
(i) From a lot of 50 tones of cement, 2% of bags shall be picked out at random, from which one sample of 15 kg. shall be taken.
(ii) For a lot of 50 to 100 tones - 2 samples
(iii) For a lot of 100 to 200 tones - 3 samples
(iv) For a lot of 100 to 200 tones - 3 samples
(v) For a lot of 200 to 300 tones - 4 samples
(vi) For a lot of 300 to 500 tones - 5 samples
(vii) For a lot of 500 to 800 tones - 6 samples
(viii)For a lot of 800 to 1300 tones - 7 samples
Results :
(a) Initial setting time - not less than 30 minutes
(b) Final setting time - not more than 100 minutes

B. Fineness test by Sieving :
Sampling :
Using any 5 samples, made as above, one test is carried out, using IS sieve no. 90 microns.
Results :
90% or more should pass through the above mentioned IS sieve.

C. Fineness test by determination of specific surface :
Sampling :
Using any 5 samples, made as above, one test is carried out.
Results :
For O.P.C, the surface area shall be 225 cm^2/gm. or more.
For P.P.C, the surface area shall be 3000 cm^2/gm.

D. Consistency test :
Sampling :
Sampling shall be as in A.
Results :
Consistency in all samples shall be about 30%.

E. Compressive strength :
Sampling :
Sampling shall be as in A.
Results :
On 2nd day, compressive strength must be 160 Kg/cm^2., for O.P.C
On 7th day, compressive strength must be 220 Kg/cm^2., for O.P.C
On 28th day, compressive strength must be 310 Kg/cm^2., for O.P.C

F. Chemical composition (IS : 4032):
Sampling :
Using any 5 samples, made as above, one test is carried out.
Results :
a. Magnesium oxide - less than 6%.
b. Sulphur as Sulphuric anhydride - less than 2.75%.
c. Loss on ignition - upto 5%.
The above is for ordinary Portland cement.

M-3A Rapid Hardening Cement (RHC) :

3A.1 Rapid hardening cement shall be from source like Gujarat High Tech, Ambuja, Birla or equivalent as approved by the Architect and Engineer-in-charge. It shall conform to IS : 8041. Test certificates showing that the cement complies to the specifications must be submitted to the Architect.

3A.2 It shall have strength in one day equal to that of OPC in 3 days. It shall be used for products like hume pipes, tiles, sleepers, poles, prestressed and precast concrete members. It shall also be used for foundations, bridges, culverts, causeways etc. where quick construction activity is required however, prior permission of the Architect and Engineer-in-charge shall be taken before use.

3A.3 It shall capable of giving required workability, final strength and better surface finish.

M-3B Sulphate Resistant Cement (SRC) :

3B.1 Sulphate resistant cement shall be from source like Gujarat High Tech or equivalent as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS code or BS-4027 & ASTM C-150 Type-II. Test certificates showing that the cement complies to the specifications must be submitted to the Architect.

3B.2 It shall be used for structures in or near sea water, where the soil conditions are aggressive, where repeated cycles of drying and wetting are occur, and also for structures which are exposed to Sulphate attack & salty weather like foundations, bridges, dams, tunnels, industrial drains, sewage pipes.

3B.3 It should possess low heat of hydration, more compressive strength at 3,7 and 28 days than OPC. It should be capable of withstanding attack of aggressive substances which damage concrete structure like Sulphates of Sodium, Magnesium, Calcium etc. It should have low co-efficient of expansion.

M-4 White Cement :

4.1 The white cement shall conform to IS : 8042-E

M-5 Coloured Cement :

5.1 Coloured cement shall be with white or grey Portland cement mixed with pigments as specified in the item of the work.

5.2 The pigments used for coloured cement shall be of approved quality and its quantity shall not exceed 10% of the cement used in the mix. The mixture of pigment and cement shall be properly ground to have a uniform colour and shade. The pigments shall have such properties as to provide for durability for colour under exposure to sunlight and weather.

5.3 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 medium/coarse natural sand, clean, well graded, hard, strong, durable and gritty. Sand particles should be free from injurious amounts of dust, clay, kankar nodules, soft or flaky particles of shale, alkali, salts, organic matter loam, mica or other deleterious substances and shall be got approved from the Engineer-in-charge and Architects. The sand shall not contain more than 8% of silt as determined by field test and 3% by laboratory test , if necessary the sand shall be washed to make it clean. **All sand to be used for plaster, brickwork , concrete shall be strictly sieved by 4.75 mm seive.**

Testing Standards :

A. Silt Content :
Sampling :
Test shall be carried out for every 150 m^3 of sand. The sample taken for testing shall weigh 10 Kg.

Results :
Permissible content shall be 3% in laboratory test & 8 % in field Test.

B. Fineness Modulus :
Sampling :
Sampling shall be as in A.
Results :
Fine sand : 2.2 to 2.6 shall be used as earth filling in plinth, zari, etc.
Medium sand : 2.6 to 2.9 shall be sued for Brickwork and plaster.
Coarse sand : 2.9 to 3.2 shall be used for concrete.

In general, the fineness modulus of sand shall not be less than 2.5 and shall not exceed 3.0. A sand having a fineness modulus more than 3.2 will be unsuitable for making satisfactory concrete.

C. The sieve analysis of sand shall be as under

IS Sieve Designation	% By weight Passive sieve	IS Sieve Designation	% By Weight passive sieve
4.75 mm	100	600 Micron	30-100
2.36 mm	90-100	300 Micron	5-70
1.18 mm	70-100	150 Micron	0-50

M-7 Stone Dust :

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

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

7.3 The height of silt visible as settled layer above the stone dust shall be 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 modulus of stone dust shall not be less than 1.80.

M-8 Stone Grit :

8.1 Grit shall consist of crushed or broken **black trap 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 flaky elongated pieces shall be avoided. It shall generally comply with the provisions of IS : 383 Unless special stone of particular quarries is mentioned, grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge and Architects. The grit shall have no deleterious reaction with cement.

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

IS Sieve Designation	% passing Through sieve	IS Sieve Designation	% Passing Through sieve
12.50 mm.	100%	4.75 mm.	0-20%
10.00 mm.	85-100%	2.36 mm.	0- 5%

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

8.4 The necessary tests for grit shall be carried out as per the requirements of IS : 2386 (parts I to VIII) , as per instructions of the Engineer-in-charge and Architect. The necessity of test will be decided by the Engineer-in-charge and Architect.

M-9 Cinder :

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

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

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

IS Sieve Designation	% Passing	IS Designation	% Passing
20 mm.	100	4.75 mm.	70
10 mm.	86	2.36 mm.	52

M-10 Lime mortar :

10.1 Lime shall conform to M-2. Water shall conform to M-1. 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 and sand shall be measured by volume.

10.3 Proportion of mortar:

10.3.1 Lime mortar shall be prepared by wet process as per IS : 1625. 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 paste. Thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

10.4 Storage:

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

10.5 Use :

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

M-11 Cement Mortar :

11.1 Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6.

11.2 Proportion of Mix:

11.2.1 Cement and sand shall be mixed to specified proportion sand being measured by measuring boxes. The proportion of cement will be by volume on the basis of 50Kg/Bag of cement being equal to 0.0342 m^3. The mortar may be hand mixed or machine mixed as directed.

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 atleast 3 times or more till a homogeneous mixture of uniform

colour 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 colour 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 minutes.

M-12 Stone Coarse Aggregate For Nominal Mix Concrete :

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

12.2 The aggregate shall generally be cubical/round in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the **black trap** or equivalent black hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete 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 6 mm. less than the minimum lateral clear distance between bars or 6 mm. less the cover, whichever is smaller.

TABLE

IS Sieve Designation	% passing for single size aggregates of Nominal Size			IS Sieve Designation	% passing for single size aggregates of Nominal size		
	40 mm	20 mm	16 mm		40 mm	20 mm	16mm
80 mm.	-	-	-	12.5 mm.	-	-	-
63 mm.	100	-	-	10 mm.	0.5	0 - 20	0.30
40 mm.	100	100	-	4.75 mm.	-	0 - 5	0.5
20 mm.	0-20	85-100	100	2.35 mm.	-	-	-
16 mm.	-	-	85-100				

Note : This percentage may be varied some what by the Engineer-in-charge when considered necessary for obtaining better destiny 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 indicated in IS : 383 and IS : 456 shall have to be carried out to ensure the acceptability. The aggregate 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.

Testing Standards :

A. Flakiness Index :
Sampling :
For every 200 m^3. of aggregates, one test shall be carried out.
Results :
The Flakiness index is taken as the total weight of the aggregates passing through the various thickness gauges, expressed as a percentage of the total weight of the sample taken.
Permissible is not more than 35% for aggregates used in concrete for wearing surfaces.

B. Impact value :
Sampling :
For every 100 m^3. of aggregates, one test shall be carried out.
Results :
The impact value shall not be more than 45% by weight for aggregates used for concrete other than

wearing surfaces.
For aggregates used for concrete to be used as wearing surface, the impact value shall not be more than 30%, by weight.

C. Abrasion Value :
Sampling :
Sampling shall be as in B.
Results :
The percentage of wear shall not be more than 35%.

M-13 Black Trap or Equivalent Hard Stone Coarse Aggregates for Design Mix Concrete :

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

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

13.3 The necessary tests indicated in IS : 383 and IS : 456 shall have to be carried out to ensure the acceptability of the material.

13.4 If the aggregates are covered with dust, they shall be washed with water to make them 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 or any other foreign material. The brick bats shall be less than 40 mm. size, unless otherwise specified in the item. The under-burnt or over-burnt brick bats and brick dust shall not be allowed.

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

M-15 Bricks :

15.1 The bricks shall be of **first quality** hand or machine moulded and made from suitable soils and kiln burnt. They shall be free from cracks, flaws and modules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform In colour. The bricks shall be moulded with a frog of size 100 mm. x 40 mm., and 10 mm. to 20 mm. deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 1 m.

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

15.3 The size of the conventional bricks shall be (9"x4.5" x 3") 230 mm. x 110 mm. x 76.5 mm.

15.4 Only bricks of one standard size shall be used on a particular work site. The following tolerances shall be permitted in the conventional size adopted in a particular work site.
Length : + 1/8"(3.0 mm.). Width : + 1/6" (1.50 mm.). Height : + 1/6"(1.50 mm.).

15.5 The crushing strength of the bricks shall not be less than **50 Kg./cm^{2,}**. No unburned/over burnt bricks shall be used for any structure. The bricks should have dimensional stability as per IS standards. The average water absorption shall not be more than 20% by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per IS : 3495 (Part I to IV) .

Testing Standards :

A. Efflorescence :
Sampling :
Test of 20 bricks is carried out from a stock of 20,000 bricks.
Results :
Moderate.

B. Water Absorption :
Sampling :
Test of 32 bricks is carried out from a stock of 35,000 bricks.
Results :
Absorption shall not be more than 20%.

C. Compressive Strength :
Sampling :
Test of 50 bricks is carried out from a stock of 1,00,000 (1 Lac) bricks.
Results :
On average the compressive strength shall not be less than **50 Kg/cm^2**. And every result shall not be less than 20% of the IS standards.

M-15A First Class Bricks for Exposed brickwork :

15A.1 First class bricks are those which strictly conform to the standard size of modular bricks, i.e. 19 cm. x 19 cm. x 9 cm. actual size, such that ten layers of brick laid in mortar shall form masonry of 1 m. height. Conventional bricks should have quality standard as per modular brick except size.

15A.2 These bricks are manufactured from good quality plastic earth, which is free from saline deposits. They are of good uniform colour. They are well burnt, giving a hard ringing sound when two bricks are struck together.

15A.3 They should have straight edges and even surfaces. They are free from cracks, chips, flaws and modules of lime.

15A.4 When immersed in water for an hour, they do not absorb water more than 1/6th of their weight. On drying, these bricks do not show any sign of efflorescence.

M-15B Calcium Silicate Bricks :

15B.1 The bricks shall be machine moulded and made from good quality and clean silicious sand, lime and flyash (maximum content upto 30% in raw material composition). They shall be free from cracks, flaws, clay, free lime. They shall have smooth rectangular faces with sharp corners and shall be uniform in size, colour and shape.

15B.2 The size of bricks shall be 228 mm. x 110 mm.x 72 mm. or as approved by the Architect. The compressive strength of bricks shall be minimum 150 kg/m$^{2.}$ and the bricks shall have very high strength to weight ratio. The bricks shall have very good resistant capacity to atmospheric conditions, optimum building properties in relation to heat insulation, sound insulation, absorption of water and fire protection.

15B.3 Calcium silicate products shall conform to the appropriate IS standards and there shall be no change required in civil application techniques while using such products in the place of traditional clay bricks.

M-15C Glass Brick :

15C.1 It shall be from Imperial or equivalent as approved by the Architect and Engineer-in-Charge.

15C.2 It shall be free from any defects like, cracks, air bubbles, uneven surface, breaks etc. During handling and laying, its edges shall not be damaged. All edges and corners of all faces shall be sharp and well shaped.

It shall be of size and colour as specified in the item or as approved by the Architect. The glass bricks shall be of uniform size and tolerance of +2 mm. shall only be allowed in dimensions of glass brick. Spots of colour other than that of bricks or in bricks shall not be allowed. The weight of each brick shall be about 2.75 kg.

15C.3 The transmission of direct light through brick shall not be less than 40%. The glass brick shall have good thermal insulation. It shall be sound proof and vibration absorber having adequate compressive strength. If bricks with groove or projections shall be used, the groove or projections shall be uniform and regular in size & shape.

M-16 Stone :

16.1 The stone shall be of specified variety such as Granite/Trap Stone/Quartz or any other type of good hard stones.
The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness 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 IS : 1124. The minimum crushing strength of the stone shall be 200 Kg/cm^2. unless otherwise specified.

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

16.3 The Khanki facing stone shall be dressed by chisel as specified in the item for Khanki facing in required shape and size. The face of 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 uniform in texture, sound, durable and free from soft patches. It shall have a minimum crushing strength of 100 Kg./cm^2. 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, edges true and square.

17.3 Those type of stones in which white clay occurs should not be used.

17.4 Special corner stone shall be provided where so directed.

M-18 Mild Steel Bars :

18.1 Mild steel bars reinforcement for RCC work shall conform to IS : 432 (Part-II) and shall be of tested quality. It shall also comply with relevant part of IS : 456.

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 upto 10 mm. length and weight payable worked out at the rate specified below :

1.	6 mm.	0.22 Kg/m.	8.	20 mm.	2.47 Kg/m.
2.	8 mm.	0.39 Kg/m.	9.	22 mm.	2.98 Kg/m.
3.	10 mm.	0.62 Kg/m.	10.	25 mm.	3.85 Kg/m.
4.	12 mm.	0.89 Kg/m.	11.	28 mm.	4.83 Kg/m.

5.	14 mm. 1.21 Kg/m.	12.	32 mm	6.31 Kg/m.
6.	16 mm. 1.58 Kg/m.	13.	36 mm.	7.99 Kg/m.
7.	18 mm. 2.00 Kg/m.	14.	40 mm	9.86 Kg/m.

18.4 Procurement of Steel should be from authorised/approved rolling mills and test certificates should be submitted with each lot.

Testing standards :

Sampling :
For every 40 tonnes of steel, atleast one test shall be done.
Results :

Thickness	Ultimate Tensile strength	Chilled state	% Elongation
0 - 20 mm.	42 Kg/cm^2.	26 Kg/cm^2.	23
20 - 40 mm.	42 Kg/cm^2.	24 Kg/cm^2.	23
40 mm. & more	42 Kg/cm^2.	24 Kg/cm^2.	23

M-19 A High Yield Strength Steel Deforms Bars :

19.1 High yield strength steel deformed bars be either cold twisted or hot rolled shall conform to IS : 1739 and IS : 1139 respectively.

19.2 Other provision and requirements shall conform to M-18 for Mild steel bars.

M-19 B Thermo-mechanically Treated Bars (TMT)

19.B.1 TMT bars shall conform to IS: 1786

19.B.1 Procurement of Steel should be from approved manufacturer and test certificates should be submitted with each lot.

M-19 C Corrosion Resisting Steel (CRS)

19.C.1 CRS bars shall conform to IS: 1786

19.C.1 Procurement of Steel should be from approved manufacturer and test certificates should be submitted with each lot.

M-20 High Tensile Steel Wire :

20.1 The high tensile wires for the use in prestressed concrete work shall conform to IS : 2090.

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 IS : 1785. Testing shall be done as per IS 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 coil having diameter not less than 350 time the diameter of wire itself, so that wire springs back straight on being uncoiled.

Testing standards :

Sampling :
For every 40 tonnes of steel, atleast one test shall be done.
Results :

Thickness	Ultimate Tensile strength	Chilled state	% Elongation
For all sizes	49.5 Kg/cm^2.	42.5 Kg/cm^2.	14.5

M-21 Mild Steel Binding Wire :

21.1 The mild steel wire shall be of 1.63 mm. or 1.22 mm. (16 or 18 gauge) diameter and shall conform to IS : 280.

21.2 The use of black wire will be permitted for binding reinforcements 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 IS : 226. The steel shall be well and cleanly rolled to the dimensions and weight specified by the IS, subject to the permissible tolerances as per IS : 1852. The finished materials shall be reasonably free from cracks, surface flaws, laminations, rough and imperfect edges and all other harmful defects mentioned in IS : 229 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. River bars shall conform to IS : 1148. The decision of the Engineer-in-charge regarding rejecting any steel section on account of any of the above defects shall be final and binding to the Contractor.

22.2 Structural steel shall conform to the following requirements. The mechanical and chemical properties shall be as below :

MECHANICAL COMPOSITION OF STEEL

Steel designation	Class of steel product	Nominal Tensile thickness in mm.	Yield stress strength min. Kgf/mm^2 in Kgf/mm^2	% elongation
ST-42 W &	Plates,	Below 6 mm.	Bend test only shall be required.	
ST-42 S	flats, bars.	upto 20 & Vc	42 to 54 26.0	23
		Over 20 upto Vc 40	42 to 54 24.0	23
		Below 10	Bend test only shall be required	
		10 upto 20 & Vc	42 to 54 28.0	23
		Over 20	42 to 54 24.0	23
ST-42 O	Plates,	Below 6 sections,	Bend test only shall be required.	
		flats,Over 6	42 to 54 28.0	23
		Below 10	Bend test only shall be required	
		10 & above	42 to 54 28.0	23

CHEMICAL COMPOSITION OF STEEL

Steel designation	Maximum percentage		
	Carbon	Sulphur	Phosphorous
ST-42 W	0.23	0.06	0.06
ST-42 S	0.25/0.28	0.06	0.06
ST-42 O		0.07	0.07

22.3 The following variety of steel shall be used for structural purposes :

ST-42 S : It shall be used for all types of structure (riveted or bolted), including those subjected to dynamic loading and where fatigue, wide fluctuations of stresses, reversal of stresses and great restraint are involved. It shall be suitable for welded structures, provided that the thickness of the material does not exceed 20 mm.

22.4 When the steel is supplied by the Contractor, test certificate of the manufacture shall be obtained according to IS : 226 and other relevant Indian Standards.

M-23 Galvanised Iron Sheets :

23.1 The galvanised iron sheets shall be from Tata or equivalent of approved zinc coating class , as approved by the Architect and Engineer-in-charge. It shall be plain or corrugated, of gauge as specified in item. The GI sheets shall conform to IS : 277. The sheets shall be undamaged in carriage and handling either by rubbing off of zinc coating or otherwise, they shall have clean and bright surface and shall be free from dents, holes, rust or white powdery deposit.

23.2 The width of GI sheet shall be as directed, as per site condition.

M-23.A GI Valleys gutter ridges :

23.A.1 The GI ridge and hips shall be of plain galvanised sheets, class-3, of the thickness, as specified in item. These shall be 600 mm. in width and properly bent up to the shape without damage to the sheets, in process of bending.

23.A.2 Valleys, gutters and flashing shall also be of galvanised 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 and curved shall be from Everest or equivalent, as approved by the Architect or Engineer-in-charge. It shall conform to IS : 459. The thickness of the sheet shall be as specified in the item. The sheet shall be free from all defects such as cracks, holes, deformation, chipped edge or otherwise damaged.

24.2 It shall manufactured by reinforcing Asbestos in cement, in such a manner that every fibre is covered with fine particles of cement to ensure maximum strength. It shall be alkali resistance and anti corrosive. It should not break during transportation, handling, laying etc. and should be non- destructible, non-inflammable and non-organic. It shall have high tensile strength and high slenderness ratio.

24.3 The minimum nominal thickness of sheets shall be 6 mm., having covering efficiency of about 90% and weight 1518 kg/cm^2. The sheet shall be free from all defects such as cracks, holes, deformation, chipped edge or otherwise damaged. The permissible bending stress shall be 130 kg/cm^2.

24.4 The accessories shall be same thickness that of AC sheets. They shall be suitable for all the types of sheets and locations. They also shall be from approved manufacturer and shall be free from any defects. The fixing of AC sheets and accessories shall conform to IS : 730.

24.5 Ridges & Hips :

24.5.1 Ridges and hips shall be of same thickness as that of AC sheets. The different types of ridges shall be suitable for its corresponding type of sheets and locations.

24.5.2 Other accessories to be used in roof such as flashing piece, caves, filler pieces, valley gutters, north light and ventilator curves, barge boards etc. shall be from standard manufacture and shall be suitable for the different types of sheets and location.

M-25 Mangalore Pattern Roof Tiles :

25.1 The mangalore pattern tiles shall conform to IS : 654 for Class AA or Class A type, as specified in the item. Samples of the tiles to be provided shall be got approved from the Engineer-in-charge and Architect. Necessary tests shall be carried out as directed.

M-26 Shuttering :

M-26A Timber/Wooden planking :

26A.1 The shuttering shall be either of wooden planking of 30 mm. minimum thickness with or without steel lining or 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 place of ballie props, brick pillar of adequate section built in mud mortar may be used.

26A.2 The form work shall be sufficiently 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, live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout.

26A.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 and Architect, before the reinforcement bars are placed in position.

26A.4 The props shall consist of ballies having 100 mm. minimum diameter, measured at mid length and 80 mm. at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plate 40 mm. thick and minimum bearing area of 0.10 m^2. laid on sufficiently hard base.

26A.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.

26A.6 The timber used in shuttering shall not be so 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 planned on the sides and surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

26A.7 As far as possible, clamps shall be used to hold the forms together and use of nails and spikes shall be avoided.

26A.8 The surface of timber shuttering that would come on 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.

26A.9 The shuttering for beams and slabs shall have camber of 4 mm. per meter (1 in 250) or as directed by Engineer-in-charge and Architect, so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the project length or as directed by the Engineer-in-charge and Architect.

M-26B Concrete Shuttering Plywood :

26B.1 It shall be made from strong and selected hard-woods. It shall be bonded with high quality Phenol Formaldehyde synthetic resin adhesive, hot pressed and then shall be further treated with a permanent type of preservative by vacuum-cum-pressure impregnation.

26B.2 Due to the bonding with Phenol Formaldehyde, it shall be moisture and weather proof. The use of selected hard-woods render hard and wear-resistant faces and thereby it shall be reusable several times. It shall be highly resistant to rot, termites and other wood inhabiting insects. Due to complete penetration of the preservative, it shall be exceedingly durable.

26B.3 It shall have high impact strength and therefore shall be used successfully in place of timber planks and steel sheets. It shall protect the concrete from rapid temperature changes and shall provide optimum conditions for setting of the concrete. As it shall possess remarkable design flexibility, it shall be ideal for curved formwork.

26B.4 Besides it shall be used as centering, shuttering and formwork of concrete columns, beams, slabs, walls, tanks, bridges, fly-overs, silos etc. It shall also be used for structural applications like external walling, roofing, flooring, curtain walls, work-site offices, in cabins of trucks, rail coaches etc.

M-26C Steel Sheeting and Steel Plates :

26C.1 Steel sheeting and steel plates should be free from clinks, twists, offsets, warps, etc. Their surface should be neat, clean and smooth. Before placing concrete, steel forms shall be thoroughly cleaned off of all rust, dust and loose materials. Colourless oil or grease of approved quality shall be applied before placing steel.

26C.2 The size of angles used for framing and bracing of steel plates should be sufficient to withstand the weight of concrete without forming clinks, twists, offsets, warps, etc. in the steel plates. Also, the gauge of steel sheeting used should not be higher than 14 G.

26C.3 Minimum two bracing angles should be provided along with angle framing while making the steel plates. It should be riveted or welded to suit the requirement of finish concrete surface. Minimum two rivets should be provided at all Four Corners and at junction of angle framing and bracing.

26C.4 If the plates are to be welded, steel sheet and angle framing/bracing should be welded from sides and at back. Welding on sides should be buffed to make the sides smooth. Also, intermittent welding should be done to keep steel sheet and angle framing/bracing in one plane.

M-27 Expansion Joints-Premoulded Filler :

27.1 The item provides for expansion joints in RCC frame structure, for internal joints as well as exposed joints, with the use of premoulded bituminous joint filler.

27.2 Premoulded bituminous joint filler, i.e. preformed strip of expansion joint filler shall not get deformed or broken by twisting, bending or other handling pressures, when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected.

27.3 Thickness of the pre-moulded joint filler shall be 25 mm., unless otherwise specified.

27.4 Premoulded bituminous joint filler shall conform to BE : 1838.

M-28 Expansion Joints-Copper Strips & Hold fasts :

28.1 The item provided for expansion joints in RCC frame structure, for internal joint as well as for exposed joints, with the use of necessary copper strip and holdfasts.

28.2 Copper sheet shall be 1.25 mm. thick and 1.25 mm. wide and shall be of `U' shape, in the middle. Copper strip shall have holdfast of 3 mm. diameter copper rod, fixed to the plate, soldered on the 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 superior quality as required for the item to be executed. The kind of wood specifically mentioned as BURMA, MARSOVA, CP, CHILL or SAG teak wood, as approved by the Architect or Engineer-in-charge, shall be used. These teakwood, as mentioned above, shall be from specified sources/origins, as approved by the Architect.

29.2 Teak wood shall generally be free from large, loose, dead or cluster knots, flaws, shades, warps, twists, bends or any other defects. It shall generally be uniform in substance and of straight fibres, as far as possible. It shall be free from knot, decay, harmful fungi and other defects of harmful nature, which will affect the strength, durability and its usefulness for the purpose for which it is required. The colour shall be uniform, as far as possible. Any efforts like painting, using any adhesive or resins materials, made to hide the defects, shall render the pieces labile to rejection by the Engineer-in-charge and Architect.

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

29.5 **First class teak wood :**

29.5.1 First class teak wood shall have no individual hard and sound knots, more than 6 cm^2. in size and the aggregate area of such knots shall not be more than 1% of the area of the 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 cm^2. in size and the aggregate area of such knots shall not exceed 2% of the area of the piece.

M-29.A Non-teak wood :

29A.1 The non teak-wood shall be chemically treated, seasoned as per IS specifications and shall be 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 the necessary approval.

29A.2 For this purpose, wood of Bio, Kalali, Siras, Behda, Jamun, Sisoo will be used for door-frames, where as only Kalali, Siras, Halda, Kalam etc. will be permitted for preparation of shutters, after proper seasoning and chemical treatment.

29A.3 The non-teak wood shall be free from large, loose, dead of cluster knots, flows, shakes, warps, bends or any other defect. It shall be uniform in substance and of straight fibres, as far as possible. It shall be free from knots, 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 colour of wood shall be uniform, as far as possible. The scantling, planks etc. shall be sawn in straight lines and planes in the direction of grain and shall be of uniform thickness. The Client will ask the agency to produce certificate from the Forest Department, in event of dispute and the decision of the Client shall be final and binding to the Contractor.

M-29B Processed Rubber Wood :

29B.1 The processed rubber wood shall be like Borotik, Silver teak or equivalent, as approved by the Architect and Engineer-in-Charge. It shall conform to IS : 401. The wood shall be made from best quality logs of rubber trees, by treating freshly sawn wood with boron base, timber preservative, as per IS : 401, and drying them uniformly in vacuum, to result into uniform texture and low moisture content wood.

29B.2 It shall be used for manufacturing furniture and furniture components, wall panelling, A.C grills, venetian blinds, wood carvings and handicrafts. It shall be suitably used for production of Door and Window shutters and panels. It shall be available in standard sizes, rough sawn, as listed below :

Length (in Ft.)	Section(W x T, in inches)
2, 3 and 4	2 x 1, 3 x 1, 4 x 1, 1.5 x 1.5, 2 x 1.5, 3 x 1.5, 4 x 1.5, 2 x 2 3 x 2, 4 x 2, 2.5 x 2.5
5, 6 and 7	2 x 2, 3 x 2, 4 x 2

29B.3 The moisture content of the processed rubberwood is 8 to 10% for furniture lengths upto 48 inches, in maximum section 3" x 2". For lengths of 48 to 84 inches, in maximum section 4" x 2.5", the moisture content is 10 to 12%. Its other properties are similar to rubberwood.

1) Density 640 Kg/m^3.
2) Hardness : Side - 538 Kg.
   End - 627 Kg.
3) Compression
   Parallel to grain - 32 N/mm^2.
   Perpendicular to grain - 4.7 N/mm^2.
4) Modulus of elasticity - 9.24 N/mm^2.
5) Shear
   Parallel to grain - 114 Kg/cm.
   Perpendicular to grain - 60 Kg/cm.
6) Shrinkage
   Radial - 2.6%
   Tangential - 6.1%

29B.4 Processed rubber wood, is easy to re-saw and for planning, boring, turning etc. It is also suitable for lacquering, painting and resin or melamine finish. Gluing or jointing shall be done with PG, UF, RF resins and PVAC glues. Butt joints and edge joints are possible and along with its property of hardness, it is suitable material for parquet flooring, staircase steps, door and window shutters and panel inserts.

M-30 Wooden Flush Door Shutters (Solid Core) :

30.1 The solid core type (water proof/ Commercial) flush door shutters shall be of decorative face or non-decorative face 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 used as per IS : 2202-(Part-I). 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 IS : 303. And waterproof plywood shall confirmed to IS 710.

30.2 The solid core shall be of wood laminate, prepared from battens of well seasoned and treated good quality wood, having straight grains. The battens shall be of uniform size of about 2.5 cm. width. These shall be properly glued and machine pressed together, with grains of each piece reversed from that of the adjoining one. The longitudinal joints of the battens shall be staggered and no piece shall be less than 50 cm. in length. Edges of the core shall be lipped internally with 1st class teak wood battens of 4 cm.(1-1/2") minimum width, glued and machine pressed along with the core.

30.3 The core surface shall then have two or three veneers firmly glued on each face. The first veneer (called cross hand) shall be laid with its grains at right angles to those of the core and the second and the third veneers with their grains parallel to those of the core.

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

30.5 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 make smooth even texture.

30.6 The shutters shall be tested for -

(1) End immersion test : The test shall be carried out as per IS : 2202 (part-I). There shall be no delamination at the end of the test.

(2) Knife test : The face panel when tested in accordance with IS : 1659 shall pass the test.

(3) Glue Adhesion test : The flush door shall be tested for glue adhesive test in accordance with IS :2202 (Part-I) . 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 & 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 continuously around the corner. Delamination at the knots, knot holes and other permissible wood defects shall not be considered in assessing the sample.

30.7 The tolerance in size of solid core type flush door shall be as under :
In Normal thickness +1.2 mm. In Normal height +3 mm.

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

M-31 Aluminium Doors, Windows, Ventilators:

31.1 Aluminium alloy used in the manufacture of extruded window sections shall conform to IS designation HEA-WP of IS : 733 and also to IS designation WVG-WP of IS : 1285. 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 Aluminium hinge of same type as in window but of larger size.

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

M-32 Rolling Shutters :

32.1 The rolling shutters shall conform to IS: 6248. Rolling shutters shall be supplied of specified type, with accessories. The size of the rolling shutters shall be as specified in the drawings. The shutters shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm.. thick and 80 mm. wide, for shutters upto 3.5 m. width and 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 roll pressed or built-up (fabricated), with jointless construction. The thickness of the sheet used shall not be less than 3.15 mm.

32.3 Hood covers shall be made of MS sheets, not less than 0.90 mm. thick. For shutters having width of 3.5 m. and above, the thickness of MS sheet for the hood cover shall be not 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 or strip of adequate strength to balance the shutters in all positions. The spring pipe shaft etc. shall be supported on strong MS or malleable CI brackets. The brackets shall be fixed on or under the lintel as specified with rawlplugs and screws bolts, etc.

32.5 The rolling shutters shall be of self rolling upto 8 m^2. clear area, without ball bearing and upto 12 m^2. clear area, with ball bearing. If the rolling shutters are of large area, 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. and 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. MS channels of heavy section, unless otherwise shown on drawings. The distance, center to center of pickets shall be 12 cm. with an opening of 10 cm.

(b) Pivoted MS 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 hold fasts, 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 drawn" or galvanised steel conforming to IS : 226 with longitudinal and transverse wire securely connected at every intersection by a process of electrical resistance welding and conforming to IS : 4948. It shall be fabricated and finished in workmanlike manner and shall be free from injurious defects and shall be dust proof. The type of mesh shall be oblong or square, as directed. The mesh sizes and sizes of 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, in each panel, as far as stock sizes permit.

M-35 Expanded Metal Sheets :

35.1 The expanded metal sheets shall be free from flaws, joints, broken strands, laminations and other harmful surface defects. Expanded metal steel sheet shall conform to IS : 412 except that blank sheets need not be with guaranteed mechanical properties. The size of the diamond mesh of expanded metal and dimensions of strands (width and thickness) shall be as specified. The tolerance on nominal weight of expanded metal sheets shall be of $\pm$ 10%.

35.2 Expanded metal in panels shall be in one whole piece, in each panel, as far as stock sizes permit. The expanded metal sheets shall be coated with suitable protective coating to prevent corrosion.

M-36 Mild Steel Wire (Wire Gauze Jali) :

36.1 Mild steel wire may be galvanised, as indicated. All finished steel wire shall be well sawn to the dimensions, and the size of the wire shall be as specified in item. The wire shall be sound, free from splits, surface flaw, rough, jagged and imperfect edges and other harmful surface defects and shall conform to IS : 280.

M-37 Plywood :

37.1 The plywood for general purpose shall conform IS : 303.
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 that, plywood offers more uniform strength, along its length and width and also offers greater resistance to cracking and splitting with change in moisture content.

37.3 Usually synthetic resins are used for 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 90^0C to 140^0C and a pressure of 11 to 14 Kg/$cm^{2.}$, on the wood. The time of heating may be anything from 2 to 60 minutes depending upon the thickness.

37.4 When water glues 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 IS : 303, the plywood for general purpose shall be of the grades namely BWR, WWR and CWR, depending upon 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 and C. After pressing, the finished plywood should be reconditioned to a moisture content not less than 8% and not more than 16%.

37.6 Thickness of plywood boards:

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.		8 mm.		16 mm.	11 ply	19 mm.
	6 mm.		9 mm.	9 ply	13 mm.		22 mm.
							25 mm.

Types of plywood :

M-37A Water Proof (Weather Proof) Plywood :

37A.1 The plywood shall be from Kitply, Wonder Wood, Anchor Board or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS : 710 and to the relevant Defence and Navy specifications.

37A.2 Plywood shall be made from veneers of hard wood timbers and bonded with high quality BWP type Phenol Formaldehyde Synthetic Resin Adhesive and hot pressed at high temperature and pressure, and further treated with a fixed type of preservative by vacuum-cum-pressure impregnation, to produce thin boards or sheets of wood panels. There are always an odd number of layers. The plies shall be placed, so that, grain of each layer is at right angles to the grain in the adjacent layer.

37A.3 Plywood shall be waterproof, weather proof, boilproof, and highly durable even against strenuous vulnerable uses. It shall resist the attack of termites, cockroaches, wood burrowers, fungus, mould, rot, decay and other wood destroying insects and marine organisms.

37A.4 The tensile strength of the plywood shall be minimum 600 kg/$cm^{2.}$ and bending strength above 400 kg/cm^2. The swelling of plywood in water should be almost negligible. Specific gravity of plywood should be 0.7 to 0.75, having screw and nail holding strength normal to face, atleast 250 kg. and 60 kg., respectively.

37A.5 The moisture content shall be less than 10% and the plywood shall have high fire resistance and shall be free from any cracks, wraps, split etc., and shall have uniform strength all over the panel surface. It shall be used for marine structures, leather tanning tables, wall panelling, and underlayment for kitchen and other furniture, subjected to heat and moisture.

M-37B Commercial Ply :

37B.1 The plywood shall be from Mafatlal Plywood Industries Ltd. or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS 303.

37B.2 Plywood shall be made from hard wood timbers, finished with selected species of timber, suitable for veneers and bonded with strictly controlled and evenly spread adhesives.

37B.3 It shall be smooth and strong and shall be free from warping, cupping and twisting.

M-37C Prelaminated - Standard and Veneered :

37C.1 **Decorative Plywood :**

37C.1.1 It shall be obtained from manufacturer as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS Code.

37C.1.2 Plywood shall be made from hard wood timbers, finished with selected species of timber, suitable for veneers and bonded with strictly controlled and evenly spread adhesives. It shall be smooth and strong and shall be free from warping, cupping and twisting.

37C.2 **Decorative Veneers :**

37C.2.1 Decorative veneered plywood shall be manufactured using veneers of the best quality timbers like Teak, Rosewood, Walnut, Laurel, White Cedar and many others.

37C.2.2 They shall be available in flitch form as well as in lay-on form, in sizes suitable to the furniture industry. They shall be available either flat or quarter sliced, varying in thickness from 0.2 mm. to 1.5 mm. Lengths shall vary upto 4 m.

M-37D Block Boards :

37D.1 They shall be manufactured from well-selected and seasoned hardwood timbers, used in sturdy construction. They shall be usually bonded with Urea Formaldehyde, however against specific requirements, Phenol Formaldehyde bonded boards shall also be available.

37D.2 They shall be strong, weather and water proof and shall be ideally used for high quality furniture and exterior applications.

M-38 Glass :

38.1 All glass shall be of the best quality, free from specks, bubbles, smokes, veins, air holes, blisters, and other defects. The kind of glass to be used shall be as mentioned in the item or specification or in the special provisions or as shown in detailed drawings. Thickness of the glass panels 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/m^2. for panes upto 600 mm. x 600 mm.

38.2.2 For panes larger than 600 mm. x 600 mm and upto 800 mm. x 800 mm., the glass weighing not less than 8.75 Kg/m^2. shall be used. For bigger panes upto 900 mm. x 900 mm., glass weighing not less than 11.25 Kg/m^2. 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 IS : 1761. Sheet glass of the specified colours shall be used, if so shown on the detailed drawings or so specified for important buildings and for panes with any dimensions 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 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, figure, ribbed or fluted, or frosted, as may be specified or 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. Electrically welded 13 mm. Georgian square mesh shall be used. Thickness of glass shall not be less than 6 mm. Wired glass shall be of the type and thickness as specified.

38.6 **Double Glazed units :**

38.6.1 Double glazed unit shall comprise of two glasses, of appropriate thickness and absolutely machine-cleaned on both sides, with an air gap of 12 mm .in-between. The space between the two glasses is kept totally dry, avoiding any condensation by sealing the space with elastomeric sealant. Thus in all, it is an insulating glass unit of around 20mm. thickness.

38.6.2 It shall be suitably used for any kind of Doors and Windows, in all areas of work and residences. It shall be absolutely and clearly transparent, giving the following advantages :

1) Total light penetration, but with dust and heat insulation.
2) Noise insulation.
3) 25% saving in electricity due to heat insulation.
4) Crystal clear transparency.

M-39 Acrylic Sheets :

39.1 Acrylic sheets shall be of thickness as specified in the item and of specified shape and size, as the case may be. Panels may flat or curved. It should be light in weight. It shall be colourless or coloured or opaque, as specified in the item. Colourless 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.

39.2 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 and jointed, as desired. Solution for the joints shall be used as per the requirement of manufacturer.

M-40 Particle Board :

40.1 The particle board used for face panels shall of best quality free from any defects. The particle boards shall be made with phenolmaldehyde adhesive. The particle boards shall conform to IS : 3087 "Specifications for wood particle board for general purpose". The size and the thickness shall be as indicated.

40.2 Particle board shall be made completely from Teakwood and shall be bonded with BWP type Phenol Formaldehyde synthetic resin to give a flat, strong and homogenised panel.

40.3 It shall be durable and shall have smooth surface so as to take any type of surface treatment, like polishing, painting, laminating or veneers. It shall be fire resistant, weather resistant, termite and insect resistant. It shall be dimensionally stable, structurally strong and acoustically superior.

40.3 It shall be available in all standard sizes as that of the plywood.

40.4 Particle board may also be available in veneered form.

M-41 Expanded Polystyrene or Framed Styroper Slabs :

41.1 The expanded polystyrene ceiling boards and tiles shall be of approved make and shall be of sizes, thickness, finish and colour, as indicated. They shall be of high density and suitable for use as insulating material. The insulating material shall be like slab of Thermocole etc.

M-42 Resin Bonded Fibre Glass :

42.1 The resin bonded fibre 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, IS : 3144 shall be followed.

42.3 Insulation wool blanket shall be with the following coverings on one or both sides, as indicated.
(1) Bituminised hessain Kraft paper suitable for use in position where moisture has to be excluded.
(2) Hessian cloth or Kraft paper, for keeping out dust.
(3) GI wire netting, suitable for surfaces to be plastered over.

M-43 Fixtures and Fastenings :

43.1 **General :**

43.1.1 The fixtures and fastenings, that is butt, hinges, tee and strap hinges, sliding door bolts, tower bolts, door latch, bath-room latch, handles, door stoppers, 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, aluminium, chromium plated iron, chromium plated brass, copper oxidised iron, copper oxidised brass or anodised Aluminium, as specified.

43.1.3 The fixtures shall be heavy types. 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 by Engineer-in-charge and Architect, as regards its quality and shape before fixing them in position.

43.1.5 Brass and anodised aluminium 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 MS Sheet.

43.4 **Siding 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 :**

43.8.1 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 Stoppers :**

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

43.10 **Door Catch :**

43.10.1 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 fixing. The catch shall be fixed 20 mm. inside the face for the door for easy operation of catch.

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 hinge 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 handed as directed.

43.13 **Casement Stays (Straight Peg 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 required. 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. in diameter and 12 mm. in length and shall be firmly riveted to the base plate, in case of iron pivot and in single piece base plate, in the case of brass pivot.

M-44 Paints:

M-44A Oil Paints:

44A.1 Oil paints shall be of the specified colour and shade 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 stainer shall be allowed. In such a case, the Contractor shall ensure that the shade of the paint so allowed shall be uniform.

44A.2 All the paints shall meet with the following general requirements:

(i) Paint 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, levering, caking or colour separation and shall be free from lumps and skins.

(ii) The paint as received shall brush easily, possess good levelling properties and show no running or sagging tendencies.

(iii) 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.

44A.3 Ready mixed paint shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures, whatsoever.

M-44B Enamel Paints :

44B.1 The enamel paint shall satisfy all general requirements in specification of oil paints. Enamel paint shall conform to IS : 2933. It shall be from Nerolac, Berger, Asian Paints or equivalent. It shall offer variety of finishes like Glossy, Semi-glossy, Pearl lustre and Matt.

44B.2 It shall be applied either by brush, roll or spray. It shall have a covering capacity of 13 to 18 m^2. per coat, depending on the surface to be painted. It shall be used both on metal and wood surfaces.

44B.3 It shall have a viscosity of application of 60 to 65 seconds, if brush or rollers are used and 30 to 40 seconds, if spraying is done. It shall have flash point at above 30 ^{0} C. The drying time shall however vary with the ambient temperature and humidity.

M-44C Heritage Wall Finish :

44C.1 It shall be from Bakelite Hylam Ltd. or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS Codes. It shall be granules, flakes, granite-flakes and granules and flakes mix.

44C.2 It shall be a two component finish. It shall be easily applicable using trowels and no special tools and training shall be required for application. The single coat application thickness shall be 1.5 mm. thick, of colour and texture, as approved by the Architect. It shall be weather and fade resistant, water and damp resistant, durable and highly washable. It shall be acid and alkali resistant, high abrasion resistant, non-toxic and shall be capable to taking any shape. It can be applied on wide variety of surface like cement mortar, plywood, plaster board, AC sheet, Asbestos board, gypsum plaster or any other materials, to get homogenous layer.

44C.3 It shall be water thinnable to avoid water contamination, incombustible and flexible. It shall be good fire resistant, anti-fungal, good impact resistant having adhesion strength more than 8 kg./cm^2. There shall not be any development of hair line cracks and no peeling off shall occur, after the maximum drying time of 4 hours and curing period of 2 days.

M-44D Polyurethane Coatings :

44D.1 It shall be from MRF Durodec or equivalent, as approved by the Architect and Engineer-in-charge.

44D.2 It shall be a three-coat application, using a brush, spray or a roller. It shall be available in variety of decorative finishes, i.e. in almost all shades and in glossy and matt finishes. It shall offer the following properties :

1) Adhesion to concrete surfaces.
2) Sealing effect against heavy rain.
3) Good water vapour diffusion.
4) Weather resistance, colour stability, gloss retention and chalk resistance.
5) Resistance to disinfectants, chemical, fire, radiation, acid gases, abrasion and wear.
6) Low soil adhesion.

44D.3 It shall be ideal for concrete, floor toppings, on calcium silicate brickwork, glass fibre reinforced concrete, and wood fibre. plaster board, fibre reinforced plasterboard. It shall absorb UV radiation and shall be easily cleaned of radioactive contamination. The ultraviolet part of the solar radiation shall not affect the coating and thereby shall be long lasting.

M-44E Armor Quartz :

44E.1 It shall be from Jenson & Nicholson or equivalent, as approved by the Architect and Engineer-in-charge.

44E.2 It is used for exterior surfaces and shall give a thick rich opaque matt finish. It shall be easily applicable using a flat brush well moistened before use. No special tools or training shall be required for application. A single coat application is enough to render a smooth, well prepared surface, in the colour and texture, approved by the Architect. It shall be weather and fade resistant, water and damp resistant, durable. It shall resist fungi and algae. It can be applied on wide variety of surface like cement mortar, plywood, plaster board, AC sheet, Asbestos board, gypsum plaster or any other absorbent material to get homogenous layer. It shall touch dry within 20 minutes and covers 20% more area than other fine textured exterior finishes.

44E.3 It shall be water thinnable, thinned with 5 to 10% of water by volume. It shall require no primer. On a well prepared surface, it shall be applied, in single coat, after one coat of Robbiacem Super cement paint. On a previously painted surface, painted with oil paints, a base coat of Armor Quartz, diluted 1:1 with water is applied before the final coat of Armor Quartz, thinned with 5 to 10% of water by volume. It shall be formulated to last for atleast 10 years.

M-44F Acrylic Emulsion :

44F.1 It shall be from Nerolac, Asian Paints, ICI, Berger or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

44F.2 It shall be used on both interiors and exteriors, on all different types of plaster, wooden surfaces, stone, brickwork, asbestos cement sheets, hard and soft boards, etc. It shall render rich smooth finish and shall provide a tough film that forms a suitable protection against all elements.

44F.3 It shall be water thinnable. It shall require no primer. On a well prepared surface, it shall be applied, after one coat of cement primer, in case it is an interior surface and waterproof cement coating, in case it is an exterior surface. On a new but highly absorbent surface, a thin coat of the same shall be applied by adding two parts of water by volume to two parts of Acrylic Emulsion by volume. On previously painted surfaces, one coat of the same shall be applied by thinning four parts of the emulsion with one or two parts of water. It shall be applied by brush, roller or spray. It shall have a covering capacity of 25-30 m^2/lit., depending on the surface and shade used. It can be washed to remove the day-to-day dirt, after the surface has been painted, minimum for a month.

M-44G Water Bound Distemper :

44G.1 It shall be from Berger, Nerolac, ICI, Asian Paints or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

44G.2 It shall be available in dry powder form and shall be prepared by adding preferably warm water, in the manner and proportion, as described by the manufacturer. It shall be applied by the conventional distemper brush to all plastered walls, ceilings and woodwork. It shall generally not require any primer, but if found necessary, a size coat made by an experienced painter from glue, soap, warm water and distemper powder shall be applied. It shall offer a covering capacity of 13-16 m^2 per Kg. depending on the surface and shade used.

M-44H Cement Paints :

44H.1 It shall be from Berger, ICI, Asian Paints or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

44H.2 It shall be manufactured from selected range of raw materials and a special cement, so the it shall be suitable for both indoors and outdoors. It shall be suitably used on concrete renderings, cement/sand renderings, cement/lime/sand renderings, asbestos sheets, fibre boards, brickwork, etc. It shall offer matt

finish. It shall require no primer and shall be water thinnable. It shall offer a covering capacity of 6-8 m^2 per Kg., depending on the surface and shade used. It shall preferably not be applied under direct sunlight to avoid patchy effect.

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 IS : 348.

M-45A Laquar Polish

45A.1 Laquar polish of ASIAN or TARALAC with thinner of same company shall be used. Surfaces to be polished shall be properly grinned with sandpaper and all grains of the wood shall be filled by sealer coat over that multiple layers of approved company's Laquar to be applied up to hot water resistance.

M-45B Wax Polish :

45B.1 The Wax polish of required tint and shade shall be prepared with the below mentioned ingredients and other necessary materials.
(i) 2 parts Bees wax conforming to IS : 1504-1968 with 1.5 parts boiled linseed oil conforming to IS : 75 and 1 part of Turpentine conforming to IS : 83 and 0.5 part Varnish conforming to IS : 337.

45B.2 Pure bees wax free paraffin or bees adulterants shall be used. The polish shall be prepared from mixture of bees wax, linseed oil, turpentine and varnish in proportion 2 : 1.5 : 1 : 0.5 by weight. The bees wax and boiled linseed oil shall be heated over a slow fire. When the wax is completely dissolved the mixture shall be cooled till it is just warn and turpentine and varnish added to it in the required proportions and entire mixture shall be well stirred.

M-45C Melamine Polish:

45C.1 The melamine polish shall be of best quality and make such as Asian Paints or equivalent, as approved by the Architect and Engineer-in-charge. It shall be transparent or opaque, as specified by the Architect.

45C.2 It shall give silken, smooth finish. The Melamine polish shall have shade and shine, either satin or glossy, as approved by the Architect. It shall be two component polish consisting of a base and hardener. It shall be capable of protecting wood from moisture, heat, cold, scratches, stains, cigarette burns etc. It shall have excellent covering capacity. It shall be applicable to all wooden surface of every shape. It shall be applied using brush or spray gun. It shall require lesser time to dry and there shall be no cracks or pealing off of the polish. There shall not be any undulation on the finished surface nor cracks at joints. It shall be of any desired shade as approved by the Architect. It shall have excellent colour, shall be free flowing and shall have good levelling properties. It shall be durable and flexible to absorb cracks. It shall have resistant to scrubs, light rays, heat etc.

M-45D Acrylic Wood Polish:

45D.1 Acrylic wood polish shall be of the best quality and make such as Nebula Chemicals Pvt. Ltd. or equivalent, as approved by the Architect and Engineer-in-charge. It shall be made from the best ingredients to give a consistent quality. It shall be water resistant, heat resistant and scratch resistant.

45d.2 It shall offer a silky smooth wood finish. It shall offer any desired shade like rosewood, amber. mahogany, walnut etc. It shall have excellent covering capacity. It shall be applied to all wooden surfaces, of every shape. It shall give a tough and durable surface. It shall require lesser time to dry and shall cover a wider area. On application, it shall form a layer of acrylic which eliminates sanding the surface and therefore helps to reduce time and labour. It shall not require any special equipment to apply.

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 homogenous in texture with crystalline and coarse grains. It shall be uniform in colour and free from stains, cracks, decay and weathering.

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

46.3 The marble chips shall be machines crushed. They shall be free from foreign matter, dust etc., except as above, the chips shall conform to IS : 2114.

M-47 Flooring Tiles :

M-47A Plain Cement Tiles :

47A.1 The plain cement tiles shall be of general purpose type. For these tiles, no pigments are used, in their manufacture. Cement used in the manufacture of the tiles shall be as per IS

47A.2 The tiles shall be manufactured from a mixture of cement and natural aggregates, using pressure process. During the manufacture, the tiles shall be subjected to a pressure of not less than 140 Kg/cm^2. The proportion of cement to aggregate, in the backing of the tiles shall be not less than 1:3, by weight. The wearing face, though the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm. size. The proportion of cement to aggregate, in the wearing layer of the tiles shall be three parts of cement to one part chips, by weight. The minimum thickness of wearing layer shall be 3 mm. The colour and texture of the wearing layer shall be uniform throughout its face and thickness. On removal from mould, the tiles shall be kept in moist condition, continuously atleast for 7 days and subsequently, if necessary, for such long period, as would ensure their conformity to requirements of IS : 1237, regarding strength, resistance to wear and water absorption.

47A.3 The wearing face of the tiles shall be plane, free from projections, depressions and cracks and shall be reasonably parallel to the backing of the tile. All angles shall be right angles and all edges shall be sharp and true.

47A.4 The tiles shall generally be square in shape, with a size of 30 cm. x 30 cm. The thickness of the tiles shall be 25 mm.

47A.5 Tolerance of length and breadth shall be $\pm$ 1 mm. Tolerance of thickness shall be + 5 mm.

47A.6 The tiles shall satisfy the test as regards transverse strength, resistance to wear and water absorption as per IS : 1237.

Testing Standards :

A. Water Absorption :
Sampling :
6 tiles out of every 3000 tiles are taken for testing.
Results :
Absorption permissible, shall be at the most 10%.

B. Transverse strength test :
Sampling :
12 tiles out of every 3000 tiles are taken for testing.

Results :
When wet :- 80 Kg/cm^2.
When dry :- 120 Kg/cm^2.

C. Abrasion test :
Sampling :
6 tiles out of every 3000 tiles are taken for testing.
Results :
Average abrasion shall not be more than 3.5 mm.

M-47B Plain Coloured Tiles :

47B.1 These tiles shall have the same specifications as plain cement tiles, as in 47A above except that they shall have a plain wearing surface, wherein pigments are used. They shall conform to IS : 1237.

47B.2 The pigments used for colouring cement shall not exceed 10% by weight of cement used in the mix. The pigments, synthetic or otherwise, used for colouring tiles shall have permanent colour and shall not contain materials detrimental to concrete.

47B.3 The colour of the tiles shall be specified in the item or as directed.

M-47C Marble Mosaic Tiles :

47C.1 These tiles have the same specifications as plain cement tiles except for the requirements stated below:

47C.2 The marble mosaic tiles shall conform to IS : 1237. The wearing face of the tiles shall be mechanically ground and filled. The wearing face of tiles shall be free from projections, depressions and cracks and shall be reasonably parallel to the backing of the tiles. All angles shall be right angles and all edges shall be sharp and true.

47C.3 Chips used in the tiles shall be of the smallest size upto 20 mm. size. The minimum thickness of the wearing layer of tiles shall be 6 mm. For pattern of chips required on the wearing face, a few samples with or without their full size photographs, as directed shall be presented to the Engineer-in-charge and Architect, for approval.

47C.4 Any particular sample, if found suitable shall be approved by the Engineer-in-charge and Architect, 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 the backing layer and wearing surface, materials, ingredients, colour shade, chips distribution, etc. required.

47C.5 The tiles shall be prepared from cement conforming to IS or coloured Portland cement, generally depending upon the colour of tiles to be used or as directed.

M-47D Chequered Tiles :

47D.1 Chequered tiles shall be plain cement tiles or marble mosaic tiles. The former shall have the same specification as per 47A above, and the latter as per marble mosaic tiles as per 47C, except as mentioned below:

47D.2 The tiles shall be of nominal size of 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.

47D.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, coloured 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.

47D.4 Tiles shall conform to IS : 1237.

M-47E Chequred Tiles for Stair Cases :

47E.1 The requirements of these tiles shall be the same as chequred tiles, as per 47D above, except in the following respects:

(1) The length of a tile including note, shall be 330 mm.
(2) The minimum thickness shall be 28 mm.
(3) The nosing shall also have the same wearing layer as that 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 the nosing and at center 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 be uniform in colour. The colour of the stone shall generally be green. Brown coloured stones shall not be allowed for use. The stones 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 450 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 -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 edges of the stones shall be truly chiselled and table rubbed with coarse sand before paving. All angles and edges of the stones of shall be true, square and free from chipping and the surface shall be true and plain.

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

M-49 Polished Kotah Stone :

49.1 Polished kotah stone shall have the same specification as Rough kotah stone, except as mentioned below:

49.2 The stones shall have machine polished surface. When brought on site, the stone shall be single polished or double polished, depending upon its use. Single polished kotah stone shall have single face of the stone polished whereas, double polished kotah stone shall have both the faces polished. The stones for paving shall generally be single polished. The stones to be used for dado, skirting, sink, veneering, sills, steps, etc., where machine polishing after the stones are fixed in situ, is not possible, shall be polished more than once for the desired finish, before fixing.

49.3 When brought at site, the colour of the stone shall be fairly uniform. 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-50 Dholpur Stone :

50.1 Dholpur sand stone shall be of best quality, as approved by the Architect and 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 shape and of uniform colour.

50.2 The size of the slab shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with the permissible tolerance of ± 2 mm.

50.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished. The stones to be used for sills, steps, brackets, coping, facias, bands, pillars, fabricated railings, jali work etc., where machine polishing after the stones are fixed in situ, is not possible, shall be double polished or polished more than once, as required.

50.4 All angles and edges of the stone slab shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone slab shall be true and plane.

50.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect, 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. No white, black or any other colour spots shall be there. Cheetah or tiger skinned stones shall not be allowed under any case.

M-50A Cobbler Stones (Interlock Pavers) :

50A.1 Cobbler stones shall be of best quality, as approved by the Architect and Engineer-in-charge and shall be obtained from reliable source. The make will be approved by the Architect and the source of supply shall not be changed without prior approval of the Architect. The stone shall be without any veins, cracks and flaws. The cobbler stones shall be even, sound, durable and regular in shape and of uniform colour.

50A.2 The size of the cobbler stone shall be as specified in the items or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with permissible tolerance of ± 2 mm.

50A.3 The stone shall have machine polished surface. When brought on site the stone shall be single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The cobbler stones to be used for walkways, roadways, parking, floors, docks, roofs, public squares etc., where machine polishing after the fixing of stones, is not possible, the stones to be fixed shall be double polished or polished more than once, as required. All angles and edges of the cobbler stone shall be true and plane.

M-51 Marble Slab :

51.1 Marble slab shall be white or of any other available colour and of best quality, as approved by the Engineer-in-charge and Architect.

51.2 Slabs shall be hard, close, uniform and homogeneous in texture. They shall have even crystalline grain and shall be 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 and Architect. Size of the slab shall be minimum 450 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 the finished slab to be used, shall be deposited by the Contractor in the office, for reference.

51.5 Except as above, the marble slabs shall conform to IS : 1130.

M-51A Blended Marble tile/slab :

51A.1 It shall of the best quality like Carara, Marbella or equivalent, as approved by the Architect and Engineer-in-charge.

51A.2 It shall be predominantly a marble tile/slab, composed of 80% to 95% of finest grains of quality selected marble aggregates, bonded together with 4% to 8% special resins, alongwith palette of colourants. It shall therefore offer a wide range of colour compared to natural marble. It shall be manufactured so, that its design goes right through the tile, insuring lasting designs.

51A.3 It shall be available in pre-cut, pre-polished, chamfered and grooved upto sizes of 600 mm. x 600 mm. Sizes upto 2400 mm. x 1200 mm. shall also be supplied. It shall have indispensable mechanical strength,

Test	Dry	Wet
Compressive strength in Kg/cm^2.	1340	1317
Flexural strength in Kg/cm^2.	308	453
Modulus of Rupture in Kg/cm^2.	462	453

It shall offer flexibility, high wear resistance, impact resistance and on testing shall be 1.5 kgcm/cm., hardness on the Moh's scale shall be 3 to 4, abrasive wear index shall be 22 and total water absorption shall be around 0.13%. It shall not be easily affected by the freeze and thawing cycling.

51A.4 It shall be non-porous and shall be used in all types of weather. It shall be used for internal and external surfaces. It shall be easily cut with a normal hand cutting machine, if required and shall be laid in the same manner as natural marble stone or with latexbased glues.

M-52 Granite Stone :

52.1 Granite shall be of approved colour and quality. It shall be got approved by the Engineer-in-charge and Architect, prior to procurement. The stone shall be hard, even, sound and regular in shape and generally uniform in colour. It shall be without any soft veins, cracks or flaws.

52.2 The thickness of the stone shall be as specified in the item.

52.3 All exposed faces shall be double polished to render 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 PVC / Vinyl Flooring :

53.1 PVC sheets/tiles for PVC/ Vinyl floor covering shall be of the best quality like Wonderfloor, Indag or equivalent, as approved by the Architect and Engineer-in-charge. It shall be of homogeneous flexible type, conforming to IS : 3462. The PVC covering shall neither develop any toxic effect while put to use nor shall give off any disagreeable odour.

53.2 Thickness of flexible type covering tiles shall be as specified in the description of the item. The flexible type shall be backed with hessain or other woven fabric. It shall be available in form of tiles, size upto 600 mm. x 600 mm. or rolls of 1.5 m. width, continuous length of 20 m. The thickness shall be approx. 1.5 to 2 mm. The dimensional stability shall be 0.3%. The following tolerance shall be applicable on the nominal dimensions of the rolls or tiles :

(a) Thickness : + 0.15 mm.
(b) Length or Width :
1.300 mm. Square tiles, + 0.20 mm.
3.900 mm. Square tiles, + 0.60 mm
2.600 mm. Square tiles, + 0.40 mm
4 Sheets and roll, + 0.10 %

53.3 It shall offer colour fastness to daylight as per the relevant IS : 3462. Allowance for curling shall be 0.6 mm. It shall be flexible and shall not break, crack or show any signs of failure.

53.4 It shall offer above average resistance to mild and diluted acids, alkalies, soaps and detergents. It shall have high abrasion resistance. At normal temperature, it shall develop an indent of 0.15 mm., after one minute and 0.20 mm., after ten minutes. It shall offer insulation resistance as per the IS : 2259. It shall have a sound reduction factor of 3db for 2 mm. thickness and 2db for 1.5 mm. thickness. It shall have self extinguishing property and water absorption at room temperature for 24 hrs. shall be 0.1%.

53.5 It shall be available in various designs and shall be recommended for floors and walls, in homes, institutions, commercial establishments, clinics and hospitals.

53.6 **Adhesive :**

53.6.1 The adhesive for PVC flooring shall be of the type and make recommended by the manufacture of PVC sheets/tiles.

M-54 Facing Tiles :

54.1 The facing tiles (burnt clay facing bricks) shall be free from cracks and nodules and 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 four 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 IS : 2691.

54.2 The standard size of facing brick tiles shall be 19 cm. x 9 cm. x 4 cm. The facing brick tiles shall be provided with frog which shall conform to IS : 1077-1976.

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

Size	Tolerances for	
	1st Class Brick	**2nd Class Brick**
19 cm.	+ 6 mm.	+ 10 mm.
9 cm.	+ 3 mm.	+ 7 mm.
4 cm.	+ 1.5 mm	+ 2 mm.

54.4 The tolerance for distortion or warpage of face or edges of individual brick from a plane surface and from a straight line, respectively, shall be as follows :

Facing dimensions	Permissible tolerance
Max. below 19 cm.	Max. 2.5 mm.
- do - above 19 cm.	Max. 3.0 mm.

54.5 The average compressive strength obtained as a sample of five tiles when tested in accordance with the procedure laid in IS : 1077 shall not be less than 175 kg/cm^2. The average compressive strength of any individual bricks shall be not less than 160 Kg/cm^2.

54.6 The average water absorption for five bricks tiles shall not exceed 12% 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 IS : 1077, 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 and Architects. They shall be flat and true to shape. They shall be free from cracks, crazing spots, 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 from the stated sizes, other than the thickness of tile shall be ± 1.5 mm. The thickness of tile shall be 6 mm. Except for the above, the tiles shall conform to IS : 777.

M-55A Coloured Glaze Tiles :

55A.1 They shall be similar to white glazed tiles mentioned above, in all respects, except that they shall be available in variety of colours and shades, from Johnson & Johnson or equivalent, as approved by the Architect and Engineer-in-charge.

M-56 Ceramic Tiles :

56.1 Ceramic tiles shall be of 1st quality such as Romano, Regency, Spartek, Stiles or equivalent, as approved by the Architect and Engineer-in-charge. They shall adequately meet the relevant IS

56.2 They shall be light weight, with thickness varying between 6 to 8 mm., depending on the manufacturer. Therefore, they require thinner floor bedding compared to mosaic/stone flooring. On laying, they require no further polishing making the floor ready to live in and use. They shall be suitably used for residences, offices, hotels, hospitals, auditoriums, restaurants, canteens, commercial complex and such other public places. They shall be extremely strong, breaking strength of the tile being 350 Kg/cm^2. and flexural strength of 350 Kg/cm^2. They shall offer good resistance to abrasion, i.e. can withstand upto 5000 grindings. They shall be scratch resistance, their hardness on the Moh's scale shall be 6.8 to 7. They shall be resistant to all acids and alkalies except hydrofluoric acid. In addition, they shall be bacteria free and fire proof, as they are fired at @ 1160^{0}C. They shall have very high acoustic damping factor and their specific gravity shall be 0.12, making them good insulators. Their resistance to thermal shocks shall be upto 10 cycles and their co-efficient of linear thermal expansion shall be 9 from ambient temperature to 100^{0}C.

56.3 They shall be available in various sizes, 8"x4", 8"x8", 8"x12", 12"x12" and 12"x16". They shall have a size tolerance of ± 0.4% to 0.75%, in length and width and ± 5% in thickness. Allowable warpage shall be ± 0.5%. Allowable squareness wedging shall be ± 0.4 to 0.5%. The allowable straightness of edges shall be ± 0.5% and allowable flatness shall be ± 0.4 to 0.5%. Their water absorption rate shall be less than 5%.

56.4 Ceramic tile for Industrial purposes, shall have a hardness of 8.6 on the Moh's scale and shall be non-skid, hard wearing, long lasting and acid and alkali resistant. They shall adequately meet the IS : 4457.

M-57 Vitrified Floor Tiles :

57.1 Vitrified floor tiles shall be of best quality like Granamite or equivalent, as approved by the Architect and Engineer-in-charge. They shall conform to the relevant IS Codes.

57.2 They shall be monolithic and available in smooth, mirror-polished and anti-skid finishes, in sizes 12"x12", 8"x8" and 8"x4". They shall have a size tolerance of ± 0.5%, in length and width and ± 5% in thickness. Allowable warpage shall be ± 0.2%. Allowable squareness wedging shall be ± 0.5%. Their water absorption rate shall be less than 0.5%. They shall offer hard-working and hard-wearing floors for homes, public buildings, apartments and airports. The tiles shall be of ASTM or DIN standards.

57.3 They shall be extremely strong, breaking strength of the tile being 1600 Kg/cm^2., flexural strength, 200 Kg/cm^2. and bonding strength of 2500 Kg/cm^2. They shall offer good resistance to abrasion, i.e. greater than 100. They shall be scratch resistance, their hardness on the Moh's scale shall be min. 7. They shall be able to resist thermal shock upto 10 cycles. They shall have a bond strength of 2500 Kg/cm^2. and shall

have a density of greater than 2.2 gm/cc. They shall have 0.60 co-efficient of friction for polished/unpolished surfaces.

M-58 Red Mandana Stone :

58.1 Red mandana stone shall be of best quality, as approved by the Architect and Engineer-in-charge. The stone shall be without any veins, cracks and flaws. The stone shall be even, sound and durable, regular in shape and of uniform colour.

58.2 The size of the stone shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with the permissible tolerance of ± 2 mm.

58.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished.

58.4 All angles and edges of the stone shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone shall be true and plane.

58.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect. It shall be ensured that the stones to be used shall not differ much in shade or tint, from the approved sample.

M-59 Jesalmer Stone :

59.1 Jesalmer stone shall be of best quality, as approved by the Architect and Engineer-in-charge. The stone shall be without any veins, cracks and flaws. The stone shall be even, sound and durable, regular in shape and of uniform colour.

59.2 The size of the shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with the permissible tolerance of ± 2 mm.

59.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished.

59.4 All angles and edges of the stone shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone shall be true and plane.

59.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect, 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. No white, black or any other colour spots shall be there. Cheetah or tiger skinned stones shall not be allowed under any case.

M-60 Shon Tiles :

60.1 They shall be of best quality and from manufacturer like Shon Mosaics or equivalent, as approved by the Architect and Engineer-in-charge. They shall conform to the relevant IS

60.2 They shall be available in the form of sheet pasted on paper for easy fixing. They shall be non-slippery, non-porous, non-sensitive and non-conductive. They shall offer good resistance to temperature changes, chemical effects, impact and pressure and surface abrasion. They shall be weatherproof and 100% fire proof. They shall be light weight and so suitable for cladding on high rise buildings. They shall be available in wide selection of colours and shall be permanent in colour. They shall be stable in form and dimension. They shall be anti-static and easy to clean.

M-61 Sintered Tiles :

61.1 Sintered unglazed tiles shall be of the best quality from Kera or equivalent, as approved by the Architect and Engineer-in-charge. It shall adequately meet the IS : 4457 specification.

61.2 It shall be available in 7 mm., 12 mm. and 20 mm. thickness and shall be used in domestic and industrial applications. It shall be available as heavy duty and acid resistant tiles, as per individual requirement.

61.3 It shall have a very high load bearing capacity, with cold crushing strength as 1500 Kg/cm^2. and shall withstand a load of 3000 Kg/cm^2. in the compression strength test. The tiles shall have extremely low porosity, because of their monolithic body structure. The water absorption shall be less than 1% and the tiles shall remain free of stains due to lubricants, oils, grease etc. The tiles shall be non-glazed and anti-skid, having a matt finish. They shall be available in special ribbed surface, also. The tiles shall be tough, have high surface hardness, 9 on the Moh's scale and shall offer extremely high resistance to wear and abrasion. They offer good resistance to acids and when tested, the loss of weight shall be around 0.25%.

M-62 Rubber Floorings :

62.1 It shall be of the best quality such as Flora or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS specifications.

62.2 It shall be available in 6 different colours with special colours supplied on minimum order and in square and round pattern. It shall have a thickness of 2.5 mm., 3 mm., 3.5 mm. and 4 mm. and sizes of 600 mm. x 600 mm. It shall be able to withstand the heaviest traffic and shall have exceptional abrasion resistance, chemical resistance, flame resistance and cigarette burn resistance. It shall have good load bearing capacity, sound deadening characteristics and anti-slip surface. It shall be easy to clean and maintain.

62.3 It shall be successfully used in Hospitals, Airports, Computer rooms, Hotels and Restaurants, Laboratories, Office and Shopping complexes, Lifts, Buses, Cinema halls and Residences.

M-63 Admixtures for Tile/Stone Cladding :

M-63A Waterproof Adhesive :

63A.1 Waterproof adhesive, shall be of best quality and from manufacturer like Feb Roffe or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code. It shall be in powdered state, complying with BS : 5980 Type 2, class AA and BS : 5385 Part 1. It shall comprise of selected Portland cements, graded sand and synthetic additives.

63A.2 It is useful for permanent adhesion of ceramic tiles, stone and marble cladding to surfaces that may be subjected to extreme weather conditions. It shall provide good tensile adhesion and shear adhesive strength, after application, in thick/thin layer beneath the tile/stone cladding. Its application and coverage shall be as specified by the manufacturer.

M-63B Rainbow Tile Mate :

63B.1 Rainbow tile mate, shall be of best quality and from manufacturer like Feb Roffe or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

63B.2 It shall be a special high grade compound, formulated with organic additives and special blend of high grade cement filling compound. It shall be available in various colours to match all types of glazed/ceramic tile. The organic colouring pigment, added in the compound shall not fade over the period of time.

63B.3 There shall be close adhesion of particle in the compound which imparts water-resistant qualities to the compound and allows to render the joints permanently water-tight, i.e. no seepage and no cracking of joints. It shall have strong bonding property so that the joint in the tiling shall never wear out.

M-64 Selected Earth :

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

64.2 The selected earth shall be good yellow soil and shall be got approved from the Architect and 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 staking of the material shall be done as directed by Architect and Engineer-in-charge, in such a way as not to interfere with any constructional activities and in proper stacks.

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

M-65 Barbed Wire :

65.1 The barbed wire shall be of galvanised steel and it shall generally conform to IS : 278. The barbed wire shall be of type-I, whose nominal diameter for line wire, shall be 2.5 mm. and for point wire, shall be 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 of them containing the barbs. The size of line and point wires and barbs 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.

65.2 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 be so finished that the four points are set and locked at right angle to each other. The barbs shall have a length of not less than 13 mm. and not more than 18 mm. The points shall be sharp and cut at an angle not greater than 35^0 of the axis of the wire, forming the barbs.

65.3 The line and point wires shall be of circular section, free from scale and other defects and shall be uniformly galvanised. The line wire shall be in continuous length and shall not contend any weld other than those in the rod before it is drawn. The distance between two successive splices shall not less than 15 m.

65.4 The length per 100 Kg. of barbed wire, IS type-I, shall be as under :
Nominal 1000 m.
Minimum 934 m.
Maximum 1066 m.

M-66 PVC Waterstops :

66.1 The PVC waterstop shall be of approved make, as approved by the Architect and Engineer-in-charge.

66.2 It shall have optimum resilience, high elasticity & stretch strength ,immune to corrosion, excellent weather resistance. They shall be manufactured to safeguard against hydrostatic pressure, water seepage, expansion or contraction of joints and to take care of any deflection or displacement arising due to change in temperature or settlement of foundation to eliminate danger of cracks.

66.3 They shall be effective in tropical climate having high mechanical strength, good ageing, longer life, shall be unaffected by acids, alkalies, metal salts and other chemicals. It shall not be hazardous and shall have fire retardant properties. It shall absorb less water than rubber, shall work as water tight seal but shall allow safe passage of seepage water and shall withstand high hydrostatic pressure. It shall be easily welded and can be installed easily, having high tensile strength and shall be capable of bearing heavy shocks arising due to turbines, earthquakes, floods etc.

66.4 It shall withstand a minimum hydrostatic pressure of 30 m. high column of water.

66.5 The selection criteria of waterstop depends upon the hydrostatic pressure, however the following points should be kept in mind :
1) Where substantial expansion/contraction of joints takes place, Dumb Bell type shall be used. 2) Where a firm grip in concrete is desired, Serrated types should be used.
3) The overall width of the waterstop should not be greater than the thickness of concrete.
4) The distance from the face of the concrete to the waterstop must not be less than half the width of the waterstop.
5) The width of the waterstop must be atleast 6 times the largest aggregate used for satisfactory compaction.

66.6 The prior approval of selected size and type of waterstop shall be taken from the Architect and Engineer-in-charge, before use.

M-67 Admixtures for Mass Concrete and Mortar :

M-67A Joint Sealant :

67A.1 The sealant shall be of best quality and from manufacturer like CICO, MC-BAUCHEMIE, PIDILITE, HMP or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67A.2 It shall be a two component polysulphide rubber joint sealant, based on a low molecular weight polymer. It should not contain chlorides or other corrosive substances.

67A.3 It shall be used for sealing joints in water retaining structures, roofs, external walls, cladding, floors, partitions, ceilings etc. It shall have excellent property to adhere most of building materials like Aluminium, Stainless Steel, Glass, Concrete, Marble, Stone, Brick, Masonry block, Plaster, Ceramic and quarry tiles, Timber etc. The modulus of elasticity of the sealant shall be less than 0.16 MPa, $\pm$10% at 100% elongation. The shore "A" hardness of the sealant shall be 22$\pm$3 @ 25°C. The operating temperature range for the sealant shall be -25°C to 800C. The permanent dynamic movement capability of the sealant shall be $\pm$25%. The tensile strength of the sealant shall not be less than 0.4 MPa. The optimum width/depth ratio shall be 2:1. The Sp.gr. of the sealant shall be 1.6 kg/lit. The sealant should be capable to resist attack of water, sunlight, oxidation, corrosive fumes, oils, petrol, diluted acids and alkalies, salt spray, aliphatic and aromatic solvents and shall not contain tar or bituminous ingredients.

67A.4 It shall posses the properties like 550% elongation at break, non-toxicity when fully cured, no staining and shrinkage less than 1%. The trafficable strength shall be achieved within 24 hours and full at 7 days (at 25°C & 250% RH). It shall possess excellent coverage capacity and more strength at low dry temperatures.

M-67B Abrasion Resistant Industrial Flooring Aggregate :

67B.1 The flooring aggregate, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67B.2 The flooring aggregate shall be a factory processed and specially graded non-oxidising, non-magnetic and chemically inert metallic flooring aggregate, free from oil and grease.

67B.3 It shall be used as a surface hardener to concrete floors. It is recommended for Factory floors, Warehouses, Hangers, Car parks and such other areas, subjected to heavy vehicular traffic. It shall also be used on open and continuously wet surfaces. The flooring aggregate shall build in wear resistance and shall produce high abrasion resistant floor surface. It shall impart extreme surface density and shall offer resistance to oil and water penetration. It shall provide a non-rusting floor surface which is easy to maintain.

67B.4 It shall be used with cement in the ratio, as per the manufacturer's instructions and spread evenly on the

surface to be treated, at the rate depending on the type of floor. The flooring aggregate shall be spread when the surface of the concrete floor is still fresh, i.e. as soon as the surface water has evaporated and then trawled, in stages, to bring about an uniform and smooth finish.

M-67C Concrete Hardener and Dustproofer :

67C.1 The Concrete hardener and dustproofer, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67C.2 It shall have a specific gravity of 1.18 and shall be applied on concrete floors, at the rate of atleast 25 lit.s per 100 $m^{2.}$ per coat. A total of three coats shall be applied for permanently hardened concrete floor, with increased abrasion resistance, increased surface density, increased resistance to chemical attack and to eliminate dust accumulation. Drying time of 4-6 hours for each coat shall be allowed before the floor is put to use or is applied with another coat of the product. Precautions shall be taken while using the product, to avoid contact with eyes and open wounds and to work in good ventilation. After application, the affected parts shall be washed copiously. It shall not be stored for a period of more than 2 months before use.

M-67D Water Repellent Coating :

67D.1 The Water repellent coating, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67D.2 Water repellent coatings for exterior exposed surfaces shall be acrylic resin based, having a Flash point of approx. 40^0C and specific gravity of 0.95.

67D.3 It shall be suitably used for concrete, brick, stone and plastered surfaces preventing moisture penetration and thus any damage to the interiors. It shall be quick acting, long lasting, invisible i.e. colourless so as to maintain the original colour of the surface treated. It shall impart sealing characteristics so that the treated surface becomes stain and dust free. The coating itself shall not darken or turn yellow with age.

M-67E Accelerating, Water Reducing Admixture and Plasticiser :

67E.1 The Accelerating, Water reducing admixture and plasticiser, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67E.2 It shall be in liquid state with a specific gravity of 1.30 and complying with ASTM C-494 Type E, IS : 9103 & IS : 2645. It shall accelerate the setting and hardening of the concrete mix, thereby achieving higher early age strength. It shall reduce the water content of the concrete without affecting its workability. It is useful for pre-cast/pre-stressed works, structural concrete works, floors, roads, runways, paving etc. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-67F Retarding, Water Reducing Admixture and Plasticiser :

67F.1 The Retarding, water reducing admixture and plasticiser, shall be of best quality and from manufacturer like CICO, Feb Roffe or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67F.2 It shall be in liquid state with a specific gravity of 1.22 and complying with ASTM C-494 Type B & D, IS : 9103, CRD-C87 Type B & D, BS 5075 Part 1. It shall be added to the concrete mix during the mixing process, at the same time as the water or the aggregates. No extension of normal mixing time is necessary. It shall extend the period of time as to placing the concrete and compacting, i.e. delay the initial and final setting time. It shall help to spread the heat of hydration over a longer period of time. It shall give a highly workable concrete with a low W/C ratio. It shall be used at the rate instructed by the manufacturer,

with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-67G Water & Weather Proof Compound :

67G.1 The water & weather proof integral cement admixture shall be of best quality and from manufacturer like Feb Roffe's Roff Hyseal, Roff hyproof, Algiproof, Hydro Shield of ConTech Chemicals or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67G.2 It shall be used as an excellent cement admixture in all types of concrete/plaster mortars, pointing mortars, masonry works, guniting works and pressure grouting works. It shall improve resistance of concrete surfaces to weathering and chemical attack. It shall be non-toxic so as to use for waterproofing water tanks, reservoirs, bio-gas tank, leaking ceiling, basements, tunnels, lift wells etc.

67G.3 It shall be mixed to concrete or plaster mortar, while mixing. First, water is added and then the admixture, at the rate instructed by the manufacturer. For use of the admixture, precaution shall be taken to use clean materials for preparation of mortar.

M-67F Plaster Admixture :

67F.1 An admixture which gives the plaster workability, durability and quality at an economical rate shall be of best quality from manufacturer like Feb Roffe (product name - Roff plaster master) Hydro Shield of ConTech Chemicals or equivalent, as approved by the Architect or Engineer-in-charge. It shall comply to the relevant IS Codes.

67F.2 It shall keep the plastering mortar plastic for a longer time, giving higher strength on prolonged curing. It shall provide cohesiveness, workability and eliminate efflorescence. It shall reduce shrinkage, cracking and crazing to the minimum.

M-68 Asbestos Septic Tank :

68.1 It shall be from Everest or equivalent, as approved by the Architect and Engineer-in-charge. It shall be of required size as shown in detailed drawing or as per specified in the item. It shall be of single piece in width and length but if required to match the specified size in depth, not more than four compartments shall be allowed (which includes top and bottom pieces and extension pieces). It shall be made from finest raw materials.

68.2 It shall be free from any joints in side walls, bottom piece, top cover and baffle walls. It shall be of two compartments separated by a baffle wall in a horizontal section. No leakage should be there from joints between pieces, depth wise. The side walls shall be capable of withstanding the earth pressure and the top cover shall be designed to carry the traffic load and surface covering load.

68.3 It shall be air tight and designed to disintegrate the sewage by bacterial action in absence of oxygen gas. It shall contain two inlets (one for regular connection and other for alternative connection) and one outlet. The inlet shall be of 100 mm. dia. and the outlet shall be of 75 mm. dia. All such connection shall be leakproof. Rejected materials shall not be used.

M-69 Asbestos Cement Building Boards:

69.1 Asbestos Cement boards shall be from Everest or equivalent, as approved by the Architect and Engineer-in-charge. It shall be made from blend of high quality asbestos mineral fibre and cement. It shall conform to IS : 2098, amended 1981.

69.2 It shall be light weight, easily workable using ordinary carpentry tools and it shall be strong enough, so as not to be broken or chipped during handling. It shall be durable, flexible, free from rot, rust and shall be termite proof, impervious to weather. It shall not sag, wrap, swell or crack and also satisfy the fireproof requirements. The thermal conductivity value `k' shall be @ 0.214 kcal/hr.m^{0}C. It shall have adequate

properties of acoustics, having absorption co-efficient between 0.01 to 0.14 and noise resistance co-efficient @ 0.03.

69.3 It shall be easily jointed using open or butt joint. Its surface shall be easily painted. It shall be of uniform thickness, as specified in detailed drawings or as approved by the Architect.

M-70 Expanded Polystyrene :

70.1 The Expanded Polystyrene shall be from Thermocole, Cooline or equivalent, as approved by the Architect and Engineer-in-charge.

70.2 It shall be processed from styropor expandable polystyrene beads. It shall have lower thermal conductivity, excellent shock absorption, better mechanical strength and high resistance to the moisture. It shall possess good acoustic properties, snow white appearance, and lightness. It shall easily be cut to any shape, size and can be fixed by any mechanical means or adhesives. It shall be painted easily.

70.3 It shall have high, dynamic load bearing capacity, excellent resistance to water vapour. The density of Polystyrene shall be 20-25 kg/m^3., having thermal conductivity value 0.025 Kcal/hr m^{O}C. The service temperature range shall be -150°C to +80°C. When soaked in water for 7 days, it shall not absorb water more than 2% by volume. The co-efficient of resistance to water vapour diffusion shall be 40 to 100.

70.4 The compressive strength at 10% deformation and cross breaking strength shall not be less than 1.0 kg/cm$^{2.}$ and 1.6 kg/cm$^{2.,}$ respectively. It shall have resistance to soaps, bleaching agents, dilute acids, alkalies, silicone oil, fresh & sea water, alcohol, liquid paraffin, petroleum jelly etc.

M-71 Phenotherm :

71.1 Phenotherm shall be from Bakelite Hylam or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to BS : 4370 and BS : 3927, wherever applicable.

71.2 It shall have superior fire resistance and thermal conductivity. There shall be no deterioration of K value on ageing, no emission of toxic fumes in an event of fire. It shall have good adhesion to facings and there shall be no shrinkage. It shall conform to the highest fire rating, Class `I' for surface spread of flame, Class `P' for ignitability and Class `O' for building regulations.

71.3 It shall not be flammable and shall retain its shape, during and after fire. It shall generate negligible smoke, so the obscuration shall remain less than 5% and shall emit non-toxic fumes during fire. It shall have K value less than 0.016 Kcal/hr m^{O}C and the working range of temperature shall be -196°C to +130°C. It shall easily be used on LSHS, fuel oil, low pressure steam and hot water lines for containers.

71.4 It shall have the closed cell content not less than 90% to result in very low water absorption, very low water vapour transmission and reduce condensation. It shall be unaffected by most aromatic and aliphatic solvents. It shall be odourless, non-colour absorbent. It shall not attract rodents/insects, resist fungal and bacterial growth, most organic solvents and chemicals. It shall be anti-corrosive, non-abrasive and hydrophobic. It shall possess good acoustical properties and electrical insulation. The density of the Phenotherm shall be 40-50 kg/m^3.

M-72 Ex-foliated Vermiculite :

72.1 The Vermiculite shall be from Bharat Heat Insulating & Refractory Industries or equivalent, as approved by the Architect and Engineer-in-charge.

72.2 It shall be hydrated laminar natural mineral having, Aluminium-Iron, Magnesium Silicates as content and shall consist of thin flat flakes, containing innumerable microscopic voids and layers. It shall have physical properties like chemical inertness, light weight, fire and rot proofness, porosity, non-abrasive nature, flakiness etc.

72.3 It shall have sintering temperature and melting point about 2300°F and 2400°F, respectively. The specific

heat and specific gravity of minerals shall be 0.2 and 2.6, respectively. The mineral should possess pH value of 7.0 and cation exchange rate 90 to 100 milli equivalent per 100 grams. The thermal conductivity K shall be 0.43-0.45 Btu.

72.4 The mineral should be incombustible and capable to withstand temperature upto 1100°C to give effective insulation. It shall be insoluble and inert to organic solvents having cold crushing strength atleast 250 Psi. The air contraction at maximum service temperature shall be less than 1%.

M-73 Cement Concrete Hollow Blocks :

73.1 Hollow concrete blocks shall be of size such that they can be bonded with brick masonry, if necessary. The blocks are generally referred by their nominal sizes which include the block and an allowance for joints. The nominal sizes are
a) 39 x 30 x 19 cm.
b) 39 x 20 x 19 cm.
c) 39 x 10 x 19 cm.
The block shall have one or more large holes or cavities which either pass through the block or do not effectively pass through (in case of closed cavity) and shall have the total solid material between 50 to 75% of the total volume of the block, calculated from the overall dimensions. In case of solid blocks, the solid material shall not be less than 75% of the total volume of the block.

73.2 The shell thickness of the blocks shall be not less than 65 mm., in any part, however based on the strength requirements, the thickness can be varied between 20 mm. to 50 mm., as follows :

Nominal block face width.	Shell thickness minimum.	Web thickness minimum.
100 or less	25	25
Over 100 to 150	25	25
Over 150 to 200	30	25
Over 200	35	30

All the above dimensions are in mm.

73.3 The volume of concrete shall not be less than half the gross volume of the block. The total width of the cavities shall not be less than 2/3rd of the overall thickness of the block. The maximum variation in the length of the blocks shall not be more than $\pm$ 5 mm. and maximum variation in height and width shall not be more than $\pm$ 3 mm.

73.3 Hollow blocks are manufactured by special machines. Casting is done in a single operation. Concrete shall be thoroughly compacted in the moulds with blunt end steel rods or vibrators or by using vibrating tables. Ordinary concrete mix 1:2:4 of very low water/cement ratio is used and shall be mixed as described in the section no. 2.00 of plain and reinforced concrete. Additives or admixtures shall be used such as a) Accelerating, water-reducing and air-entraining admixtures, b) Water-proofing agents, etc. High compressive strength and very dry consistency enables to remove the blocks for curing, immediately after casting. In case of manual compaction, the mixture shall be placed into the mould, in layers of about 50 to 75 mm. and each layer is thoroughly tamped until the whole mould is filled up and struck off level with a trowel. In case of mechanical compaction, the mould shall be filled up to overflow, vibrated or mechanically tamped and struck off level. Steel wire may be embedded in each block while casting. Rapid hardening cement may be used. After demoulding, the blocks shall be protected untill they are sufficiently hardened to permit handling without damage. The blocks shall be thoroughly cured for atleast 14 days and shall be dried out for a period of 4 weeks, before placing. They shall be stacked with voids horizontal to facilitate thorough passage of air. The blocks shall be allowed to complete their initial shrinkage before placing. Water absorption shall not be more than 10% by mass.

73.4 Hollow blocks have better thermal properties than solid blocks. Further hollow blocks made from light weight concrete have still better insulation against heat. They shall conform to the following three grades:

Grade A - They shall be used as load bearing units and shall have a min. block density of 1500 Kg/m^3. They shall possess min. average compressive strength of 35, 45, 55 and 70 Kg/cm^2. respectively, for its sub-category, at 28 days.

Grade B - They shall be used as load bearing units and shall have block density less than 1500 Kg/m^3. but not less than 1000 Kg/m^3. They shall possess min. average compressive strength of 20, 30 and 50 Kg/cm^2. respectively, for its sub-category, at 28 days.

Grade C - They shall be used as non-load bearing units and shall have block density less than 1500 Kg/m^3. but not less than 1000 Kg/m^3. They shall possess min. average compressive strength of 15 Kg/cm^2. at 28 days.

Grade D - Solid Concrete Blocks - They shall be used as load bearing units and shall have block density not less than 1800 Kg/m^3. They shall possess min. average compressive strength of 40 and 50 Kg/cm^2. respectively, for its sub-category, at 28 days.

73.5 They shall have a variety of surface textures ranging from very fine close texture to a coarse open texture, by proper selection, grading and proportioning of the aggregates. Further the texture shall be developed by treating the surface while the units are still green. Colour shall be rendered by adding non-fading mineral pigments.

73.6 Well made units shall not require plaster, in case of unimportant buildings. Two or three coats of cement paint shall be sufficient to render the masonry resistant to rain water. However, if plaster is intended, the unit shall have a sufficiently rough surface to afford good key to the plaster. Water-proofing admixtures shall be used in the plaster.

M-74 Silicone paint :

74.1 It shall be of the best quality, like Hydroseal - Siliconate Epoxy or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

74.2 It shall be prepared by mixing Silicone and Epoxy. It shall be applied on dry as well as damp surfaces. It shall be non-toxic and odourless, so shall be suitable for drinking water structures also. It shall render the surface impervious to water and shall prevent water penetration. It itself shall penetrate into the structure and shall form a strong film on the pores of the structure surface, making the surface water-tight, non-toxic and erosion free.

74.3 It shall be water thinnable. Before use, the hardener of the Siliconate Epoxy shall be mixed with resin and thinned with water, in the proportions described by the manufacturer. It shall be applied with a suitable spray gun with a fine nozzle. An overlap of 25 to 30 cm. shall be preferred. It shall be semitransparent but on drying it shall become transparent.

M-75 Curved Corrugated Asbestos Cement Sheets :

75.1 It shall be of the best quality such as Everest or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS specifications.

75.2 It shall be available in nominal thickness of 6 mm. with an overall width of 1050 mm. and laid width of 876 mm. It shall be available in standard lengths of 2743 mm. and 3048 mm. It shall have a nominal radius of 2743 mm.

75.3 It shall provide an arch roofing system of which the semi-circular arch shall be the most stable. It shall provide a self-supporting roof construction and shall be used for wide varieties of structures for agricultural, industrial and domestic uses, garages and for temporary site offices and for storage of implements. It shall be easily erected without any need of expertise and as temporary sheds without any foundation requirements.

M-76 Red Mud Plastic (RMP) Sheet :

76.1 RMP sheet shall be of Regal, Elephant, Rita or equivalent, as approved by the Architect and Engineer-in-charge.

76.2 It shall not be hazardous to health. It shall have minimum thickness of 1.0 mm. and minimum tensile strength of 400 kg/cm^2. It shall have high impact strength and it shall not be easily breakable.

76.3 The roofing sheets shall withstand the effects of sun, wind, rain, snow, large temperature variations without any loss of smoothness and lustre. It shall be smoothly & attractively finished and opaque in nature. It should be extremely flexible, so as to be bent at any angle without cracking, stretching or becoming soft.

76.4 It shall be durable, free from any cracks and vermite & termite proof. It shall be very light in weight, @ 2.5 kg/m^2. It shall be easily handled and installed. It shall not break during cutting or drilling.

76.5 The roofing sheet shall have good thermal insulation and shall be resistant to heat, acid and alkali. It shall be of uniform colour, as approved by the Architect.

M-77 Polyethylene Sheets :

77.1 Polyethylene sheet shall be from Profeel, Ramplast or equivalent, as approved by the Architect and Engineer-in-charge.

77.2 It shall be produced by using a continuous, smooth chemical process, at constant pressure and temperature. The Polyethylene sheets should be light weight, soft, smooth and flexible, which can be easily handled and laid. It shall be 100% water proof, acid proof, alkali proof, fire resistant and fully opaque.

77.3 It shall be resistant to fungus, moth, toxic gases and agents having affinity to water. It shall have excellent bonding strength and thermal conductivity shall be 0.023 kcal/m hr^{O}C. It shall conform to IS : 5913 and IS : 3792, wherever applicable. It shall prevent corrosion, chemical action, leakage, seepage, pollution.

M-78 Aluminium Corrugated Building Sheets :

78.1 It shall be of the best quality and from reputed manufacturer like Indal or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS : 1254, in all respects. The aluminium alloys used in the manufacture of the sheets shall conform to IS : 737.

78.2 The sheets shall be light in weight, having a density of about 2.70 gms/cm^3. Due to the formation of a thin transparent hard film of inert aluminium oxide, on the surface of the sheet, it shall possess high corrosion resistance. The sheets shall be non-fragile and shall be exceptionally durable. As aluminium reflects a high proportion of the radiant heat, the sheets provide excellent insulation when used for cladding/roofing. The sheets shall be non-combustible, non-flammable and non-sparking. As aluminium is elastic, the sheets shall offer high resistance to denting and shall be shatter-proof. Co-efficient of linear expansion of aluminium is 0.000024 per ^{o}C and therefore the lateral expansion of the sheets shall be readily accommodated in the corrugations. The sheets shall offer no health hazard and shall be totally hygienic.

78.3 It shall be available in trapezoidal and rounded corrugations and shall be extensively used for various Industrial buildings, Warehouses, Aircraft hangers, Power plants, Storage sheds, Bunk houses etc. It shall be innovatively used as interior partitions, wall panels, flase ceiling etc.

M-79 Fibreglass Translucent Roofing :

79.1 It shall be of the best quality such as Glass poll or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to BSS : 4154.

79.2 It shall be a combination of glass fibre mat and polyester resin, suitably modified to resist ultraviolet

degradation. It shall disperse light rays, allowing uniform diffused light penetration. It shall absorb the heat rays and so helps to save electricity. It shall be available in (1) Clear grade - where light transmission shall be 87% to 90%. and (2) Natural white/green/blue/yellow/red - where light transmission shall be 60% to 70%. It shall be available in lengths of 1.5 m. to 3 m. The width shall be equivalent to that of asbestos/galvanised and aluminium corrugated sheets. It shall have a thickness of 1.2 mm., with a tolerance of $\pm$ 0.2 mm.

79.3 It shall have a coefficient of linear expansion of .000012 per ^{o}C. Its heat distortation temperature shall be approximately 75□C. It shall have thermal conductivity of 0.22 Kcal/mh^{O}C. It shall have an impact strength of 14.5 Ft, hardness of 40 - 50 Barcol and Brinell 26. It shall have a tensile strength of 600 - 800 Kg/cm$^{2.}$ and compressive strength of 1200 - 1400 Kg/cm^{2}. On soaking for 24 hrs., at 25°C, its water absorption shall be 0.24%. It shall have effective resistance to most chemicals except strong acids.

79.4 It shall be suitably used for industrial and residential roof coverings, where light transmission is desired. It shall also be used to cover swimming pools, gardens and terraces, if desired. It shall be normally self cleaning type but when used in industrial areas, it shall be cleaned with water and soap.

M-80 Poly-carbonate Sheet :

80.1 Polycarbonate sheets for versatile glazing shall of the best quality such as Lexan or equivalent, as approved by the Architect and Engineer-in-charge. It shall meet all the requirements of BS : 6262. For impact performance, it shall meet the BS : 6206 requirements and for anti-bandit requirements, it shall conform to BS : 5544.

80.2 It shall be as transparent as glass, but shall have half its weight. It shall be tough and yet flexible. It shall have strong impact strength and shall offer thermal and sound insulation. It shall resist the effects of weather, shall be unbreakable and shall provide protection against forced intrusion. It shall be used for roof glazing, door and window glazing as well as privacy glazing, on many different types of buildings. As light weight, it shall be feasible to use it on wider spans. It promotes natural light and shall impart an impression of spaciousness.

80.3 It shall have tensile strength greater than 70 N/mm^{2}. Its flexural modulus shall be 2500 N/mm$^{2.}$ and flexural yield strength shall be 100 N/mm^{2}. It shall have an impact strength (falling dart) greater than 200 Nm. It shall have an indentation hardness - H358 10 of 98 N/mm^{2}. and H358 60 of 93 N/mm^{2}. Its coefficient of linear expansion shall be 0.00067 per ^{o}C and thermal conductivity shall be 0.21 W/m.K. It shall have a specific gravity of 1.2 gm/cc. and water absorption @ 24 hrs. 23°C shall be 10 mg. Its elongation at break shall be greater than 100%. It shall have a higher coefficient of thermal expansion. It shall allow light transmission of between 82% and 90%, depending on the thickness of the sheet. It shall not transmit UV radiation upto 385 Nm. It shall resist the effect of chemicals. It shall have self-extinguishing, low flame spread characteristics and low fire propagation indices.

M-81 Bullet Resistant Laminate :

81.1 It shall be of the best quality such as Lexgard or equivalent, as approved by the Architect and Engineer-in-charge.

81.2 It shall be polycarbonate sheet, laminated together using a patented general electric interlayer film with a mar-resistant finish. It shall be bullet-resistant, shall not spall, splinter or crack and shall have a long lasting glazing for surface appearance. It shall be 60% less in weight compared to bullet-proof glass. It shall have a K-value of 3.06 W/m^{2} K for thermal insulation and allow light transmission of 63%, when 33 mm. thick.

81.3 It shall be suitably used in Banks, Police stations, Cash counter etc., wherever there is a risk of deliberate attack.

M-82 Polyester Films :

82.1 It shall of the best quality such as Sun Control Garware or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS specifications.

82.1 It shall reject about 75% of the total solar energy. It shall reduce 97% of the harmful UV radiation. It shall eliminate 80% of the sun glare. It shall make the glass surface shatter resistant when bonded on to glass. It shall be free from all fire hazards. It shall be available in various reflective shades.

M-83 High Molecular Plastic Film :

83.1 The film shall be from Om Agro Industrial Plastics Pvt. Ltd. or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS Code.

83.2 It shall be fully impervious to provide a complete water barrier system. The tensile strength of the film shall not be less than 450 kg/cm^2. The tear resistance of the film shall not be less than 3200 g/100/micron having 650% ultimate elongation. The impact tensile strength and temperature resistance shall not be less than 2000 kg/cm^2. and 90°C respectively.

83.3 The film shall be flexible having uniform thickness as specified in the respective item. It shall have long life in buried condition. Saline or mineral water and alkali content in soil or cement or most of the chemicals shall have no effect on the film. The film shall discourage weed growth under the lining.

M-84 Gypboard :

84.1 It shall be of the best quality from India Gypsum or equivalent, as approved by the Architect and Engineer-in-charge.

84.2 It shall be formed by enclosing and bonding together a core of set gypsum plaster by two sheets of heavy paper. It shall offer high standard of safety, thermal efficiency and aesthetics. It shall be light in weight, shall offer good fire resistance and shall render faster construction. It shall be suitably used in areas subjected to continuously damp or wet conditions, except bathrooms, where gypboard partitions shall be properly protected by tiles or other impervious materials. It shall be a non-resonant material, rendering sound insulation. It shall be strong, durable and dimensionally stable. It shall offer a smooth surface which can be painted, tiled or wall papered. It shall block the passage of heat and shall retard the spread of fire. It shall hide upto 60 db of sound, when erected in the proper manner.

M-85 Ceiling Tiles :

85.1 It shall be of the best quality, such as Gypboard, Sitatex or equivalent, as approved by the Architect and Engineer-in-charge. It shall adequately follow the IS : 3129.

85.2 They shall be made either from gypboard or from sugarcane fibres, as specified in the item.

85.3 They shall be resistant to fire, termites, fungus, woodboring, insects and other wood deteriorators. They shall be resistant to delamination due to moisture and cyclic changes in weather and humidity. They shall have high structural strength, good thermal insulation properties, thermal conductivity at mean temperature shall be 4.2 K.cal/cm./m^2./hr./^{O}C and good fire retardant properties. It shall have a density of 288 Kg/m^3. $\pm$ 10% and shall weigh 3.71 Kg/m^2. Whenever, P.F resin shall be used in bonding, good weather and boiling-water proof properties shall be rendered under ISS and BSS specifications. They shall favourably absorb sound, rendering good acoustic properties.

85.4 They shall be available in ready-to-fix, ready-cut standard sizes of 610 mm. x 610 mm. x 12 mm., in various design and plain tiles shall be available in sizes, 2440 mm. x 1220 mm. x 12 mm., 1220 mm. x 1220 mm. x 12 mm., 1220 mm. x 610 mm. x 12 mm. and 610 mm. x 610 mm. x 12 mm. They shall be suitably used in residences, public places, bank buildings, studios, showrooms, computer centres, telecommunication buildings etc.

M-86 Permagard :

86.1 Permagard shall be from India Foils Ltd. or equivalent, as approved by the Architect and Engineer-in-charge.

86.2 It shall be made by laminating aluminium foil/strip with polyethylene film on both sides. It shall be a continuous sheet of metal having overlapped and sealed edges, which shall be sealed using a heat sealer or hot molten bitumen. It shall resist the action of water, moisture, salts, chemicals, oxidation and corrosion. It shall be 100% water proof.

86.3 No joints shall be allowed in sheets brought to site. However, the joints required at site shall be sealed using either hot molten bitumen or Teflon coated heat sealer, making an air tight bond, which is totally impervious to water and moisture. The thickness of permagard shall be 0.26 mm. $\pm$ 0.03 mm. The weight shall not be less than 0.54 kg/m^2. It shall have excellent abrasion power.

M-87 Thermolay :

87.1 It shall be from STP Ltd. or equivalent, as approved by the Architect and Engineer-in-charge.

87.2 It shall comprise of modified bitumen impregnated reinforcement fabric, sandwiched between coats of polymer modified bitumen, with the underside covered with thermofusible polythylene film and the topside finished with coarse sand. It shall be available in continuous roll, length 10 m. and width 1 m. The thickness of the membrane shall be 4 mm.

87.3 It shall have a tensile strength of 150 Kg. min. (longitudinal) and 100 Kg. min. (traverse). It shall have good heat resistance and flexibility. It shall be able to take up thermal and structural stresses, without fatigue. It shall offer high resistance to puncture and indentation load. Net weight per roll shall be 50 Kg. It shall act as a water-tight and vapour barrier system, when laid.

M-88 Sliding Door Tracks/Channel :

88.1 It shall be from Agend, Coburn System or equivalent, as approved by the Architect and Engineer-in-charge.

88.2 It shall be made with highest quality precision engineering to give the ultimate in smooth, frictionless action and to move the doors silently, at the touch of a finger. It shall carry a load upto 100 lbs., to ensure life time trouble free operation from all components. It shall be in three classifications :
Straight sliding :
When a clear wall space equivalent to the area of one leaf should be available to the right of the opening either inside or outside the opening.

Sliding and Folding, end hung :
Where clearance is restricted, such arrangement is recommended. It shall provide maximum possible free space when folded to the open position.

Sliding and Folding, center hung :
It shall be provided where there is restriction of space. It shall provide smooth running action and unobtrusiveness of fittings. It shall enable the leaves to fit closely between the jambs of the opening.

88.3 All these sliding gears are top hanging with bottom guides. All movements shall be on ball bearing so that friction is reduced to minimum.

Track : It shall be made from sturdy steel with protective zinc coating. The shape of the track shall ensure true, smooth running and prevents door from jumping off. It shall be adjusted horizontally to compensate for minor irregularities in floor level.

Roller Hangers : It shall be made from 16 gauge zinc plated steel, housing containing tough Nylon rollers with exclusive differential movement. No lubrication shall be required. The hanger platter fitted to the top of the doors shall have lateral adjustment feature, to compensate for minor irregularities in surface by positioning the door at slightly varying distances from wall.

End Stops : It shall be made from sturdy zinc plated steel angle, shaped to ensure positive stopping action and prevent door in conjunction with rubber buffers or hangers.

Floor guide : It shall be manufactured from tough nylon, shaped, to allow smooth movement of grooved doors or non-grooved doors.

M-89 Sand Stone Grills/Baluster :

89.1 It shall be from Dilpasand Shilp or equivalent, as approved by the Architect and Engineer-in-charge.

89.2 It shall be made from best quality Bansipahadpur/Sandstone, having uniform colour (no other colour spot shall be allowed) and texture. The sand stone shall be even, sound, durable and free from any veins, cracks and flaws. The thickness of the stone used shall be as specified in item of work, with the permissible tolerance of 2 mm.

89.3 The grills/Baluster shall be produced by fine chiselling. All edges, faces and angles of fine hand chiselled grills, columns, baluster shall be machine polished, as specified in item.

M-90 Anti-Corrosive Paints :

M-90A Ferroshield :

90A.1 It shall be from STP Limited or equivalent, as approved by the Architect and Engineer-in-charge.

90A.2 It shall be a high build bituminous emulsion, specially formulated for protection against corrosion. It shall form a dry film, 2 mm. thick, which shall not crack at low temperatures nor crocodile at very high temperatures. It shall also be used as waterproofing material on flat, sloped and steeped roofs. It shall be applied by brush and by heavy duty airless spraying.

M-90B Tankmastic :

90B.1 It shall be from STP Limited or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS : 158-1982 and IS : 9862.

90.2.2 It shall be special bituminous paint, which shall have no harmful reaction on drinking water. It shall be used to protect the inside of water tanks and pipe connections, against corrosion. It shall be applicable on steel, wood, concrete, iron etc. It shall have a covering capacity of 12 m^2/lit..

M-90C Pipekote :

90C.1 It shall be from STP Limited or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS : 158.

90C.2 It shall be a heavy duty bituminous paint, which shall not impart any odour or taste to water, carried in the steel water pipelines, tanks and pen-stocks. It shall be applied on the inside surface of the water pipeline, tanks and pen-stocks. It shall be resistant to mild acids, alkalis and shall withstand heat upto $150^{O}C$. It shall render a heavy body protective film. If zinc-rich, epoxy primer shall be used, better results of pipekote shall be obtained.

M-90D Silvershield :

90D.1 It shall be from STP Limited or equivalent, as approved by the Architect and Engineer-in-charge.

90D.2 It shall be a bituminous aluminium-finish paint formulated for application over anti-corrosive paints. It shall have a covering capacity of 10 m^2/lit..

M-90E Shalimastic HD :

90E.1 It shall be from STP Limited or equivalent, as approved by the Architect and Engineer-in-charge. It shall comply with the US Dept. of interior bureau of reclamation specification CA-50.

90E.2 It shall be a viscous, heavy-duty, anti-corrosive waterproof coal tar paint. It shall offer resistance to acids and alkalis. It shall be used for protection of all types of iron and steel structures.

M-91 Powder Paints :

91.1 Powder paints shall of superior quality such as Hawcoplast of Hardcastle & Waud Mfg. Co. Ltd. or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS specifications.

91.2 It shall be available in the following types :
Epoxy :
It shall be tough and resistant to chemicals. However, it shall have poor exterior durability.
Epoxy polyester :
It shall provide a decorative finish and shall have better overbake resistance.
Polyester - TGIC :
It shall provide exterior durability but it shall form a slightly thicker film.
Polyurethane :
It shall provide exterior durability and shall form a thin film coating.

M-92 MDF (Medium Density Fibre) Wood :

92.1 The MDF wood shall be from Nuwud or equivalent, as approved by the Architect and Engineer-in-charge and shall conform to IS : 12406.

92.2 MDF wood shall be manufactured from wood fibres and synthetic resin binder to produce homogenous sheet material, having minimum density about 600 to 900 kg/m^3. It shall have moisture content less than 8% and water absorption less than 12% at 24 hours soaking. It shall have modulus of rupture and tensile strength atleast 50 N/mm$^{2.}$ and 0.8 N/mm$^{2.}$, respectively.

92.3 The screw withdrawal strength shall be minimum 3000 N. for face and 1800 N. for edge. It should be highly resistant against termite, insects and it should possess good heat and sound insulation. It should be easily workable for moulding, carpentry, routing etc. It should be free from any cracks, wraps, splits etc. and should possess uniform strength in all direction.

M-93 Polyurethene Foam Insulation :

93.1 Polyurethane foam shall be from SDC, FGP, Excilite, VCM or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Code.

93.2 It shall have high strength to weight ratio alongwith excellent thermal insulation and acoustic absorption. It shall be based on the exothermic, catalytic reaction of polyisocynates with polyol molecules containing hydroxyl groups in the presence of blowing agent. It shall be perfectly homogenous and having uniform characteristics like perfect adhesion to metal surfaces, higher insulation capacity, maximum resistance and lightness. It shall be perfect non-hygroscopic, completely water proof having dimensional stability, optimum thermal insulation, fire retardancy.

93.3 It shall be of low foam density, not more than 40 Kg/m^3. The thermal conductivity shall be 0.02 Kcal/m hr□C. The compressive strength shall not be less than 2.5 Kg/cm$^{2.}$ and 1.2 Kg/cm$^{2.}$, in direction parallel to rise and perpendicular to rise respectively. The close cell content of the foam shall be 90 to 95% and it shall be workable within the temperature range of -150°C to +80°C. The water vapour permeability shall be 2.0 perms/in.

M-94 Fiberglas Reinforced Plastics (FRP):

94.1 Fiberglas Reinforced Plastic shall be from CEAT or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS Code.

94.2 It shall be either unidirectional reinforced or sheet moulded or filament wound epoxy to match the purpose of work and item of tender. It shall have versatile chemical inertness, electrical resistance and mechanical strength, ease of processibility, repeatability and predictability. It shall have desirable characteristics like

light weight, high strength, stiffness, toughness, thermal insulation properties, superior weather resistance, complete elasticity, fatigue, creep, resistance to corrosion, rot, swelling, insects, fungus etc.

94.4 There shall be no yield point beyond which buckling or denting of the FRP occurs, to reduce the possibility of irritating damages for minor stresses or impacts. The density, flexural strength and flexural modules shall not be less than 1.5 mg/m^3., 1000 MPa and $40x10^3$ MPa, respectively. It shall have minimum tensile strength, tensile modulus and compressive strength of 1000 MPa, $40x10^3$ MPa and 250 MPa, respectively. The FRP shall have thermal conductivity about 0.2 w/m^{O}C. Thermal coefficient of expansion shall be less than $10x10^{-6}$ per ^{O}K.

94.5 The minimum glass content shall be 60%. The weight index for stiffness and tensile strength at yield shall not be less than 0.6 and 0.9 respectively. No damage should be there while testing at impact energy of 8 joules. The level of translucency should be greater than 80% of diffused transmission that of direct light. It shall provide superior aesthetic value with incorporated colour. It shall be good fire retardant, durable and impermeable to water.

M-29A (Amendment in material specification M-29 as per building specification)

Teak wood

29A.1 The teak shall be first quality as per **M29.5.** equivalent to best quality Ghana teak.

29A.2 All teak shall be used only after KILN seasoning.

29A.3 The teak wood shall be applied with linseed oil without any colour pigment or powder.

29A.4 Use of white teak wood shall not be permitted in any case.

29A.5 The colour of the teak wood shall be uniform as far as possible with no white grains.

M 35(A) Stainless steel wire mesh

35A.1 Stainless steel wire mesh shall be for general purpose mosquito net gauge 26x14 mesh of Stainless Steel.

M-37A Water Proof (Weather Proof) Plywood :

37A.1 The plywood shall be from Kitply, Anchor Gold or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS : 710-1976 and to the relevant Defence and Navy specifications.

37A.2 Plywood shall be made from veneers of hard wood timbers and bonded with high quality BWP type Phenol Formaldehyde Synthetic Resin Adhesive and hot pressed at high temperature and pressure, and further treated with a fixed type of preservative by vacuum-cum-pressure impregnation, to produce thin boards or sheets of wood panels. There are always an odd number of layers. The plies shall be placed, so that, grain of each layer is at right angles to the grain in the adjacent layer.

37A.3 Plywood shall be waterproof, weather proof, boilproof, highly durable even against strenuous vulnerable uses. It shall resist the attack of termites, cockroaches, wood burrowers, fungus, mould, rot, decay and other wood destroying insects and marine organisms.

37A.4 The tensile strength of the plywood shall be minimum 600 kg/$cm^{2.}$ and bending strength above 400 kg/cm^2. The swelling of plywood in water should be almost negligible. Specific gravity of plywood should be 0.7 to 0.75, having screw and nail holding strength normal to face, atleast 250 kg. and 60 kg., respectively.

37A.5 The moisture content shall be less than 10% and the plywood shall have high fire resistance and shall be free from any cracks, wraps, split etc., and shall have uniform strength all over the panel surface. It shall be used for marine structures, leather tanning tables, wall panelling, underlayment for kitchen and other furniture, subjected to heat and moisture.

M 45(A) Linseed oil

45A.1 The linseed oil shall be double boiled CAT brand only.

45A.2 No color pigment or powder shall be added.

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Item Specifications
for
Civil Works

BLANK

2.01 Providing and laying in position machine batched, machine mixed plain cement concrete (PCC) of specified grade including all leads and lift/depth, compaction, vibration, curing, transporting and pumping wherever necessary including the cost of form work (if required) and removal of formwork etc. complete as directed by the Engineer.

a) PCC 1:2:4 (1 cement : 2 coarse river sand : 4 stone aggregates using 40 / 20mm nominal size graded hard granite / black trap stone aggregate obtained from quarry)
b) PCC 1:3:6 (1 cement : 3 coarse river sand : 6 stone aggregates using 40 / 20mm nominal size graded hard granite / black trap stone aggregate obtained from quarry)
c) PCC 1:4:8 (1 cement : 4 coarse river sand : 8 stone aggregates using 40 / 20mm nominal size graded hard granite / black trap stone aggregate obtained from quarry)
d) PCC 1:5:10 ((1 cement : 5 coarse river sand : 10 stone aggregates using 40 / 20mm nominal size graded hard granite / black trap stone aggregate obtained from quarry)

1.0 **Materials:** Water shall conform to M-1. Sand to M-6. Cement to M-3. Black trap stone aggregate 40/ 20mm mm. Maximum nominal size to M-12. Nominal mix design shall be done as per M3F

2.0 **Workmanship :**

2.1 **General**: Before commencing the concreting, the depth and width of the excavated foundation shall be checked as per the drawing. The bed of foundation trenches shall be cleared off of all loose materials, levelled, watered and rammed, as directed.

2.2 The concrete mix is not required to be designed by preliminary tests and only nominal mix as per IS: 456-2000 shall be followed. The proportion of the concrete mix shall be 1:2:4 (1 cement: 2 coarse sand: 4 graded Black trap stone aggregate 20 mm. nominal size) by volume. **All Concrete work shall have fair finished concrete surface unless otherwise specified. Mix design shall be carried out for environmental exposure condition as given in IS 456:2000 page 18 table 3.**

2.3 **The nominal mix concrete shall only be used for concrete grade M20 and lower.**

2.4 The ingredients required for ordinary concrete containing one bag of cement of 50 Kg. by weight (0.0347 m^3.) for different proportions of mix shall be as under : (as per IS 456:2000 Table 9 pg 23)

Grade of Concrete	Total Qty of Dry aggregate by mass per 50 kg of cement to be taken as the sum of individual mass of fine and Coarse aggregate, (Maximum) in kg	Proportion of fine aggregate to coarse aggregate	Qty of water per 50 kg of Cement, (Maximum) liters
M 10 (1:3:6)	480	Generally 1:2 for FA to CA by volume but subject to upper limit of 1:1.5 and lower limit 1:2.5	34
M 15 (1:2:4)	330		32
M 20 (1:1.5:3)	250		30

2.5 The proportion of the fine to coarse aggregates shall be adjusted from upper limit to lower limit progressively as the grading of fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger. Graded coarse aggregate shall be used. For an average grading of fine aggregate (Zone II of table 4 of IS 383), the proportions shall be 1:1.5, 1:2 and 1:2.5 for the maximum size of aggregates 10mm, 20mm and 40mm respectively.

2.6 The water cement ratios shall not be more than those specified in the above table. The cement of the mix specified in the table shall be proportionately increased, if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction so that the water cement ratio specified in the table is not exceeded.

2.7 The workability of the concrete shall be controlled by maintaining a water-cement ratio that is bound to give a concrete mix which is just sufficiently wet to be placed and compacted without difficulty, with the means available.

2.8 The maximum size of coarse aggregate shall be as large as possible within the limits specified but in no case greater than 1/4th 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.

2.9 For reinforced concrete work, coarse aggregates having maximum nominal size of 20 mm. are generally considered

satisfactory.

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

2.11 Coarse and fine aggregate shall be batched separately. All in aggregate may be use if specified by Engineer-in-charge.

2.12 Admixture (chloride free) may be used in concrete only with approval of the Architect and Engineer-in-charge based upon the evidence that with the 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 admixtures.

2.13 The cost of the formwork shall be included or excluded as per the item description.

2.14 For hot and cold weather precautions to be taken are as follow:

1. Temperature of coarse aggregate shall be maintained as per IS specifications by use of Ice Flakes for mass concrete. In hot weather, ice flakes shall be added in the concrete or aggregate shall be kept cool by sprinkling water. Necessary corrections shall be performed in the mix design of the concrete.
2. Coarse aggregate shall be stored under shed in case of hot weather temperature.
3. Avoid concreting in the noontime in case of hot weather and during night time in case of Cold weather.
4. In hot weather, the formwork shall be sprinkled with water before commencing the concrete work.

3.0 Workmanship :

3.1 **Proportioning :** Proportioning shall be done by volume, except cement which shall be measured in terms of bags of 50 Kg. weight. The volume of one such bag being taken as 0.0347 m^3. Boxes of suitable sizes shall be used for measuring sand and aggregate. The size of the boxes (internal) shall be 30 cm. x 30 cm. and 38 cm. deep or as per the convenience of the contractor. The Internal volume of the box shall be taken as 0.0347 m^3. While measuring the aggregate and sand, the box 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 bulkage 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 maintained throughout the construction. The mixer shall comply with IS 1791 and IS 12119. 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 about half a minute of dry mixing, measured quantity of water required 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 colour 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 the 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 Architect and Engineer-in-charge for small jobs or for certain other reasons, it shall be done on a smooth watertight platform large enough to allow efficient turning over the ingredients of concrete before and after adding water. Mixing platforms shall be so arranged that no foreign material gets mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Specified quantity of 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 % above that specified.

3.2.3 Mixers, which have been out of use for more than 30 minutes, shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to by the Architect and Engineer-in-charge, the first batch of concrete from the mixture shall contain only 2/3rds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

3.3 **Consistency :** The degree of consistency which shall depend upon the nature of the work and methods of vibration of concrete, shall be determined by regular slump tests in accordance with IS : 1199-1959. The slump of 10 mm. to 25 mm. shall be maintained for workability. The concrete shall be compacted with vibrator -needle or surface type depending on the nature of application.

3.4 **Inspection :**

3.4.1 Contractor shall give the Architect and 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 forms shall be thoroughly cleaned. Contractor shall proper access with railing for inspection of work.

3.4.2 Centering design and its erection shall be got approved from the Architect and Engineer-in-charge. One carpenter with helper shall invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited after reinforcement is 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/ PVC cover of suitable size and thickness as per the drawing shall be tied to the reinforcement. Timber, kapachi or stone pieces shall not be used for this purpose. For exposed concrete members PVC blocks of grey color shall only be used.

3.4.3 All formwork shall be cleaned and made free from standing 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 Architect and Engineer-in-charge has been obtained.

3.4.4 **Formwork for Exposed concrete surface (If indicated):**

3.4.4.1 All vertical members for formwork shall be of steel like acroprops, H frame etc. Care shall be taken to set all formwork in perfect line, level (or in required camber or slope as specified) and plumb. Formwork propping shall be strong, rigid and sturdy. The formwork shall be as per pattern & design shown in drawings. Formwork shall be done accurately and precisely so as to achieve neat, clean and smooth concrete surface, in line, level and plumb. Clinks, twists, offsets, warps, riveting etc. in plates or forms shall not be allowed. Before placing concrete, forms shall be thoroughly cleaned off of all rust, dust and loose materials. Mould release agent of approved make or as per the Architect / Engineer incharge shall be applied on sheathing before placing the reinforcement steel. Also the formwork material will be of laminated plywood/best quality steel sheathing or any sort of such material, as approved by the Architect, so that all exposed concrete surfaces have uniform colour and texture. After deshuttering, all concrete surfaces shall be properly rendered with sand paper or emery stone. The sample of the exposed concrete shall be got approved by the architect or engineer inchagre

For walls and columns, the sheathering plates shall be bolted with special nuts and bolts- spring coils and PVC cone spacer. No through bolts shall be allowed.

3.4.4.2 For all kind of exposed concrete work only one brand (to be approved by the Architect or Engineer-in-charge) of cement shall be used.

For exposed concrete element specified in the drawing, steel shuttering made out of CR MS sheet not less than 2mm thickness (14 guage) or laminated plywood with steel supporting frame work shall be used.

For other concrete shuttering material shall be as follows:

- Columns: Moulds from marine ply with wooden battens or steel plates
- Straight walls / Curved wall in plan: Marine plywood with wooden battens / Acro make or equivalent make steel plates and soldiers.
- Beam: steel plates and marine ply with battens

3.5 **Transportation, laying and compaction:**

3.5.1 The method of transporting and placing concrete shall be as approved by Engineer-incharge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place.

3.5.2 Concreting shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete, which has been in position for more than 30 minutes, unless a proper construction 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 Architect and Engineer in-charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 m. when internal vibrators are used and not exceeding 0.3 m. in all other cases.

3.5.3 Unless otherwise agreed to by the Architect and Engineer-in-charge, concrete shall not be dropped into place from a height exceeding 2 m. when trunking or chutes are used they shall be kept closed and used in such a way so as to avoid segregation. When concreting has to be resumed on a surface, which has hardened, it shall be roughened, swept clean, thoroughly wetted and covered with a 13-mm. thick 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 laitance shall be removed by scrubbing the wet surface with wire or

bristle brushes, care being taken to avoid dislodgment of any particles or coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to 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 needle or surface vibrators/ iron ranmmer, unless otherwise, permitted by the Architect and Engineer-in-charge for exceptional case, such as concreting under water, where vibrators cannot be used. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of breakdowns.

3.5.5 Concrete shall be judged to be compacted when the mortar fills the spaces between the coarse aggregate and begins to cream upto form an even surface. Compaction shall be completed before the initial setting starts i.e. within 30 minutes of addition of water to dry mixture. During compaction, it shall be observed that needle vibrators are not applied on reinforcement, as it tends to destroy the bond between concrete and reinforcement.

3.6 **Curing :** Immediately after placing and compaction, concrete shall be protected from weather, including rain, running water, shocks, vibration, traffic, rapid temperature changes, frost and drying out process. After 24 hours it shall be covered with wet sacking basin 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 The contractor shall set up a site laboratory to carry out various tests as specified. The laboratory shall include equipments like cube testing machine, slump cone, cube moulds for concrete and mortar, mechanical balance, sieve set, flakiness testing apparatus, core cutter etc.

3.7.2 Samples from fresh concrete shall be taken as per IS : 1199 and cubes shall be made, cured and tested at 7 days or 28 days as per requirements in accordance with IS : 516. 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 of concrete for testing at 28 day
1-5 $m^{3.}$	1
6-15 $m^{3.}$	2
16-30 m^3.	3
31-50 m^3.	4
51 and above	4 + one additional for each additional 50 m^3or part thereof.

NOTE : Atleast 1 sample shall be taken from each shift. Three test specimens shall be made for each sample for testing at 28 days. Additional samples must be taken to determine strength at 7 or 3 days or at the time of striking the formwork, or to determine the duration of curing, or to check the testing error. The samples of concrete shall be taken on each day of the concreting as per above frequency. The number of specimens may be suitably increased as deemed necessary by the Architect and Engineer-in-charge when procedure of tests given above reveals a poor quality of concrete and in other special cases.

3.7.2 The test results of the sample shall be average of the strength of 3 specimens. The individual variation shall not be 15% of the average strength of the sample. The compressive mean strength for the group of 4 non-overlapping consecutive test results shall be as per col. 2 table 11 of IS 456:2000 and individual test results shall be as per col. 3 of table 11 of IS 456:2000.

3.8 **Stripping :**

3.8.1 The Architect and Engineer-in-charge shall be informed in advance by the Contractor of his intention to strike the formwork. While fixing the time for removal of formwork, due consideration shall be given to local conditions, character of the structure, the weather and other condition that influence the setting of concrete and of the materials used in the mix. In normal circumstances (generally where temperature are above 20°C) and where ordinary concrete is used, forms may be struck after expiry of periods specified in IS 456:2000 11.3.1 page 25 for respective item of formwork.

3.8.2 All formwork shall be removed without causing any shock or vibration as would damage the concrete. Before the soffit and

struts are removed, the concrete surface shall be gradually exposed, where necessary in order to ascertain that the concrete has sufficiently hardened. Centering shall be gradually and uniformly lowered in such manner as to permit the concrete to take stress due to its own weight uniformly and gradually. Where internal metal ties are permitted, they 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 25 mm covers to the finished concrete surface. Where it is intended to re-use the formwork, it shall be cleaned and made good to the satisfaction of the Architect and Engineer in-charge. After removal of formwork and shuttering the Engineer-in-charge shall inspect the work and satisfy by random checks that concrete produced is of good quality.

3.8.3 The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full load of the slab, beam or arch as the case may be together with any live load likely to occur during curing or further construction.

3.8.4 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 atleast 25 mm. below the surface of the concrete and the resulting holes be filled by cement mortar. All fine mortar lines caused by form joints, all cavities produced by the removal of form ties 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 sand. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces, which are pointed, shall be kept moist for a period of 24 hours. For repairing concrete members, suitable bonding agent shall be used as directed by the consultant.

3.8.4 If rock pockets/honeycombs in the opinion of Architect and Engineer-in-charge are of such an extent or character so as to effect the 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 portion of the structure affected with no extra cost.

3.9 Incase contractor intends to use Ready Mix Concrete (RMC), contractor shall submit specifications for RMC and obtain prior approval from the engineer-incharge.

4.0 Mode of Measurements and Payment :

4.1 The consolidated cubical contents of concrete work as specified in item shall be measured. The concrete laid in excess of section shown on drawing or as directed shall not be measured. No deduction shall be made for: (as per SP 27)

a. Ends of dissimilar materials such as joists, beams, posts, girders, rafters, purline trusses, corbels and steps etc. upto 500 $cm^{2.}$ in section.
b. Architectural openings upto 0.1 m^2.
c. No extra labour should be paid for forming such openings, voids or pockets of any shape.

4.2 The rate includes cost of all materials, labour, 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, for all floors, all shapes at any height and level, and in any position.

4.3 The rate shall be for a unit of one m^3.

4.4 The cost of the formwork shall be included or excluded as per the item description.

2.02 Providing and laying BBCC and curing complete, in foundation and plinth. (for all civil, plumbing and electrical works).

a) **1:3:6 (1 cement: 3 coarse sand : 6 graded brick bats 40 mm -maximum nominal size.)**
b) **1:4:8 (1cement: 4 coarse sand: 8 graded brick bats 40mm-maximum nominal size)**

1.0 Materials : The specifications of item no. 2.01 shall be followed except that the brick bats shall be used as coarse aggregates instead of stone aggregates. Brick bats aggregate shall conform to M-14.

2.0 Workmanship : The relevant specification of item no. 2.01 shall be followed except that the brick bat shall be used as coarse aggregate instead of graded stone aggregate. The concrete shall be compacted with iron rammer.

3.0 Mode of Measurements and Payment :

3.1 The relevant specification of item no. 2.01 shall be followed for mode of measurements and payment.
3.2 The rate shall be for a unit of one m^3.

2.03 Providing, laying and curing etc. grade slab 100mm thick with nominal reinforcement in plinth or plinth protection

excluding formwork and excluding reinforcement with 1:2:4 (M-15) Cement Concrete -(1 cement : 2 coarse sand : 4 graded Black trap stone aggregate 20 mm. nominal size) (for all civil, plumbing and electrical works)

The relevant specifications of item no. 2.01 shall be followed except that the concrete work shall be for grade slab. The rate includes the cost of formwork and excludes cost of reinforcement. The rate shall be inclusive of providing broom/ wire finish surface if required. The rate shall be for a unit of one m2.

2.04 Providing and laying Reinforced Cement Concrete and curing etc. complete, for reinforced concrete work, for all floors, at all heights, in any position, for all structures- slabs, beams, columns, coping, walls, sloping roofs, arches, lintels, sills, stair case, pile caps etc of any shape and size. (for all civil, plumbing and electrical works)

1:1.5:3 (1 cement : 1.5 coarse and : 3 graded Black trap stone aggregate 20 mm. Maximum nominal size)

a) Excluding the cost of formwork and reinforcement
b) Including cost of formwork and excluding cost of reinforcement

1.0 Materials & Workmanship :

1.1 The relevant specification of item no. 2.01 shall be followed except that the work shall be carried out for reinforced concrete work and grade of concrete shall be as specified in the item.
All concrete work shall have fair finished concrete surface unless otherwise specified in the drawing.

In addition, the following stipulations shall be followed for:

The bars shall be kept in position by the following methods :
(I) In case of beam, slab, wall and column, sufficient number of PVC block or precast cover block in cement mortar 1:2 (1 cement : 2 coarse sand) about 4 cm. x 4 cm. round or square section and of thickness equal to as specified in the drawing shall be placed between the bar and shuttering to maintain the requisite cover in the concrete member.
In case of cantilevered or doubly reinforced beams/slabs, the top main reinforcing bars shall be held in position by introducing chair of appropriate bar spacers or supports bar at 1.0 to 1.2 m. centers.

(II) The bars shall be tied with GI binding wires as per the instructions given by Architect or Engineer-incharge.

(III) In case of columns and walls, the vertical bars shall be kept at the top of the mould in position by means of timber/steel templates with slots accurately cutout in them. The templates shall be removed after concreting has been done below it. The bars may also be suitably tied by means of annealed GI wires to the shuttering to maintain their position during concreting. The GI wire shall be tied in such a way that they shall not get embedded in the concrete.

1.2 All dowel bars projecting from columns, columns beams, slabs, etc, to which other bars and concrete are to be attached or bounded to later on, shall be protected with a coat of thin neat cement grout, if the bars are not likely to be incorporated with succeeding mass of concrete within the following 10 days. This coat of thin neat cement shall be removed before concreting. All dowels to be kept in position by tying stirrups or a bar.

1.3 The cost of the reinforcement and formwork shall be included or excluded as per the item description.

1.4 The concrete shall be placed at all heights and for all shapes.

2.0 Mode of Measurements and Payment :

2.1 Relevant specification of item no. 2.01 shall be followed. The rate shall be excluded or included as per the item description.
2.2 The volume occupied by reinforcement shall not be deducted from RCC work.
2.3 The rate shall be for a unit of one m^3.
2.4 The rate includes placing the concrete at all heights, levels and shapes.

2.05 Providing and laying RCC 1:1.5:3 / M20 (1 cement : 1.5 coarse sand : 3 graded Black trap stone aggregate 20 mm. Maximum nominal size) for exposed RCC lintels, chhajjas, pattas, sill, slabs, corbellings, cornices, and fins (only external face of the member will have expose RCC as per detailed drawing) at all floors, levels, location and shapes, including curing etc. complete, including the cost of formwork but excluding the cost of reinforcement etc. complete. (for all civil, plumbing and electrical works)

1.0 Materials & Workmanship :

1.1 The relevant specifications of item no. 2.04 shall be followed except that exposed concrete work shall be for lintels, chhajjas, pattas, sill slabs, corbellings, cornices, and fins. Relevant specifications of item no. 3.03.a and 3.03.b shall be followed for formwork and centering work for exposed concrete work.

2.0 Mode of Measurements and Payment :

2.1 The relevant specifications of item no. 2.04 shall be followed except that the item includes the cost of formwork and centering work for rendering exposed surfaces to the above specified concrete works. The rate excludes the cost of reinforcement.

2.1 The rate shall be for an unit of one m^3.

2.2 The rate includes placing the concrete at all heights and for all shapes.

2.3 The surface, which is shown in drawing as exposed finish, shall only be included in this item.

2.06 Providing and laying CC 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded Black trap stone aggregate 20 mm. Maximum nominal size) for elements like lintels, sill slabs, chhajjas, corbelling, pattas, copings, cornices, steps for spirals, fins etc., for all floors, levels, shapes and locations including curing, etc. complete. The rate shall also include for erecting and fixing the pieces in position with necessary equipment and materials. The weight of any precast member shall not exceed 300 Kg. per piece. (for all civil, plumbing and electrical works) The item shall be for

a) for RCC precast elements
b) for exposed RCC precast elements

1.0 Materials :

1.1 The relevant specifications of item no. 2.05 shall be followed except that work shall be carried out for precast reinforced concrete as specified in the item.

1.2 All precast members shall be cast on site and not obtained from any manufacturing unit. Sufficient curing shall be done before placement of the same.

1.3 The method of transporting and placing the precast members shall be as approved by the Architect and Engineer-in-charge. Members shall be so transported that no breakage or undue stresses are induced in them.

1.4 All members shall have a key provided on both the faces i.e. top and bottom surfaces, of adequate size so as to fill the same with concrete while laying. The function of this key is to avoid the leakage through the joint between the precast member and the member on which it is laid.

1.5 While fixing the precast member, the key provided in the member shall be filled with ordinary cement concrete made of same proportion as that of the member except that grit shall be used instead of stone aggregate. Except for the key, cement mortar of proportion 1:1 (1 part cement : 1 part sand) shall be spread over the surface on which the member is to be laid. The mortar shall be of dry consistency as is possible to use. The member and the surface shall be thoroughly cleaned before placement and both shall be kept moist for a sufficient period after placement.

1.6 Rendering exposed surface for the exposed RCC precast elements shall be carried out and the rate for the same shall be included in this item. The centering and shuttering shall be done as per item no 3.03a and 3.03b

2.0 Mode of Measurements and Payment :

2.1 Relevant specification of item no. 2.05 shall be followed. The rate shall include cost of formwork but exclude the cost of reinforcement.

2.2 The volume occupied by reinforcement shall not be deducted from RCC work.

2.3 The rate shall be for a unit of one m^3.

2.07 Providing and fixing precast CC jali or grill CC 1:1.5:3 (1 cement :1.5 coarse sand : 3 graded Black trap stone aggregate 10 mm. max nominal size)/ cement mortar 1:2 (1 cement : 2 coarse sand) reinforced with 6 mm. dia. mild steel wire/ MS wire mesh, including roughening, cleaning fixing and finishing in cement mortar 1:3 and

curing etc. complete, as directed and as per approved architectural drawings. (for all civil, plumbing and electrical works) The size of the precast CC jail or grill shall be:

a) 500 X 250 mm

b) 200 X 200 mm

General : The thickness of the precast CC jail or grill shall be as per the item description.

1.0 **Materials :** Water shall conform to M-1. Cement to M-3. Sand to M-6. Mortar to M-11. Aggregate to M-8. Mild steel wires to M-18. Shuttering to M-26.MS wire mesh shall conform to M-36

2.0 **Workmanship :**

2.1 Precast jali shall be of CC 1:2:4 (1 cement : 2 coarse sand : 4 graded Black trap stone aggregate 6 mm. nominal size) reinforced with 6 mm. dia mild steel wire unless otherwise specified. 25mm thick CC jail shall be casted with cement mortar 1:2 **(1 cement : 2 coarse sand)**

2.2 The thickness of jali shall be as specified in the item. The work shall be of precast and relevant specifications of item no. 2.06 shall be followed. The design of precast concrete jali shall be as per approved Architect's detail drawing.

2.3 The jali shall be set in position true to line and level before the jambs sills and soffits of the opening are plastered. It shall then be properly cemented with cement mortar 1:3: (1 cement : 3 sand) and rechecked for levels. Finally the jambs, sills and soffits shall be plastered gripping the jali uniformly on all sides.

3.0 **Mode of Measurements and Payment :**

3.1 The item shall be measured in m^2 of the visible area of the work done. It includes the casting and placement of the jali.

3.2 The rate shall be for an unit of one m^2.

2.08 **Supplying, fabricating and placing in position reinforcement bars confirming to IS-1786 reinforcement for RCC structure / items as per design including transporting steel to the work site, handling, decoiling, cutting, bending, cranking, fabricating to required shape, placing in position, binding with 18 guage (1.22 mm) GI wires, welding if necessary by using approved welding rods etc. for all levels, all place, all height as per drawing etc. complete as directed by the engineer-in-charge. The quoted rate should be inclusive the cost of binding wire, chairs, pins, brackets and the same will not be measured and paid separately. (rolling margin's and wastage shall not be paid.) Measurement will be made on the length basis and converted into weight by using standard co-efficient). The reinforcement shall be -**

The reinforcement shall be

a) Mild steel reinforcement, yield stress not less than 250 N/mm2
b) High yield deform steel bars Fe-415, yield stress not less than 415 N/mm2
c) TMT bars- Fe-415, yield stress not less than 415 N/mm2
d) TMT bars Fe- 500, Fy-500 Mpa
e) TMT bars Fe-550, yield stress not less than 550 N/mm2
f) TMT bars- CRS Fe- 500, yield stress not less than 500 N/mm2
g) TMT bars- CRS Fe-550, yield stress not less than 550 N/mm2

1.0 **Materials :** Mild steel bars shall conform to M-18. GI binding wires to M-21. High yield deform steel M-19A. TMT M19B.

2.0 **Workmanship :**

2.1 The work shall consist of furnishing and placing reinforcement to the shape and dimensions, as shown on the drawings or as directed.

2.2 The type of reinforcement shall be as per the item description. The contractor shall submit the test certificate from steel manufacturer as and when required. The test results shall be verified, if required in any reputed laboratory.

2.3 Steel shall be clean and free from rust and loose mill scale, at the time of fixing in position and subsequent concreting.

2.4 Bar bending schedule shall be made by the contractor before starting the work. The payment shall be done based on

quantity worked out in bar bending schedule. The bar bending schedule shall be prepared as per SP 34.

2.5 **Mild Steel:**

2.5.1 Reinforcing steel shall conform accurately to the dimensions given in the bar bending schedules shown on relevant drawings. Bars shall be bent cold to specified shape and dimensions or as directed using a proper bar bender, operated by hand or power to attain proper radius of bends. Bars shall not be bent or straightened in a manner that will injure the material. Bars bent during transportation or handling shall be straightened before being used on the work. They shall not be heated to facilitate bending. Unless otherwise specified, a U type hook at the end of each bar shall invariably be provided to main reinforcement. The radius of the bend shall not be less than twice the diameter of the round bar and the length of straight part of the bar beyond the end of the curve shall be atleast 4 times the diameter of the round bar. In case of bars which are not round and incase of deformed bars, the diameter shall be taken as the diameter of circle having an equivalent effective area. The hooks shall be suitably encased to prevent any splitting of the concrete.

2.6 **High yield strength deformed steel:**

2.6.1 The specification of HYSD steel shall be same as mild steel bars. The bars shall be used with or without hooks at the ends. Deformed bars without hooks shall comply with relevant anchorage requirements.

2.7 **TMT bars**

2.7.1 The specification of TMT steel shall be same as mild steel bars. The bars shall be used with or without hooks at the ends. Deformed bars without hooks shall comply with relevant anchorage requirements.

2.8 All the reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position with 16 Guage GI binding wire of size not less than 1mm as approved by Engineer-incharge or Architect. The rebars shall be placed with stay blocks or metal chair spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars shall not be allowed to sag between supports nor displaced during concreting or any other operations of the work. All devices used for positioning shall be of non-corrodible material. Wooden and metal supports shall not extend to the surface of concrete, except where shown on drawing. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing shall not allowed. Pieces of broken stone or brick and wooden blocks shall not be used. Layers of bars shall be separated by spacer bars, Precast mortar blocks or PVC cover blocks shall be used to maintain the cover of the concrete members as directed by Engineer Incharge or Architect. Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To prevent reinforcement from corrosion, concrete cover shall be provided as indicated on drawing. All the bars projecting from concrete and to which other bars are to be spliced and which are likely to be exposed for a period exceeding 10 days shall be protected by a thick coat of neat cement grout.

2.9 Bars crossing each other where required shall be secured by 16 guage GI binding wires (annealed) of size not less than 1 mm., in such manner than they do not slip over each other at the time of fixing and concreting.

2.10 As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed. Where directed, where practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm. or 1.25 times the maximum size of the coarse aggregate, whichever is greater by concrete between them. Where not feasible, overlapping bars shall be bound with annealed wires not less than 1 mm. thick, twisted tight. The overlaps shall be staggered for different bars and located at points along the span where neither shear nor bending movement is maximum in beam and slab.

2.11 Whenever indicated on the drawings or desired by the Architect and Engineer-in-charge, bars shall be joined by couplings which shall have a cross section sufficient to transmit the full stresses of bars. The ends of the bars that are joined by coupling shall be upset for sufficient length so that the effective cross sectional the base of threads is not less than normal cross section of the bar. Threads shall be standard threads. Steel coupling shall conform to IS : 226.

2.12 When permitted or specified on the drawings, joints of reinforcement bars shall be welded with appropriate welding rod as per the instructions given by Structural Engineer. The type of welding, size of fillet etc shall be as approved by Structural Engineer. Welded joints shall preferably be located at points when steel will not be subject to more than 75 % of the maximum permissible stresses and welds so staggered that any one section not more than 20 % of the rods are welded. Only electric are welding using a process which excludes air from the molten metal and conforms to any or all other special provisions for the work shall be accepted. Suitable means shall be provided for holding bars securely in position during welding. It shall be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous

surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, grease paint and other foreign matter before welding. Only competent welders shall be employed on the work. The M.S electrodes used for welding shall conform to IS : 814. Welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency of test shall be as directed.

2.13 At the time of concreting, a bar fitter shall remain at site to keep the reinforcement in position.

2.14 Rolling margin shall be checked for each lot of steel received at site. This rolling margin shall be considered for reconciliation of steel at the end of the project or after the end of each month as per the decision of engineer -incharge. Allowable wastage and rolling margin for the reconciliation of reinforcement steel shall be applicable as per Part B of *General Conditions of Contract.*

3.0 Mode of Measurements and Payment :

3.1 Reinforcement shall be measured in length including overlaps, separately for different diameters as actually used in the work. Where welding or coupling is resorted to in place of lap joints, such joints shall be measured for payment as equivalent length of overlap as per design requirement. From the length so measured, the weight of reinforcement shall be calculated in tones by using standard IS co-efficient. Length shall include hooks at the ends. The wastage of steel and binding wires shall not be measured and the cost of these items shall be needed to be included in the rate for reinforcement. The rolling margin of steel shall not be paid extra.

3.2 The rate for reinforcement includes cost of GI binding wires. Cutting, bending, placing, binding and fixing in position as shown on the drawings and as directed. It shall also include all devices like chairs, pins etc. for keeping reinforcement in approved position, cost of joining as per approved method and all wastage, covers –PVC or Cement mortar and spacer bars.

3.3 The rate shall be for a unit of one MT.

2.09 Labour charges for fabricating and fixing in position steel reinforcement for RCC structures as per design including handling at site, cutting, bending and binding with wires, welding if necessary etc. for all floors complete as directed by Engineer. Measurement will be made on the length basis and converted into weight by using standard IS co-efficient (rolling margin's and wastage will not be paid). (for all civil, plumbing and electrical works).

The reinforcement shall be

a) Mild steel reinforcement, yield stress not less than 250 N/mm2
b) High yield deform steel bars Fe-415, yield stress not less than 415 N/mm2
c) TMT bars Fe- 500, yield stress not less than 500 N/mm2
d) TMT bars Fe-550, yield stress not less than 550 N/mm2
e) TMT bars- CRS Fe- 500, yield stress not less than 500 N/mm2
f) **TMT bars- CRS Fe-550, yield stress not less than 550 N/mm2**

The relevant specifications of item no. 2.08 shall be followed except that the rate shall be for only handling, cutting, bending, placing, binding and fixing in position as shown on the drawings and as directed. It shall also include all devices like chairs, covers, pins, binding wires, etc. for keeping reinforcement in approved position, cost of joining as per approved method. The cost of reinforcement shall not be included. This item will be operable when the steel is supplied by the Client. The measurement shall be done in length. From the length so measured, the weight of reinforcement shall be calculated in tones by using standard IS co-efficient. Length shall include hooks at the ends.
Rolling margin shall be checked for each lot of steel received at site. This rolling margin shall be considered for reconciliation of steel at the end of the project or after the end of each month as per the decision of engineer -incharge. Allowable wastage and rolling margin for the reconciliation of reinforcement steel shall be applicable as per Part B of General Conditions of Contract.
The rate shall be for a unit of one MT.

2.10 Providing and laying in position machine mixed, machine batch, machine vibrated design mix cement concrete for reinforced cement concrete work of M20 grade using graded black trap stone aggregates of maximum 20mm nominal (down graded) size obtained from approved quarry including fine aggregates conforming to latest IS 383 with minimum cement content (without fly ash) for durability shall be followed as per approved design mix and latest IS 456 (whichever is higher) for all elements of any shape and size, at all places and heights/ depths including transporting to site, laying of concrete to site by any means like pumping or tower crane etc., vibrating, finishing and curing etc. and including Admixtures in recommended proportions as per IS 9103 to accelerate, retard setting of concrete, to improve workability without impairing strength and durability as per direction of Engineer-in-charge. Rate shall be inclusive of providing grooves, drip moulds, ghisis, pockets, cutouts etc. and

labour for insert sleeves if any wherever required while casting. Rate also to include lift charges and scaffolding for all heights / depths from FFL / GL. (for all civil, plumbing & electrical works).
The item shall
a) exclude the cost of formwork & reinforcement
b) include the cost of formwork and exclude the cost of reinforcement

2.11 Providing and laying in position machine mixed, machine batch, machine vibrated, design mix cement concrete for reinforced cement concrete work of M25 grade using graded black trap stone aggregates of maximum 20mm nominal (down graded) size obtained from approved quarry including fine aggregates conforming to latest IS 383 with minimum cement content (without fly ash) for durability shall be followed as per approved design mix and latest IS 456 (whichever is higher) for all elements of any shape and size, at all places and heights/ depths including transporting to site continuous agitating mixer, laying of concrete to site by any means like pumping or tower crane etc., vibrating, finishing and curing etc. and including Admixtures in recommended proportions as per IS 9103 to accelerate, retard setting of concrete, to improve workability without impairing strength and durability as per direction of Engineer-in-charge. Rate shall be inclusive of providing grooves, drip moulds, ghisis, pockets, cutouts etc. and labour for insert sleeves if any wherever required while casting. Rate also to include lift charges and scaffolding for all heights / depths. (for all civil, plumbing & electrical works).
The item shall
a) exclude the cost of formwork & reinforcement
b) include the cost of formwork and exclude the cost of reinforcement

2.12 Providing and laying in position machine mixed, machine batch, machine vibrated design mix cement concrete for reinforced cement concrete work of M30 grade using graded black trap stone aggregates of maximum 20mm nominal (down graded) size obtained from approved quarry including fine aggregates conforming to latest IS 383 with minimum cement content (without fly ash) for durability shall be followed as per approved design mix and latest IS 456 (whichever is higher) for all elements of any shape and size, at all places and heights/ depths including transporting to site continuous agitating mixer, laying of concrete to site by any means like pumping or tower crane etc., vibrating, finishing and curing etc. and including Admixtures in recommended proportions as per IS 9103 to accelerate, retard setting of concrete, to improve workability without impairing strength and durability as per direction of Engineer-in-charge. Rate shall be inclusive of providing grooves, drip moulds, ghisis, pockets, cutouts etc. and labour for insert sleeves if any wherever required while casting. Rate also to include lift charges and scaffolding for all heights / depths. (for all civil, plumbing & electrical works).
The item shall
a) exclude the cost of formwork & reinforcement
b) include the cost of formwork and exclude the cost of reinforcement

3.0 Materials : Water shall conform to M-1. Cement to M-3. Sand to M-6. Grit to M-8. Coarse aggregate M-13. Design mix conform to M3G

4.0 General :

4.1 The relevant specifications of item no. 2.01 shall be followed except that the concrete mix shall be designed from preliminary tests the proportioning of cement and aggregates shall be done by weight and necessary precautions shall be taken in the production to ensure that the required work cube strength is attained and maintained. The controlled concrete shall be in grades of M-20, M-25, M-30 and M-35, with prefix controlled added to it. The letter "M" refers to mix and numbers specify 28 days works cube compressive strength of 150 mm. cubes of the mix expressed in N/mm^2.

4.2 **Before quoting the rate, contractor shall confirm the exposure condition for the design of concrete. Mix design shall be carried out for environmental exposure condition as given in IS 456:2000 page 18 table 3.**

4.3 **All concrete work shall have fair finish concrete surface unless otherwise specified.**
For exposed concrete element specified in the drawing fair finish steel shuttering made out of MS sheet not less than 14 gauge/ laminated plywood and supporting frame work shall be of steel. Proper care shall be taken in MS shuttering at the time of concreting during monsoon to achieve rust free concrete surface. The concrete surface shall be rendered if required to give fair finish.

For other concrete shuttering material shall be as follows:
- Columns: Moulds from marine ply with wooden battens or MS steel plates
- Straight walls / Curved wall in plan: Marine plywood with wooden battens / Acro make or equivalent make plates and soldiers.
- Beam: Bottom - timber / steel plates, Sides - Steel plates / marine ply with battens

4.4 The concrete shall be designed as per relevant IS code- IS 10262 and SP 23, with or without chemical admixture to provide the grade of concrete having required workability and characteristic strength as per IS 456:2000. The proportion of cement, sand and coarse aggregates shall be determined by weight. The weight batch machine shall be used for maintaining proper control over the proportion of aggregates as per mix design. The design mix shall be got approved by Engineer in-charge before starting the concrete work. The minimum cement content shall depend on the exposure condition of the concrete. The minimum cement content given in table (IS 456:2000, table 5) shall be adopted irrespective of whether the contractor achieves the desired strength with less quantity of cement. The strength requirements of different grades of concrete shall be as under :

Grade of Concrete	Compressive strength of 15 cm. cubes in N/mm^2 at 7 and 28 days conducted in accordance with IS : 516-1959.		
	At 7 days	At 28 days	Max size of agg. In mm
M-10	7	10	20
M-15	10	15	20
M-20	13.5	20	20
M-25	17	25	20
M-30	21	30	20
M-35	24	35	20
M-40	28	40	20

In all cases, the 28 days compressive strength specified in above table be the criteria for acceptance or rejection of the concrete.

4.5 Where the strength of a concrete mix as indicated by tests, lies in between the strength of any two grades specified in the above table, such concrete shall be classified in for all purposes as concrete belonging to the lower of the two grades between which its strength lies.

4.6 The Contractor shall take necessary care to avoid sand streaks, air holes, honey combining etc., on finished concrete surface.

5.0 Workmanship :

5.1 **Proportioning**

5.1.1 The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with means available except where it can be shown to the satisfaction of the Architect and Engineer-in-charge that the supply of properly graded aggregate of uniform quality can be maintained till the completion of work. Grading of aggregate shall be controlled by obtaining the coarse aggregate, in different sizes and blending them in the right proportions as required. Aggregate of different sizes shall be stocked in separate stock piles. The required quantity of material shall be stock piled several hours, preferably a day before use. The grading of coarse and find aggregate shall be checked as frequently as possible, the frequency for a given job being determined by the Architect and Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading, as approved for samples used in the preliminary tests.

5.1.2 In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag a reasonable number of bags shall be weighed separately, to check the net weight, where cement is weighed from bulk stocks at site and not by bags. It shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in clean and serviceable condition. Their accuracy shall be periodically checked and calibrated in standard laboratory.

5.2 **Mixing, consistency, inspection, transportation and laying, formwork for exposed concrete, sampling & testing of concrete and stripping time for the form work:s** These shall be same as item no. 2.01 The compressive strength and slump test shall be performed by third party or outside laboratory is required.

5.3 It is most important to keep the specified water cement ratio constant and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined by the Architect and Engineer-in-charge, according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates, IS : 2386 (Part III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates due to variation in their moisture content.

5.4 The minimum cement content for the various mixes shall be as under :

MIX	MINIMUM CEMENT CONTENTS PER CU.M. OF CONCRETE	MIX	MINIMUM CEMENT CONTENTS PER CU.M. OF CONCRETE
M-150	285 Kg.	M-250	360 Kg.
M-175	300 Kg.	M-300	400 Kg.
M-200	325 Kg.	M-350	430 Kg.

5.5 All RCC works shall be carried out as per the detailed drawings and direction of Architects and Engineer-in-charge. The concrete shall be placed at all heights, levels and for all shapes

5.6 **Incase contractor intends to use Ready Mix Concrete (RMC), contractor shall submit specifications for RMC and obtain prior approval from the engineer-incharge.**

6.0 Mode of Measurements and Payment :

6.1 The relevant specifications item no. 2.01 shall be followed except that the controlled concrete RCC work for work as specified in item shall be measured under this item. The rate shall exclude or include the cost of formwork and reinforcement as per the item description.

6.2 The rate shall be for a unit of one m^3.

6.3 The rate shall be inclusive of chemical admixture like plasticizer etc. No additional payment shall be paid on this account.

2.13 Providing and laying controlled CC M-20 for exposed RCC lintels, chhajjas, pattas. sill slabs, corbellings, cornices, and fins (only external face of the lintel will have expose RCC as per detailed drawing), at all floors, heights, levels and shapes including curing, etc. complete including cost of formwork and excluding the cost of reinforcement (for all civil, plumbing and electrical works).

2.14 Providing and laying controlled CC M-25 for exposed RCC lintels, chhajjas, pattas. sill slabs, corbellings, cornices, and fins (only external face of the lintel will have expose RCC as per detailed drawing), at all floors, heights, levels and shapes including curing, etc. complete including cost of formwork and excluding the cost of reinforcement (for all civil, plumbing and electrical works).

2.15 Providing and laying controlled CC M-30 for exposed RCC lintels, chhajjas, pattas. sill slabs, corbellings, cornices, and fins (only external face of the lintel will have expose RCC as per detailed drawing), at all floors, heights, levels and shapes including curing, etc. complete including cost of formwork and excluding the cost of reinforcement (for all civil, plumbing and electrical works).

1.0 Materials & Workmanship : The relevant specifications of item no. 2.10 shall be followed except that exposed concrete work shall be carried out for lintels, chhajjas, pattas, sill slabs, corbellings, cornices, and fins, using controlled cement concrete as mentioned in the item description. Relevant specifications of item no. 3.03.a and 3.03.b shall be followed for formwork and centering work for exposed concrete work.

2.0 Mode of Measurements and Payment :

2.1 The relevant specifications of item No. 2.10 shall be followed except that the item includes the cost of formwork and centering work in pattern as per the drawing. Rendering and touch up if required to obtain uniform finished surface shall be included in the rate. The rate does not include the cost of reinforcement.

2.2 The rate shall be for a unit of one m^3.

2.16 Providing and laying controlled CC M-20 and curing, etc. for RCC work in dome, shells and vaults, of any thickness, etc. complete, as per approved Architectural drawings, for all floors. (for all civil, plumbing and electrical works).

a) Excluding the cost of formwork and reinforcement
b) Including the cost of formwork but excluding the cost of reinforcement

2.17 Providing and laying controlled CC M-25 and curing, etc. for RCC work in dome, shells and vaults, of any thickness, etc. complete, as per approved Architectural drawings, for all floors. (for all civil, plumbing and

electrical works).

a) Excluding the cost of formwork and reinforcement

b) Including the cost of formwork but excluding the cost of reinforcement

2.18 Providing and laying controlled CC M-30 and curing, etc. for RCC work in dome, shells and vaults, of any thickness, etc. complete, as per approved Architectural drawings, for all floors. (for all civil, plumbing and electrical works).

a) Excluding the cost of formwork and reinforcement

b) Including the cost of formwork but excluding the cost of reinforcement

The relevant specification of item no. 2.10 shall be followed except that the work shall be for RCC domes and vaults, for all floors, at any height and level, in any position. The rate shall exclude or include the cost of formwork and reinforcement as per the item description.

2.19 Providing, and laying machine mixed and machine vibrated controlled CC with curing, etc. complete, including the cost of formwork but excluding the cost of reinforcement, for pre-cast lintels, sill slabs, copings, blocks, pattas, cornices, corbelling, precast spiral staircase steps including erecting and keeping in position with necessary scaffolding, at all floors, at any height and level, in any position. The rate shall also includes for fixing and finishing required for fixing the members, etc. complete, as per approved Architectural drawing. The weight of the member shall not exceed 300 Kg. per piece. (for all civil, plumbing and electrical works). The cement concrete shall be

a) M20

b) M25

The relevant specification of item no. 2.10 shall be followed same for concrete work except that the work shall be for pre-cast concrete members as specified in the item. For precasting, the relevant specifications of item no. 2.06 shall be followed. The rate is inclusive of casting, formwork, scaffolding for erecting, equipment required, fixing in position in cement mortar, etc. complete.

2.20 Providing and laying machine mixed and machine vibrated controlled CC having exposed surfaces, including curing, etc. complete, including the cost of formwork but excluding the cost of reinforcement, for pre-cast lintels, sill slabs, copings, blocks, pattas, cornices, corbelling, sides of spiral staircase steps, including erecting and keeping in position with necessary scaffolding, at all floors, at any height and level, in any position. The rate shall also includes for fixing and finishing required for fixing the members, etc. complete, as per approved Architectural drawing. The weight of the member shall not exceed 300 Kg. per piece. (for all civil, plumbing and electrical works). The cement concrete shall be

a) M20

b) M25

The relevant specification of item no. 2.10 shall be followed same for concrete work except that the work shall be for pre-cast concrete members as specified in the item. For precasting, the relevant specifications of item no. 2.06 shall be followed. The rate is inclusive of casting, formwork, scaffolding for erecting, equipment required, fixing in position in cement mortar, etc. complete. The rate includes cost of providing necessary formwork, staging required cost of all materials, labour, etc. required for exposed surface. The relevant specification of item no. 3.03.a and 3.03.b shall be followed for formwork. The work shall be carried out to the entire satisfaction of Architect and Engineer-in-charge, as per drawings and instructions.

The work shall be measured in m^3.

.

2.21 Extra for providing and mixing chemical additives or admixtures, as approved by the Architect & Engineer-in-charge, as per the specifications stipulated by the manufacturer. (for all civil, plumbing and electrical works). (The make and its technical specifications must be specified herein.)

a) Integral waterproofing compound for concrete

b) Waterproofing compound for waterproof plaster

c) Plasticizer for concrete

i) Rapid Hardening Additives

ii) Curing Compound

d) Accelerator or retarder admixture

General:

The chemical admixture shall be of reputed company like Fosroc, Cico, Roffee or equivalent. The chemicals to be used shall be approved by the engineer incharge or architect.

1.0 Materials: The additives and admixture materials shall be as per the manufacturer's standards. They shall conform to M-67, M67B, 67E, 67E, 67C, 67H, 67F, 67G, 67D, 63, 63B, 63A.

2.0 **Workmanship:** The additives and admixtures used for different purpose shall be as specified by manufacturer.

3.0 **Mode of Measurements and Payment:** The rate shall be for a unit of one Kg/ litre

2.22 **Providing and laying in position controlled CC M-20 for Vaults and Currency chests, at any floor, including provision of required openings for doors, manholes, plenum ducts, etc., as required by the security bylaws, excluding the cost of formwork and reinforcement, with special nuts and bolts- spring coils and PVC cone spacer (to be left in the concrete, if required), mechanical compaction, curing, finishing, etc. complete. The rate should include for embedding tang bar reinforcement, grouting and embedding the vault doors, manhole doors, ventilators, exhaust fan etc. Once they are fitted in the openings provided, necessary certificate from PWD/RBI authorities or other concerned authorities must be taken and submitted to the Client. (for all civil, plumbing and electrical works).**
1) Vault floor (without bottom shuttering)
2) Vault floor/roof (with bottom shuttering)
3) Vault walls (450 mm. Or 300mm thick)
a) Excluding cost of formwork and reinforcement
b) Including cost of formwork and excluding cost of reinforcement

The relevant specification of 2.10 shall be followed except that the work shall be carried out for vaults and currency chest in controlled CC M-20. The rate shall be excluding or including the cost of the formwork and reinforcement as per the item description.

The rate shall be for a unit of one m^3.

2.23 **Providing and laying in position controlled CC M-25 for Vaults and Currency chests, at any floor, including provision of required openings for doors, manholes, plenum ducts, etc., as required by the security bylaws, excluding the cost of formwork and reinforcement, with special nuts and bolts - spring coils and PVC cone spacer (to be left in the concrete, if required), mechanical compaction, curing, finishing, etc. complete. The rate should include for embedding tang bar reinforcement, grouting and embedding the vault doors, manhole doors, ventilators, exhaust fan etc. Once they are fitted in the openings provided, necessary certificate from PWD/RBI authorities or other concerned authorities must be taken and submitted to the Client. (for all civil, plumbing and electrical works).**
1) Vault floor (without bottom shuttering)
2)Vault floor/roof (with bottom shuttering)
3) Vault walls (450 mm. Or 300mm thick)
a)Excluding cost of formwork and reinforcement
b)Including cost of formwork and excluding cost of reinforcement

The relevant specification of 2.22 shall be followed except that the grade of concrete shall be M-25. The rate shall be excluding or including the cost of the formwork and reinforcement as per the item description.

The rate shall be for a unit of one m^3.

2.24 **Providing and laying in position controlled CC M-30 for Vaults and Currency chests, at any floor, including provision of required openings for doors, manholes, plenum ducts, etc., as required by the security bylaws, excluding the cost of formwork and reinforcement, with special nuts and bolts - spring coils and PVC cone spacer (to be left in the concrete, if required), mechanical compaction, curing, finishing, etc. complete. The rate should include for embedding tang bar reinforcement, grouting and embedding the vault doors, manhole doors, ventilators, exhaust fan etc. Once they are fitted in the openings provided, necessary certificate from PWD/RBI authorities or other concerned authorities must be taken and submitted to the Client. (for all civil, plumbing and electrical works).**
1) Vault floor (without bottom shuttering)
2)Vault floor/roof (with bottom shuttering)
3) Vault walls (450 mm. Or 300mm thick)
a)Excluding cost of formwork and reinforcement
b)Including cost of formwork and excluding cost of reinforcement

The relevant specification of 2.22 shall be followed except that the grade of concrete shall beM-30. The rate shall be excluding or including the cost of the formwork and reinforcement as per the item description.

The rate shall be for a unit of one m^3.

2.25 Providing and placing RMCof following grades at all floors for all RCC or CC elements of the building including vibrating, curing, cleaning the site etc complete, supplied by L&T or equivalent confirming to relevant standards specifications. The rate of item is inclusive of cost of cement. RMC process shall be fully automatic and computerised. Proportion of the ingredients shall be approved by Engineer in-charge before placing of the concrete. Testing of all materials and produced concrete shall be done as per the relevant IS standards of the concrete. Rate shall be excluding the cost of form work and reinforcement. Grade of concrete shall be as per following. Contractor to install the new ready mix plant of requisite capacity (for all civil, plumbing and electrical works).

1.0 The relevant specification of item 2.10 shall be followed. The rate shall be inclusive of the RMC from plant to the site.

2.0 Materials:

2.1 Water shall confirm to M-1, Cement to M-2, sand to M-3. Graded stone aggregate 20mm nominal size to M-5.

2.2 Measurement and storage of materials: measurement and storage of materials shall be done in accordance with the requirements of IS:456:2000.

3.0 Basis of Supply:

3.1 Depending upon the agreement the ready mix concrete shall be supplied on iehter of the following basis:

a) Specified strength based on 28-day compressive strength of 15cm cubes tested in accordance with IS :456-2000.
b) Specified mix proportion.

3.2 when the concrete is manufactured and supplied on the basis of specified strength, the responsibility for the design of mix shall be that of the contractor and the concrete shall confirm to the requirements specified.

4.0 General Requirements:

4.1 the minimum quantity of cement and the details regarding proportioning and works control shall be in accordance with IS:456:2000 or our specification stated in item 2.7.

4.2 when a transit mixer is used for transportation of concrete, no extra water should be added to the concrete from else where after initial introduction of mixing water from the batch, except when on arrival at the site of the work, the slump of the concrete is less than that specified: such additional water to bring the slump within required limits shall be injected into that specified: such additional water to bring the mixer under such pressure and direction of flow that requirements for uniformity are met.

4.3 when a transit mixer is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be complete within one and half hour (when the prevailing atmospheric temperature is at or below 20 degree celcius) of adding the mixing water to the dry mix of cement and aggregate or of adding the cement to the agreegate which ever is earlier.

7.0 Temperature

7.1 The temperature of the concrete at the place and time of delivery shall not less than 5-degree Celsius above the prevailing shade temperature is less than 2.5 degree Celsius and the thermometer reading is falling.

6.0 Sampling and Testing

6.1 to be followed as per specification mentioned in Item no. 3.7

7.0 Records and Certificates

The contractor shall keep from the manufacturer batch records of the quantities by mass of all the solid materials, of the total amount of water used in mixing and of the results of all tests. If required by the architect, the contractor shall furnish certificates, at agreed intervals, giving this information.

8.0 Concrete Manufactured And Supplied On The Basis Of Specified Strength

8.1 The contractor shall supply the following information for guidance of the manufacturer:

a) The type of cement to be used
b) MSA
c) Type of admixture to be used, if specified
d) Min. acceptable strength
e) Slump of concrete or compacting factor
f) Ages at which the test cubes or beams are to be tested, and the frequency and number of test to be made

g) Any other requirement

8.2 Tolerances: Unless otherwise agreed to between the architect and the contractor, the concrete shall be deemed to comply with the requirements of this standard, if the results o f tests where applicable lie with in the tolerance specified below:

8.2.1 Consistency of workability: The slump average of two test) shall not differ from the specified value by ± 10mm for a specified slump of 75mm. The compacting factor average of two tests shall be within ± 0.03 of the value specified. If any other method of determining consistency to be used, a suitable tolerance shall be agreed to between the purchaser and the manufacturer. The test for consistency or workability shall be completed within 15 minutes of the time of recipt of the ready mix concrete at the site.

8.2.2 Aggregate- When tested in accordance with IS 2386 (part-I)-1963, the quantity of aggregate larger than the max. size specified by the purchaser shall not exceed 5% of the qty. of coarse aggregate and all such excess shall pass through sieve of next higher size.

9.0 Mode of Measurement

The relevant specification item no. 3.02, 3.03.a shall be followed except that the controlled concrete RCC work for work as specified in item shall be measured under this item. The rate excludes cost of cement, formwork and reinforcement and is for any cross sectional area of the members specified in the item.

Note : All concreting works shall be provided with ready mix plant only. In case any concreting less than 6.0 cum to be done at site without RMC plant, then contractor shall have to get prior approval from the engineer in-charge. In this case, the specifications of relevant item and IS to be followed.

2.26 Providing and wet drilling accurate and clean holes of specified diameter in RCC walls, slabs, beam or any other RCC member without vibration by core cutting (diamond drilling) machine of approved make for laying service lines including scaffolding, safety majors, disposing the debris, cleaning, making good, providing epoxy mortar/ micro concrete/ patch repair mortar/ Non shrink grout for concrete for grouting the gaps around the pipes for all levels/ all height, after approval of engineer in charge etc compete. Measurement shall be taken for the depth of holes in running meter for specified diameter. Holes shall made by authorized approved agency. Scanning of reinforcement shall be carried out before core cutting if required and as suggested by Engineer in charge. Location of core cutting shall be approved by Engineer in charge.

A) Diameter of holes up to 52 mm clear
B) Diameter of holes upto 77 mm clear
C) Diameter of holes upto 102 mm clear
D) Diameter of holes upto 152 mm clear

1.0 Materials & Workmanship : Holes shall be drilled in the RCC member and surface shall be cleaned after drilling. Marking of the holes to be got approved from the site engineer. Necessary platform for the machine location and electrical wire management shall be made and shall be adhere to all safety standards.

2.0 Mode of Measurements and Payment :

2.1 The rate shall be for an unit of one rmt..

2.27 Cutting of the reinforcement bar of any dia. with gas cutter including making the surface finished etc. complete. This item will be operated only if required by engineer in charge.

1.0 Materials & Workmanship : Prior approval to be taken from the site engineer before cutting the reinforcement. The cut reinforcement shall be recorded separately. Surfaces around the cut reinforcement shall be properly finished as per the approval of the site engineer

2.0 Mode of Measurements and Payment :

2.1 The rate shall be for an unit of one no.

2.28 Welding of the reinforcement bar of any dia. for structural connection of the dowels. (for all civil, plumbing and electrical works).

1.0 Materials & Workmanship : Prior approval to be taken from the site engineer before welding the reinforcement. The length of the welding shall be as per the drawing and approval of the structural consultant. Relevant specification of best quality welding shall be followed.

2.0 Mode of Measurements and Payment :

2.1 The rate shall be for an unit of one no.

2.29 Drilling and fixing reinforcement dowel of any dia. using epoxy grout. (for all civil, plumbing and electrical works).

1.0 Materials & Workmanship : Drilling diameter shall be more the diameter of the reinforcement to be grouted. The type and proportion of the epoxy material shall be got approved from the site engineer. If required sample of the same shall be approved prior to execution of the work.

2.0 Mode of Measurements and Payment :

2.1 The rate shall be for an unit of one no.

2.30 Providing and laying neat cement finish of the concrete surface including using the additional cement mortar and bonding chemical, curing etc. complete. (for all civil, plumbing and electrical works).

1.0 Materials & Workmanship : The concrete surface shall be finished with the neat cement and sand proportion to be decided based on the type of surface the concrete. Necessary bonding chemical to be added. Finishing shall be uniform and quality of the same to be approved by engineer in-charge.

2.0 Mode of Measurements and Payment :

2.1 The rate shall be for unit of one sqm.

2.30a Making the chase in the RCC wall/slab of average 75 mm width x average 40 mm deep including finishing the same using the bonding chemical and rich grit mortar and chicken mesh etc. complete. (for all civil, plumbing and electrical works).

1.0 Materials & Workmanship : Chased shall be done in the RCC member and surface shall be cleaned after drilling. Only machine to be used for the chasing and no manual chasing is allowed. Marking of the chases to be got approved from the site engineer. Necessary platform for the machine location and electrical wire management shall be made and shall be adhere to all safety standards.

2.0 Mode of Measurements and Payment:

2.1 The rate shall be for an unit of one rmt.

2.31 Providing in position rigid PVC pipe sleeves of 6Kg/cm2 and length as per design for following diameters for services wherever pipes pass through walls/ slabs/ beam before concreting. All pipes shall be accurately cut to the required sizes, laid as per drawing, kept in the position while laying reinforcement and shuttering, sleeves shall not get displaced while concreting, and burrs removed before laying. Open ends of the pipe shall be closed as the pipe is installed to avoid clogging while concreting. Measurement shall be taken up to two decimal. (minimum 0.01 mt.). Rate shall be inclusive of removal of sleeves before water proofing or grouting. For all floors/ all levels/ all heights. Location of sleeve shall be approved by Engineer in charge.

a) 75mm Diameter
b) 110mm Diameter
c) 160mm Diameter
d) 200mm Diameter

1.0 Materials and Workmanship

1.1 The PVC pipe shall confirm to M – P28. Before pouring the concrete PVC sleeves are placed in between the reinforcement as per drawing. Both ends of the sleeves shall be closed with Pipe sleeves 50mm larger diameter than pipes shall be provided wherever pipes pass through walls, slab and circular space filled with fire proof materials like putty, fire seals etc. all pipes shall be accurately cut the required sizes in accordance with relevant code and bars removed before laying. Open ends of the pipes shall be closed with thermocol or gunny bags to avoid entrance of foreign matters. Care shall be taken that sleeves remain in position while concreting. To Vertical sleeves shall finish 50mm above finish floor level.

2.0 Mode of Measurements and Payment:

The rate shall be for unit of one Rmt. No wastage should be paid.
Measurement should be taken up to two decimal. (minimum 0.01 mt.)

3.01 Providing ordinary formwork with shuttering plywood/ steel sheathing and steel supporting system so as to give fair finish, including centering, shuttering and propping, etc. complete, height of propping and centering below supporting floor to ceiling not exceeding 5.0 m., and removal of the same for in-situ reinforced concrete, in foundations, footings, bases of columns, walls, columns, slabs, beams, sills, lintel, coping, stair etc. for all heights, levels, shapes and locations. (for all civil, plumbing & electrical works).

1.0 Materials :

1.1 Shuttering plywood shall conform to M-26B and M26C. The thickness of the plywood sheathing shall be as per the shape and size of the concrete member.

1.2 The dimensions of scantling and battens shall conform to the design. The strength of the wood shall not be less than that assumed in the design.

1.3 Contractors shall design the formwork and get it approved by the Engineer-incharge.

2.0 Workmanship :

2.1 The formwork shall conform to the shape, lines and dimensions as shown on the drawings and shall be so constructed so as to remain sufficiently rigid and water-tight, during the placement and compaction of the concrete. Adequate arrangement shall be made by the Contractor to safe guard against any settlement of the formwork during the course of concreting and after concreting. The formwork of shuttering, centering, scaffolding, bracing, etc. shall be as per the design and shall be made from shuttering plywood with batten/ steel plates and steel supporting system. In case of double height, false staging should be erected preferably with Acro-props & spans or H frames.

2.2 **Cleaning & Treatment of Forms :** All rubbish, particularly chipping, shaving and saw dust shall be removed from the interior of the form before the concrete is placed and the formwork in contact with concrete shall be cleaned thoroughly. The surface shall be coated with approved release agent as directed by Engineer Incharge or Architect. Care shall be taken that the coating is not applied on the construction joints surface and steel reinforcement bars.

2.3 **Stripping Time :** In normal circumstances and where ordinary portland cement is used, formwork may be struck after expiry of the following periods :

(a) Sides of walls columns and vertical faces of beams		16 to 24 hours.
(b) Slab soffit (props to be refixed immediately after removal of formwork)		3 days
(b) Beam soffits (Props left under)		7 days.
(c) Removal of props for slabs -	(i) Slabs spanning upto 4.5 m.	7 days.
	(ii) Slabs spanning over 4.5 m.	14 days.
(d) Removal of props to beams and Arches -	(i) Spanning upto 6 m.	14 days.
	(ii) Spanning over 6 m.	21 Days.

2.4 **Procedure while removing the formwork :** All formwork shall be removed without such shocks or vibrations as would damage the reinforced concrete surface. Before the soffit formwork and struts are removed, the soffits and the concrete surface shall be exposed where necessary, in order to ascertain that the concrete has sufficiently hardened.

2.5 **Centering :**

2.5.1 The centering to be provided shall be got approved. It shall be sufficiently strong to ensure absolute safety of the formwork and concrete work before, during and after pouring concrete till it achieved full strength. Watch should be kept to see that behavior of centering and formwork is satisfactory during concreting. Erection should also be such that it would allow removal of forms in proper sequence without damaging either the concrete or the forms to be removed.

2.5.2 The props of centering shall be provided on firm foundation or base of sufficient strength to carry the loads, without any settlement. Wedges shall be provided at the base of the fixed prop (wooden and steel) for its easy removal. Props shall be adequately braced to withstand the lateral forces.

2.5.3 The centering and formwork shall be inspected and approved by the Engineer-in-charge, before concreting. But this will not relieve the Contractor of his responsibility for strength; adequacy and safety of formwork and centering. If there is a failure of formwork or centering, the Contractor shall be responsible for the damages to the work, injury to life and damage to property.

2.5.4 For walls, columns and beams, the shuttering plates on either side shall be bolted with tie rods made from spring coils on either side, welded with two nos 8mm MS rods. PVC cone shall be placed on either side of the tie rod. The whole tie rod assembly along-with PVC cone shall be placed/fixed with special type of bolts on either side of the shuttering plates. Length of the tie rod along-with PVC cone shall be equal to the width / thickness of the element to be shuttered.

2.6 Scaffolding :

2.6.1 All scaffolding, hoisting arrangements and ladders, etc. required for facilitating of concreting shall be provided and removed on completion work by Contractor, at his own expense. The scaffolding, hoisting arrangement, ladders etc. shall be strong enough to withstand all live, dead and impact loads expected to act and shall be subject to the approval of the Architect and Engineer-in-charge. However, Contractor shall be solely responsible for the safety of the scaffolding, hoisting arrangement, ladders, work and workmen, etc.

2.6.2 The scaffolding, hoisting arrangements and ladders shall allow easy approach to the work spot and afford easy inspection.

2.7 **Reuse :** Before re-use, all forms shall be inspected by the Engineer-in-charge and their suitability shall be ascertained. If, any of the forms are found to be unsuitable, they shall be immediately removed from the site. The forms ascertained for re-use, shall be scarred, cleaned, and joints gone over and repaired, wherever required. The inside surface shall be retreated to prevent adhesion to concrete.

3.0 Mode of Measurements and Payment :

3.1 Formwork shall be measured as an area in $m^{2.}$ of shuttering in contact with concrete except in the case of inclined members and portion of curved pro-files, in which case, only area of underside shall be measured for payment.

3.2 Formwork to secondary beams shall be measured upto the sides of main beams but no deduction shall be made from the formwork of the main beam at the inner section point. No deduction shall be made from the formwork of a column at inner section of beams.

3.3 The rate is applicable to all conditions of working and unsupported height between the slabs upto 4.5 m. The rate shall include the cost of materials, its transportation at site and labour for various operations involved such as :

(a) Splayed edges, notching, allowance for overlaps and passing at angles, battens centering, shuttering, strutting, propping, bolting, nailing, wedging, easing, striking and removal.
(b) Filleting to form stop chamfered edges or splayed external angles not exceeding 20 mm. width to beams, columns and the like.
(c) Temporary opening in the forms for pouring concrete.
(d) Scarring, removal of rubbish, dressing with mould release agent to prevent adhesion of concrete with shuttering,
(e) Raking or circular cutting.
(f) Making necessary grooves, gishis, Architectural cut-outs, pockets and drip moulds.

The rate is for the completed item.

3.4 The rate shall be for a unit of one m^2.

BRICKWORK:

4.01 **Providing and laying Bricks masonry works using common burnt clay conventional building bricks confirming to IS 1077-1986 of having crushing strength not less than 35 Kg/cm2. In any shape, location & all depth, including curing, scaffolding, racking / flush jointing etc. complete, as directed. (For all civil, plumbing & electrical works).**

a) In foundations and plinth

i) C.M 1:4 **ii) C.M 1:5** **iii) C.M 1:6**

b) Super structure above plinth

i) C.M 1:4 **ii) C.M 1:5** **iii) C.M 1:6**

1.0 **Materials :** Water shall conform to M-1. Cement to M-3. Sand to M-6. Brick to M-15. Cement mortar to M-11.

2.0 **Workmanship :**

2.1 **Proportion :** The proportion of the CM shall be as mentioned in the item description (cement : medium sand), by volume.

2.2 **Soaking of bricks :** The bricks required for masonry shall be thoroughly wetted with clean water for about 24 hours before use or as directed. The cessation of bubbles, when the bricks are wetted with water is an indication of thorough 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 the bond; closer and in such case it 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 brick shall first be properly bedded and set home by gently tapping with the handle of the 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 the 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 joints shall be truly vertical. Vertical joints in alternate courses shall generally be in one vertical plane. The thickness of brick course shall be kept uniform.

2.3.4 The bricks shall be laid with the frog facing upwards. A set of tools comprising of wooden straight edges, manson's spirit level, square half meter rub (right angle), pins, string, level pipe 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, having thickness greater than 23 cm. shall be kept in proper plumb. All the connected brick work shall be kept not more than 1 m. 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°. In a day brick work shall not be laid more than 1m or 10 courses in height.

2.3.6 All the fixtures, pipe outlets of water, etc. which are required to be built in the wall shall be embedded in CM, as per the drawings or as directed. The frames of doors, windows, cupboards, etc. shall be housed into the brick work at the correct location and level, as directed. The heavy steel doors, windows frames, etc. shall be built in with brick work, but for ordinary steel doors and windows, required opening for frames, hold-fasts, etc. shall be left in the wall and frames shall be embedded later on in order to avoid damage to the frames.

2.3.7 Necessary scaffolding shall be provided by the Contractor. The supports of the scaffolding shall be sound and strong, tied together with horizontal pieces over which the scaffolding planks shall be fixed. Normally simple scaffolding only shall be allowed. In this case horizontal pieces of the scaffolding shall rest in the holes, made in the header coarse only. The Contractor is responsible for providing and maintaining sufficiently strong scaffolding so as to withstand all loads likely to come upon it.

2.3.8 No through holes shall be left in brickwork to support the scaffolding. Only double scaffolding shall be erected. In case the holes are left in the brickwork, it shall be filled with 1:4:8 PCC.

2.4 **Joints :**

2.4.1 Bricks shall be so laid that all joints are quite flush with mortar. Thickness of joints shall not exceed 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 green so as to provide key for plaster or pointing to be done, subsequently.

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

2.4.3 At the end of day's work or on holidays the top of unfinished masonry shall be kept wet. If the mortar becomes dry, white or powdery, for want of curing, work shall be pulled down and re-built at Contractor's expense.

2.5 **Curing :** Fresh work shall be protected from rain suitably. Masonry work shall be kept moist on all the faces for minimum period of 7 days. The top of masonry work shall be kept well wetted at the end of the day's work.

2.6 **Preparation of foundation bed :** If the foundation is to be laid directly on the excavated bed, the bed shall be levelled, cleared off of all loose materials, cleaned and wetted before starting masonry work. If masonry is to be laid on concrete footing, the top of concrete shall be roughened, cleaned and moistened. The Contractor shall obtain approval of the Engineer-in-charge for the foundation bed, before foundation masonry is started. When pucca flooring is to be provided flush with the top of the plinth, the inside of the plinth wall shall be lowered down having an offset of the same thickness of the flooring with respect to the outside plinth wall top or as directed.

3.0 Mode of Measurements and Payment :

3.1 The measurement of this item shall be taken for the brick masonry fully completed in foundation upto plinth or above plinth for all levels, heights, shapes and locations as per the item description.. The limiting dimensions not exceeding those shown on the drawings 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, nor any extra payment shall be made for embedding in masonry or making holes in respect of following items :

(1) End of joists beams, posts, girders, rafters, purlins, trusses, corbel, steps etc. where cross sectional area does not exceed 500 cm^2.
(2) Architectural openings in walls, parapet and compound walls, not exceeding 1.0 m^2. area.
(3) Wall plates and bed plates, bearing of slabs, chhajjas and the like whose thickness does not exceed 10 cm. and the bearing does not extend to the full thickness of wall.
(4) Drainage holes, recesses for cement concrete blocks to embed hold fasts for doors, windows etc., forming toothings, grooves etc. and providing cramps for holding stone lining.
(5) Iron fixtures, pipes upto 300 mm. dia.; holdfasts and doors and windows built into masonry and sanitary and water supply pipes, etc., for concealed electrical wiring and any other fixtures or inserts.
(6) Forming chases of section not exceeding 350 cm^2. in masonry.

3.3 Apertures for fire places shall not be deducted nor shall extra labour required to make splaying of jambs, throating and making arches over the aperture be paid for separately. The rate shall include for work of any shape e.g. pillars of any size and shape, curved or tapered walls, drip courses, projections, parapets, load bearing walls, sills, ottas, steps, tank walls, platforms and counter walls, ducts, channels and architectural mouldings like corbelling, pattas, etc.

3.4 The rate shall be for a unit of one m^3.

4.01 Providing and laying brick work using common burnt clay conventional building bricks, having crushing strength not less than 35 Kg/cm^2, including curing, scaffolding, etc. complete, as directed. (for all civil, plumbing and electrical works).

a) Super structure above plinth for all levels, location, shapes etc.

i) C.M 1:4
ii) C.M 1:5
iii) C.M 1:6

The relevant specification of item no. 4.01 shall be followed except that the strength shall be 35 Kg/cm^2 instead of 50 Kg/cm^2

4.03 Providing and laying Half brick, 4-1/2" thick masonry using common burnt clay conventional building bricks confirming to IS 1077-1986, having crushing strength not less than 35 Kg/cm2, for all floors / all heights / all levels, in any shape, in any position, including curing, scaffolding, etc. complete, as directed (for all civil, plumbing & electrical works).

I) With reinforcement

a) 115mm thick
i) C.M 1:3
ii) C.M 1:4

b) 75mm thick
i) C.M 1:3
ii) C.M 1:4

II) Without reinforcement
a) 115mm thick
i) C.M 1:3
ii) C.M 1:4
b) 75mm thick (brick on edge)
i) C.M 1:3
ii) C.M 1:4

1.0 **Materials :** Bricks shall conform to M-15. Water to M-1. Cement to M-3. Sand to M-6. Cement mortar to M11.

2.0 **Workmanship :**

2.1 Relevant specifications of bricks, wetting and laying of brick, joints, curing, etc. shall conform to item no. 4.01 except that the brick work of half bricks, 115 mm. thick shall be carried out, at all heights, levels, location, shapes etc. The thickness and the C.M shall be same as mentioned in the item description.

2.2 All bricks shall be laid stretcher wise, breaking joints with those in the upper and lower courses. The wall shall be taken truly plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. The bricks shall be laid with frogs upwards. A set of mason's tools shall be maintained on work site as required for frequent checking.

2.3 MS bars, 6 mm. dia., 2 nos. shall be provided at every 3rd course. The end of reinforcement shall be fully embedded in the main wall on both sides as directed. Reinforcement shall be placed on top of the bottom most course and then on every 3rd course. Lap shall be of 15 cm.

2.4 In a day brickwork shall not be laid more than 1m or 10 courses in height.

2.5 The joints in course where reinforcement is placed shall allow sufficient mortar cover to the reinforcement.

3.0 **Mode of Measurements and Payment :**

3.1 The half brick masonry work for all heights, levels, locations and shapes shall be measured under this item. The limiting dimensions shall not exceed those shown in the plan or as directed. Any work done extra over the specified dimensions shall not be measured and paid for. The rate shall include the reinforcement if it is given in the item description.

3.2 The relevant specifications of item no. 4.01 shall be followed. The length shall be measured nearest to one cm.

3.3 The rate shall be for a unit of m^2.

4.04 **Providing and laying half bricks thick Honey comb brick work with burnt clay conventional building bricks, having crushing strength not less than 50 Kg/cm^2., in CM 1:4 (1 cement : 4 coarse sand), including curing, scaffolding, etc. complete, as directed, at all floors. (for all civil, plumbing and electrical works).**

1.0 **Materials :** Bricks shall conform to M-15. Cement mortar to M-11.

2.0 **Workmanship :** The relevant specifications of item no. 4.03 shall be followed except that the honey comb masonry work shall be carried out in thickness of half bricks in CM 1:4 (1 cement : 4 coarse sand) as and where directed, with all lifts, in any position.

3.0 **Mode of Measurements and Payment :**

3.1 The honey-comb masonry work shall be measured in m^2. The full area of honey-comb work shall be measured without deduction for openings.

3.2 The rate shall be for all floors, at any height and level.

3.3 The rate shall be for a unit of one m^2 of wall surface.

4.05 **Extra labour only for forming 300 /350 mm wide cavity walls having any size thickness leaves. Extra labour rate shall be for RCC wall ties, forming weep (below) and vent (upper) holes, closing of cavities at sill jamb and head, scafolding, cleaning, finishing, curing etc. complete as directed by engineer-in-charge for all floors, levels and shapes. Mode of measurement shall be as under:-**

a) Brick work in cavity walls either half (115 mm) brick thickness as per item no 4.03 or 230/350 mm thickness as per item no 4.01 shall be measured and paid in relevant tender item. RCC and reinforcement for band should be paid in relevent items.

b) width of cavity wall shall not be meausered.

c) Labor and material for closing cavities at the jambs, bottom of wall, sills and heads of opening shall be as described and measured in relevant tender items.

d) The item shall include use of device for keeping cavity clear and forming the requisite weep and vent holes, cleaning cavity and nothing extra on this account shall be payable.

e) Length and height of the cavity wall for only one side shall be measured and paid.

1.0 **Materials :** Bricks shall conform to M-15. Water to M-1. Cement to M-3. Sand to M-6. Cement mortar to M-11.

2.0 **Workmanship :**

2.1 Relevant specifications of bricks, soaking and laying of bricks, joints, curing, etc. shall conform to item no. 4.01 except that the brick work shall be carried out for cavity walls constructed using bricks or blocks so arranged to provide an air space within the wall.

2.2 Usually, cavity wall is constructed of 2 leaves, 115mm thick, with a cavity in between. The bricks are laid flat as stretchers in each course, breaking joints. Each leaf of the cavity wall shall not be less than 115 mm. thick. If the 2 leaves are of different thickness, the thicker leaf shall be made on the inside. These walls shall not be built more than 4.5 m high and 9 m long. Where longer lengths and heights are desired, the walls are divided into panels with intermediate RCC vertical mullions and horizontal runners.

2.3 The 2 leaves of the cavity wall are tied together at specified intervals, by galvanised iron, mild steel or wrought iron wall ties made of flats of 20 mm. x 5 mm., cranked or twisted at their mid-point with the ends split or fish tailed. 6 mm. dia. MS wires spaced at 1m horizontal distance and 500mm vertical distance in staggered position. There shall be atleast 5 ties per m^2. Additional ties shall be used near openings. The ties are sloped towards the exterior side so that water does not flow along the tie from the outer leaf to the inner leaf. The ties shall be given a coating of Bitumen before insertion to protect it against corrosion. The ties are built into the horizontal bed joints during erection.

2.4 RCC band shall also be provided at sill and lintel level in place of MS, GI or wrought iron ties. The width of the wall ties shall be same as the wall thickness and height shall be one brick thick.

2.4 The cavities are not kept continuous. The width of the cavity shall not be less than 50 mm. and not more than 80 mm. with a maximum of 150 mm.

2.5 Cement mortar used in masonry work shall be in proportion of 1 part of cement and 4 parts of sand, by volume.

2.6 If the cavity wall thickness is 350mm, the wall shall be connected with brick wall ties at approximately 1mc/c. The details shall be as per the drawing.

3.0 **Mode of Measurements and Payment :**

3.1 The rate shall be for a unit of one sqm. The measurement of cavity shall be taken along a plane at the center of the cavity.

3.2 The work of cavity brick wall shall be measured under this item in cum. Measurements shall not be taken separately for 2 leaves. Cavity shall not be measured. Binders or ties shall be measured per number and included in the rate unless specified otherwise. The cost of RCC runner/ ties shall be paid in the respective item.

3.3 Other relevant specification shall be as per 4.01.

4.06 **Providing and laying precast concrete block masonry (including quoin block, jamb block, closer etc.) with solid concrete precast blocks of approved size, made of C.C. (cement : coarse sand : graded stone aggregate of 20 mm. and down gauge), in, for all floors, levels, heights and shapes etc. complete, as directed. (for all civil, plumbing and electrical works).**

a) Concrete block made of C.C 1:3:6 and cement mortar 1:5

b) Concrete block made of C.C 1:3:6 and cement mortar 1:4

1.0 Materials :

1.1 Aggregate shall conform to M-12. Sand to M-6. Cement to M-3.

1.2 The solid cement concrete block shall be precast with concrete of 1:3:6 as mentioned in the item description. mix (cement : graded sand : graded stone aggregate).

1.3 A block shall be deemed to be solid if the solid material is not less than 75% of the total volume of the block calculated from over all dimensions.

1.4 The nominal size of the blocks shall be one of the following.

1.4.1 Size-A : 40 x 20 x 20/10 cm., Size-B : 40 x 15 x 20/10 cm.

1.4.2 The size other than those specified above may be used with the approval of the Architect.

1.5 The blocks may be machine made. The concrete mix, the mixing of concrete, the manufacturing of blocks, curing and drying shall be accordance with para-6 to 10 of IS : 2185-1967.

1.6 Faces of blocks shall be flat and rectangular. Surface finish shall be rendered smooth or plastered with CM 1:3 (1 cement : 3 coarse sand), as directed. The payment for the rendering shall be included in this item.

1.7 The average compressive strength of 8 blocks, when determined in the manner described in IS : 2185-1967, shall not be less than 50 Kg/cm^2. of gross area. The lowest strength of an individual block shall not be less than 75% of average compressive strength of the 8 blocks.

1.8 Concrete blocks shall be stored and stacked properly in such a way to avoid any contact with moisture at site. They shall be stock plied on planks or other supports free from contact with ground and covered to protect against wetting.

1.9 Cement mortar of proportion 1:5 or 1:4 as described in item description shall conform to M-11.

2.0 Workmanship :

2.1 The blocks need not be wetted before or during laying in the walls. In case climatic conditions so required, the top and the sides of block may only be slightly moistened so as to prevent absorption of water from the mortar and ensure the development of required bond with mortar.

2.2 **Joints :**

2.2.1 Operations of laying precast cement concrete block masonry shall be carried out in accordance with instructions detailed in IS : 6042-1962. The mortar shall not be spread so much ahead of the actual laying of the units that it tends to stiffen and loose its plasticity; thereby resulting in poor bond. For most of the work; mortar shall be spread over the entire top surface of the block so that the horizontal joint shall be 10 mm. thick except in the case of extended joint construction. The mortar joints shall be struck off flush with wall surface and when the mortar has started stiffening, it shall be compressed with rounded or U-shaped tool. The mortar shall be pressed against the units with a jointing tool after the mortar has stiffened in effect intimate contact between the mortar and the masonry unit and obtained a weather tight joint. Normally full mortar bedding shall be adopted as it shall enable full utilisation of the load carrying capacity, however, where walls shall carry lighter loads, the mortar shall be spread only over the front and rear shells and not on the webs. This shall arrest the seepage of water through the joints.

2.2.2 To maintain uniform thickness of the jointing mortar, wooden batten 10mm x 10mm shall be placed on either side of the block for each layer. The batten shall be removed once the mortar attains sufficient strength.

2.2.3 For vertical joints, the mortar shall be applied on the vertical edges of the front and rear shells of the blocks. It shall be more convenient to apply mortar on the edges of the succeeding units and then placing it horizontally well pressed against the previously laid unit. It may be necessary to add mortar, particularly to the vertical joints, to ensure that they are well filled.

2.3 **Laying :**

2.3.1 The first course shall be laid with great care, making sure that it is properly aligned, levelled and plumbed. The blocks for this course shall be first laid without mortar, over the footing, along the string lightly stretched, to determine the correct position and also adjust their spacing. When the blocks are set in proper position, the 2 corner blocks are removed, a full mortar bed is spread for them on the footing and are then laid back again in place, truly level and

plumb. The string is then stretched tightly along the faces of the two corner blocks. Thereafter, each block shall be removed and re-laid over a bed of mortar, with their faces to coincide with the string line. After every 3 or 4 blocks have been laid, their correct alignment, level and verticality shall be checked. Special C shaped blocks (Biaxial) shall be used to make provision for service pipe lines, holdfasts, lintel etc.

2.3.2 **Quoins and Closer :** Special quoins blocks (with a return face equal to half the length of normal face) shall be cast for all building blocks and slabs and for external work. Proper half length closer shall be cast and not cut from full size blocks. The returned ends of blocks for door and windows reveals and quoins shall be finished with a fair face in the mould.

2.3.3 Construction of the wall may be started either at the corners first or from one end proceeding on the other direction. If the corners shall be built first, they shall be built four or five courses higher than the center of the wall. Each block shall be checked with a level or straight edge to ascertain that the blocks are in one plane. Each course, shall be stepped back by half-block and the horizontal spacing of the block shall be checked by placing a mason's level diagonally across the corners of the block.

2.4 Only double scaffolding shall be used. The scaffolding shall be strong and sound. No holes in the masonry for supporting shall be allowed.

2.5 **Curing :** The curing of concrete block masonry shall be carried out atleast for 7 days.

3.0 Mode of Measurements and Payment :

3.1 The relevant specifications of item no. 4.01 shall be followed.

3.2 The work of concrete block masonry for all floors, at any height and level shall be measured under this item.

3.3 The rate shall be for a unit of one m^3.

4.07 Providing and laying precast concrete block masonry in partition walls, 10 cm. thick, with solid precast block of approved size (including quoins, blocks, jamb blocks, closer etc, in CM 1:3, for all floors, etc. complete, as directed. (for all civil, plumbing and electrical works)

a) Blocks made of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm. and down gauge),

1.0 Materials : The relevant specifications of item no. 4.06 shall be followed except that the precast concrete blocks shall be of suitable size for 10 cm. thick partition wall, i.e. size `C'- 390mm x 100mm x 190mm and the proportions of CM shall be 1:3 (1 cement : 4 coarse sand).

2.0 Workmanship : The relevant specifications of item no.4.08 shall be followed except that the precast concrete blocks shall be of suitable size for 10 cm. thick partition wall, i.e. size `C' and the proportions of CM shall be 1:3 (1 Cement coarse sand).

3.0 Mode of Measurements and Payment :

3.1 The relevant specifications of item no. 4.03 shall be followed.
3.2 The rate shall be for a unit of one m^2.

4.08 Providing and laying precast concrete block masonry (including quoin block, jamb block, closer etc.) with hollow precast concrete blocks of approved size, in CM 1:3, for all floors, levels, heights, shapes etc. complete, as directed. (for all civil, plumbing and electrical works)

a) **Blocks made of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 10 mm. and down gauge),**

1.0 Materials :

1.1 Aggregate shall conform to M-12. Sand to M-6. Cement to M-3. Precast hollow concrete block to M-73.

1.2 The actual size of the blocks shall be one of the following.

1.2.1 Size-A : 39 x 29 x 19 cm., Size-B : 39 x 19 x 19 cm., Size-C : 39 x 14 x 19 cm.

1.2.2 The size other than those specified above may be used with the approval of Architects.

1.3 The blocks may be either machine made or hand made. The concrete mix, the mixing of concrete, the manufacture of blocks, curing and drying shall be accordance with para-6 to 10 of IS : 2185-1967. The hollow blocks shall be open or closed cavity as per the drawing.

1.4 Faces of blocks shall be flat and rectangular. Surface finish shall be rendered smooth or plastered with CM 1:3 (1 cement : 3 coarse sand) as directed.

1.5 The average compressive strength of eight blocks when determined in the manner described in IS : 2185-1967 shall not be less than 50 Kg/cm^2. of gross area. The lowest strength of an individual block shall not be less than 75% of average compressive strength of eight blocks.

1.6 Cement mortar of proportion as per the item description shall conform to M-11.

2.0 **Workmanship :** The relevant specifications of item no. 4.06 shall be followed and in addition to that the following shall be followed :

For provision of Door and window frames :

a) A course of solid block masonry shall be provided under the door and window openings or a 10 cm thick precast concrete sill-block under the windows. This solid course shall extend for at least 20 cm. beyond the opening, on either side.

b) For jambs of very large doors and windows, either solid block shall be provided or the hollow blocks used shall be filled with concrete mix of 1:3:6.

c) Mild steel holdfasts shall be so fixed that they coincide with the block course level. Their ends shall be embedded in the hollow, which has to be filled with concrete mix 1:3:6.

3.0 **Mode of Measurements and Payment :**

3.1 The relevant specifications of item no. 4.01 shall be followed.

3.2 The work of hollow concrete block masonry shall be measured under this item.

3.3 The rate shall be for a unit of one m^3.

4.09 **Precast concrete block masonry in partition walls, 10 cm. Thick or specified in the drawing, with hollow block of approved size (including quoins, blocks, jamb blocks, closer etc.), made of C.C. 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 10 mm. and down gauge), in CM 1:3, for all floors. (for all civil, plumbing and electrical works)**

1.0 **Materials :** The relevant specifications of item no. 4.07 shall be followed except that the precast concrete blocks shall be of suitable size for 10 cm. thick partition wall or as specified in the drawing, i.e and the proportions of CM shall be 1:3 (1 cement : 4 coarse sand).

2.0 **Workmanship :** The relevant specifications of item no.4.08 shall be followed except that the precast concrete blocks shall be of suitable size for 10 cm. thick partition wall, i.e. Size 39 x 10 x 19 cm and the proportions of CM shall be 1:3 (1 Cement coarse sand).

3.0 **Mode of Measurements and Payment :**

3.1 The relevant specifications of item no. 4.03 shall be followed.

3.2 The rate shall be for a unit of one m^2.

4.11 **Providing and fixing 190 x 190 mm line light glass bricks as per approved sample with PVC spacer and 2 nos. 5mm dia GI wires placed through spacers horizontally as well as vertically and anchored in the surrounding concrete/brickwork by rebarring with chemical of HILTI or equivalent. The white cement sand mortar in joints in 1:2 (cement:sand) proportion shall be used as per the drawings and direction of Architect or Engineer-in-charge, etc. and for all floors, levels, heights, shapes etc. complete. (for all civil, plumbing and electrical works)**

1.0 **Materials** : Glass brick shall be of good quality, manufactured by "KIG brand- Indonesian" or equivalent as approved and specified in the item. The size of the block shall be 190x190x80mm or otherwise specified in the drawing.Concealed PVC spacer and 5mm GI wire shall be provided. **Sample shall be approved by the Architect or Engineer-incharge.**

2.0 **Workmanship :**

2.1 The glass brick shall be fixed with best workmanship as and where directed, at all heights with necessary scaffolding. The glass brick shall be fixed with white CM 1:2, as directed. Relevant specification of item no.4.01. shall be followed.

2.2 Before starting of the work, markings of the glass bricks @ 20cm C/C shall be done on jambs, bottom and ceilings.

2.3 Two numbers of 5mm thick GI wires dowels to be anchored in each joint horizontal as well as vertical by drilling holes and filling the same with HILTI or equivalent chemical.

2.4 The PVC concealed spacer (with provision for passing the 2 no. GI wires in horizontal and vertical direction) shall be provided to maintain grooves/ space for GI wire and cement mortar at the junction of two glass bricks.

2.5 The sample of the glass brick partition made of 1mx1m shall be got approved by the Engineer-Incharge.

2.6 The glass brick shall be fixed with placing GI wires vertically as well horizontally after passing through the spacer and having minimum lap length of ±200mm in staggered pattern as per the site condition at all places, heights and shapes. The glass brick shall be fixed with white CM 1:2, as directed. After completion of the placing of the bricks, joints between the bricks and around it shall be finished with white cement and cleaned properly.

2.2 Additionally, as the glass bricks cannot be broken, the opening etc. shall be so designed that full size bricks can be used at all places.

2.3 The vertical joints in this type of work shall be truly vertical and the horizontal shall be truly horizontal, so that the pattern within the brick also gives a true to line and level appearance.

2.4 The specifications shall be followed as per the item description.

3.0 **Mode of Measurements and Payment :**

3.1 The relevant specification of item no. 4.01 shall be followed.

3.2 The rate shall be for a unit of one $m^{2.}$ inclusive of grooves of 1cm on all sides for a visible area of work done. No wastage shall be permitted and measured.

4.14 **Extra for providing exposed finish to brickwork of all thickness, at all heights, shapes and locations in any position. (for all civil, plumbing and electrical works)**
The bricks used shall be
a) Wire cut bricks
b) Best quality hand moulded bricks

1.0 **Materials :** First class best quality having crushing strength 50 kg/ cm^2 either wire cut or hand moulded as per the sample approved by architect and engineer-incharge. The bricks shall conform to M-15A.

2.0 **Workmanship :** The relevant specification of normal brick masonry shall be followed and additional care should be taken in the following scope of works :

a) The bricks used shall be laid true in line, level and plumb.
b) The bricks shall be laid as per the drawing (The no. of courses of brick shall be specified in the drawing).
c) The dimension of opening for doors, windows etc shall be kept as per the details given in the drawing.
d) No bricks, which are broken, chipped, wrinkled, or which have irregular edges or corners, shall be used. the colour of the bricks shall be uniform.
e) The thickness of joints shall not exceed 12 mm. and shall be even in thickness. For the same, wooden fillets 10 mm. thick and 12 mm. wide shall be placed at the edge of the joints so that no mortar comes onto the surface of the bricks and a regular thickness of the joint is maintained. The face joints shall be raked out as directed by raking tools daily, during the progress of work, when the mortar is still green so as to provide key for pointing to

be done, subsequently. All horizontal joints shall be truly horizontal and all vertical shall be truly vertical.

f) The surface shall be cleaned thoroughly of all mortar dropping. The surface shall be rendered to give a good surface finish.
g) Double scaffolding shall be used either of steel or bamboo during execution of this work.
h) No holes shall be provided in the wall for the support of scaffolds etc.
i) Bricks shall be tested for efflorescence as per the relevant IS code.
j) Water used for curing shall be free from salts - Sodium and calcium as they may cause leeching on the surface of the brick masonry.
k) In case of hand moulded bricks, selected bricks shall be used for jambs, corners etc. If required, the bricks shall be made right-angled by chiseling, rubbing etc.

3.0 Mode of Measurements and Payment :

3.1 The rate shall be over and above the rate for normal masonry work for using best quality brick. The rate shall be for a unit of sqm. The rate shall include cost of rendering, etc.

3.2 The rate shall only be paid for visible brickwork surface i.e. the surface, which is pointed and rendered, irrespective of the thickness of the brick work.

3.3 Other relevant specifications of item no. 4.01 shall be followed.

(II) RUBBLE MASONRY WORK :

4.15 Providing and laying uncoursed rubble masonry, with hard stone of approved quality, in foundations and plinth, in CM, including leveling, etc. complete, as directed. (for all civil, plumbing and electrical works) The minimum crushing strength of the stone shall be
i) 1:6 (1 cement : 6 coarse sand
a) 200 Kg/cm^2.b) 100 Kg/cm^2.
ii) 1:5 (1 cement : 5 coarse sand
a) **200 Kg/cm^2.b) 100 Kg/cm^2.**

1.0 Materials : The cement mortar shall conform to M-11. Stones to M-16.

2.0 Workmanship :

2.1 **Dressing of Stones :** Stone used for uncoursed rubble masonry work shall be hammer dressed on the sides, and beds in such a way as to close up with the adjacent stone in the masonry work as strongly as possible. The face stone shall be dressed in such a manner as to give a specified pattern such as diagonal touching etc. The face of the stone shall be so dressed that brushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on the face to be plastered, it shall not project by more than 19 mm. nor shall have depressions more than 10 mm. from the average wall surface.

2.2 **Laying :**

2.2.1 All the stone shall be sufficiently wetted before laying to prevent absorption of water from mortar. The wall shall be built truly in plumb (or true to required batter when so specified). All connected walls in a structure shall normally be raised up uniformly and regularly. However, if for any specific reason, one part of masonry is required to be left behind, the wall shall be racked back at an angle not steeper than 45°, vertical toothed joints in masonry shall not be allowed. The work shall be carried out regularly and masonry of any day will not be raised by more than 1 m. in height, at a time.

2.2.2 The stone shall be laid in an uncoursed fashion or random facing etc. However, the masonry is required to be brought to level at various stages viz. plinth level, window sill level, roof level and any other level specifically shown in the drawings. This may be done by adjusting the laying of stones upto the level specified or the nearest to that level and then by providing levelling coarse of cement concrete 1:5:10 (1 cement : 5 sand : 10 graded stone aggregate 20 mm. nominal size) to bring the masonry work upto the desired level or as otherwise specified.

2.2.3 Proper bonding shall be achieved by closely filling in adjacent stones as well as by using bond stones or through stones as described herein below. Face stones shall extend back sufficiently and bond well with the masonry. The stone shall be carefully set so as to break joints and avoid formation of vertical joints. The depth of stone from the face of wall inward shall not be less than height or breadth at the face. The hearting or interior filling of the wall shall consist of rubble stones which may be of any shape. Neither the face stone nor the hearting stone shall be so small to pass through circular ring of 150 mm. internal diameter in any direction nor shall any of them shall have minimum

thickness 100 mm.

2.2.4 All stone shall be carefully laid, hammered down by a wooden mallet into position and solidly embedded in mortar. Chips and spawls of stone may be used wherever necessary to avoid thick mortar beds or joints. At the same time no hollow space shall be left anywhere in the masonry. The chips used shall not be more than 20% by volume of masonry. The hearting stone shall be laid nearly in level with face stones except at vertical bond stone laid at 1 m. intervals or plumbs projecting about 150 to 200 mm. shall be firmly embedded to form vertical bonding in masonry.

2.3 **Bond Stones :** Bond stones or through stones running right across the thickness of the wall shall be provided in walls upto 600 mm. thick. In thicker walls two stones overlapping each other by at least 150 mm. shall be provided across the thickness of the wall to form bond stones. There shall be atleast one bond stone for every 0.5 $m^{2.}$ of walls surface. The bond stone shall be marked by a distinguishing letter during construction for subsequent verification and shall be laid staggered in subsequent layers.

2.4 **Quoins :** The quoins or corner stone shall be selected stone neatly dressed with hammer and/or chisel to form the required corner angle and laid header and stretcher alternatively. The bed and top surface of quoins shall be chiselled, dressed to give horizontal joints. The quoins shall have a uniform chisel draft of at least 25 mm. width at four edges of each exposed face, all the edges of the same face being in one plane. No quoin stones shall be smaller than 0.025 $m^{3.}$ in volume.

2.5 **Jamb Stones :** The jamb stone shall be made with stone specified for quoins, except that the stone provided on the jambs shall have their length equal to thickness of wall upto 600 mm. and a line of headers shall be provided for walls thicker than 600 mm. as specified for bond.

2.6 **Joints :** All the joints shall be completely filled with mortar and their width shall not exceed 25 mm. When plastering or pointing is not required to be done, the joints shall be struck and finished simultaneously while laying the stone. Otherwise the joints shall be racked to a minimum depth of 20 mm. by a racking tools, during progress of laying while the mortar is still green.

2.7 **Scaffolding :** Single or double scaffolding shall be used. The scaffolding shall be strong and sound. The holes left in masonry for supporting scaffolding shall be filled and made good with 1:4:8 PCC before plastering or pointing.

2.8 **Curing :** Green work shall be protected from rains by suitably covering the same. Masonry shall be kept constantly moist on all the faces atleast for a period of 7 days. The top of masonry shall be flooded at the close of the day.

3.0 Mode of Measurements and Payment :

3.1 All work shall be measured on the basis of finished dimensions and measured net except where otherwise specified. Only specified dimensions shall be allowed. Anything extra shall not be measured and paid for. The masonry work in foundation and plinth shall be measured under this item. No deduction shall be made nor extra payment shall be made for the following :

(a) Ends of joints, beams, posts, girders, rafters, purlins, trusses, corbels, etc. each upto 500 cm^2. in section.
(b) Opening each upto 0.1 m^2.
(c) Wall plates and bed plates bearings of chhajja and like upto 10 cm. depth (hearing of floor and roof slabs shall be deducted from masonry).
(d) Drain holes and recesses for cement concrete block to embed holdfasts for doors and windows.
(e) Building in the masonry iron fixtures pipes upto 300 mm. dia holdfasts of doors and windows.
(f) Forming cheeses in masonry upto section of 350 cm^2.

3.2 The rate shall be for a unit of one m^3.

4.16 Providing and laying coursed rubble masonry, with hard stone of approved quality, in foundation and plinth, in CM 1:6 (1 cement : 6 coarse sand), etc. complete, as directed. (for all civil, plumbing and electrical works) The minimum crushing strength of stones shall be

i) 1:6 (1cement : 6 coarse sand)
a) 200 Kg/cm^2. b) 100 Kg/cm^2.
ii) 1:5 (1 cement ; 5 coarse sand)
a) 200 Kg/cm^2. b) 100 Kg/cm^2.
iii)1:4 (1 cement : 4 coarse sand)
a) 200 Kg/cm^2. b) 100 Kg/cm^2.
iv)1:3 (1 cement : 3 coarse sand)
a) 200 Kg/cm^2. b) 100 Kg/cm^2.

1.0 **Materials :** Cement mortar shall conform to M-11. The stone to M-16.

2.0 **Workmanship :**

2.1 **Dressing of Stone :** The face stone shall be hammer dressed so as to give approximately rectangular block shape. They shall be squared on bed and side joints. The bed joints shall be rough chisel dressed for a depth of atleast 50 mm. back from the faces and the side joints shall be dressed to a depth of atleast 40 mm. back from the face, such that no portion of the dressed surface shall be projected more than 10 mm. from a straight edge held against the surface. The remaining portions of surface shall not project above the chisel dressed bed and side joints. The bushing of the face shall not project by more than 40 mm. on an exposed face and 10 mm. on a face to be plastered. The hammer dressed stone shall also have a rough tooling for a minimum width of 25 mm. along the four edges of the face of the stone.

2.2 **Laying :**

2.2.1 All stones shall be wetted before laying. The wall shall be built-up truly plumb (or to required better where so specified).

2.2.2 All connected masonry in a structure shall normally be raised up uniformly and regularly. However, if for nay specific reasons, one part of wall is required to be left behind, such wall shall be raked back at an angle not steeper than 45°. Vertical toothed joints in masonry shall not be allowed. The work shall be carried out regularly and masonry of any day shall not be raised by more than 1 m. in height at a time.

2.2.3 All the courses, shall be laid truly horizontal. The height of course shall not be less than 150 mm. nor more than 300 mm. Face stone shall be laid in alternate header and stretcher fashion.

2.2.4 They shall be so arranged as to break joints by atleast 75 mm. Stones shall be laid with grains horizontal so that the load is transmitted along the direction of their maximum crushing strength. The depth of stone shall not be less than the height or breadth. The breadth of a face stone shall not be less than 150 mm. Each face stone shall be of the same height in any given course. The courses shall be built in perpendicular to the pressure which the masonry will bear. In case of battered wall (such as retaining walls) the beds of the stone and the plane of courses shall be laid with their bed perpendicular to the battered face.

2.2.5 The hearting or the interior filling of the wall shall consist of flat bedded stone carefully laid on their proper beds in mortar. Chips and spawls of stone shall be used where necessary to avoid excessive use of mortar. Care being taken to see that no hollow space shall be left any where in the masonry. Chips shall not be used below the hearting stone to bring these upto the level of stones. The use of chips shall be restricted upto the filling of interstices between the hearting stone but the volume of chips shall be limited to 15% of the total volume of the masonry work for that.

2.3 **Bond Stones :** The relevant specifications of item no. 4.15 para 2.3 shall be followed except that the hard stone shall be provided for atleast 1.8 m. length of every course.

2.4 **Quoins :** The quoins, which shall be of the same height as the course to which it belongs shall be formed from selected stone of atleast 400 mm. length. They shall be laid square or beds as stretcher and headers alternatively. The beds shall be rough, chisel dressed to a depth of atleast 100 mm. These stones shall have a minimum uniform chisel draft of 25 mm. width at four edges. All the edges being in the same plane. Quoin stones shall not be smaller than 0.025 m^3. in volume and it shall not be less than 300 mm. in length, 25% of them being not less than 500 mm. in length.

2.5 **Joints :** All the bed joints shall be horizontal and all side joints shall be vertical. Face joints shall not be more than 10 mm. thick. All joints shall be properly and completely filled up with mortar. On cases where no plastering or pointing is required to be done the joint shall be struck flush and finished simultaneously while laying stones. In other cases, the joint shall be raked to a minimum depth of 20 mm. by raking tools during the progress of work while the mortar is still green.

2.6 **Curing :** The relevant specifications of item no. 4.15 para 2.8 shall be followed.

3.0 **Mode of Measurements and Payment :**

3.1 The relevant specifications of item no. 4.15. shall be followed.

3.2 The rate shall be for an unit of one m^3.

4.17 **Providing and laying uncoursed rubble masonry, with hard stone of approved quality, for superstructure above plinth level and for all the floors, in CM 1:6 (1 cement : 6 coarse sand) including curing, levelling, etc. complete, as directed. (for all civil, plumbing and electrical works)**
The minimum crushing strength of the stone shall be
a) 200 Kg/cm^2. **b) 100 Kg/cm^2.**

1.0 **Materials :** Cement mortar shall conform to M-11. The rubble to M-16.

2.0 **Workmanship :**

2.1 The relevant specifications of item no. 4.15 shall be followed, except that the work shall be done in CM 1:6 for superstructure, for all floor levels.

2.2 Single or double scaffolding may be used. The scaffolding shall be strong and sound. In case single scaffolding is used, the holes shall be carefully made good as directed.

3.0 **Mode of Measurements and Payment :**

3.1 The relevant specifications of item no. 4.15 shall be followed.

3.2 The rate shall be for an unit of one m^3.

4.18 **Providing and laying coursed rubble masonry, with stone of approved quality, for superstructure above plinth level and for all the floors, in CM 1:6 (1 cement : 6 coarse sand), etc. complete, as directed. (for all civil, plumbing and electrical works)**
The minimum crushing strength of the stone shall be
a) 200 Kg/cm^2. **b) 100 Kg/cm^2.**

1.0 **Materials and Workmanship :**

1.1 The relevant specifications of item no. 4.15 shall be followed except that the coursed rubble masonry works shall be carried out for superstructure above plinth level for all floor levels.

1.2 Single or double scaffolding may be used. The scaffolding shall be strong and sound. In case single scaffolding is used, the holes shall be carefully made good as directed.

2.0 **Mode of Measurements and Payment :**

2.1 The relevant specifications of item no. 4.15 shall be followed.

2.2 The rate shall be for an unit of one m^3.

(III) **HOLLOW CONCRETE BLOCK WORK :**

4.19 **Providing and laying of hollow concrete block masonry for jali work made out from M20 grade 200mm thick hollow block of different size to create a pattern as per drawing confirming to IS 2185 Part I grade A (7.0). Block Jali wall shall be constructed in polymer added cement mortar 1:4 (1 cement : 4 coarse sand) as per recommended proportion including roughening, cleaning, fixing and finishing/ rendering in grey and white cement sand mortar 1:1 in the line and level and in pattern including finishing, curing at all heights with necessary scaffolding etc complete as per the drawing and direction of Engineer in charge. Contractor shall get approval of loose sample and mock up from Architect/ Engineer in charge before execution.**
Note: Payment should as per actual area of jali made out of hollow block, no deduction of hollow gap of block should be consider for payment.

1.0 **Materials :**

1.1 Water shall conform to M-1. Lime shall conform to M-2. Cement to M-3. Sand to M-6. Grit to M-8. Fly ash shall conform to the relevant IS Code.

1.2 **Hollow Concrete Blocks (Open Cavity) :**

1.2.1 **Block Dimensions :**

1.2.1.1 Nominal block Dimensions for through and through hollow (open cavity) concrete blocks shall be as below:
a) 200 mm. x 400 mm. x 200 mm.

b) 150 mm. x 400 mm. x 200 mm.
c) 100 mm. x 400 mm. x 200 mm.

1.2.1.2 The term "nominal" means that the dimensions include the thickness of the mortar joint of 10 mm. on all sides. The actual dimensions shall be 10 mm. short of the nominal dimensions.

1.2.2 **Tolerances :**

1.2.2.1 The maximum variation in the length of the unit shall not be more than ±5 mm. and maximum variation in width and height of the unit, not more than ±3 mm.

1.2.2.2 Face shells and webs shall increase in thickness from the bottom to the top of the unit (flared web and face shells).

1.2.3 **Ingredients :**

1.2.3.1 **Fly Ash :** Fly Ash should be confirming to IS 3812 (Part III) 1966 (upto a maximum of 20% of fine aggregates).

1.2.4 **Additives and Admixtures :** Additives used may be as below :
a) Plasticizer and air entraining admixtures confirming to IS 9103 - 1979.
b) Fly Ash confirming to IS 3812 (Part III).

1.2.5 **Manufacturing Process :**

1.2.5.1 The concrete mixed used for blocks shall not be richer that one part by volume of cement & 6 parts by volume of combined aggregates.

1.2.5.2 The concrete to be machine pressed at a pressure of @ 15000 psi with a w/c ratio of @ 0.35 with hydro-pneumatic vibrations and pressing.

1.2.6 **Curing :** The blocks to be steam cured after they are sufficiently hardened to enable handling for one day duration and then to be cured by water spray for seven before they are ready for despatch.

1.2.7 **Surface Texture and Finish :** In case of building not required plaster the surface texture of the unit shall be fine-close texture which shall be painted be 2-3 coats of cement paint to render it resistant to rain water. If it is intended to plaster concrete masonry, the block shall have sufficiently rough texture to afford a good key to the plaster.

1.2.8 **Physical Requirements :**

1.2.8.1 **General :** All units shall be sound & free of crack and other defects which interfere with the proper placing of the unit, or impair the strength or performance of the construction Minor chipping resulting from the customary methods of handling during delivery, shall not be deemed grounds for rejection.

1.2.8.2 **Dimensions :** The over all dimensions of the units when measured as per appendix A of IS 2185 Part I shall be in accordance with 1.1.1 subject to the tolerance mentioned in 1.1.2.

1.2.8.3 **Block Density :** The net density of the concrete used shall be 2000 Kg/m^3.

1.2.8.4 **Compressive Strength :** The minimum compressive strength at the time of despatch, being the average of eight units shall not be less than 70 kg/cm^2 on gross area.

1.2.8.5 **Water absorption :** The water absorption, being an average of three units determined in the manner prescribed in appendix `D' of IS 2185 part I shall not be more than 8% by mass.

1.2.8.6 **Drying Shrinkage :** The drying shrinkage of the units when unrestrained being the average of three units, determined in the manner prescribed in appendix `E' of IS 2185 part I, shall not exceed 0.1%.

1.2.8.7 **Moisture movement :** The moisture movement of dry blocks on immersion in water, being an average of three units, when determined in the manner prescribed in appendix `F' of IS 2185 part I shall not exceed 0.09%.

1.2.9 **Tests :** As described in appendices A to F of IS 2185 part I on sample of units selected.

1.3 **Masonry Mortar :**

1.3.1 **Grade of Mortar :** Masonry mortar used shall be of proportion 1:1:6 (1 part cement, 1 part lime and 6 parts sand) Minimum grade as per IS 2250 - 1981 to be MM 3.

1.3.2 **Preparation of Masonry Mortar :**

1.3.2.1 **Proportioning :** It shall be proportioned only by full bags Hydrated lime and aggregates shall be measured by volume using gauge boxes of suitable capacity.

1.3.2.2 **Preparation :** When coarse sand is used the lime putting and sand in the required proportions shall after preliminary mixing on a water-tight platform, with necessary addition of water, be ground in a mortar shall taking care to rake up continuously the mortar particularly at the corners, and also adding water as and when required during grinding.

1.3.2.3 The mix shall then be transferred to a mechanical mixer to which the required quantity of cement is added and the content mixed for at least three minutes.

1.3.2.4 When fine sand is used the mixing operations shall be as above except that grinding may be emitted for the preliminary mixing of lime putty and sand. (P.S. : when factory made hydrated lime confirming to IS: 712-1973 is used, grinding of lime and sand is not necessary).

1.3.2.5 If the mixture of lime putty and sand is not used immediately for mixing with cement, it shall be kept protected from drying out till the time of use.

1.3.2.6 When adding water in the mortar during mixing operations, it shall be ensured that it is added only to the extent necessary for obtaining working consistency for the mortar and not more.

2.0 Workmanship and Construction Methods :

2.1 **Modular Co-ordination :**

2.1.1 Hollow concrete block walls shall preferably be planned on the basis of modular co-ordination with a view to making the maximum use of full and half length units.

2.1.2 The cutting of units at the site shall be restricted to the minimum. Attention shall be paid to modular co-ordination while fixing the overall length and height of the wall; width and height of door, window and other openings; and wall dimensions between doors, windows and corners. All horizontal dimensions shall be in multiples of nominal half-length of the units and all vertical dimensions shall be multiples of full-height units.

2.2 **Avoidance of Crack Formation :** The major causes of cracks in the structure of hollow concrete block wall or partition and measures for their prevention are as below :

2.2.1 **Structural Movements :** Cracks may arise from alterations in length, curvature or orientation of the structural members enclosing a wall or partition due to load settlement, thermal expansion or changes in moisture content.

2.2.2 In the case of framed structures, erection partitions and panel walls shall be delayed wherever possible until the frame has taken up much as possible any deformation occurring due to structural loads.

2.2.3 **For floor deformation and movement :** The floor upon which a partition is built may deflect under load brought upon it after the partition is built. Where such deflections tend to create non-continuous bearing, the partition shall be strong enough to span between the points of least floor deflection or shall be capable of adapting itself to the altered conditions of support without cracking. This may be achieved by embedding horizontal reinforcement such as 6 mm. diameter bars or any other suitable reinforcement, or, if possible, by providing a reinforcement concrete band at every 40 cm height.

2.2.4 **Ceiling deflection or movement :** A ceiling above a wall or partition may deflect under loads applied after its erection, or through thermal or other movements. The wall or partition shall be separated from the ceiling by a gap, or by a layer of resilient material, to avoid cracking as a result of such deflection. Where this cannot be done, the risk of cracking, in the case of plastered finishes, may be diminished to some extent by reinforcement of the joint between the ceiling and the wall or partition, or by forming a cut between the ceiling plaster and the wall plaster.

2.3 **Storage and handling of materials :** The blocks shall be stored in such a way as to avoid any contact with moisture on the site. They shall be stock-piled on planks or other supports free from contact with the ground and covered to protect against wetting. The blocks shall be handled with care and damaged units shall be rejected.

2.4 **Wetting of Blocks :** The blocks need not be wetted before or during laying in the walls. In case the climatic conditions so require, the top and the sides of the blocks may only be slightly moistened so as to prevent absorption of water from the mortar and ensure the development of the required bond with the mortar.

2.5 **Laying Concrete Block Masonry :**

2.5.1 **Use of Mortar in Masonry :** Hollow concrete block masonry in superstructure shall be laid in composite mortar comprising one part of cement, one part of lime and six parts of sand depending upon the grading of sand.

2.5.2 **Horizontal (Bedding) Joints :** Mortar shall be spread over the entire top surface of the block including front and rear shells as well as the webs to a uniform layer of one centimeter thickness. Normally full mortar bedding shall be adopted as it enables fuller utilization of the load-carrying capacity of the blocks. But where the walls carry light loads, such as panel walls, in a framed structure `face shell' bedding may be used. In this type of bedding, the mortar is spread only over the front and rear shells and not on hit webs, which help to arrest the seepage of water through the joints penetrating to the interior surface of the walls.

2.5.3 **Vertical (Cross) Joints :** For vertical joints, the mortar shall be applied on the vertical edges of the front and rear shells of the blocks. The mortar may be applied either to the unit already placed on the wall or to the next unit to be laid alongside of it. But it will be more convenient to apply mortar on the edges of the succeeding unit when it is standing vertically and then placing it horizontally well-pressed against the previously laid unit. However, whatever the method used for applying mortar, care must be taken to product well-compacted vertical joints.

2.5.4 In the case of two cell blocks, there is a slight depression on their vertical sides, which may also be filled up with mortar where is considered necessary to secure greater lateral rigidity.

2.5.5 Mortar shall not be spread so much ahead of the actual laying of the units that it tends to stiffen and lose its plasticity, thereby resulting in poor bond. For most of the work, the joints, both horizontal and vertical, shall be one centimeter thick. Except in the case of extruded-joint construction described later, the mortar shall be raked out from the joint with a trowel to a depth of about one centimeter as each course is laid to so as to ensure good bond of the plaster.

2.5.6 When the mortar has stiffened somewhat, it shall be firmly compacted with a jointing tool. This compaction is important, since mortar, while hardening, has a tendency to shrink slightly and thus pull away from the edges of the block. The mortar shall be pressed against the units with a jointing tool after the mortar has stiffened to effect intimate contact between the mortar and the masonry unit and obtain a weather-tight joint.

2.5.7 All the joints shall be now pointed with 1:2 cement mortar to ensure they are weather proof.

2.6 **Operations for laying Block Masonry :**

2.6.1 **First Course :** The first course of concrete masonry shall be laid with great care, making sure that it is properly aligned, levelled and plumbed, as this shall assist the mason in laying succeeding courses to obtain a straight and truly vertical wall.

2.6.2 Before laying the first course, the alignment of the wall shall be marked on the foundation footings, rafts, plinth beams or on sub base. The blocks for this course shall first be laid dry, that is without mortar over the sub base along a string lightly stretched between properly located corners of the wall in order to determine the correct position of the blocks including those of the cross-walls jointing it and also adjust their spacing. When the blocks are set in proper position, the two corner blocks shall be removed, a full mortar bed spread shall be spread on the sub base and these blocks laid back in place truly level and plumb. The string shall then be stretched tightly along the faces of the two corner blocks and the faces of the intermediate ones adjusted to coincide with the line. Thereafter each block shall be removed and re-laid over a bed of mortar. After every three or four blocks have been laid, their correct alignment, level and verticality shall be carefully checked.

2.6.3 The construction of walls may be started either at the corners first or started from one end proceeding in the other direction. If the corners of the wall are built first, they shall be built four or five courses higher than the centre of the wall. As each course is laid at the corner, it shall be checked for alignment and level and for being plumb. Each block shall be carefully checked with a level or straight-edge to make certain that the faces of the block are all in the same plane. This precaution is necessary to ensure truly straight and vertical walls.

2.6.4 The use of a storey-rod or course-pole, which is simply a board with markings 20 cm apart, provides an accurate method of finding the top of the masonry for each course. All mortar joints shall be one centimeter thick. Each course, in building the corners, shall be stepped back by a half-block and the horizontal spacing of the block shall be checked by placing a mason's level diagonally across the corners of the block.

2.6.5 When blocks are laid between the corner blocks, a mason's line shall be stretched from corner to corner for each

course and the top outside edge of each block shall be laid to this line. The manner of handling or gripping the block shall be such as to position the block properly with minimum adjustment.

2.6.6 To assure satisfactory bond, mortar shall not be spread too far ahead of actual laying of the block or it will stiffen and lose its plasticity.

2.6.7 As each block is laid, excess mortar extruding from the joints shall be cut off with the trowel and thrown back on the mortar board to be reworked into the fresh mortar. If the work is progressing rapidly, the extruded mortar cut from the joints may be applied to the vertical face-shells of the block just laid. Should there by any delay long enough for the mortar to stiffen on the block, the mortar shall be removed from the mortar board and fresh mortar shall be prepared and used. Dead mortar that has been picked up from the scaffold or from the floor shall not be used.

2.7 **Provision for Door & Window Frames :**

2.7.1 A course of "C" channel block shall be provided under the doors and windows opening.

2.7.2 The jambs of doors and windows shall be grouted in the hollows of the `c' channel blocks with concrete of mix 1:3:6.

2.7.3 Mild steel bar holdfasts should be so fastened to the door or window frames that these occur at `c' block course level and their ends are embedded in the `C' block hollow and grouted in 1:3:6 cement concrete.

2.8 **Provision for Roof and Services :**

2.8.1 The course immediately below the roof slab shall be built with `c' shaped blocks with hollows facing upwards and shall be filled with 1:3:6 concrete later on, or else grouted alongwith the concreting of the roof slab with connecting steel carried on inside the roof slab. (in case of load bearing construction).

2.8.2 Alternatively (in RCC framed structure) course of solid blocks may be used as the top course.

2.8.3 `C' type blocks shall be used, vertically as well as horizontally, on each face, to cater the need of holdfasts of doors and windows, concealed piping (electrical and plumbing) wherever specified as per drawing and design.

2.9 **Rendering and Other Finishes :**

2.9.1 The plaster furnishes shall be applied in accordance with IS : 2402 - 1963 code of practice for external rendered finishes.

2.9.2 The concrete block masonry shall be rendered with at least one coat of 6 to 12 mm. thickness of 1:4 cement mortar. The sand to be used for the plaster shall be graded from 3 mm. downwards.

2.9.3 Where it is necessary to have the concrete block surface exposed, the wall shall be treated with two coats of approved quality of cement based paint.

3.0 Mode of Measurements and Payment :

3.1 The measurement of this item shall taken for the hollow concrete block masonry fully completed. The limiting dimensions not exceeding those shown on the drawings 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 block work, nor any extra payment shall be made for embedding in masonry or making holes in respect of following items :

(1) End of joists beams, posts, girders, rafters, purlins, trusses, corbel, steps etc. where cross sectional area does not exceed 500 cm^2.
(2) Architectural openings in walls, parapet and compound walls, not exceeding 1.0 m^2 area.
(3) Wall plates and bed plates, bearing of slabs, chhajjas and the like whose thickness does not exceed 10 cm. and the bearing does not extend to the full thickness of wall.
(4) Drainage holes, recesses for cement concrete blocks to embed hold fasts for doors, windows etc., forming toothings, grooves etc. and providing cramps for holding stone lining.
(5) Iron fixtures, pipes upto 300 mm. dia.; holdfasts and doors and windows built into masonry and sanitary and water supply pipes, etc., for concealed electrical wiring and any other fixtures or inserts.
(6) Forming chases of section not exceeding 350 cm^2 in masonry.

3.3 Apertures for fire places shall not be deducted nor shall extra labour required to make splaying of jambs, throating and making arches over the aperture be paid for separately. The rate shall include for work of any shape e.g. pillars of any size and shape, curved or tapered walls, drip courses, projections, parapets, load bearing walls, sills, ottas, steps, tank walls, platforms and counter walls, ducts, channels and architectural mouldings like corbelling, pattas, etc.

3.4 The concrete block masonry shall be measured in sq.mts. The finished work shall be inspected for faults/cracks, line level etc. and the length and height of the masonry wall shall be measured in meters. The sq.mt. of work executed shall so be arrived at (for both reinforced and non-reinforced block masonry).

4.20 Providing and laying of concrete blocks confirming to IS 2185 Part I grade A (7.0) in composite mortar 1:4 (1 part cement and 4 part of sand) in line and level including providing and fixing of vertical and horizontal steel in hollows of the masonry as per design and grouting these reinforced hollows in cement concrete of the grade specified from time to time) including raking out of joints on both sides and pointing them with 1:2 cm (1 part cement, 2 part sand) with finishing curing at all heights with necessary scaffolding etc complete as per the drawing and direction of Engineer in charge. The cost of reinforcement and concrete should be excluded from total rate. The same shall be paid separately. The rate shall also include for use of `C' type (Biaxial) blocks to make provision for service pipe lines, holdfasts, structural requirements (refer cl. 2.8.1) etc. as per the drawing and design. (for all civil, plumbing and electrical works) The concrete block shall be

a) 190mm thick
b) 140mm thick

The relevant specification of item no. 4.19 shall be followed except that the hollow concrete block masonry shall be reinforced vertically as well as horizontally.
The concrete and reinforcement shall be paid under the relevant item as per the specifications.

4.21 Providing, laying and filling (with pneumatic gun) the expansion joints, grooves, cracks or gaps with silicone sealant of neutral cure, including cleaning, scraping the joints with necessary backup material and abro tapes to a line, etc. complete, as directed.

1.0 Materials : Silicone sealant shall be of GE (Silpruf) or WECKER brands and shall be used of 300 ml packing cartridge directly available from company.

2.0 Workmanship :

2.1 Silicone sealant shall be provided as and where directed as per detail drawing and design. Before applying the sealant, the surface shall be properly cleaned, dried and free from any loose materials. It shall be applied with cartridge.

2.2 The joint shall be cleaned and made dry completely. All loose material such as sand, concrete, dust, etc. shall be removed. Best quality back up material shall be used to bring the width and depth of the joint to the required dimensions.

2.3 Silicone sealant of required quality shall be used. The colour of the sealant shall be grey, white, black or transparent Silicone sealant shall be filled in the joints to the required depth. The filled sealant shall be pressed and fixed by required instruments till air trapped is removed. The top surface shall be smooth and levelled. Required depth and width ratio shall be as per the suppliers specification. Polypropylene bond breaker tape shall be provided at the base of the expansion joint which will allow two sided adhesion. This will allow silicone sealant to stretch freely with the joint.

2.4 The work shall be carried out in the best workmanship as directed by the Architect in true line and level, for all heights, in any position.

2.5 The reconciliation of the cartridges shall be done at site. The no. of cartridges used at site shall be recorded.

3.0 Mode of Measurements and Payment:

3.1 The item will be measured and paid in terms of no. of cartridges consumed as per actual work done. Wastage shall not be measured and paid for.

3.2 Contractor has to maintain the day to day register of filled cartridges supplied, consumed and empty cartridges at site. The procedure of the records shall be as established by the client and architect.

BLANK

ALLUMINIUM WORKS

5.01 Alluminium Work:

Providing and fixing in position frames/ shutter for any type of aluminium work like aluminium door, composite door-window, window (sliding, openable, side hung, top hung, fixed etc.), casement window, aluminium partition, aluminium fixed louvers, fixed window any type of aluminium sections of make Jindal/ Indal/ Hindalco as per approved make having minimum 50 micron pure polyester powder coating of approved shade, texture & colour of approved make for all floors/ all levels/ all heights/ all shapes/ all sizes including cutting, bending, crimping, fabricating in best workmanship manner etc as per the drawing, specification and as directed by Architect or Engineer-in-Charge.

Rate shall be inclusive of providing aluminium sections (conventional sections for partition and wooden flush doors and Euro-profile for casement window-door/ sliding windows -doors), cutting, fabrication, errection and fixing to the best workmanship manner, including

1) Sheet metal screws and casted solid aluminum corner cleats fixed with external byttins with a spring for rapid and secure joint assembly for casement and sliding shutter and frame; 2) Glazing clips for receiving infill panel; 3) Best quality wool pile where ever shutter touches the frame and compatible microwave cured EPDM rubber; 4) Dash Anchor fasteners of HILTI HRDUGT or equivalent for fixing the frame assembly to the RCC or masonry surfaces. Minimum 1 anchor fastener shall be used for every 600 mm length of section for stability of frame. 5) 10mm GI tie rod for connecting vertical stile at top and bottom for aluminium door shutter and 4mm thick solid aluminium corner cleat of full thickness of section for connecting style and horizontal rails; 6) providing and fixing packing at every 600mm c/c of average 6 mm compact sheet of width (equal to section width less 30mm for backer rod and sealant); 7) Filling the gap between wall and frame on both sides (outside and inside) with polyethylene baker rod of avg. 10 mm thickness of approved make and color and then sealing the remaining gap with neutral grade G/M (Glazed & Metal) weather silicon sealant of approved make and color.

but excluding. 1) Necessary hardware; 2) Glazing or Infill material.

Shop drawing shall be prepared and get approved from the consultants before procurement of material by the contractor. Work shall carried out as per the approved shop drawings and approved sample. Actual weight of installed Aluminium sections which are visible shall only be measured and shall be considered for the payment. Contractor shall provide guarantee for stability, water tightness etc for 12 months after defects liability period.

1.0 Material

1.1 For Aluminium section, Material Technical specification – M-79b (Aluminum section) is to be followed.

1.2 Powder coating of aluminium section shall be of approved make and shade and as per manufacturer's specifications. (as per item description)

1.3 Aluminium corner cleats, glazing clip, wool pile, EPDM rubber, Anchor fastener, compact sheet, backer rod, silicon sealant shall be of approved make and approved by consultants.

2.0 Workmanship

2.1 The work is to be carried out as per the best workmanship manner, as per the shop drawing prepared by contractor and approved by consultants and as per the approved sample.

2.2 The Contractor shall have to give a **guarantee bond**, for pure polyester powder coating / anodizing, on appropriate Stamp paper for a period of 10 years. In this period he shall attend to and rectify all

complaints without causing any inconvenience to the Owners/Client. The form of Guarantee Bond shall be as prescribed below:

"I/We ..... (Contractor) hereby guarantee that work shall remain unaffected and shall not be in any way damaged by atmospheric conditions, for a period of 10 years after the completion of the work of Powder Coating / anodizing the aluminum doors as per the terms and conditions of the Contract and guarantees to redo the affected work without claiming any extra cost."

2.3 Approved make selected clear glass (frosted) / wired glass / toughen glass / compact sheet / SS 316 wire mash of specified thickness as mentioned in the drawings shall be used in doors/ partition. Wired glass / frosted glass louvers shall be provided wherever shown in the drawings after grinding the edges.

2.4 The EPDM Gaskets shall be of size and profile as shown in drawings and as called for, to render the glazing, doors, curtain wall / glazing, windows, ventilators etc. air and water tight. Samples of gaskets shall be submitted for approval and the EPDM gasket approved by Engineer-in-Charge shall only be used. The contractor shall submit documentary proof of using the above material in the work to the entire satisfaction of Engineer in- Charge.
All gaskets used shall be 100% EPDM / silicones rubbers gaskets of approved colour for long life guarantee.

2.5 Necessary operating device (as per design) for operation of louvers of windows, ventilators, sky lights, including necessary rods shall be provided as per item description.

2.6 Necessary provision for rain water disposal shall be done in the bottom guides/frames as per the drawing.

2.7 Packing between wall/ column and aluminium frame shall be of compact sheet of 6 mm (equal to section width less 30mm for backer rod and sealant) thick at every 600mm c/c, filling the gap between aluminium frame and adjacent wall by average 10 mm thick polyethylene baker rod and sealing the remaining gap with neutral grade glazed and metal weather silicone sealant of approved make and shade.

2.8 The civil work as required for fixing of floor springs, hold fast or other works required for the erection and completion of doors/ windows etc. shall be done by the Contractor without any extra cost.

2.9 The Contractor shall be responsible for the windows/ doors/ curtain wall glazing/ grills etc. being set straight, in plumb level and for their satisfactory operations after the fixing is completed.

2.10 Wherever required and as directed strengthening of members shall be done by providing steel/ MS Concealed members without extra cost.

2.11 The quantities are provisional and may vary to any extent. No claim will be taken into consideration in this matter.

2.12 Details/ arrangements for after sales / maintenance services shall be furnished. Work shall be carried out in co-operation and in coordination with all other agencies working at site as per the drawing.

2.13 Sealant

2.13.1 The sealants of approved grade and colour shall only be used. The silicone for perimeter joints (between Aluminium section and RCC/Stone masonry) shall be of make approved as suggested by the Engineer in Charge.

2.13.2 Method of Application

Surface Preparation : Clean all joints and glazing pockets by removing all foreign matter and contaminants such as grease, oil, dust, water, frost, surface dirt, old sealants or glazing compounds and protective coatings.

2.13.3 Masking

Areas adjacent to joints shall be masked to ensure neat sealant lines. Masking tape shall not be allowed to touch clean surfaces to which the silicone sealant is to adhere. Tooling shall be completed in one continuous stroke immediately after sealant application and before a skin forms and masking shall be removed immediately after tooling.

2.13.4 Application

Install backer rod of appropriate size and apply silicone sealant in a continuous operation using a positive pressure adequate to properly fill and seal the joint. The silicone sealant shall be tooled with light pressure to spread the sealant against backing material and the joint surfaces before a skin forms.

A tool with convex profile shall be used to keep the sealant within the joint. Soap or water shall not be used as a tooling aid. Remove masking tape as soon as silicone joint is tooled.

2.13.5 *Tolerance:* A tolerance of ± 3 mm shall be allowed in the width of silicone joints. The depth of the joints at throat shall not be less than 6 mm.

3.0 Mode of Measurement and Payment

3.1 All the aluminium sections including snap beading fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimeter. The weight calculated on the basis of actual average (average of five samples) weight of composite section in kilogram correct to the second place of decimal shall be taken for payment. (Weight shall be taken after anodizing). The weight of cleat shall be added for payment. Neither any deduction nor anything extra shall be paid for skew cuts. The item shall be measured length and multiply with relevant co-efficient and paid in Kg.

3.2 The rates quoted shall be inclusive of manufacture, supply and installation at site and inclusive of all the necessary fixing hardware as shown in the drawing.

3.3 The rates shall also be inclusive of providing and applying 6mm thick compact sheet at 600mm c/c as packing, 10 mm thick backer rod and neutral cure weather silicone sealant of Dow Corning or equivalent with ordinary gun or compressed air operated gun as per the requirement and making the joints aluminium doors, windows, curtain wall glazing etc. on the external periphery of the building at the junction of two different materials as directed by engineer-in-charge.

3.4 Rate shall be inclusive of all wastages of aluminium, necessary EPDM rubber gasket between glazing clip and glass/ filler sheet, C P Brass, Sheet metal or SS screws, fasteners, sealant masking tape etc. as per the drawing. Cutting, fabrication, erection, fixing, protecting & cleaning until handing over to client to the best workmanship manner as per the Architectural drawings and approved sample.

3.5 The rates must be in accordance with detailed drawing with dimensions of aluminium sections in frames and shutters as shown in the drawing. Rate shall be valid also if any deviation is proposed.

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

5.01.2 Providing and fixing in position frames and shutter (sliding / fixed / openable - casement) aluminium windows from Euro profile sections and euro hardware accessories as per approved shop drawings/ sample and aluminium sections of approved make like Jindal or equivalent having 50 micron thick polyester powder coated (of approved make, colour, shade and texture) all floors / all levels / all heights / all shapes and for all sizes as per the drawing, specification or as directed by Architect or Engineer - in - Charge.
Rate shall be inclusive of providing aluminium sections, cutting, fabrication, erection at any level and fixing to the best workmanship manner, including
1) Sheet metal screws and casted aluminium corner cleats (The corner joints of the frame shall be made at 45 degree using die-cast aluminium corner cleats fixed with external battens with a spring for rapid and secure joint assembly.) etc for assembling the frame and shutter; 2) Glazing clips for receiving infill panel; 3) Best quality wool pile for sliding shutter and compatible EPDM gaskets for making windows weatherproof; 4) Anchor fasteners of HILTI HRDUGT or equivalent for fixing the frame assembly to the RCC or masonry surfaces. Minimum 1 anchor fastener shall be used for every 600 mm length of section for stability of frame. 5) Approved make and colour weather silicone sealent (minimum 6mm width X 6 mm depth) over approved make and colour baker rod but excluding
1) Rough ground to fix a frame with wall or any surface. Work shall have to be carried out as per the approved shop drawings and approved sample.
Actual weight of installed Aluminium sections which are visible shall only be measured and shall be considered for the payment. Infill panels shall be paid in relevant tender items.

The relevant specifications of item no. 5.01 shall be followed except the item is to be carried out as per the drawing for aluminium windows made of Euro profile aluminium sections.

5.02 Providing and fixing aluminium operable system louvers of 50 micron Pure Polyester Powder Coating of approved shade & colour and texture manufactured by Techanal, Domal, Sai aluminium - Shashal or equivalent with operating mechanism frame louver with gasket and piles. The corner joints of the frame shall be made at 45 degree using die-cast solid aluminium corner cleats fixed with external byttins with a spring for rapid and secure joint assembly. Gaskets shall be of EPDM material. Work shall be carried out in the existing door/ window frame as per sample approved by Architect / EIC. Operating panel should be provided as per drawing. Actual measurement of system with louvers shall be measured and paid in smt. Rate should be inclusive of aluminium sub frame for housing operating system.

The relevant specifications of item no. 5.01 shall be followed except the item is to be carried out as per the drawing for aluminium operable louver of approved make with all necessary system for operating as per manufacturer's specifications.
Contractor shall prepared shop drawing based on intent/ concept drawing and approved by consultant/ Engineer in charge. The work is to be carried out as per the best workmanship manner, as per the shop

drawing. Contractor shall prepare mock-up with full joinery detail and hardware as suggested by engineer in charge. Contractor shall submit loose samples of all material before fabrication of mock-up.
Aluminium extruded sections having 50 micron thick polyester powder coating of approved make and shade and as per manufacturer's specification.
The item shall be measured and paid in Sqm.

5.03 Providing and fixing fixed aluminium louvers made out of louver section no 20552 of Jindal 2 mm thick (0.599 kg /mt wt) or equivalent of max 1.5 mt. length each including fixing with the suitable aluminium flat of 45 x 4 mm thickness having 15 micron colour anodizing or 50 micron pure polyester powder coating and then fixed in to door / window frame complete as per the shop drawing & sample approved and to the directions of Engineer-in-charge. Only actual installed quantity of louvers with flat shall be considered for payment in smt. Doors and window frames in which louvers are fixed shall be paid in kg in the relevant tender item.

The relevant specifications of item no. 5.01 shall be followed except the item is to be carried out as per the drawing for aluminium louver/ fins with all necessary accessories and hardware.
Contractor shall prepared shop drawing based on intent/ concept drawing and approved by consultant/ Engineer in charge. The work is to be carried out as per the best workmanship manner, as per the shop drawing. Contractor shall prepare mock-up with full joinery detail and hardware as suggested by engineer in charge. Contractor shall submit loose samples of all material before fabrication of mock-up.
Aluminium extruded sections having 50 micron thick polyester powder coating of approved make and shade and as per manufacturer's specification.
Rate shall be for all material, labour, shop drawing, mockup, approval, scaffolding etc complete for all height all level. Only MS work shall be paid in relevant tender item.
The item shall be measured and paid in Kg.

5.04 Providing and fixing glazing with clear flot glass of specified thickness in aluminium door, window, ventilator shutters and partitions etc. Including EPDM rubber on the periphery of the glass, snap beading, glazing clips, neutral cure weather Silicone sealant of Dow corning 789 of approved shade etc. complete for all height / all levels / all floor in all shapes as per the architectural drawings and directions of engineer-in-charge. Installed area of glass shall be measured and paid and without any wastage. In case of half round/ round shape windows, rectangular/ square area shall be measured and paid.

5.04.1 a) 4 mm thick clear flot glass
5.04.2 b) 5 mm thick clear flot glass
5.04.3 c) 6 mm thick clear flot glass
5.04.4 d) 8 mm thick clear flot glass

5.05 Providing and fixing glazing with 6mm thick clear toughen glass of specified thickness in aluminium door, window, ventilator shutters and partitions etc. Including EPDM rubber on the periphery of the glass, snap beading, glazing clips, neutral cure weather Silicone sealant of Dow corning 789 of approved shade etc. complete for all height / all levels / all floor in all shapes as per the architectural drawings and directions of engineer-in-charge. Installed area of glass shall be measured and paid and without any wastage. In case of half round/ round shape windows, rectangular/ square area shall be measured and paid.

5.05.1 a) 6 mm thick fully tampered glass
5.05.2 b) 8 mm thick fully tampered glass
5.05.3 c) 10 mm thick fully tampered glass
5.05.4 d) 12 mm thick fully tampered glass

Material
Glass shall be of approved make and shade with required technical property.
Glass panes shall be free from flaws, specks or bubbles. All panes shall have properly squared corners and straight edges.
The glass shall be clear float glass and should be approved by the Engineer in Charge. It shall be clear, float transparent and free from cracks subject to allowable defects. The float glass shall conform to the IS 14900.
Glass for glazing shall conform to IS 2835 or IS 2553. The use of other types of glass, such as frosted glass, wired glass and toughen glass may also be specified by the Engineer-in- Charge.
Panels of shutters shall be flat and well sanded to a smooth and level surface.

Measurements
Length and breadth of installed glass panes shall be measured correct to a cm. The area of the glass panes as fixed shall be calculated in square meter correct to two places of decimal of the actual glazing sheet installed without considering any wastage. In case of half round/ round shape windows, rectangular/ square area shall be measured and paid.

Rate
The rates shall include the cost of labour and material involved in all the operations described above. The item shall be measured and paid in sqmt.

Relevant specifications of item no. 5.01 shall be followed except the item consist of glazing with EPDM rubber on the periphery of the glass, glazing clips, neutral cure weather silicone sealant of Dow Corning 789 etc. as per the sample approved by Architect.

5.06 Providing and fixing 6 mm thick wired glass of approved make and specified thickness in frame work with necessary cutting of glass as per approved shop drawing & specifications including providing and fixing EPDM quality rubber on the periphery of the glass, snap beading, glazing clips, neutral cure weather Silicone sealant of Dow corning 789 etc. complete etc. complete for all floors, all levels, all heights and in all shapes as per the directions of Architect/ Engineer-in-charge. Actual installed area shall be measured and paid. In case of half round/ round shape windows, rectangular/ square area shall be measured and paid.

The relevant specifications of item no. 5.05 shall be followed except the uses of wire glass instead of toughen glass.
The item shall be measured and paid in Sqm of the actual wired glass installed without considering any wastage.

5.07 Providing and fixing glazing with Heat strengthen glass of specified thickness in aluminium door, window, ventilator shutters and partitions etc. Including EPDM rubber on the periphery of the glass, snap beading, glazing clips, neutral cure weather Silicone sealant of Dow corning 789 of approved

shade etc. complete for all height / all levels / all floor in all shapes as per the architectural drawings and directions of engineer-in-charge. Installed area of glass shall be measured and paid and without any wastage. In case of half round/ round shape windows, rectangular/ square area shall be measured and paid.

5.07.1 a) 6 mm thick fully Heat strengthen glass
5.07.2 b) 8 mm thick fully Heat strengthen glass
5.07.3 c) 10 mm thick fully Heat strengthen glass
5.07.4 d) 12 mm thick fully Heat strengthen glass

The relevant specifications of item no. 5.05 shall be followed except the uses of Heat strengthen glass instead of toughen glass.
The item shall be measured and paid in Sqm of the actual wired glass installed without considering any wastage.

5.08 Providing and fixing 4mm thick back painted Glass of approved make as internal wall lining work with 6mm thick 303 grade BWR play as per design. Ply shall be fixed on wall with required framing, fastener etc. Glass shall be edge polished and fixed with adhesive/ tape as per manufacturer recommendation. Actual installed area of glass shall be measured for payment without considering any wastage.

1.0 Materials:
1.1 4mm thick back painted glass shall be approved make and shade.
1.2 Plywood – 6 mm thick 303 grade as per material specification of approved make.

2.0 Workmanship:
2.1 Contractor shall be submitted shop drawings for the approval before installation**.**
2.2 Glass wall cladding shall be fixed in best workman ship manner as per manufacturer's specification.
2.3 6mm thick backing play shall be on wall/ framing with necessary hardware, screw, fastener, adhesive etc as per approved shop drawing. Back painted glass shall be fixed on plywood with required adhesive, hardware and tap as per manufacturer's specification. The Contractor shall be responsible for the partitions and doors being set straight, in plumb level and for their satisfactory operations after completing the installation.

3.0 Mode of Measurements and Payment:

3.1 The rate shall be for unit of one Sqmt
3.2 Actual installed area of glass shall be measured and paid without considering any wastage.

5.09 Providing and fixing solid core 35 mm thick flush type door shutter (non decorative) of approved make (Battens should be chemically treated & kiln seasoned & binding agent should be phenol phormaldihide) and of required size, as per approved drawing, design and direction. The rate shall also include external lipping of 6mm thick and made of seasoned teak wood equivalent to best quality Ghana teak all around and 2 coats of synthetic enamel painting including 1 coat of wood primer or lapi/ oil and water finished polishing or lacquer polishing to lipping, all as per approved drawing,

design & direction, etc. complete, sample to be got approved by the Architect or Engineer-in-charge. Measurement including lipping shall be considered for payment.
Necessary hardware and finishing of shutter shall be separately measured and paid in the relevant tender items.

1.0 Flush Door Shutter:

Flush door shutters shall have a solid core and may be of the decorative or non-decorative (Paintable type as per IS 2202 (Part I). Nominal thickness of shutters may be 25, 30, 32, 35, 38 or 40 mm. Thickness and type of shutters shall be as specified.

1.1 Width and height of the shutters shall be as shown in the drawings or as indicated by the Engineer in-Charge. All four edges of the shutters shall be square. The shutter shall be free from twist or warp in its plane. The moisture content in timbers used in the manufacture of flush door shutters shall be not more than 12 per cent when tested according to IS 1708.

1.2 Core

The core of the flush door shutters shall be a block board having wooden strips held in a frame constructed of stiles and rails. Each stile and rail shall be a single piece without any joint. The width of the stiles and rails including lipping, where provided shall not be less than 45 mm and not more than 75 mm. The width of each wooden strip shall not exceed 30 mm. Stiles, rails and wooden strips forming the core of a shutter shall be of equal and uniform thickness. Wooden strips shall be parallel to the stiles. End joints of the pieces of wooden strips of small lengths shall be staggered. In a shutter, stiles and rails shall be of one species of timber. Wooden strips shall also be of one species only but it may or may not be of the same species as that of the stiles and rails. Any species of timber may be used for core of flush door. However, any non-coniferous (Hard wood) timber shall be used for stiles, rails and lipping.

1.3 Face Panel

The face panel shall be formed by gluing, by the hot-press process on both faces of the core, either plywood or cross-bands and face veneers. The thickness of the cross bands as such or in the plywood shall be between 1.0 mm and 3.0 mm. The thickness of the face veneers as such or in the plywood shall be between 0.5 mm and 1.5 mm for commercial veneers and between 0.4 mm and 1.0 mm for decorative veneers, provided that the combined thickness of both is not less than 2.2 mm. The direction of the veneers adjacent to the core shall be at right angles to the direction of the wooden strips. Finished faces shall be sanded to smooth even texture. Commercial face veneers shall conform to marine grade plywood and decorative face veneers shall conform to type I decorative plywood in IS 1328.

1.4 Lipping

Lipping, where specified, shall be provided internally on all edges of the shutters. Lipping shall be done with battens of first class hardwood or as specified of depth maximum 10 mm. For double leaved shutters, depth of the lipping at meeting of stiles shall be not less than 25 mm. Joints shall not be permitted in the lipping.

1.5 Rebating

In the case of double leaves shutters the meeting of stiles shall be rebated by 8 mm to 10 mm. The rebating shall be either splayed or square type as shown in drawing where lipping is provided. The depth of lipping at the meeting of stiles shall not be less than 25 mm.

1.6 Opening for Glazing

When required by the purchaser opening for glazing shall be provided and unless otherwise specified the opening for glazing shall be 250 mm in height and 150 mm or 200 mm in width unless directed otherwise. The bottom of the opening shall be at a height of 1.4 m from the bottom of the shutter. Opening for glazing shall be lipped internally with wooden batten of width not less than 25 mm. Opening for glazing shall be provided where specified or shown in the drawing.

1.7 Venetian Opening

Where specified the height of the venetian opening shall be 350 mm from the bottom of the shutter. The width of the opening shall be as directed but shall provide for a clear space of 75 mm between the edge of the door and venetian opening but in no case the opening shall extend beyond the stiles of the shutter. The top edge of the opening shall be lipped internally with wooden battens of width not less than 25 mm. Venetian opening shall be provided where specified or shown in the drawing.

1.8 Tolerance

Tolerance on width and height shall be + 3 mm and tolerance on nominal thickness shall be ± 1.2 mm. The thickness of the door shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm when measured at any two points.

1.9 Adhesive

Adhesive used for bonding various components of flush door shutters namely, core, core frame, lipping, cross-bands, face veneers, plywood etc. and for bonding plywood shall conform to BWP type, phenol formaldehyde synthetic resin adhesive conforming to IS 848.

1.10 Tests

Samples of flush door shutters shall be subjected to the following tests:

(a) End Immersion Test

(b) Knife Test

(c) Glue Adhesion Test

One end of each sample shutter shall be tested for End Immersion Test. Two specimens of 150 x 150 mm size shall be cut from the two corners at the other end of each sample shutter for carrying out Glue Adhesion Test. Knife Test shall be done on the remaining portion of each sample shutter.

1.11 Sample Size

Shutters of decorative and non-decorative type from each manufacturer, irrespective of their thickness, shall be grouped separately and each group shall constitute a lot. The number of shutters (sample size) to be selected at random from each lot for testing shall be as specified in Table 1.11. If the total number of shutters of each type in a work (and not the lot) is less than twenty five, testing may be done at the discretion of the Engineer-in-Charge and in such cases extra payment shall be made for the sample shutter provided the sample does not fail in any of the test specified in 1.10. For knife test, glue adhesive test, slamming test, the end immersion test, the number of shutters shall be as per below Table.

TABLE
Sample Size and Criteria for Conformity

Lot Size	*Sample Size*	*Permissible no. of Defective*	*Sub. Sample size*
(1)	*(2)*	*(3)*	*(4)*
Upto 26 to 50	8	0	1
51 – 100	13	1	2
101 – 150	20	1	2
151 – 300	32	1	3
301 – 500	50	2	4
501 and above	80	2	5

1.12 Criteria for Conformity

All the sample shutters when tested shall satisfy the requirements of the tests laid down as per IS. The lot shall be declared as conforming to the requirements when numbers of defective sample does not exceed the permissible number given in col. 3 of Table 9.10. If the number of sample shutters found unsatisfactory for a test is one, twice the number of samples initially tested shall be selected and tested for the test. All sample shutters so tested shall satisfy the requirement of the test. If the number of samples found unsatisfactory for a test is two or more, the entire lot shall be considered unsatisfactory.

1.13 Fixing

For side hung shutters of height upto 1.2 m, each leaf shall be hung on two hinges at quarter points and for shutter of height more than 1.2 m, each leaf shall be hung on three hinges one at the centre and the other two at 200 mm from the top and bottom of the shutters. Top hung and bottom hung shutters shall be hung on two hinges fixed at quarter points of top rail or bottom rail. Centre hung shutter shall be suspended on a suitable pivot in the centre of the frame. Size and type of hinges and pivots shall be as specified. Flap of hinges shall be neatly counter sunk into the recesses cut to the exact dimensions of flap. Screws for fixing the hinges shall be screwed in with screw driver and not hammered in. Unless otherwise specified, shutters of height more than 1.2 mm shall be hung on butt hinges of size 100 mm and for all other shutters of lesser height butt hinges of size 75 mm shall be used. For shutter of more than 40 mm thickness butt hinges of size 125 × 90 × 4 mm shall be used. Continuous (piano) hinges shall be used for fixing cup-board shutters where specified.

1.14 Measurements

Actual shutter including lipping area shall be measured for payment to the nearest cm in closed position covering the rebates of the frames but excluding the gap between the shutter and the frame. Overlap of two shutters shall not be measured. All work shall be measured net as fixed and area calculated in square meters to nearest two places of decimal. No extra rate shall be payable for providing rebates in double leaved shutters. No deduction shall be made for providing Venetian opening and opening for glazing (vision panel). Vision panel shall be also paid in relevant tender item.

1.15 Rates

The rate includes the cost of material and labour involved in all the operations described above.

The rate shall be for unit of one Sqmt.

5.10 Providing and fixing 1 mm thick Laminate sheet of approved make and shade on Non decorative flush door, any ply surface etc with necessary nails, screws, adhesives as per drawings and approved sample. Laminate shall be either glossy or Swede finish. The rate shall be for all heights, all floors, all places etc complete as directed by engineer in charge. Actual laid area shall be measured and paid without considering any wastage.

Laminate should be as per IS 2046 and of approved make and shade. Sample shall be get approved by consultants before execution.
The relevant specification of 5.09 shall be followed, but laminates over it as per specifications.
The rate shall be for a unit of one m^2 of the actual laminates installed.

5.11 Providing and fixing 3.5 to 4 mm thick Veneer including BWP 710 ply backing of approved make and shade on Non decorative flush door, any ply surface etc with necessary nails, screws, adhesives as per drawings and approved sample. Veneer shall be selected and sorted for uniform straight lined, light coloured from matching group. The rate shall be inclusive of lacquer polishing or oil-water finish on veneer surface. The rate shall be for all heights, all places, all places, etc complete as directed by engineer in charge. Actual laid area shall be measured and paid without considering any wastage.

Veneer shall be of approved make and shade including BWP 710 ply backing. Sample shall be get approved by consultants.
Decorative face veneers shall conform to type I decorative plywood in IS 1328.
The relevant specification of 5.18 shall be followed, but teak veneer over it as per specifications.
The rate shall be for a unit of one m^2 of the actual venner installed.

5.12 Providing and fixing laminated Compact Sheet of any size, any shape, any color, any texture as per approved sample (approved by architect) and specified thickness in aluminium frame and shutter work with necessary cutting of sheet, single side, double side coloured as per drawing & specifications including providing and fixing EPDM quality rubber/ silicon sealant/ adhesive tape/ screwing on the periphery of the sheet as per the required thickness etc. complete at all floors/ all levels/ all heights as per the drawing & directed by EIC / Architect. Cut edges of the compact sheet shall be provided with masking tape. Actual installed quantity shall be measured and paid. Rate shall be inclusive of all type of wastage.

5.12.1 5mm thick compact sheet
5.12.2 6mm thick compact sheet
5.12.3 8mm thick compact sheet

1.0 Materials:

1.1 Compact sheet shall be of approved make, shade and texture. Sample shall be get approved by consultants.

2.0 Workmanship:

2.1 Compact sheet shall be fixed in best workman ship manner as a tight infill panel with EPDM quality rubber/ silicon sealant/ 3M tape/ screwing on the periphery of the sheet as per the required thickness

etc. complete at all floors/ all levels/ all heights as per the drawing & directed by Engineer in charge.

3.0 Mode of Measurements and Payment:

3.1 The rate shall be for unit of one m^2 of the actual compact sheet installed.

5.13.1 Providing and fixing powder coated (powder coating not less than 40 microns) non vision extruded aluminium Air Transfer Grill of required sizes to be fixed in the opening made in the laminated/ non decorative flush door shutters. The grill shall be 1.20 mm thick, in approved size, shade, and pattern, shape, as per the drawing and as per directions of Engineer - in - charge. Rate shall be inclusive of cutting the door as per approved grill size, providing and fixing required depth of lipping on the cutting edges of flush door shutter with finishing. The air transfer grill shall be of double frame and fixed flush with the surface of door shutter on both sides. Area of the Air Transfer Grill on one side of door shutter shall be measured for payment.

Air transfer grill for flush door shutter shall be of approved make and pattern as per specifications. Grill shall be having min 40 micron polyester powder coating of approved make and shade as per manufacturer's specification. Samples of grills shall be approved by Engineer-in-charge before installation.

Flush door (laminated/ ply surface) shall be cut as per size of approved grill. Grill shall be fixed in cut-out with required depth of lipping on the cutting edges of flush door shutter as per drawing. The air transfer grill shall be of double frame and fixed flush with the surface of door shutter on both sides with finishing.

Only one side of grill area shall be measured for payment.

The rate shall be for a unit of one Sqm.

5.13.2 Providing and fixing view panel in 35 to 40mm thick flush doors having 4 mm thick toughen glass and 4 to 6 mm thick Ghana teak tapered bedding on all the four sides and on both the faces of toughened glass with lacquer polish on it. The rate shall be inclusive of cutting the door, provision of glass with both side lipping, painting/ polishing with primer and lapi, glass and other accessories required for fixing the view panel, making good etc complete. Size and location of view panel shall be as per drawing and actual size of view panel with bedding patti shall be measured and paid in Sqmt.

Relevant specification shall be followed as per item no.5.09 shall be followed for fixing vision panel in flush door shutter and as per item description.

Where specified the height of the Venetian opening shall be 350 mm from the bottom of the shutter. The width of the opening shall be as directed but shall provide for a clear space of 75 mm between the edge of the door and venetian opening but in no case the opening shall extend beyond the stiles of the shutter. The top edge of the opening shall be lipped internally with wooden battens of width not less than 25 mm on both side of glass. Venetian opening shall be provided where specified or shown in the drawing.

The rate includes the cost of material and labour involved in all the operations described above. Actual size of view panel with bedding patti shall be measured and paid without considering any wastage. The rate shall be for unit of one Sqmt.

5.14 Providing and fixing in position SS 304 - 18 x 16 mesh and 32gauge Mosquito net of any size any shape having 50 micron pure polyster powder coating of approved make and shade for aluminium sliding shutter/ fixed shutter or in front of aluminium louvers as per shop drawing prepared by contractor and sample as approved by consultants. Jali shall be fixed with ss304 grade screws and fasteners required to tighten the Jali/ Net including EPDM quality rubber/ silicon sealant/ structural sealant etc complete for all floors, all levels, all heights. Only installed area of mosquito net shall be measured and paid in Sqm without considering any wastage. All aluminium sections shall be paid under relevant tender item.

1.0 Material and workmanship:

SS 304 – 18 x 16 mesh mosquito net having 50 micron polyester powder coating of approved make and shade shall be approved by consultants.

Mosquito net shall be installed as per drawing and as directed by engineer in charge in existing aluminium frame/ shutter with good workmanship manner.

Installed sample shall be approved too.

2.0 Mode of measurement and Payment:

The item shall be measured for a unit of sqm as actual installed area without considering any wastage. The aluminium frame shall be paid in relevant tender item.

5.14.1 Providing and fixing in position PVC Forsting Glass film of 3M make (of any pattern, shade and type) on glass window, partitions and doors for internal use. Film shall be pasted on glass without any appearing any air bubble. The rates shall be for all shapes and all heights with necessary scaffolding complete as per the Architectural drawings and manufacturer's specification & instructions as directed by the Architect and Engineer-in-charge

1.0 Material and workmanship:

Frosted Glass film shall be of approved make and shade and as per approved sample.

2.0 Workmanship:

Contractor shall clean the glass surface to paste the film. Film shall be pasted on glass without any appearing any air bubble.

3.0 Mode of measurement and Payment:

Pasted area of film shall be measured for payment without considering any wastage for all level all height.

The item shall be measured for a unit of sqm.

5.14.2 Extra for frosting process on the glass of any thickness in any pattern as per approved sample and as directed by EIC and Architect. Glass shall be processed by approved glass processor.

This item shall be considered only where frosting process is extra for any thickness of glass in any pattern as per drawing or as directed by engineer in charge. Relevant specification shall be followed as per approved make up architectures satisfactory result.

The item shall be measured for a unit of sqm.

HARDWARES

General Notes for Hardware: Supplying and fixing heavy quality fixtures and fittings for doors, windows, ventilators, partition wall, cabinets with necessary screws, nails, machine pins etc. at all floor/ all levels/ all heights complete. The fittings and fixtures hardware as described in items or of make approved by Architect. Sample shall be approved before execution. As per description, SS hardware shall be of 304 grade or 316 grade according to approved make. The fixture & fastenings shall be provided as under:

5.15 Providing & fixing single/ double action hydraulic floor spring with SS cover plate & adjustable concealed casted top pivot (two piece) and bottom strap of approved make for wooden/ aluminium doors of specified capacity with minimum one year guarantee. Rate shall be inclusive of cutting of floor neatly, grouting the floor spring & cleaning/ polishing the floor & maintaining in good working condition until defect liability period. In case of Aluminium shutter bottom arm of floor spring & top pivot shall be firmly fixed in the aluminium members using required size of teak wood by making rabbet in the wood. The Floor Spring shall conform to EN 1154.

a) Hold open having weight up to 100 kg and width 1200mm with std. spindle and cover plate. Closing force complying with EN 1154 2 – 4

1.0 Hydraulic floor spring shall be of approved make, high quality and required capacity as per manufacturer's specification and as directed by engineer in charge.

(1) The closing time of the floor spring shall be easily adjustable between 3 and 20 seconds for which a suitable device to adjust the speed shall be provided.

(2) After being fitted in position the door leaf shall be opened through 90º plus 5º and released. When opened to an angle less than a right angle the door shall swing back automatically.

1.1 Workmanship

The floor spring shall be free from all mechanical defects, sharp edges and other surfaces defects.

The Contractor shall have to give a guarantee bond for the floor spring, on appropriate Stamp paper for a period of 1 year. In this period he shall attend to and rectify all complaints without causing any inconvenience to the client. The form of Guarantee Bond shall be as prescribed below:
"I/We ..... (Contractor) hereby guarantee that the hydraulic door closers or Floor Spring shall remain unaffected and shall not be in any way damaged by normal usage, pulls and pushes, for a period of 1 year after the completion of the work of supplying & fixing the Hydraulic Door Closers to aluminium doors as per the terms and conditions of the contract and guarantees to redo the affected work without claiming any extra cost."

1.2 Fixing

Suitable recess of the required size shall be cut in floor and the floor spring with all its components viz. cover plate, outer box with slide plate etc. shall be embedded in floor.

1.3 Measurement

The floor spring shall be measure in numbers.

1.5 Rate

The rate shall be include the cost of labour and material involved in all the operations described above and making good the floor.

5.16 Providing & fixing hydraulic rack and pinion concealed door closer with controlled adjustable closing speed and power adjustable with back check with track arm with screws to pivoted/ hinged door of approved make for specified door width with minimum five year guarantee. All adjustment screws face fixed. Rate shall be inclusive of fixing with using the template as per manufacturer's specification. The door closer shall conform to EN 1154 standard.

a) with standard arm/ parallel valve and with two independent closing valves and latching speed adjustable by arm without mounting back plate, Closing force complying with EN 1154 2 - 4 for up to 1000 mm door width

Hydraulic door closer shall be of approved make, high quality and required capacity as per manufacturer's specification and as directed by engineer in charge.

The Contractor shall have to give a guarantee bond for the Hydraulic door closer and floor spring, on appropriate Stamp paper for a period of 1 year. In this period he shall attend to and rectify all complaints without causing any inconvenience to the client. The form of Guarantee Bond shall be as prescribed below:

"I/We ..... (Contractor) hereby guarantee that the hydraulic door closers or Floor Spring shall remain unaffected and shall not be in any way damaged by normal usage, pulls and pushes, for a period of 1 year after the completion of the work of supplying & fixing the Hydraulic Door Closers to aluminium doors as per the terms and conditions of the contract and guarantees to redo the affected work without claiming any extra cost."

5.17 Providing & fixing SS-304 grade butt hinge of specific size with necessary screws etc. complete of approved make and as sample as approved by Architect and Engineer in Charge.

a) 100 x 75 x 3 mm - with ball Bearing

Butt hinges of approved make shall be of high quality (with ball bearing / without ball bearing) as per the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.

The rate shall be for unit of one No.

5.18.1 Providing & fixing set of dead lock for single/ double shutter door, with 55mm backseat, 20mm square for end with 72 mm centers including strike plate sis 304 in brass finish as per DIN 18251-1, grade 2 and prepared for euro profile cylinder (EPC) including strike plate and EPC length 60/70 mm standard Euro profile Pin Cylinder/ Half pin cylinder of approved make with both side key/ one side key one side knob/ slot operation with pair of Brass/ SS 304 Escutcheons (key hole plate) of approved for wooden doors with necessary SS Phillips head screws etc complete as per drawing and sample approved by engineer in charge. Rate shall be for all heights, all floors and all places. The lock shall be with 3 keys.

Dead lock with 55mm setback, 60/70mm Euro profile Pin Cylinder with pair of Escutcheons of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. SS 304 satin finish standard dead lock with 60/70 mm Euro profile Pin Cylinder with both side key/one side key - one side knob/ one side knob - one side slot with one pair of Escutcheons (key hole plate) for wooden/aluminium doors.

Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one Set. (Lock body, pin cylinder, strike plate, Escutcheons, 3 no key)

5.18.2 Providing & fixing set of narrow style dead lock dead lock for single/ double shutter door, with 25/ 35mm backseat, 20mm square for end with 72 mm centers including strike plate ss 304 in brass finish as per DIN 18251-1, grade 2 and prepared for euro profile cylinder (EPC) including strike plate and EPC length 60/70 mm standard Euro profile Pin Cylinder/ Half pin cylinder of approved make with both side key/ one side key one side knob/ slot operation with pair of Brass/ SS 304 Escutcheons (key hole plate) of approved for wooden doors with necessary SS Phillips head screws etc complete as per drawing and sample approved by engineer in charge. Rate shall be for all heights, all floors and all places. The lock shall be with 3 keys.

Narrow style Dead lock with 25mm/ 35mm setback, 60/70mm Euro profile Pin Cylinder with pair of Escutcheons of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. SS 304 satin finish narrow style dead lock with 60/70 mm Euro profile Pin Cylinder with both side key/one side key -one side knob/ one side knob - one side slot with one pair of Escutcheons (key hole plate) for wooden/aluminium doors.
Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one Set. (Lock body, pin cylinder, strike plate, Escutcheons, 3 no key)

5.18.3 Providing & fixing Mortise lock with lever handle having 72mm centre to centre, 55mm Backset 20mm Square forend and 60/ 70mm standard Europrofile Pin Cylinder of approved make with both side key /one side key - one side knob operation and SS 304 grade hollow tubular pipe pair of Mortise handle with cap of 22mm dia 150mm long with a pair of Escutcheons for wooden /aluminium/ metal doors with necessary ss phillips head screws etc complete for wooden/ aluminium/ metal doors with necessary SS Phillips head screws etc complete for all floor all height as per drawing and sample approved by engineer in charge. The lock shall be with 3 keys.

Mortise lock with 60/ 70mm Euro profile Pin Cylinder, pair of tubular mortise handle with pair of Escutcheons of approved make shall be of high quality as per the drawing and as per manufacture's specification. SS 304 satin finish standard mortise lock with 60/70 mm Euro profile Pin Cylinder with both side key/ one side key - one side knob operation and SS 304 grade hollow tubular pipe pair of Mortise handle of 22mm dia 150mm long with one pair of Escutcheons (key hole plate) for wooden/ aluminium doors.
Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No. (Lock body, pin cylinder, strike plate, pair of tubular mortise handle, Escutcheons, 3 no key)

5.18.4 Providing and fixing narrow stile mortise lock with lever handle package having backset as per door size, 20mm square forend and 60/ 70mm standard Europrofile Pin Cylinder of approved make with both side key/one side key - one side knob operation and SS 304 grade hollow tubular pipe pair of Mortise handle with cap of 22mm dia 150mm long with a pair of Escutcheons for wooden/aluminium/ metal doors with necessary ss phillips head screws etc complete for wooden/ aluminium/ metal doors with necessary SS Phillips head screws etc complete for all floor all height as per drawing and sample approved by engineer in charge. The lock shall be with 3 keys.

Mortise lock with 60/ 70mm Euro profile Pin Cylinder, pair of tubular mortise handle with pair of Escutcheons of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. SS 304 satin finish standard narrow stile mortise lock with 60/70 mm Euro profile Pin Cylinder with both side key/ one side key - one side knob operation and SS 304 grade hollow tubular pipe pair of Mortise handle of 22mm dia 150mm long with one pair of Escutcheons (key hole plate) for wooden/ aluminium doors.
Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No. (Lock body, pin cylinder, strike plate, pair of tubular mortise handle, Escutcheons, 3 no key)

5.18.5 Providing and fixing Tubular dead bolt for toilet door of approved make with necessary screws etc. complete as directed by Engineer in charge.

Tubular dead bolt of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one Pair (Set).

5.18.6 Providing and fixing Mortise shaft dead bolt with key (Alen Key lock) with 57mm backset and 25mm square forend in stainless steel satin finish of approved make with necessary screws etc. complete.

Mortise shaft dead bolt with key (Alen Key lock) with BS 57mm and 25mm square forend in SS satin finish shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.18.7 Providing and fixing Electronic Door Lock of approved make for wooden door having thickness of 35 to 50 mm of following specifications.
1) Dead Latch Lock Type with 30 RFID Cards and 78 Pin Codes
2) 2 keys for mechanical over ride function
3) Shall have dimensions of Front Body 37.97 (D) X 70 (W) X 170 (H) mm and Back Body 25.48 (D) X 70 (W) X 179 (H) mm
4) low battery indicator and emergency power supply
5) anti panic egress function from inside

Contractor Shall provide 1 year manufacturer's warranty against material and workmanship. Rate shall be inclusive of lock, nesscry fixing hardwarer, cutting of wooden door shutter, making good etc complete as directed by engineer in charge.

5.18.8 Providing and fixing SS 304 grade Corner Lock for frame less Glass door of approved make with necessary fitting, making good etc complete as directed by Engineer in charge.

Corner lock for frame less glass door of approved make, finish and size shall be of high quality as per the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one no.

5.19 Providing & fixing SS 304 grade push-pull pair of handle made out of satin (brush) finish hollow pipe of 1.0mm thick having offset (C or D shape)/ H-shape/ D-shape of approved make with necessary screws etc. complete for wooden doors/ aluminium doors/ metal doors as per drawing as approved by Architect and Engineer-in-charge. Rate shall be for all heights, all floors, and all places. The length of handle should be perfect center to center as below specified.

5.19.1 a) 200 mm long x 19 mm dia
5.19.2 b) 300 mm long x 22 mm dia
5.19.3 c) 450 mm long x 25 mm dia
5.19.4 d) 600 mm long x 25 mm dia
5.19.5 d) 800 mm long x 32 mm dia
5.19.6 d) 1000 mm long x 32 mm dia

Push – Pull Handle of approved make, shape and finish shall be made out of 1.5mm thick hollow pipe of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one Pair (Set).

5.20 Providing & fixing 150 mm (minimum rod size shall be 12mm) satin nickel plated brush finish brass or SS 304 brush finish D shape rod handles with bracket of EPPW or equivalent with necessary screws etc. complete as approved by Architect and Engineer-in-charge.

D shape rod handle of EPPW or equivalent shall be of approved make and high quality as per the drawing as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.

The handles shall be measured in numbers. Sample shall be approved by EIC.

5.21 Providing & fixing 25mm diameter (1.5mm thick) SS 304 satin (brush) finish Disabled Grab Rails/ handle of 600mm long of approved make with necessary SS 304 grade screws etc. complete as per drawing as sample approved by Engineer-in-charge. Rate shall be for all heights, all floors and all places.

Disable grab rail/ handle of size 25mm dia, 1.5mm thick and 600mm long of approved make and shape shall be of high quality as per the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.22 Providing & fixing of specified height (minimum rod size shall be 10mm) chrome plated brass or SS 304 brush finish Tower bolt (barrel type) of approved make in wooden doors/ aluminium doors/ metal doors with necessary screws etc complete as approved by Architect and Engineer-in-charge.
a) 300 mm x10 mm rod size
b) 450mm x10 mm rod size

Tower Bolt of approved make and shape with minimum rod dia 10mm shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.23 Providing & fixing of SS 304 satin finish lever action Flush tower bolt with 19mm projecting bolt (extended rod of 600mm length) aluminum casted of approved make for double shutters aluminum door, with necessary screws etc. complete as approved by Engineer-in-charge. Rate shall be for all heights, all floors and all places.
Flush/ Concealed Tower Bolt with 19mm projecting bolt and 600mm long (extended rod type) aluminium casted for double shutters aluminium door of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.24 Providing & fixing SS brush finish solid Door Stopper with magnet, fixed type, wall mounted of approved make with necessary screws etc. complete as approved by Engineer-in-charge in Charge.

Wall mounted magnetic Door Stop or Door stopper of required size as per door opening condition of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.25 Providing & fixing SS 304 brush finish Door buffer with rubber base, lever type, shutter mounted of EPPW, magnum, Kich or equivalent with necessary screws etc. complete as approved by Engineer-in-charge in Charge.

SS 304 brush finish door buffer required size as per door opening condition of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all

floors and all level.
The rate shall be for unit of one No.

5.26 Providing and fixing SS 304 grade Internal signage of size 1.2mm thick (brush/ satin finish) in laser print/ eaching and fiiled with duco paint of approved make and as specified type including fixing by any approved means etc complete as directed by engineer in charge. Edge and corners of plate shall be grinded, and polished. The pattern/lettering and logo shall be as per the architects design.

Signage shall be approved make and high quality as shown in the drawing as per manufacture's specification. Measurement shall be done in numbers.

5.27 Providing and fixing SS 304 grade kick plate of size 1200mm x 300mm x 1.2mm for disable toilet door of approved make including fixing etc complete as directed by engineer in charge.

Kick plate shall have 1.2 to 1.5 mm thickness, cute corner, grinded edges of required size as per approved sample for disable toilet door/ kitchen door as per drawing of approved make. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.28 Providing & fixing Aluminium powder coated butt hinges of required capacity of approved make for casement window/ door (europrofile) with necessary accessories, screws etc. complete of approved make and as sample approved by Engineer in Charge.

Aluminium powder coated butt hinges of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.29.1 Providing and fixing powder coated single point lock with mortise handle/ inbuilt flush handle (without lock) of approved make of required capacity including all required accessories like nib, nib holder, counter plate, fork, pawl, polyamide strip etc as per approved manufacturer recomendatation for aluminium sliding doors and window with necessary screws etc complete as directed by engineer in charge.

Mortise handle with single point lock (without lock) with of required capacity for aluminium sliding window/door with heavy gear mechanism should be of approved make like Alualpha, Giesse, Lavaal or equivalent and high quality as per the drawing as per manufacture's specification.
The rate shall be for unit of one No with all required accessories for fixing the lock.

5.29.2 Providing and fixing powder coated Two point lock with mortise handle (without lock) of approved make with heavy gear mechanism of required capacity including all required accessories like nib, nib holder, counter plate, fork, pawl, polyamide strip etc as per approved manufacturer recomendatation for aluminium sliding doors and window with necessary screws etc complete as directed by engineer in charge.

Mortise handle with two point lock (without lock) with of required capacity for aluminium sliding window/door with heavy gear mechanism should be of approved make like Alualpha, Giesse, Lavaal or equivalent and high quality as per the drawing as per manufacture's specification.
The rate shall be for unit **of one No** with all required accessories for fixing the lock.

5.29.3 Providing and fixing powder coated multi point lock with mortise handle (without lock) of approved make with heavy gear mechanism of required capacity including all required accessories like nib, nib holder, counter plate, fork, pawl, polyamide strip, etc as per approved manufacturer recomendatation for aluminium sliding doors and window with necessary screws etc complete as directed by engineer in charge.

Mortise handle with multi point lock (without lock) with of required capacity for aluminium sliding window/door with heavy gear mechanism should be of approved make like Alualpha, Giesse, Lavaal or equivalent and high quality as per the drawing as per manufacture's specification.
The rate shall be for unit **of one No** with all required accessories for fixing the lock.

5.30.1 Providing and fixing powder coated single point lock with mortise handle (without lock) of approved make with heavy gear mechanism of required capacity including all required accessories like handle, fork, connector, extensior, polyamide, locking point, corner transmission and striker etc as per approved manufacturer recomendatation for aluminium casement door and window (top hung or side hung) with necessary screws etc complete as directed by engineer in charge.

Single point locking handle without key with of required capacity for aluminium casement window/ door should be approved make like Alualpha, Giesse, Lavaal or equivalent and high quality as shown in the drawing as per manufacture's specification.
The rate shall be for unit of one No with all required accessories for fixing the lock.

5.30.2 Providing and fixing powder coated Two point lock with mortise handle (without lock) of approved make with heavy gear mechanism of required capacity including all required accessories like handle, fork, connector, extensior, polyamide, locking point, corner transmission and striker etc as per approved manufacturer recomendatation for aluminium casement door and window (top hung or side hung) with necessary screws etc complete as directed by engineer in charge.

Two point locking handle without key with of required capacity for aluminium casement window/ door should be approved make like Alualpha, Giesse, Lavaal or equivalent and high quality as shown in the drawing as per manufacture's specification.
The rate shall be for unit of one No with all required accessories for fixing the lock.

5.30.3 Providing and fixing powder coated multi point lock with mortise handle (without lock) of approved make with heavy gear mechanism of required capacity including all required accessories like handle, fork, connector, extensior, polyamide, locking point, corner transmission and striker etc as per approved manufacturer recomendatation for aluminium casement door and window (top hung or side hung) with necessary screws etc complete as directed by engineer in charge.

Multi point locking handle without key with of required capacity for aluminium casement window/ door should be approved make like Alualpha, Giesse, Lavaal or equivalent and high quality as shown in the drawing as per manufacture's specification.
The rate shall be for unit of one No with all required accessories for fixing the lock.

5.31 Providing and fixing Window adjuster cum stay open restrictor (opening limit arm) of approved make for side hung window with necessary screws etc complete as directed by engineer in charge.

Aluminium powder coated Window adjuster cum stay open restrictor opening limit arm) of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one Pair.

5.32 Providing and fixing stainless steel (SS 304 grade) adjustable sliding friction windows stays (for easy cleaning) 16" size having maximum width 900mm, max weight capacity - 30 kg of cotswold, Securitize, Giesse of required capacity and approved quality with necessary stainless steel 304 grade screws etc to the side hung/ top hung windows as per direction of Engineer-in-charge complete.

5.33 Providing and fixing powder coated fixed handle (dummy handle) of Alualpha, lavaal, Giesse or equivalent without any mechanism including all required accessories etc as per approved manufacturer recomendatation for aluminium double shutter casement/ sliding door and window with necessary screws etc complete as directed by engineer in charge.

Aluminium powder coated fixed handle for aluminium double shutter casement/ sliding door and window of approved make shall be of high quality as per drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one no.

5.34 Providing and fixing adjustable/ fixed Teflon roller bearing set with reinforced nylon casing of polismar, lavaal, sotralu or equivalent (twin or single wheel according to weight and size) for sliding window/door as per drawing etc complete as directed by engineer in charge.

Adjustable/ fixed Teflon roller bearings set with reinforced nylon casing (twin or single wheel according to weight and size) for sliding window/door of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.35 Providing fixing testing and commissioning automatic double Sliding door operator system ES 200 (easy) 6.25 meter long) of Dorma or equivalent for 2 x 85 kg (max) sliding shutter with 2 no of sensors with self learning mechanism, micro processor control drive unit safety device-light barrier,

mechanical components, toothed belt, glass clamped floor guide, fail secure system in case of fire, body in standard finish silver anodized etc. complete. with following specifications.
Glass Clamping Rail - 1550 mm - 2 Nos
Floor Guide for Glass Door - 2 Nos
Radar Eagle STD 6 - 1 Nos. - Silver Zensafe Radar (Motion + Presence) - 1 Nos
Five Position Program Switch with knob - 1 Nos
Cable For Program Switch - 1 Nos
Flap Seal/ Brush seal For 12mm glass 3mtr long - 2 Nos
Soft nose Seal for 12mm glass 3mt long-2 No
The quoted rate shall include all design, engineering & shop drawing approval from architect & consultant. The rate shall also include complete providing of automatic sliding door operator system with all accessories, fixing operator to the supporting MS section, testing and smooth operation of aluminium framed glass shutters, anchor fasteners, scaffolding, tools tackle etc .
The cost of providing, fabricating amd fixing aluminium work, Glass and MS work shall be paid in relevant tender item..

1.0 GENERAL

1.1 DESCRIPTION

A. This section specifies equipment, controls and accessories for automatic operation of sliding doors.

1.2 RELATED WORK

A. Aluminum frames entrance work and steel work.
B. Door hardware;
C. ACCESS CONTROL.
D. Glass and glazing of doors and frames;
E. Electric general wiring, connections and equipment requirements;

1.3 QUALITY ASSURANCE

A. Automatic door operators, controls and other equipment shall be products of a manufacturer regularly engaged in manufacturing such equipment for a minimum of three years.
B. One type of automatic door equipment shall be used throughout the building.
C. Equipment installer shall have specialized experience and shall be approved by the manufacturer.

1.4 WARRANTY

A. Automatic door operators shall be subject to the terms of the "Warranty of system" with certain period.

1.5 SUBMITTALS

A. Submit in accordance with SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
B. Manufacturer's literature and data describing operators, power units, controls, door hardware and safety devices.
C. Shop Drawings:
1. Showing location of controls and safety devices in relationship to each automatically operated door.

2. Showing layout, profiles, product components, including anchorage, accessories, as applicable.
3. Submit templates, wiring diagrams, fabrication details and other information to coordinate the proper installation of the automatic door operators.

1.6 DELIVERY AND STORAGE

A. Delivery shall be in factory's original, unopened, undamaged container with identification labels attached.

2.0 PRODUCTS

2.1 SLIDING DOOR OPERATORS

A. General: Sliding doors shall have electric operators, and the following requirements as applicable. Assembly shall be single or bi-parting sliding doors as shown on drawings.
B. Door Operation: Doors shall be opened by electric motor pulling door from closed to open position and shall stop door by electrically reducing voltage and stalling door against mechanical stop. System shall permit manual control of door in event of power failure. Opening and closing speeds shall be adjustable. All door panels shall allow "breakout" to the full open position to provide instant egress at any point in the door's movement.
C. Operators: Completely assembled and sealed electromechanical operating unit, all located in cast aluminum housing and filled with specified.
D. Sliding Door Hardware Guide Rollers, Door Carrier: Top door carriers shall ride on steel rollers incorporating sealed bearings as per manufacturer's specifications.
E. Locking Hardware: Provide any locking hardware as per security oriented requirements. Provide doors with manufacturers' standard hook bolt lock (keyed both sides) where physical security is required and free egress is not required at all times. At doors with access control devices (card readers, etc.) provide doors with electronic deadbolt locking to prevent the doors from manually sliding open.
F. Door Closers: Provide all breakout or swing-out panels with door closers concealed in the top rail of the door.
G. Flap Seal/ Brush seal : Provide appropriate seal for packing between two shutter or fixed panel as per manufacturer's specifications.

2.2 POWER UNITS

Each power unit shall be self-contained, electric operated and independent of the door operator. Capacity and size of power circuits shall be in accordance with automatic door operator manufacturer's specifications.

2.3 DOOR CONTROLS

Opening and closing actions of doors shall be actuated by controls and safety devices specified.

2.4 SAFETY DEVICES

A. General: Area over which doors slide shall be a safety section and anyone standing in path of door's movement shall be protected by a safety device.

3.0 EXECUTION

3.1 INSTALLATION

A. Coordinate installation of equipment with other related work. Secure operator components to adjacent construction with suitable fastenings. Conceal conduits, piping, and electric equipment, in finish work.

B. Install power units in locations shown. Where units are to be mounted on walls, provide structural steel supports or for the units. All equipment shall be accessible for maintenance and adjustment.

4.0 MODE OF MEAASUREMENTS

The rate shall be for unit of one No.

Glazing, Structural steel work and electrical work should be paid in relevant items as per specifications.

5.36 Curtain Wall System with single or double glass unit

Designing, fabricating, testing, protection, installing and fixing in position curtain wall system designed to with stand the wind pressure of 145 kg/sq.mtr confirming to IS -875 part III. (The system must pass the proof test at 1.5 times design wind pressure i.e. 217 kg/sq.mtr without any failure). The profile system is based on capped curtain wall design and glass is held all around by mechanical pressure plate and cap with microwave cured EPDM gaskets in all four sides of glazing, with necessary brackets of aluminium alloy of 6065 with three dimensional adjustment with serrations and serrated washers to arrest the wind load movement, SS 316 grade anchor bolts, screws and fasteners with non staining weather sealant and 1.5mm thk flashing sealed all around parameter inside and outside to seal the gaps between curtain wall and the building structure all complete required to perform as per specification and drawing in conjunction with BOQ.

The system shall be designed for 3 barrier gasket system based on pressure equalization principle with drainage provision at all panel bottom & thermal break gasket barrier between pressure plate and aluminium grid work for improved thermal performance and weather performance, spandrel panel shall have pressure release & condensation drainage provisions, The system shall be able to accommodate building movements, thermal expansions resulting from surface temperatures of up to 80deg cel, temperature differential of 25 deg cel thermal expansions and the seismic movements without creating excessive stress. The system shall be designed to accommodate minimum 10mm vertical movement between floors. All metal joints in the wet area shall be with small joint sealant applied to ensure water tightness, so curtain wall system becomes water tight.

The extruded aluminium sections of Alloy 6063 T5/ T6 and tolerances confirming to DIN standard from approved extruder. The structural profiles shall have minimum 2.5mm wall thickness. All the visible surfaces shall have Super Durable polyester Powder coating finish as per manufacturer's specifications. The non visible aluminium surfaces shall have minimum chromatizing treatment.

The quote rate shall include all design, engineering & shop drawing prepared by contractor and approval from consultant. The quote rate shall include all Taxes, duties, statutory obligations and safety code compliance as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by the Engineer in Charge.

Quote rate for complete system as mentioned above and for with following glass thickness and unit.

a) With 32mm DGU : Clear Substrate :- 8mm Thk. coated neutral colour Glass + 16mm Air Gap + 8mm Clear Glass of Saint Gobin ST 136, HORIZON(SCN 145) or equivalent having maximum value as following

SHGC (Solar factor) = 0.45, U value = 3.18 W/Sqm and K = 0.56 BTU/HrSqFt DegF

Relevant specification shall be followed as per relevant material specifications and as per manufacturer's specifications. Item should be executed by only approved installer with complete system.

Contractor shall prepared shop drawing with designing based on intent/ concept drawing and approved by consultant/ Engineer in charge. The work is to be carried out as per the best workmanship manner, as per the shop drawing. Contractor shall prepare mock-up with full joinery detail and hardware as suggested by engineer in charge. Contractor shall submit loose samples of all material before fabrication of mock-up.
The Contractor shall provide curtain wall with specified glazing, having all the performance characteristics all complete, as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by the Engineer-in-Charge.
The item also includes the cost of all mock ups at site, cost of all samples of the individual components on the assembled working structural glazing as specified, cleaning
and protection till the handing over of the building for occupation. In the end, the Contractor shall provide a water tight curtain wall system having all the performance characteristics etc. all complete as required.

However, for the purpose of payment, only the actual area on the external face of the curtain wall with glazing shall be measured in sqm up to two decimal places.

5.37 Providing and fixing of Hollow metal 2 Hour fire rated metal doors (120 minute integrity and 30 minute insulation) of approved make and in any shade any finish as per IS 3614 – 2021 for stability and integrity. Pressed Galvanized steel confirming to IS 277 with the following specification. Recommended fire door shall have doors tested at CBRI or ARAI for maximum rating of 2hrs with minimum 30 mins insulation with vision panel. Test certificates shall be available for vision liters/ panels as part of the fire door assembly. Independent glass test certificates will not be accepted. Manufacturer test certificate shall cover doors both single & double leaf doors and hardware shall be of 120 minutes Fire Rating and third party approval certificate from reputed agency such as CERTIFIRE / UL etc. Any deviation in specification and sheet thickness other than what is mentioned in the test certificates are not allowed. Proper label confirming the type of door and the hourly rating is mandatory. Approved manufacturer subject to Engineer – in- charge approval and shall be ISO certified company.

5.37.1 Fire rated Door frame shall be single rebate profile of size 125mm x 55 mm made out of 1.60mm (16 gauge) minimum thick galvanized steel sheet. Frames shall be as per tested design and field assembled with self tabs. All provision shall be mortised, drilled and tapped for receiving appropriate hardware. Frames shall have inbuilt grooved sealing system and shall be site fitted with EPDM smoke seal as per IS:3614-2021. Rubber door silencers shall be provided on the striking jamb. Frames shall be provided with back plate bracket and anchor fasteners for installation on a finished plastered masonry wall opening. Once frame installed shall be filled with PUF as recommended by the manufacturer or engineer.
Door shutter and frames shall be finished with minimum 50 micron pure polyester powder coated and shall have passed minimum 500 hours of salt spray test as per the directions of Engineer - in- charge. Rate shall be inclusive of all above mentioned components including anchor fasteners.
(Cost of SS ball bearing hinges is excluded).

5.37.2 Fire rated Door shutter shall be 46mm thick fully flush double skin metal door with or without vision lite. Door shutter shall be manufactured from 1.2mm (18 gauge) minimum thick galvanized steel sheet. The internal construction of the door shall be rigid reinforcement pads for receiving appropriate hardware. The infill material shall be high density insulation material with Intumescent seals and smoke seal as per IS:3614-2021. All doors shall be factory prepped for receiving appropriate hardware and provided with necessary reinforcement for hinges, locks, and door closers. The edges shall be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable shall be provided as per manufacturer's recommendation with a clip on arrangement. Auto drop down seal shall be fixed at bottom of shutter of required size and type.

Door shutter and frames shall be finished with minimum 50 micron pure polyester powder coated and shall have passed minimum 500 hours of salt spray test. The cost includes all above material, labour, finishing, fixing except vision panel, ball bearing butt hinges, mortise sash lock, hydraulic door closer, panic device and external trim with design liver handle, which shall be paid in relevant tender item.

5.37.3 Providing and fixing fixed vision panel glass in fire rated door having minimum 5 mm clear borosilicate 2 hour fire rated glass of approved make with a clip-on arrangement with ceramic/ fire rated gasket and as per manufacturers recommendation.

1.0 Material & Workmanship

Fire rated door shall be as per item description and shall be of approved make and shade as per drawing. Hollow metal 2 hr fire rated doors as per IS 3614 part-1 & part-2 for stability and integrity. Pressed Galvanized steel shall confirm to IS 277.

Sample shall be approved by engineer in charge before installation.

1.1 Door shutter:

Door leaf shall be 46mm thick fully flush double skin door with or without vision lite. Door leaf shall be manufactured from 1.2mm (18guage) minimum thick galvanised steel sheet. The internal construction of the door shall be rigid reinforcement pads for receiving appropriate hardware. The infill material shall be resin bonded honeycomb core. All doors shall be factory prepped for receiving appropriate hardware and provided with necessary reinforcement for hinges, locks, and door closers. The edges shall be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf.

Door shutter shall be constructed from 1mm thick galvanized steel sheet formed to provide a 40/42mm thick fully flush, double skin door shell with lock seam joints at stile edges. Internal Reinforcements are provided at top, Bottom and Stile Edges for Fire Rating. The inner core is rock wool or light weight Honey Comb Raised Board or mild wool containing no asbestos or other inorganic fibres. The internal construction of the doors varies with the degree of Fire Rating as tested.

1.2 Door frame:

Door frame shall be double rebate profile of size 143 x 57 mm made out of 1.60mm (16gauge) minimum thick galvanized steel sheet. The edges shall be interlocked with a bending radius of 1.4mm. Frames shall be mitred and field assembled with self tabs. All provision shall be mortised, drilled and tapped for

receiving appropriate hardware. Rubber door silencers shall be provided on the striking jamb. Frames shall be provided with back plate bracket and anchor fasteners for installation on a finished plastered masonry wall opening. Once frame installed shall be grouted with cement & sand slurry necessary for fire doors on the clear masonry opening.

1.3 Vision Panel:

Vision lite wherever applicable shall be provided as per manufacturer's recommendation with fire rated ceramic gasket of approved make as beading and screws from inside. The glass shall be 6mm clear borosilicate fire rated glass of relevant rating of the door.

1.4 Finish:

All doors and frames shall be finished with etched primer coating, stove zinc phosphate primer and thermosetting polyurethane aliphatic grade paint of approved color. The door leaf and frame shall have passed minimum 350 hours of salt spray test.

1.5 Test:

Recommended fire door shall have doors tested at CBRI or ARAI for maximum rating of 2hrs with vision panel. Test certificates shall be available for vision lites /panels as part of the fire door assembly. Independent glass test certificates shall not be accepted. Manufacturer test certificate shall cover doors both single and double leaf and all doors supplied shall be within the tested specimen, deviation in specification and sheet thickness other than what is mentioned in the test certificates are not allowed. Proper label confirming the type of door and the hourly rating is mandatory.

2.0 Mode of measurement:

The rate shall be for unit of one meter for frame.
Rate shall be inclusive of frame, back plate, rubber silencer, smoke seal, anchor fastner, finishing of frame and installation but excluding the cost of SS ball bearing hinges.

The rate shall be for unit of one sqm for door shutter.
Rate shall be inclusive of shutter with infill material, bottom seal, finishing cost and installation but excluding the cost of Vision panel and all fire rate hardware.
The rate shall be for unit of one sqm for Fire rated vision panel.

5.37.4 Providing and fixing 120 min fire rated SS 304 Ball Bearing Butt Hinges 100mm x 75mm x 3 mm CE marked for fire rated metal door of approved make with necessary screws etc. complete as recommended by manufacturer and as directed by Engineer in Charge.

SS ball bearing Butt hinges of size 100mm x 75mm x 3 mm CE marked for fire rated or non fire rated metal door of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.37.5 Providing and fixing 120 min fire rated Mortise sash lock of approved make with 70 mm Cylinder Thumb turn with pair of SS 304 Lever handle CE marked for fire rated metal door of approved make

with necessary fittings etc. complete as recommended by manufacturer and as directed by Engineer in Charge.

Mortise lock with 70mm Pin Cylinder thumb turn with lever CE marked for fire rated or non fire rated metal door of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.37.6 Providing & fixing Fire rated (120 minutes) hydraulic rack and pinion door closer with controlled adjustable closing speed and power adjustable with back check with track arm with screws to hinged door of approved make EN size 2-4 with minimum one year guarantee. All adjustment screws face fixed. Rate shall be inclusive of fixing with using the template as per manufacturer's specification & maintain in good working condition until defect liability period. The door closer shall conform to EN 1154 standards and CE marked with necessary fittings etc. complete as recommended by manufacturer and as directed by Engineer in Charge.

Relevant specifications shall be followed as per item no 5.16 except 120 minutes fire rated door closer with back check and standard arm with two independent closing valves and latching speed adjustable by arm instead of door closer for normal door.
The rate shall be for unit of one No.

5.37.7 Providing and fixing Dorma PHA 2000 1 point panic device in Contour design on active leaf and 2 point modular on inactive leaf, carry bar for rebated double door. For fire and smoke check doors, with steel latch, security anti thrust latch consisting of 2 x 2102F, 2 x 2105, PHX 04 and PHX 03 in silver finish. As per EN 1125, CE marked with necessary fittings etc. complete as recommended by manufacturer and as directed by Engineer in Charge.

1 point panic device in Contour design, carry bar for single door for fire and smoke check doors, with steel latch, security anti thrust latch CE marked for fire rated or non fire rated metal door of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.37.8 Providing and fixing External trim with design lever handle of Dorma PHT 05 or approved equivalent make suiting the panic bar for fire and smoke check doors. For max. 60mm thick door prepared for half euro profile cylinder and in Silver finish with necessary fittings etc. complete as recommended by manufacturer and as directed by Engineer in Charge.

External trim with design lever handle of Dorma PHT 05 or approved equivalent make suiting the panic bar for maximum 60mm thick door prepared for half euro profile cylinder CE marked for fire rated or non fire rated metal door of approved make shall be of high quality as shown in the drawing and as per manufacture's specification. Rate should be inclusive of material, labour for fixing and necessary consumable hardware as per specification for all height, all floors and all level.
The rate shall be for unit of one No.

5.39 Providing fixing 6mm thick frame less mirror of approve make in any shape and sizes as per drawing. Mirror shall be fixed on 6mm thick cement bonded particle board (Bison panel) backing. Cement bonded particle board shall be fixed to wall with approved SS 304 fastener. All edges of glass shall be sharp grinded, cute corner and polished. Glass shall be fixed with silicon sealant/ 3M tape etc complete at all floors/ all levels/ all heights as directed by engineer in charge. Installed area of mirror shall be considered for payment without wastage.

1.0 Materials:

1.1 6mm thick frame less mirror shall be approved make and shade.

1.2 Cement bonded particle board – 6 mm thick 304 grade as per material specification of approved make.

2.0 Workmanship:

2.1 Contractor shall be submitted shop drawings for the approval before installation**.**

2.2 Mirror shall be fixed in best workman ship manner as per manufacturer's specification.

2.3 6mm thick backing play shall be installed with necessary hardware, screw, fastener, adhesive etc as per approved shop drawing. Mirror shall be fixed on 6mm thick cement bonded particle board with required silicon sealant, hardware and tap as per manufacturer's specification. The Contractor shall be responsible for the partitions and doors being set straight, in plumb level and for their satisfactory operations after completing the installation.

3.0 Mode of Measurements and Payment:

The rate shall be for a unit of one Sqm.

5.40 Providing and fixing toilet cubical systems with box type bottom support and wall mounted partition of approved make in required size partition and door width with 18mm thick antibacterial, antifungal (conforming to JIS Z2801:2010 and ASTM G21-2015 standards respectively) with Green guard Certification, including doors, pilasters & intermediate panels, which shall be resistant to heat, bacteria, water, chemical, scratch, termite and impact. Compact board shall be resistance to water immersion through permissible increase on thickness and mass <0.60% and board density >1.35kg/cm3 and manufactured under EN438-2&3:2005 standard. Compact panel shall be of approved shade, texture and make.

Front panels shall be of box support and Pilaster will be fixed with wall fixed of SS (316 grade).

The intermediate panels will be attached to the wall with the help of approved SS channels (grade316) and all required hardware, made up of stainless steel as per manufacturer's specification. Door knob, gravity hinges, Thumb turn locksets with occupancy indicators, coat hooks with door stopper, U channel, top rail with corner connector, adjustable foot/ pedestal, Rubber noise deafening tape, screw & wall plugs shall be approved under the instruction of Engineer-in-charge. All screw shall be of SS 316 grade in stain finish. All pilasters are supported by SS 306 bottom cladding. The floor with a clearance height up to 110 mm.

Cubical shall be procured and install from system manufacturers and not self made and assembled. Dimensions of the cubical system shall be as per conceptual drawing and as per site condition.

Contractor shall prepare shop drawing with all hardware and accessories for approval before execution. Work shall be carried out as per approved shop drawing.

Note:- Total Area of Board (used in door or in front or in partition) shall be measured for payment which will include cost of all SS fittings, SS pilasters mentioned in the item. However, MS work, if required, for suspending cubicle system shall be paid in relevant item.

1.0 Materials:

1.1 As per manufacturer's specification and shall be of approved make and texture.

2.0 Workmanship:

2.1 Contractor shall be submitted shop drawings for the approval before installation**.**

2.2 Partitions shall be fixed in best workman ship manner as per manufacturer's specification. The Contractor shall be responsible for the partitions and doors being set straight, in plumb level and for their satisfactory operations after completing the installation.

3.0 Mode of Measurements and Payment:

3.1 The rate shall be for unit of one Number of the actual unit installed for item (a) & (b). Item (c) shall be measured in Meter.

3.2 The rates quoted shall be inclusive of all necessary accessories for unit of same manufacture, supply and installation at Site.

5.41 Urinal partion

Providing and fixing Urinal Partitions of Merino UMP SS SERIES or equivalent as per approved make as per manufacturer's specifications of 1200 mm height. Partion is of 12mm thick solid Compact Laminate made with core of phenol resin treat papers with black colour top layer treated with special melamine resin under high pressure and temperature, which should be resistant to heat, bacteria, water, chemical, scratch and impact. Finished product should be as per approved texture, shade & drawing detailing and developed according to IS-2046 and BS-476/97 standards. The partition shall include necessary hardware fittings, made out of stainless steel (Minimum SS Grade-304), as per manufacturer's specifications and approved by Project Manager. Hardware used for fixing should consist of -

1) SS 304 Right Angle Brackets

2) S.S.Screws 304 G & P.V.C Wall Plugs

1.0 Materials:

5.11 As per manufacturer's specification and shall be of approved make and texture.

2.0 Workmanship:

2.1 Partitions shall be fixed in best workman ship manner as per manufacturer's specification.

2.0 Mode of Measurements and Payment:

2.1 The rate shall be for unit of Sqm of the actual installed area of partition.

3.2 The rates quoted shall be inclusive of all necessary accessories for unit of same manufacture, supply and installation at Site.

5.41.A Providing and fixing 6mm thick MR grade IS-710 grade plywood for fixing aluminium sheet of window frame with required screws, fastener, adhesive etc complete for all floor all height as directed by engineer in charge.

1.0 Materials:

1.1 Material specification of Ply wood - M86 is to be followed.

2.0 Workmanship:

2.1 Ply wood shall be fixed on aluminium section to receive the aluminium sheet in best workman ship manner as a tight infill panel with screw, fastner, adhesive etc as shown in drawing and as directed by engineer in charge.

3.0 Mode of Measurements and Payment:

3.1 Aluminium frame work shall be paid in relevant tender item

3.2 The rate shall be for unit of one m^2 of the actual Ply wood sheet fixed.

5.42 Dry Wall Partition System

Providing and fixing 122mm thick double layered dry wall partition system of approved make which includes inner layer of tapered edge minimum 12.5mm thick Fire Resistant Gypsum Board having density of minimum 790 kg/m3 (conforming to IS 2095 Part 1 : 2011/ EN520 : 2004, TYPE-F/ ASTM C1396, TYPE X) and outer layer of tapered edge 12.5mm thick Calcium sulphate dihydrate encased in paper liners, with glass fibers and other additives having density minimum 900 kg/m3 of approximate size 1200 x 2400mm, complies with EN 520:2004 – Type A, D, R, I, Thermal Conductivity: 0.24 w/mºK, Thermal resistance: 0.05 m2K/w.

Framing system - GI framing system is consist of Close stud/ C stud of size approximate 72 x 0.5mm as per IS 513 having Y/S-minimum 230 Mpa, and Finish- AZ150 (IS 15961) with knurled/ serrated/ ribbed pattern. Stud shall be placed at 600mm c/c in 72x0.5mm (approx) floor and ceiling channel. Floor & Ceiling channel is anchored to the floor & ceiling using zinc coated Rawl plug of size Ø8x45mm and having Pull out Load -7.5kN / anchor fasteners of required capacity as per manufacturer's specification at 600mm c/c in zigzag manner. Floor channel to be wrapped with 70µ Self Adhesive LDPE moisture barrier film to further improve corrosion resistance performance. A nogging channel of 48x0.5mm width has to be provided at the horizontal joints of the two boards.

50mm thick Glass wool slab of density 20kg/m³ with black glass fiber cloth with holding clip shall be used to hold Glass wool slab in its position.

Gypsum boards shall be fixed with drywall screws of 25mm/ 35mm at minimum spacing of 600mm at centre and 300mm at periphery. Boards shall be jointed and finished so as to have a flush look which includes filling and finishing with Jointing compound, Joint Paper tape, angle beads at corners. Gypsum surface shall be finished with skimming coat as per manufacturer's specification to receive paint on it. The junction of the partition with masonry/ RCC & all penetration through the partition has to be treated with fire and acoustic sealant of approved make.

1.0 Material

122 mm thick double layered dry wall partition system which includes inner layer of tapered edge 12.5mm thick Fire Resistant Gypsum Board and outer layer of tapered edge 12.5mm thick Calcium sulphate dehydrate encased in paper liners, with glass fibres and other additives having following properties.

1. 12.5mm thick Fire Resistant Gypsum Board - Density minimum 790 kg/m3 (confirming to IS 2095 Part 1 : 2011/ EN520 : 2004, TYPE-F/ ASTM C1396, TYPE X).

2. 12.5mm thick Calcium sulphate dehydrate encased in paper liners, with glass fibers and other additives density minimum 900 kg/m3 having approximate size 1200x2400mm.

3. complies with EN 520:2004 – Type A, D, R, I, Thermal Conductivity: 0.24 w/mºK, Thermal resistance: 0.05 m2K/w.

4. 50mm Rock wool slab of density 20kg/m³ shall be placed in metal framework.

GI framing system is consist of Close stud/ C stud of size approximate 72 x 0.5mm as per IS 513 having Y/S-minimum 230 Mpa, and Finish- AZ150 (IS 15961). Stud shall be placed at 600mm c/c in 72x0.5mm (approx) floor and ceiling channel. Floor & Ceiling channel is anchored to the floor & ceiling using zinc coated Rawl plug of size Ø8x45mm and having Pull out Load -7.5kN / anchor fasteners of required capacity as per manufacturer's specification at 600mm c/c in zigzag manner. Floor channel to be wrapped with 70µ Self Adhesive LDPE moisture barrier film to further improve corrosion resistance performance. A noggin channel of 70x0.5mm width has to be provided at the horizontal joints of the two boards.

Gypsum boards shall be fixed with drywall screws of 25mm/ 35mm at minimum spacing of 600mm at centre and 300mm at periphery. Boards shall be jointed and finished so as to have a flush look which includes filling and finishing with Jointing compound, Joint Paper tape, angle beads at corners. The junction of the partition with masonry/ RCC & all penetration through the partition has to be treated with fire and acoustic sealant of approved make.Glass wool holding clip should be used to hold Glass wool slab in its position.

All material used for shall be of approved make.

2.0 Workmanship

(i) Panels are stored in a dry place and water should not come in contact with panels during or after construction. If the panels get wet, they should not be used.

(ii) The floor should be perfectly level before laying the first course. All panels must be properly aligned to the plumb. Successive layer of panels must be alternatively staggered so that vertical joints are not in the same line.

(iii) The recommended quantity of Gypsum Bonding Plaster must be used for joints and filling the grooves made for conduits, pipelines, etc. Excess Bonding Plaster must be scooped and removed, so that the joints and the places where the grooves are filled in are flush and even.

(iv) The walls should be dry and sanding done properly especially at joints before the primer is applied so that the surface is even and joints will not be visible after painting. Avoid chasing with chisel and hammer. Use electrical saw or grooving tools for conduiting etc.

(v) The recommended span of walls is maximum 6 meters and maximum height is 4.5 meters.

(vi) Gypsum panel can easily be cut with coarse tooth hand saw, electric jigsaw, etc. The panels can be cut, sawn, drilled, milled or dowelled on the job. For concealed piping and conduit, the depth of groove should not exceed 50 mm. Hammer and chisel techniques to form chases must be avoided.

(vii) Sanding: This application is to make the surface level without undulations. To make the gypsum wall surface level (in particular at joints, where there is excess bonding plaster), do sanding with sand paper at joints and other places, wherever you find uneven surface, otherwise joints will be visible after painting. It is important to sand all joints uniformly.

(viii) Primer Application: The purpose of the primer is to give a better adhesion to the paint and also to reduce consumption of paint on the wall. Water thinable primers shall be used only.

Contractor shall prepared shop drawing based on concept drawing including services and prepared mock-up of required area. As per approved shop drawing and mock-up, contractor shall start the

work. Contractor shall furnished certification of entire system for STC 48 and 120 minutes Fire rating or to the desired level.

3.0 Measurements

The length and height shall be measured correct to a cm. Area shall be calculated in square meters correct to two place of decimal. No deduction shall be made for ducts, opening made from the standard size of panel. Actual installed quantity shall be measured and paid.

4.0 Rate

The rate shall include the cost of materials and labour involved in all the operations described above and including cost of making openings for light fittings, switch board, any other services cutouts made with frame of perimeter member suitably fixed etc. complete for all level all height and as directed by the Engineer in Charge but excluding the cost of painting work. The rate shall be unit of Sqm.

7.01a **Providing and laying average 10mm thick single coat cement finish cement plaster in CM 1:4 on ceilings and stair soffits at all floors, all shapes, all heights with necessary scaffolding, curing, making grooves, forming pattas, hacking properly RCC surface etc. complete, with floating coat of cement slurry as directed by the Architect and Engineer-in-charge. (for all civil, plumbing and electrical works)**

1.0 **Materials :** Water shall conform to M-1. The cement mortar of proportion 1:3 shall conform to M-11.

2.0 **Workmanship :**

2.1 Scaffolding: Wooden ballies, bamboo, planks, trestles and other Steel 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. The sample shall be approved by architect or engineer-incharge before starting the work.

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. Smooth surface shall be roughened by wire brushing if it is not hard and by dense hacking if it is concrete. In case of concrete surface, if a chemical retarder or shuttering oil has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles shall be cleaned off and care shall be taken that none of the retarder is left on the surface. Trimming of projections on brick/concrete surface wherever necessary shall be carried out to get an even surface.

2.2.2 Raking of joints in case of masonry wherever necessary shall be allowed to dry out for sufficient period before carrying out the plasterwork.

2.2.3 Scaffolding for carrying out plastering work shall be double scaffolding having two sets of vertical supports so that the scaffolding is independent of the walls.

2.3 **Preparation of Surface :**

2.3.1 All putlog holes in brickwork and junction between concrete and brickwork shall be properly filled in advance. Joints in brick work shall be raked about 10 mm. and concrete surface shall be hacked to provide grip to the plaster. Projecting burrs of mortars formed due to gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brush/coir brush to remove dirt, dust etc., and the surface thoroughly washed with clean water to remove efflorescence, grease and oil etc., and shall be kept wet for a minimum of two hours before application of plaster.

2.3.2 For external plaster, the plastering operation shall be started from the top floor and carried downwards. For internal plaster, the plastering operations may be started wherever the building frame and cladding work are ready and the temporary supporting ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting plaster to walls.

2.4 **Applications of Plaster :**

2.4.1 The plaster about 5 cm. x 5 cm., shall be first applied horizontally and vertically at not more than 2 m. 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 by working a wooden straight edge reaching across the gauges with small upwards and sideways movements at a time. Finally, the surface shall be finished off true with a trowel or wooden float according to the texture, smooth or sandy granular, as may be required. Excessive Trowelling or over working the float shall be avoided. All corners, arises, angles and junctions etc. shall be carried out with proper templates to the size required. The surface shall be finished smooth using neat cement at the ratio of 2.2 kg/m2.

2.4.2 Cement mortar shall be used within half an hour after addition of water. Any mortar or plaster which is partially set shall be rejected and removed from the site.

2.4.3 In suspending the work at the end of the day, the plaster shall be left out, clean to line both horizontally and vertically. While recommencing the plaster, the edges of the old work shall be scrapped 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 shall not be nearer than 15 cm. to any corners or arises. Horizontal joints in plasterwork 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 patched up later on.

2.4.4 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 sufficiently. Soaking of walls shall be avoided and only as much water

as can be readily absorbed shall be used, excessive evaporation on the sunny or windward side of building in hot air or dry weather shall be prevented by hanging mats or gunny bags on the outside of the plaster and by keeping them wet.

3.0 Mode of Measurements & Payment :

3.1 The rates shall include for work at any height, position, and floor and for all necessary scaffolding, etc. as may be required. The rates shall also include for hacking and/or bush hammering to form key for plaster and for spatter dash treatment, as specified, as and where necessary.

The rates shall also include for all work in narrow width, arises, rounded angles, chamfered external angles, drip moulds, grooves and for making good after all trades.

The rate shall also include for groove with cement finish upto 12 mm. x 6 mm. to be formed in plaster at junction of slab and beam and slab and brick without any extra charge. The rate shall also include for similar grooves in plaster at the junction of masonry and wood or steel door/window/ventilator frame or at bottom of beam/lintels as drip moulds without extra charge.

3.2 All plastering shall be measured in m^2, unless otherwise specified. Length, breadth or height shall be measured correct to a centimetre.

3.3 Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooved 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 the surface.**

3.4 The measurement of wall plastering shall be taken between the walls or partitions (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. Flowing/folding soffits shall be measured separately.

3.7 For jambs, soffits, sills, etc., openings exceeding 0.5 sqm and not exceeding 3.0 sqm, area deductions and additions shall be made in the following manner: -
(a) No deductions shall be made for end joints, beams, posts, etc. for openings not exceeding 0.5 sqm. each and no addition shall be made for reels, jambs, soffits, sills, etc. of these opening for finish to plaster around ends of joints, beams, posts, etc.
(b) Deduction for openings exceeds 0.5 sqm. but not exceeding 3.0 sqm. 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 any wall are plastered with same plaster, deduction shall be made for one face only.
(ii) When two faces of any wall are plastered with different types of plasters or if one faces is plastered and the other pointed, deductions shall be made from the plaster or pointing on the side of frame for door, windows, 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 area of plaster and/or pointing as the case may be.

3.8 For openings having door frames equal to projection beyond the thickness of wall, full deduction for opening shall be made from each plastered face of the wall. Jambs, soffits and sills shall be measured separately and paid for.

3.9 In case of openings having area above 3.0 m^2 each, full deduction shall be made for the opening but jambs, soffits, and sills shall be measured additionally.

3.10 The rate shall be for a unit of one $m^{2.}$

7.01b Providing and laying average 10 mm thick single coat mala finish plaster in CM 1:3, on ceilings and stair soffits at all floors, all shapes and all heights with necessary scaffolding, curing, making grooves, forming pattas, hacking properly RCC surface etc. complete as directed by the Architect and Engineer-in-charge. (for all civil, plumbing and electrical works)

The relevant specification of item no. 7.01a shall be followed except that the proportion of mortar shall be 1:3 instead of 1:4 and mala finish shall be provided instead of Cement finish cement plaster. Instead of even and smooth finish with neat cement slurry, mala fininsh without applying neat cement slurry shall be carried out by rubbing aluminium

patti and steel trowel untill cement slurry is seen on the surface evenly. Sample shall be got approved by the Engineer-incharge before starting the work. The mode of measurement shall be for a unit of sqm. The mode of measurement and payment shall be as per 7.01a

7.02a **Providing and laying average 15mm. thick single coat cement finish cement plaster in CM 1:3 on sides of masonry work, at all floors, all shapes and all heights with necessary scaffolding, curing, making grooves, forming pattas and drip moulds, hacking the RCC surface etc. complete, with floating coat of cement slurry as directed by the Architect and Engineer-in-charge. (for all civil, plumbing and electrical works)**

1.0 **Materials & Workmanship: The** relevant specifications of item no. 7.01a shall be followed same except that the thickness shall be 15 mm. instead of 10 mm. The surface shall be finished smooth using neat cement at the ratio of 2.2 kg/m2.

2.2 **Mode of Measurements & Payment:**

2.1 The mode of measurement and payment shall be the same as in item no. 7.01a.

2.2 The rate shall be for a unit of one m^2.

7.02b **Providing and laying average 12-15 mm thick single coat mala finish plaster in CM 1:3, on masonarywork / blockwork / RCC at all floors, all shapes and all heights with necessary scaffolding, curing, making grooves, forming pattas, hacking properly RCC surface etc. complete as directed by the Architect and Engineer-in-charge (for all civil, plumbing & electrical works).**

The relevant specification of 7.01b shall be followed except that the thickness of the plaster shall be 15 mm instead of 12 mm.

7.02c **Extra for providing lime neeru finish on walls and corner to be finished with cement slurry at all floors, all shapes and all heights, to the plastered surface @ 2.2 Kg/sq.m including cost of lime, scaffolding, rubbing with small trowel, watering, etc. complete as directed.**

1.0 **Materials:** Water shall conform to M-1. The cement mortar of proportion 1:4 shall conform to M-11. Lime shall conform to M-2. Otherwise, the relevant specifications of item no. 7.02a shall be followed except that the surface shall be finished smooth using lime @ 2.2 kg/m^2. The plastered surface shall be rubbed with small trowel as specified.

7.02d **Reduction in item no. 7.02a for providing wired finish instead of floating coat of cement slurry.**
The relevant specifications of item no. 7.02a shall be followed except that the surface shall not be finished smooth using cement @ 2.2 kg/m2. The rate shall be reduction in the rate for providing wired finish instead of floating coat of cement slurry.

7.03 **Providing & laying average 20 mm. thick cement plaster in two coats at all heights, all shapes and all levels with first coat in CM 1:4 (1 cement: 4 coarse sand) rough wired finish and second coat in CM 1:2 cement mala finish (finished with steel trowel) including scaffolding, curing, making grooves, forming pattas and drip mould, hacking RCC surface etc. complete, as directed by Architect or Engineer-Incharge. (for all civil, plumbing & electrical works).**

1.0 **Materials & Workmanship:** The relevant specifications of item No. 7.01a shall be followed except that the thickness of the plaster shall be average 18 mm. and shall be carried out as specified in the item. The base coat shall be carried in CM 1:4 having average 12-15 mm. thickness. Before the plastered surface hardens roughing shall be done to receive the second coat. Second coat shall be applied only after minimum curing of 72 hours. The second coat shall be carried out in CM 1:3 having average 8-5 mm thickness. The surface shall be finished smooth with steel trowel (Mala finish).

2.0 **Mode of Measurements and Payment:**

2.1 The relevant specifications of item No. 7.01a shall be followed.

2.2 The rate shall be for a unit of one m^2.

7.03.a **Providing & laying average <u>18mm thick</u> cement plaster for 230mm brick wall in <u>single coat</u>, CM 1:4 with cement finish cement plaster on unfair side of brickwork (finished with floating coat of neat cement slurry**

@2.2kg/m2) at all floors, all shapes and all height including scaffolding, curing, making grooves, forming pattas and drip mould, etc. complete as directed. (for all civil, plumbing & electrical works).

The relevant specifications of item no. 7.01a shall be followed except that the plaster is carried out in single layer of 18-mm. thickness, in CM 1:4.

7.03.b **Providing & laying average 18mm thick cement plaster for 230mm brick wall in double coat, CM 1:3 with mala finish plaster on unfair side of brickwork (finished with steel trowel) at all floors, all shapes and all height including scaffolding, curing, making grooves, forming pattas and drip mould, etc. complete as directed (for all civil, plumbing & electrical works).**

The relevant specification of item no. 7.01b shall be followed. Before applying the second coat of plaster, the wall surface shall be sprinkled/ sprayed with cement mortar 1:3 to cover the undulation of unfair face of the brickwork. The second coat shall be applied after 3 days of curing. The cement mortar proportion of second coat shall be 1:3.

7.04 **Providing and laying average 18-20 mm. thick Sand face cement plaster on walls upto any height above ground level and for all shapes consisting of average 12-15 mm. thick backing coat of CM 1:4 (1 cement: 4 coarse sand) and average 6 mm. thick uniform grained textured finish coat using by any means in CM 1:2 (1 cement: 2 sand), including scaffolding, forming grooves, drip moulds, pattas, hacking RCC surface, curing etc. complete (for civil, plumbing & electrical works).**

1.0 **Materials :** Water shall conform to M-1. Cement mortar shall conform to M-11.

2.0 **Workmanship :**

2.1 The work shall be carried out in two coats. The **backing coat (base coat) shall be 12-15mm thick in CM 1:4** (1 cement : 4 coarse sand) and the relevant specifications of item no. 7.01a and 7.03 shall be followed. Before the first coat hardens its surface shall be beaten up by edges of wooden tapers and close-wired finish shall be made on the surface. The subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days depending upon the weather conditions. The surface shall not be allowed to dry during this period. Before applying the second coat neat cement slurry shall be applied on the wall surface.

2.2 The second coat shall be completed to **average 6 mm. thickness in CM 1:2** as described above. The surface shall then be tapered to uniform grained texture by using by any means, as specified. The sample of sand face shall be got approved before the work is started. The whole work shall be carried out uniformly as per the sample approved.

2.3 **Curing :** The curing shall be started overnight after finishing of the plasterwork. The plaster shall be kept wet for a period of 7 days. During this period, it shall be protected from all damages.

3.0 **Mode of Measurements and Payment :**

3.1 The relevant specifications of item No.7.01a shall be followed. The rate shall be for all floors, all heights, all levels and all shapes.

3.2 The rate shall be for a unit of one m^2 measured flat.

7.05 **Providing and applying rough cast plaster consisting of wet plastic mix of 3 part cement, 6 part sand and 4 parts of 6 mm. to 10 mm. size crushed stone aggregate, applied with a scoop or trowel and finished to uniform texture to exterior faces, at all floors, at any height, including forming grooves, bends, pattas, etc. as directed and providing and applying a base plaster, 12-15 mm. thick in CM 1:4, with necessary scaffolding, curing, etc. as per the pattern in drawings including grooves etc. all complete as directed. (for all civil, plumbing & electrical works).**

1.0 **Materials :** Water shall conform to M-1. Sand shall conform to M-6. Stone aggregate shall conform to M-8. Cement mortar shall conform to M-11.

2.0 **Workmanship :**

2.1 The work shall be carried out in two coats. The base coat shall be in CM 1:4 and the relevant specifications of item no. 7.02a, 7.02b, 7.02c, 7.02d shall be followed. Before the first coat hardens its surface shall be beaten up by edges of wooden tappers and close- wired surface shall be made on the surface. The subsequent coat shall be applied after

this coat has been allowed to set for 3 to 5 days depending upon the weather conditions. The surface shall not be allowed to dry during this period.

2.2 The second coat shall be completed to 8 mm. average thickness in CM 1:2 using crushed stone aggregate as described above. This mix is thrown on to the wall by means of a scoop or plaster's trowel to produce an uniform rough appearance. This is called roughcast. After second coat, the surface shall be washed with water and sponge to remove excess slurry.

3.0 Mode of Measurements and Payment :

3.1 The relevant specification of item no. 7.01a shall be followed.

7.06 Providing and applying pebble-dash plaster consisting of average 10 mm. thick coat of wet mix of 1 part cement,1 part dolomite powder and 6 mm. to 10 mm. size selected river shingle, applied with a scoop or trowel and finished to an uniform texture to exterior faces, at all floors, all shapes at any height, including forming grooves, bends, pattas, etc. as directed and providing and applying a base plaster of 12-15 mm. thick in CM 1:4, with necessary scaffolding, curing, hacking RCC surface etc. as per the pattern in drawings including grooves etc. all complete, as directed. (for all civil, plumbing & electrical works).

1.0 Materials : Water shall conform to M-1. Sand shall conform to M-6. Selected shingle of 6 mm. to 10 mm size shall be well washed. Cement mortar shall conform to M-11.

2.0 Workmanship :

2.1 The work shall be carried out in two coats. The base coat shall be in CM 1:4 and the relevant specifications of item no. 7.02a shall be followed. Before the first coat hardens its surface shall be beaten up by edges of wooden tappers and close wired surface shall be made on the surface. The subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days depending upon the weather conditions. The surface shall not be allowed to dry during this period.

2.2 The second coat shall be completed to 10 mm. average thickness in CM 1:6 using selected shingle of size 6 mm. to 10 mm. as described above. This mix is thrown on to the wall by means of a scoop or plaster's trowel to produce an uniform pebbly appearance. This is called pebble-dash plaster. After second coat, the surface shall be washed with water and sponge to remove excess slurry.

3.0 Mode of Measurements and Payment : The relevant specification of item no. 7.01a shall be followed.

7.07 Providing and laying average 25 mm. thick Stonecrete Plaster comprising of two coats, first coat of 15 mm. thick plaster in CM 1:4 and second coat of 10 mm. thickness shall be with specially prepared mixture of 1 part of cement, 1.25 part of crushed stone chips, 1 part dolomite powder with suitable pigment (as approved by Architect and Engineer-in-charge), at all heights with necessary scaffolding including forming grooves, bends, drip moulds, patta, curing etc. as per the pattern in drawings including grooves etc. complete. (for all civil, plumbing and electrical works) The stone chips shall be

a) Jaisalmer stone
b) Kota stone
c) Red madras
d) Black Khadappa

1.0 Materials : The relevant specification of item no. 7.01a shall be followed except that the thickness of the base coat shall be 15 mm. and proportion of mortar shall be CM 1:4. The crushed stone chips shall be of number 0,1,2 & 3 of approved colour, source as approved by Architects and Engineer-in-charge. The proportion of cement, stone chips and dolomite powder shall be 1:1.25:1.

2.0 Workmanship :

2.1 The relevant specification of item no. 7.01a shall be followed. The base surface shall have keys for receiving finishing coat. It shall be cured for 48 hours and then allowed to dry out, before being treated again with water as in the case of original surface.

2.2 The final coat shall be of a specially prepared mixture of ordinary grey cement and white cement with the required pigment blended with it (if required), crushed stone sand of approved grade and shade in the proportion as described above applied to a finished thickness of 10 mm. It shall be pressed, level trowelled and finished with a steel trowel. Trowelling should be kept to a minimum as excessive Trowelling may cause hair cracks and crazing. Floating shall be

carried out only after the final rendering has slightly dried out. The impression of joints to the pattern shown in the drawings or as directed by the Architects shall then be marked on the face of the topping by pressing a light string with a trowel.

2.3 Grooves shall then be formed with the help of Aluminium channel of required size as per the Architectural drawings and they shall be finished neatly. The whole work shall be done as per the pattern of the sample approved by the Architect.

2.4 After the surface has been cured for about 48 hours and the surface hardened sufficiently, the face shall be dressed with fine chisel very carefully to give the appearance of chisel dressed stone of the pattern desired.

3.0 Mode of Measurements and Payment:

3.1 The relevant specification of item no.7.01a shall be followed.

7.08 Providing and laying average15 mm. thick Silvecrete Plaster using white cement, having two coats, first coat of 12mm thick plaster in CM 1:4 and second coat of 3mm avg. thickness shall be in cement plaster of proportion 1:1:1 (1 part cement, 1 part of marble chips no. 0 to 1 with 1 part dolomite powder (as approved by architect and engineer in charge)), at all heights with necessary scaffolding including forming grooves, bends, drip moulds, patta etc. complete. (for all civil, plumbing & electrical works).

1.0 Materials : The relevant specification of item no. 7.07 shall be followed. The marble chips shall be of number 0 to 1, of approved colour and source as approved by the Architect and Engineer-in-charge. The proportion of cement, marble chips with dolomite powder and sand shall be 1:1:1.

2.0 Workmanship :

2.1 The relevant specification of item no. 7.07 shall be followed. The base surface shall have keys for receiving the finishing coat. It shall be cured for 48 hours and then allowed to dry out, before being treated again with water as in the case of original surface.

2.2 The final coat shall be of a specially prepared mixture of ordinary grey cement and/or white cement with the required pigment blended with it (if required), marble chips with dolomite and sand in proportion as described above and shall be applied to a finished thickness of 3 mm. It shall be pressed, level trowelled and finished with a steel trowel. Trowelling should be kept to a minimum as excessive trowelling may cause hair cracks and crazing. Floating shall be carried out only after the final rendering has slightly dried out. The impression of joints to the pattern shown in the drawings or as directed by the Architect shall then be marked on the face of the topping by pressing a light string with a trowel. Grooves shall then be formed with the help of Aluminum channel of required size as per the Architectural drawings and they shall be finished neatly. The whole work shall be done as per the pattern of the sample approved by the Architect.

2.3 After the surface has been cured for about 48 hours and the surface has hardened sufficiently, the face shall be dressed with fine chisel very carefully to give the appearance of chisel dressed stone of the pattern desired.

3.0 Mode of Measurements and Payment :

3.1 The relevant specification of item no. 7.01a shall be followed.

7.09 Providing & laying in line and level stone cladding on exterior wall average 20 mm. thick stone and length and width not exceeding 1.2 m. & 0.6 m. respectively, rough or polished sand stone of approved quality like Karoli red or equivalent, selected and sorted for its uniform colour, in cladding to external and internal surfaces as per design, including grouting with 1:2 cement mortar 12 mm. average thickness, joints are to be filled with approved colour pigments of approved shade & white cement/ grey cement whichever required as specified by the Architect etc. complete. The rate should also include for necessary gun metal/ SS clamps and copper clips for fixing arrangements etc. including cleaning, polishing, scaffolding complete. (for all civil, plumbing & electrical works).

1.0 Materials : Sand stone slabs of approved shade, variety, size and thickness as specified in the item shall be used. They shall be of selected quality, dense, uniform and homogeneous in texture and free from cracks or other structural defects. The exposed face shall have no veins or unsightly stains and defects. They shall have uniform milky white or coloured shade or patterns of colours as approved by the Architect. Samples shall be got approved by the Architect before ordering the slabs. The surface shall be fine polished and sides machine cut, true to square.

2.0 Workmanship :

2.1 Sand stone or any other Stone in Facia or Dado:

When a single course of sand stone slab is to be fixed as in dado etc., the slabs shall be fixed as described below. Mortar pads of 1:2 CM of uniform width shall be stuck on to the wall at close intervals and the sand stone slabs with machine cut edges shall be pressed on to them firmly. The remaining cavities if any, shall then be filled with thin grout of cement mortar of the same proportion. The sound coming, on gently tapping of the slab will indicate if there are any hollows. When the hollow cannot be filled with grout and the finished slab continues to give a hollow sound on tapping the slab shall be removed and reset.

2.2 For facia work, where more than one course is required, the sand stone slabs shall be fixed in the same way as described above except that at horizontal joints of the slabs and adjacent slabs shall be held together by mechanical non corrosive- gunmetal, copper or Stainless steel clamp. The sample shall be approved by the architect or engineer incharge.

2.3 The stones shall be secured to the backing by non corrosive strips 20X3mm and suitable length embedded in the bcking. The adjoining stone shall be secured to each other by 4 mm. dia., 35 mm. long non corrosive pin dowels. The clamps and pin dowels shall be spaced not more than 600 mm. apart. The samples of pins dowels and clamps shall be got approved from the Architects and Engineer-in-charge. One end of the fish tailed clamp shall be positioned in the groove on the top edge of the stone and the other end in the backing. The cladding shall be laid layer by layer. Each layer shall be grouted with cement mortar 1:2.

2.4 In addition, copper holdfasts/dowels shall be provided to anchor the slabs to the wall. The holdfast shall be counter-sunk into the joints of the slab and it shall be located about a meter apart subject to a minimum of one for each slab for each horizontal joint. The facing shall be fixed truly in plumb and in perfect line or curves as shown on the plans. The courses and joints shall be as directed by Architect and Engineer-in-charge. The surface shall be protected from sun and rain and cured for ten days and shall be finally hand polished. The rate shall include erecting and removing double scaffolding, equipment etc.

3.1 **Mode of Measurements and Payment :**

3.2 The relevant specification of item no. 7.01 shall be followed and only clear visible area will be measured and paid. These shall include clamps, pins, non corrosive fasteners, screws etc.

7.10 Providing & laying stone cladding in line and level, average 20 mm. thick and length and width not exceeding 1.2 m. & 0.60 m. respectively, white or pinkish sand stone of approved quality like Bansipahadpur, or equivalent, selected and sorted for uniform colour, in cladding to external and internal surfaces as per design, including 1:2 cement mortar bedding of 12 mm. average thickness, joints are to be filled with approved colour pigments of approved shade & white cement wherever required, as specified by the Architect etc. complete. (for all civil, plumbing & electrical works).
The rate should also include for necessary gun metal clamps and copper clips for fixing arrangements etc. complete.

The relevant specification of item no. 7.09 shall be followed except that sand stone shall be pinkish white Dholpur in place of Red sand stone.

7.11 Providing & laying stone cladding in line and level, average 20 mm. thick and length and width not exceeding 1.2 m. & 0.45 m respectively, Jesalmer stone of approved colour, quality, selected and sorted for uniform colour, in cladding to external and internal surfaces as per design, including 1:2 cement mortar bedding of 12 mm. average thickness, joints are to be filled with approved colour pigments of approved shade & white cement wherever required as specified by Architect etc. complete. The rate should also include for necessary gun metal clamps and copper clips for fixing arrangements etc. complete. (for all civil, plumbing & electrical works).

The relevant specification of item no. 7.09 shall be followed except that Jesalmer stone is used in place of Red sand stone.

7.12 Providing and fixing G.I. hexagonal chicken mesh of size 20mm x 20mm of 22 gauge at junction of concrete and brick work or between different materials after making "V" grove between two different material surface and filled with rich cement mortar and @ 100mm on each side of Joint including necessary "U" nails/ screws/ washers with cleats for fixing, overlaps, scaffolding at all floors/ all levels/ all heights etc. complete as per specifications and direction of Engineer-in-charge. For civil, plumbing, electrical & infrastructure works.

1.0 Material: Chicken wire mesh having openings **20 mm. x 20 mm. of 22 gauge** shall be provided as directed.

2.0 Workmanship:

2.01 The mesh is to be fixed with nails and cement paste at the junctions of different materials (column and brickwork, at beam bottom level- on the face of beam and brickwork) to avoid cracks in the plaster

2.02 Chicken mesh shall be fixed in advance of the plasterwork. Chicken mesh shall be fixed in such a way that it is totally concealed in the plaster. Chicken mesh shall be fixed in such a way that minimum75mm mesh is provided on either side of the joint. The mesh shall be fixed with both the elements with the help of nail/ screws. Drilling shall be carried out if required in RCC member.

2.03 The mesh shall be over lapped by 15 cms in the length while joining the two pieces of mesh and also at corners.

3.00 Mode of measurement and payment:

3.01 The item will be measured and paid in sqm. Only clear visible area will be measured and paid. No extra payment shall be done for over lapping of mesh.

7.13.a Pointing on brick work/block/ stone with cement mortar 1:2 (1 cement : 2 sand), flush pointing. (for all civil, plumbing & electrical works).

1.0 Materials : Water shall conform to M-1. Cement mortar shall conform to M-11.

2.0 Workmanship :

2.1 The flush pointing work shall be carried out with cement mortar of proportion 1:2 (1 part of cement and 2 parts of coarse sand) by volume.

2.2 **Preparation of surface :**

2.2.1 The joints shall be raked to such a depth that the average of new mortar measured from either the sunk surface of finished pointing or from the edge of the brick shall be average 10 mm.

2.2.2 The joints shall then be cleaned with a wire brush and wetted thoroughly for 6 hours before pointing is commenced.

2.3 **Application of Mortar & Finishing :**

2.3.1 The mortar shall be pressed into the raked out joints with a pointing trowel according to the type of pointing specified in item. The mortar shall not spread over the corner edges or surface of the masonry. The pointing shall then be finished with the pointing tools and horizontal joints false lined with masons string

2.4 **Curing :** The pointing shall be cured for 7 days. During this period, it shall be suitably protected from all damages.

3.0 Mode of Measurements and Payment :

3.1 No deductions shall be made for end of joints, beams and posts, etc. for openings not exceeding 0.5 m^2 each and no addition shall be made for reveals, jambs, soffits, sill, etc. of these openings.

3.2 Deductions for openings exceeding 0.5 $m^{2.}$ but not exceeding 3.0 m^2. each, shall be paid as follows and no addition shall be made for reveals, jambs, soffits, sills, etc. of these openings.
(i) When both faces of walls are pointed with same type of pointing deduction shall be made for one face only.
(ii) When two faces of walls are pointed with different type of pointing or if one face is plastered and the other is pointed, deduction shall be made in the plaster or pointing on the side of frame for door, windows, etc, on which the width of reveals is less than that on the other side but on the other side but no deduction shall be made from plaster or pointing on the other side.
(iii) When only one face is treated and the other fade is not treated, full deduction shall be made, if the width of the reveals on the treated side is less than on the untreated side, but if the width of the reveal is more, then no deduction shall be made nor any addition shall be made for reveals jambs soffits, sills, etc.

3.3 In case of openings of area above 3.0 $m^{2.}$ each, deduction shall be made for opening but jambs, sills and soffits, shall be measured.

3.4 The rate shall be for a unit of one $m^{2.}$. The rate shall include scaffolding etc. complete.

7.13.b **Pointing on brick work with cement mortar 1:2 (1 cement : 2 sand), flush inclined type pointing.**

The relevant specifications of item no. 7.13.a shall be followed except that the pointing shall be flushed inclined instead of flushed.

7.13.c **Pointing on brick work with cement mortar 1:2 (1 cement : 2 sand), grooved pointing.**

The relevant specifications of item no. 7.13.a shall be followed except that the pointing shall be grooved instead of flushed.

7.13.d **Pointing on brick work with cement mortar 1:2 (1 cement : 2 sand), struck pointing.**

The relevant specifications of item no. 7.13.a shall be followed except that the pointing shall be struck instead of flushed.

7.13.e **Pointing on brick work with cement mortar 1:2 (1 cement : 2 sand), V-grooved pointing.**

The relevant specifications of item no. 7.13.a shall be followed except that the pointing shall be V-grooved instead of flushed.

7.13.f **Pointing on brick work with cement mortar 1:2 (1 cement : 2 sand), V-pointing.**

The relevant specifications of item no. 7.13.a shall be followed except that the V-pointing shall be done instead of flushed.

7.14 **Providing cement vata, 10 cm. x 10 cm. size, quarter round concave/ triangular in cement concreter 1:2:4 including neat cement finishing, curing, hacking the RCC surface, etc. complete. (for all civil, plumbing & electrical works).**

1.0 **Materials :** Water shall conform to M-1. Cement mortar shall conform to M-11.

2.0 **Workmanship :** The work of cement vata of 10 cm. x 10 cm. size shall be carried out at junctions of parapets and terraces as directed. The vata shall be finished in quarter round shape. The work shall be carried out in the best workman-like manner. The internal portion of rain water pipe shall be rounded off properly during constructing the vata. The work shall be cured for 7 days.

3.0 **Mode of Measurement and Payment :**

3.1 The work shall be measured for finished item in rmt.

3.2 The rate shall be for an unit of one rmt. The rate shall include hacking the RCC surafce, curing etc. complete.

7.15a **Providing and laying average 10 mm thick single coat Portland cement based Perlite plaster in 1:4 proportion (1 part cement and 4 parts perlite aggregate) as per the manufacturers specifications and direction given by architect and Engineer-incharge. (for all civil, plumbing & electrical works).**

7.15b **Providing and laying average 19 mm thick double coat Portland cement based Perlite plaster in 1:4 proportion for both coats (1 part cement and 4 parts perlite aggregate) as per the manufacturers specifications and direction given by architect and Engineer – in – charge. (for all civil, plumbing and electrical works).**

7.15c **Providing and laying average 22 mm thick three coat Portland cement based Perlite plaster, first and second coat in 1:4 CM (1 cement and 4 parts perlite aggregate) and finishing coat in 1:3 CM (1 cement and 3 parts perlite aggregate) as per the manufacturers specifications and direction given by architect and Engineer-incharge. (for all civil, plumbing and electrical works)**

1.0 **Material**

Water shall conform to M-1. Cement shall conform to M-3 and Perlite aggregate shall be as per M-72A. Air entraining agent shall be of approved make.

2.0 Workmanship:

Relevant specification of item no. 7.01a shall be followed

2.1 **Preparation of surface:** The surface shall be prepared as per item no. 7.01a.

2.2 **Preparation of mortar:** The proportion shall be as per the item description. The mortar shall be mixed on a dry platform. Perlite and Portland cement is mixed in paddle type plaster mixer. Required amount of water approx 0.1 lit/ bag and air entraining agent as per manufactures specification shall be mixed in the mixer followed by cement and mix until slurry is formed.

2.3 Add perlite aggregate to the mix until required wet density is achieved. The thickness of perlite portland cement plaster for single, double and three coat shall be 10mm, 19mm and 22mm respectively. The plaster shall be cured for a period of 48 hours.

3.0 Mode of measurement:

Relevant specification of item no. 7.01a shall be followed. Actual area which is plastered shall be paid for. The rate shall be for a unit of one sqm.

Note: All the waterproofing treatment shall be executed through a water- proofing agency approved by the manufacturer and/or Engineer In Charge. A written guarantee on non-judicial stamp paper shall be submitted by the main Contractor and his sub contractor who has carried out work for a minimum period of ten years from the certified date of completion for the satisfactory performance of the entire water-proofing system.

8.01.a **Providing and laying conventional (India Type) cement based brickbat coba water proofing treatment average 115mm thick and minimum thickness at khurra/ channel as 65 mm including preparation of surface as required for treatment on roofs, balconies, terraces etc. at all floors consisting of following operations and furnishing a guarantee bond in prescribe format of 10 years on Rs.100.00 stamp paper between main contractor, client and approved water proofing agency.**

1) Cleaning and applying a cement slurry at the rate 2.75 Kg per sqm mixed with water proofing compound as manufacture's specification as directed by engineer-in-charge over the slab including adjoining walls up to 300mm height including testing the surface, grouting the cracks if leakage is found before the treatment .

2) Laying brick bats with mortar using broken bricks/ brick bats 25 mm to 115mm size with maximum 50% of cement mortar of mix 1:5 admixed with water proofing compound conforming to IS : 2645 in minimum 20 mm thick layer of beading cement mortar of mix 1:5 (1 cement :5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge to required slope and treating similarly the adjoining walls up to 300 mm height including rounding of junctions of walls and slabs.

3) After three days of proper curing applying a second coat of cement slurry at the rate 2.75 Kg per sqm admixed with water proofing compound conforming to IS : 2645 including laying glass fiber cloth of approved quality in top layer of plaster and finally Finishing the surface to make wired finish with average 12-20 mm thick joint less cement mortar of mix 1:4 (1 cement :4 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge.

4) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Engineer-in-Charge. (Only plan area shall be measured, vata shall not be measured separately and paid for.)

1.0 **Materials :** Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Stone grit shall conform to M-8. Brickbats shall conform to M-14. Cement mortar shall conform to M-11. Approved polymer based waterproofing compound shall be added in cement mortar as per manufacturer's specification (Cico no.1 or equivalent) and shall conform to M-67

2.0 **Workmanship :**

2.1 Unless otherwise specified proprietary waterproofing treatment shall be executed through **approved specialized water proofing agency**. Contractor shall furnish a guarantee of 10 years on stamp paper to the employer directly and the tender rate shall be inclusive of the same.

A guarantee bond on appropriately stamp paper shall be given by the contractor to the client in the manner form prescribed below:

FORM OF GUARANTEE BOND

"I/We .....(Contractor) hereby guarantee that work will remain unaffected and will not be in any way damaged by water or any other form of humid condition, for a period of 10 years after completion of the work of water-proofing as per the terms and conditions of the contract and the Contractor hereby indemnifies and agrees to save the Client from any loss and or damage that might be caused on account of water and or other similar form of humid conditions and hereby guarantees to make good any loss or damage suffered by the Client and further guarantees to redo the affected work without claiming any extra cost."

2.2 This guarantee shall remain in force for a period of 10 years from the completion of the work under the contract and it shall remain binding to the Contractor for period of 10 years.

2.3 While tendering the contractors should clearly stipulate the type of treatment proposed to be provided by them and the name and particulars of firm through whom they propose to carry out the treatment.

2.4 The surface shall be cleaned of foreign matter such as fungus, moss, dirt and dust by wire brushing and dusting. Any cracks which may allow leakage of water shall be identified by ponding before starting the treatment. The slab surface shall be washed with water and cement slurry with waterproofing compound @ 2.75 kg/ m2.

2.5 Cement mortar 1:5 shall be laid on the slab with waterproofing compound. The dosage of the waterproofing compound

shall be as per the manufacturers specification.

2.6 The surface to be treated shall have a minimum slope of 1 in 120.The brickbats of varying size as per requirement shall be arranged in proper gradient using cement mortar 1:5 according to the desired slope. Suitable waterproofing chemical shall be added to make the CM water tight and then cement mortar 1:3 shall again be provided on top of the brickbats, including the waterproofing compound which shall be added in the CM and finishing on top with neat cement @ 2.75 kg/m2. The top surface shall be finished rough surface as per the direction so as to receive the next finishing item.

2.7 The testing shall be done by ponding for atleast 48 hours.

2.8 Well defined cracks other than hair cracks in the treated structure shall be cut to `V' section, cleaned and then filled up flush with 1:1 cement sand mortar with polymer based waterproofing compound.

2.9 The surface under treatment, part of parapet (incase of balcony or terrace) and gutters, drain mouths etc. over which the water proofing treatment is to be applied, shall be cleaned of all foreign matter such as fungus, moss and dust by wire brushing and dusting.

2.10 Drain outlet shall be suitably placed with respect to the surface gradient to ensure rapid drainage and prevention of local accumulation of water on the treated surface. Masonry drain mouth, shall be widened sufficiently and rounded with cement mortar.

2.11 For cast iron drain outlets, a groove shall be cut all around to touch the treatment.

2.12 When a pipe passes through a roof on which water proofing treatment is to be laid, a cement concrete angle fillet shall be built round it and the water proofing treatment shall be taken over the fillet.

2.13 In case of masonry parapet wall over 450 mm. in height, for tucking in the water proofing treatment, a horizontal groove 75 mm. wide and 65 mm. deep at minimum height of 300 mm. above terrace level shall be left in the vertical face at the time of construction, the horizontal face of the groove shall be shaped with cement mortar 1:4.

2.14 In case of low parapet where the height does not exceed 450 mm., no groove shall be provided and the water proofing treatment shall be carried right over the top.

2.15 In case of existing R.C.C. and stone wall cutting the chase for tucking in the water proofing treatment is not recommended.

2.16 At the junction between the terrace slab and vertical face of the parapet wall, a fillet 75-100 mm. in radius shall be constructed.

2.17 At the drain mouths the fillet shall be suitably cut back and rounded off for each application of water proofing treatment for easy flow of water.

2.18 Outlet at every low dividing wall about less than 300 mm. in height, shall be rounded smooth and corners rounded off f or easy application of water proofing treatment.

2.19 The top surface shall be kept wired finish to receive the china mosaic. In case china mosaic is not to be provided, the surface shall be kept cement finished @ 2.75kg/m2 and marked with 300x300mm false square (with string).

3.0 Mode of Measurements and Payment :

3.1 The rate shall include providing water proof cement concrete terracing of adequate thickness to give desired slope for drainage of rain water from terraces.

3.2 The measurements for this item shall be taken as under:

(a) Water proofing of roof shall be measured in $m^{2.}$, plan area of treated surface shall be measured correct to a centimeter.
(b) Measurement shall be taken for the plan area of roofing/terrace. Flashing treatment including flashing over the parapet wall up to 300 mm from terrace. Low dividing walls and expansion joints and at the pipe projections etc. Overlapping and tucking into flashing grooves shall not be measured extra and paid for.
(c) In measurements, no deduction shall be made for either openings or recess for chimney stacks, roof lights etc. having areas upto 0.4 m2. Deduction shall be made in measurements for full opening but nothing extra shall be paid for extra labour and materials in forming such openings.

3.3 The rate includes cost of all materials and labour required to carry the works as per the above specifications. The rate also includes cleaning and hacking the RCC parapet and inverted beam surface and treating the cracks shall not be paid separately. Cutting of horizontal grooves in parapet walls for tucking in water proofing treatment shall not be measured or paid separately.

3.4 Measurements shall be based on the drawings or as executed on site, the lesser of the two shall be given. No extra payment shall be made for rounding and vata at the junction of slab & parapet. A deposit at the rate of 50% of the cost of this item from the running and final bills shall be recovered and retained for the first one year after completion of the work and 10% of the same or equivalent bank guarantee shall be retained for the balance of the guarantee period and shall be refunded only after the completion of the guarantee period.

3.5 This item shall be measured and paid in m^2.

8.02a **Providing and laying cement water proofing of average <u>75 mm.</u> thick for sunk slabs, cleaning and applying cement slurry with water proofing chemical like Cico no. 1 or equivalent, arranging brick bats in cement mortar 1:5 according to the slope, adding suitable chemical for water-tightness and testing the same after 3 days ponding, providing on top cement mortar 1:3 including waterproofing compound and finishing the top with neat cement @ 2.75 kg/m^2 and as per direction and instructions, complete at all levels and floors, including rounding off upto 300mm height using 1:1 cement mortar and brickbats. A guaranteed bond for 10 years shall be furnished. The work should be carried out through an approved specialized water proofing agency**

8.02b **Providing and laying cement water proofing of average <u>50mm thick</u> for sunk slabs, cleaning and applying cement slurry & waterproofing chemical, arranging black trap 40mm/ 20mm in cement mortar 1:4, according to the slope, adding suitable chemical for water-tightness and testing the same after 3 days ponding, providing on top cement mortar 1:3 including waterproofing compound and finishing the top with neat cement @ 2.75 kg/m^2 and as per direction and instructions, complete at all levels and floors, including rounding off upto 300mm height using 1:1 cement mortar and brickbats. A guaranteed bond for 10 years shall be furnished. The work should be carried out through an approved specialized water proofing agency.**

Material and Workmanship:
Black trap stone aggregate 40/ 20mm mm. Maximum nominal size shall conform to M-12. The relevant specification of item no. 8.01 shall be followed except that thickness of waterproofing shall be average 75mm or 50mm instead of 115mm. Guarantee bond shall be furnished same as item no. 8.01a.

8.02.c **Providing and laying water proofing treatment to vertical and horizontal surfaces of depressed portions of toilets, pantry and like of: A) I course of applying cement slurry @ 4.4 Kg./Sq.m. mixed with water proofing compound conforming to IS:2645 in recommended proportions. b) II course of 20mm cement plaster 1:3 (1 cement: 3 Coarse sand) mixed with water proofing compound in recommended proportion. c) III coarse of applying blown or/residual bitumen applied hot at 1.7 Kg/Sq.m of area. d) IV course of 400-micron thick PVC sheet. (Overlaps at joints of PVC sheet should be 100 mm wide and paste to each other with bitumen @ 1.7 kg./Sq. m.**
The relevant specification of item no. 8.01a shall be followed except that thickness of waterproofing shall be 25 -30mm average instead of 115 mm.

The work of waterproofing shall be carried in sunk floors which comprises of:

1) Bitumen primer shall be applied after cleaning the slab surface. A coat of hot bitumen 30/40 @ 2.4kg/ sqmt shall be applied and screed with 6 mm. thick stone grit.

2) After the third course 400micron thick sheet is to laid over the bitumen with consideration of 100mm overlapping either side.

A guaranteed bond on appropriately stamped paper shall be given by the contractor to the client in the manner form as described in item no. 8.01a.

8.03 **Providing and laying cement water proofing of average 75 mm. thick for sunk floors using bitumen primer and hot bitumen 30/40 @ 2.4 kg/m^2 and 6mm thick stone grit, arranging brick bats according to slope in cement mortar 1:5, adding suitable chemical to make water tight and providing on top cement mortar 1:3 including waterproofing compound and finishing with neat cement @ 2.75 kg/m^2 as per the direction etc. complete, including furnishing guarantee bond for 10 years. The work should be carried out through an approved**

specialized water proofing agency
The relevant specification of item no. 8.01a shall be followed except that thickness of waterproofing shall be 75 mm. average instead of 115 mm.

The work of waterproofing shall be carried in sunk floors which comprises of:

2) Bitumen primer shall be applied after cleaning the slab surface. A coat of hot bitumen 30/40 @ 2.4kg/ sqmt shall be applied and screed with 6 mm. thick stone grit.

2) Waterproofing treatment with brickbats shall be carried out as described above in item no 8.01a

A guaranteed bond on appropriately stamped paper shall be given by the contractor to the client in the manner form as described in item no. 8.01a.

8.04 Providing and laying polymer based waterproof compound like Tapcrete P151 of Cico Technologies limited or equivalent in three coats as per manufacturers specifications and direction of Architect or Engineer incharge.

The chemical shall be of approved make like- Tapcrete P151- Cico Technologies Limited. The surface shall be cleaned to remove all dust, foreign matters, loose materials etc. New flat surface like sub-base concrete shall be made reasonably smooth so as not to impede the application of the coating and to avoid sharp projections. All concrete shall be thoroughly pre-wetted for at least one hour prior to the application of coating. When placing the coating, water shall be removed so that surface is only damp. In case there shall be standing water, depressions are filled and leveled using Tapcrete fillers. For fillers, the mixing ratio is 1 kg cement: 1.5 by silica sand and 0.52kg Tapecrete.
The consumption per sqm for the first coat shall be 0.25 kg Tapcrete and 0.5 kg cement and for second coat 0.40 Tapcrete and 0.80 kg cement. After first coat the surface shall be allowed to dry for 5 hours. During this no water is to be used for curing. In case of high temperature and low humidity combined with high wind condition, the surface shall be covered with polythene sheet. After the application, curing shall be done maximum 4 days starting one day after the application. Third coat shall be Tapcrete brush topping 1.5mm thick with consumption 0.67 kg tapcrete, 1.30 kg cement and 1.3 kg fine silica. The applications shall be as per the manufacturers specification.
The measurement shall be for a unit of a sqm.

8.05 Providing and laying cushioning layer of 1:4:8 BBCC as per the required slope with water proofing compound, using 20mm nominal size brick bat on RCC slab after cleaning the slab top properly and applying neat cement slurry @2.75 kg/sqm with water proofing compound like Cico No.1 or equivalent as per suppliers specification. The BBCC shall be machine mix, well compacted with wooden templet cured etc complete at all places and all heights including rounding off upto 300mm height using 1:1 cement mortar and brickbats.
a) Average thickness of BBCC- 75mm
b) Average thickness of BBCC- 90mm

1.0 Materials: Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Brickbats shall conform to M-14. Approved waterproofing compound shall be added in cement mortar as per manufacturer's specification (Cico Industries Ltd. or equivalent). Cement mortar shall conform to M-11.

2.0 Workmanship :

2.01 Relevant specification of item no. 8.01 shall be followed. The surface under treatment, part of parapet (incase of balcony or terrace) and gutters, drain mouths etc. over which the water proofing treatment is to be applied, shall be cleaned of all foreign matter such as fungus, moss and dust by wire brushing and dusting.

2.02 Well defined cracks other than hair cracks in the treated structure shall be cut to `V' section, cleaned and then filled up flush with cement sand mortar 1:1 with polymer based waterproofing compound.

2.03 The surface to be treated shall have a minimum slope of 1 in 120. The grading shall be carried out prior to the application of water proofing treatment by cement mortar. Before starting BBCC, cement slurry, @ 2.75 kg/sqm with polymer based water proofing compound like Tapcrete 151 of Cico Industries Ltd. or equivalent as per suppliers specification shall be thoroughly applied on the surface.

2.04 Machine mixed BBCC of 1:4:8 with water proofing compound Cico no.1 or equivalent as per suppliers specification and 20mm nominal size brick bats shall be laid on the surface as per the desired slope.

2.05 The compaction shall be done by wooden templet (patti) till the cement slurry comes on the top. No ramming shall be

allowed.

2.06 Vatta shall be provided at the junction of wall and terrace slab. The fillet of the vatta shall be 75mm in radius or as pet the drawing and in concave shape upto 300mm height in proportion 1:1 (cement : coarse sand) mortar with water proofing compound Cico no.1 or equivalent as per suppliers specifications. Brickbats shall be embedded in the junction as per brick bat coba indian waterproofing treatment.

2.07 The testing shall be done by ponding for atleast 48 hours to check the leakage of water. The area where leakage is observed, the BBCC above the same shall be removed as per direction of Engineer in-charge and leakage shall be stopped by appropriate method like injection grouting etc. BBCC shall be re-laid after testing. (No extra payment shall be paid for this)

2.08 Drain outlet shall be suitably placed with respect to the surface gradient to ensure rapid drainage and prevention of local accumulation of water on the treated surface. Masonry drain mouth, shall be widened sufficiently and rounded with cement mortar.

2.09 When a pipe passes through a roof on which water proofing treatment is to be laid, a cement concrete angle fillet shall be built round it and the water proofing treatment shall be taken over the fillet.

2.10 At the drain mouths, the fillet shall be suitably cut back and rounded off at each outlet for easy flow of water. Outlet at every low dividing wall less than 300 mm. in height, shall be rounded smooth and corners rounded off for easy application of water proofing treatment.

8.06a Providing & laying Box type waterproofing treatment through approved specialized water proofing agency to floor of under ground structures including hacking the RCC surface. The treatment comprises of `Cetroof' waterproofing layer, average 85 mm thick, using one layer of best quality rough kotah stone.

1.0 Material and Workmanship :

1.1 Rough kotah stone shall conform to M-48. The relevant specification of other materials shall be as in item no. 8.01. Approved waterproofing compound shall be added in cement mortar as per manufacturer's specification (Cico no.1 or equivalent).

1.2 85 mm. thick 'Cetroof` layer shall consist of the following layers :-

1) Bottom layer of 20 mm. thick 1:4 CM bedding with approved waterproofing chemical shall be laid over PCC base.
2) 25-30 mm. thick rough kotah stone- 2ft X 1 ½ ft (undressed dimension) laid above the mortar layer. Joints shall be sealed by 1:1 CM with approved waterproofing chemical like Cico no. or equivalent.
3) On the top of this layer, a final layer of 40 mm. thick I.P.S.- 1:1 ½ : 2 with waterproof compound like Cico no. 1 shall be laid.
4) The final layer shall be RCC raft M20, 150mm thick with nominal reinforcement kept at top.

1.3 A guarantee bond on appropriate stamp paper shall be given by the contractor to the client in the manner form as described in item no. 8.01.

2.0 Mode of Measurements and Payment : The relevant specifications of item no. 8.01 shall be followed. The payment of concrete and reinforcement shall be made in relevant items.

8.06b Providing & laying Box type waterproofing treatment through approved specialized water proofing agency to floor of under ground structures including hacking the RCC surface. The treatment comprises of `Cetroof' waterproofing layer, average 125mm thick using two layers of best quality rough kotah stone placed diagonally with cut joints.

1.0 Material and Workmanship :

1.1 Rough kotah stone shall conform to M-48. Approved waterproofing compound shall be added in cement mortar as per manufacturer's specification (Cico no.1 or equivalent). The relevant specification of other materials shall be as in item no. 8.01.

1.2 125 mm. thick 'Cetroof` layer shall consist of the following layers :-
1) Bottom layer of 20 mm. thick 1:4 CM bedding with approved waterproofing chemical shall be laid over PCC base.
2) 25-30 mm. thick rough kotah stone- 2ft X 1 ½ ft (undressed dimension) laid above the mortar layer. Joints shall be sealed by 1:1 CM with approved waterproofing chemical like Cico no. or equivalent.

3) Above the first layer, second layer of kotah stone shall be laid same as 1) and 2).
4) On the top of this layer, a final layer of 40 mm. thick I.P.S.- 1:1 ½ : 2 with waterproof compound like Cico no. 1 shall be laid.
5) The final layer shall be RCC raft M20, 150mm thick with nominal reinforcement kept at top.

1.3 A guarantee bond on appropriate stamp paper shall be given by the contractor to the client in the manner form as described in item no. 8.01.

2.0 **Mode of Measurements and Payment :** The relevant specifications of item no. 8.01 shall be followed.

8.07 **Providing & laying Box type waterproofing treatment through approved specialized water proofing agency to external vertical surfaces of under ground structures. The treatment comprise of 'Cetroof` waterproofing layer, average 40 mm. thick for walls, using one layer of best quality rough kotah stones.**
The relevant specification of item no. 8.07a shall be followed except that 40 mm. thick waterproofing layer shall be done instead of 80 mm. thick layer.

40 mm. thick 'Cetroof` layer shall consist of the following layers :-

1) First layer of best quality rough kotah stone – 2 X 1 ½ ft shall be laid in 1:1 cement mortar with waterproof compound like Cico No.1 or equivalent for joints keeping a distance minimum 6-8 mm from the surface of the wall.
2) Only one layer of kotah stone shall be placed in a day. After the layer is placed, each stone shall be grouted individually with cement sand mortar 1:1 (sand used shall be seveied).
3) After completion of the work, 12mm thick cement mortar 1:3 with waterproofing compound like CiCo no. 1 or equivalent shall be applied. Then the surface shall be finished smooth with neat cement slurry with water proofing compound @ 2.75 kg/m2.

A guarantee bond on appropriate stamp paper shall be given by the contractor to the client in the manner form as described in item no. 8.01.

8.08.a **Providing 15 mm. thick water proof cement plaster in <u>single coat</u> on brick/ block masonry, at all heights, finished even and smooth in CM 1:3 (1 cement : 3 sand), including providing and mixing water proofing materials such as Fosroc, Cico no.1 or equivalent as approved by the Architect and Engineer-in-charge, in cement mortar in proportion recommended by the manufacturer and finishing the surface with neat cement slurry @ 2.75 kg/ m2 etc. complete including furnishing a guarantee bond for 10 years. (for all civil, plumbing and electrical works)**

1.0 **Materials & Workmanship :** The relevant specifications of item No. 7.01a shall be followed except that the water proofing materials of approved make- Cico No.1 or equivalent, conforming to M-67, shall be added to the cement at the rate specified or as directed by the Engineer-in-charge and Architect. The proportion of water proofing materials to be mixed with 50 kg. bags shall be as recommended by the manufacturer of the water proofing material, used. The thickness of plaster shall be 15 mm. thick instead of 10 mm. The surface of the wall shall be applied with cement slurry and polymer bondng agent like Tapcrete 151 or equivalent. The plaster shall be in cement mortar 1:3 with waterproofing and non-shrinkage compound like Hydro Shield powder of Contech Chemicals or equivalent.

The guarantee bond shall be furnished for a period of 10 years as per item no. 8.01a

2.0 **Mode of Measurements and Payment:**
2.1 The payment shall be made for 15 mm. thick water proof plaster work, as per the relevant specifications of item no. 7.01a. The rate shall include the waterproofing and non shrink chemicals.

2.2 The rate shall be for an unit of one $m^{2.}$ for plaster work using water proofing material per bag of cement weighing 50 kg.

8.09.a **Providing 15 mm thick water proof cement plaster in single coat on brick/ block masonry or RCC wall, at all heights, finished even and smooth in CM 1:3 (1 cement : 3 sand) including providing and mixing water proofing materials of approved make in recommended proportions by manufacture as approved by the Architect and Engineer-in-charge and finishing the surface wired finish to receive the tiles / smooth finish with a floating coat of neat cement slurry at 2.75 Kg / sqm as directed etc. complete including furnishing a guarantee bond for 10 years. (Item shall be operated for outer surface of Water Tank, other than water retaining structures (UG & OHT), swimming pool, toilet sunks, basements etc.)**

1.0 **Materials & Workmanship :** The relevant specifications of item No. 7.01a shall be followed except that the water proofing materials of approved make- Hydroshield of ConTech chemicals, Cico No.1 or equivalent, conforming to M-67, shall be added to the cement at the rate specified or as directed by the Engineer-in-charge and Architect. The proportion of water proofing materials to be mixed with 50 kg. bags shall be as recommended by the manufacturer of the water proofing material, used. The thickness of plaster shall be 15 mm. thick instead of 10 mm. RCC surface shall be properly hacked. The surface of the wall shall be applied with cement slurry and polymer bonding agent like Tapcrete 151 or equivalent. Both the coats shall be applied by spraying cement mortar 1:3 with waterproofing compound. The water-proofing compound shall be mixed in proportion approved by the manufacturer. In case of Hydro Shield, liquid and powder shall be mixed in the proportion approved by the manufacturer.

The guarantee bond shall be furnished for a period of 10 years as per item no. 8.01a

2.0 **Mode of Measurements and Payment:**

2.1 The payment shall be made for 15 mm. thick water proof plaster work, as per the relevant specifications of item no. 7.01. The rate shall include the waterproofing and non shrink chemicals. The rate shall include cleaning and hacking the surface.

2.2 The rate shall be for a unit of one $m^{2.}$ for plaster work using water proofing material per bag of cement weighing 50 kg.

8.09.b **Providing and laying 65 mm. thick water proof cement concrete flooring for IPS in 1:2:2 (1 Cement : 2 Sand : 2 Graded Aggregate 20mm nominal size) on RCC swimming pool floor, at all heights in line, level and gradient, including mixing water proofing materials of approved make, in cement concrete in proportion recommended by the manufacturer and leaving the surface rough wired finish to receive the glass mosaic tiles etc complete including furnishing a guarantee bond for 10 years. (for all civil, plumbing & electrical works).**

1.0 **Materials & Workmanship:** The relevant specifications of item No. 9.14.a shall be followed except that the water proofing materials of approved make- Hydroshield of ConTech chemicals, Cico No.1 or equivalent, conforming to M-67, shall be added to the cement/concrete at the rate specified or as directed by the Engineer-in-charge and Architect. The proportion of water proofing materials to be mixed with 50 kg. bags shall be as recommended by the manufacturer of the water proofing material, used. The thickness of concrete shall be 50 mm. RCC surface shall be properly hacked before laying of waterproof cement concrete. The surface of the wall shall be applied with cement slurry and polymer bonding agent like Tapcrete 151 or equivalent. The layer shall be laid in a slope as shown in the drawing and fillets (haunches or vata) shall be provided as per design. The waterproofing compound shall be mixed in proportion approved by the manufacturer. In case of Hydro Shield, liquid and powder shall be mixed in the proportion approved by the manufacturer.

The guaranteed bond shall be furnished for a period of 10 years as per item no. 8.01a

2.0 **Mode of Measurements and Payment:**

2.1 The payment shall be made for average 40 mm thick IPC in 1:2:2 waterproof cement concrete, as per the relevant specifications of item no. 9.01. The rate shall include the waterproofing and non shrink chemicals. The rate shall include cleaning and hacking the surface.

2.2 The rate shall be for a unit of one $m^{2.}$ for plaster work using water proofing material per bag of cement weighing 50 kg

8.10.a **Providing and laying permashield aluminum water proofing, using bitumen primer and hot bitumen, 6 mm. thick stone grit and cement mortar concrete screed 25-75mm thickness laying Permaguard/ permashield, finishing the top with 40 mm. screed cement concrete or any other material as per the choice of the Architect, etc. complete, including furnishing of a guarantee for 10 years. The work should be carried out as per the instructions of the manufacturer of Permaguard, M/s. India foils Ltd., The treatment shall be for the following:**

a) terraces and under roof gardens.
b) Sunk floor of toilets, swimming pools and basement
c) Behind wardrobes and cupboards
d) Lining to canals, tanks, ponds etc.

1.0 **Materials :**

1.1 Permaguard is an aluminium foil/strip laminated with polythene film on both sides. The edges of the strips are overlapped and sealed by a heat-sealer or hot molten bitumen to make it a continuous sheet. At present Permaguard is marketed by M/s. India Foils Ltd. and Permashield is marketed by Hindalco Industries Ltd. (Aditya Birla Group) It

shall conform to M-86.

1.2 Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Stone grit shall conform to M-8. Cement mortar shall conform to M-11. Bitumen of grade 85/25 or 95/15 shall conform to IS : 73.

2.0 Workmanship :

2.1 The relevant specification of item no. 8.01 shall be followed.

2.2 The work of waterproofing shall be carried at the location as mentioned in the item description:

1) The surface to be waterproofed must be thoroughly swept cleaned with wire brush and be clear of all dust and dirt particles and washed with water. Make a niche on the parapet wall about 225mm (9") high from the bottom of the surface to be waterproofed, on all sides of the surrounding walls. The niche shall be atleast 50mm deep inside the wall. A layer of cement plaster in CM 1:4 or screed concrete 1:2:4. This layer shall be applied after cleaning the base surface of all debris with water. The thickness of the layer must be maintained between 25 mm. to 75 mm. depending on the length of the terrace and the desired gradient. Uniform gradient slope of 1:60 to 1:100 shall be maintained. The concrete shall be cured before starting the subsequent treatment.
This layer may however be omitted if necessary gradient is already provided in the RCC slab and the slab is smooth and evenly finished.

2) One day before laying the Permagaurd, a coat of molten bitumen of desired temperature or bitumen primer-Bitukote Nift is then applied on the area equal to the width of the Permaguard strip to be laid subsequently. Apply adhesive/ hot bitumen grade 85/25 conforming to IS 702-1988 @ 2.4 kg/m2 all along the parapet wall/ side wall, including inside the niche
If the Permaguard strips are to be heat-sealed, then the overlaps are kept free of bitumen. Otherwise, molten bitumen is also applied over the overlaps before pressing the strips together.

3)Permaguard strips are laid so that the first strip of Permaguard is laid along the bottom of the slope. The subsequent strips are laid in the same manner, ensuring that the lower edge of the second strip overlaps on the upper edge of the first strip, overlap width being min. 50 mm. wide. These overlaps are sealed with Teflon coated heat-sealer or molten bitumen to make a continuous sheet of Permaguard. The process is repeated till the entire surface is covered with the foil.

4) At the end of the corners, corner piece shall be formed. The details shall be as per the manufacturers specification.

5) When there is a parapet wall, a groove/niche shall be made (50 mm. in depth & 125mm above roof level) all along the parapet. While laying Permaguard, leave an extra 175 mm. (both lengthwise and widthwise) after the end of the roof. Apply molten bitumen all along the parapet wall covering the area upto the groove and the groove itself. Insert the 50 mm. (of 175 mm.) of Permaguard into the groove and press the remaining 125 mm. onto the wall. Seal the groove with cement concrete 1:2:4.

5) For laying Permaguard near/around drain pipes, make a circular tube of Permaguard/ Permashield overlapping one end over the other. The tube should approximately be of the same dia. as that of the pipe. Insert this tube into the pipe leaving 100 mm. projection out, keeping the lap joint minimum 50mm of the tube on top. Cut this 100 mm. at right angles to each other to make 4 strips. 3 of these are flushed on the parapet wall and the 4th into the roof with hot molten bitumen. The 125 mm. Permaguard pressed onto the parapet wall shall have a hole cut slightly smaller than the opening of the drain pipe so that the pipe is not blocked and the material is flushed into the pipe over the already laid Permaguard tube with hot molten bitumen or portable heat sealer machine. Lastly brush the mouth of the pipe liberally with hot molten bitumen.

6) Over the Permaguard apply molten bitumen using sprinkler and brush. Sprinkle coarse sand evenly on top of the bitumen layer. This will help to bond the Permaguard to the top finishing layer of either screed concrete or any other desired finish.

7) A top protective layer/ wearing coat of IPS, cement mortar of required thickness shall be laid over the bonding film and a vata of minimum 150mm shall be formed on all sides along the parapet wall base.

Following precautions shall be taken during the treatment process:
a) Foil shall be applied on the dry surface. It shall not be applied during rainy season.
b) It shall be ensured that the foil is not damaged during storage, transportation etc.
c) Proper care shall be taken while working of sloping roof. Safety belts or ladders shall be used while laying the

sheets.

d) The foil used shall be free of cracks, holes or any other damage.

2.3 A guarantee bond on appropriately stamped paper shall be given by the contractor to the client in the manner form described in item no. 8.01.

3.0 **Mode of Measurements and Payment :** The relevant specifications of item no. 8.01a shall be followed. Water proofing of roof shall be measured in $m^{2.}$ plan area of treated surface shall be measured correct to a centimeter.

8.11 Integral crystalline waterproofing system with barrier type coating

Providing and appling barrier type integral crystalline waterproofing treatment (surface coating) of Penetron, Kryton or equivalent to basement walls/ under ground water ratining structure etc. having speed of penetration 31 Cm in 56 days and resistance to 16 bar hydrostatic water head from negative side & capable of reducing permeability of concrete by more than 90 %, compared with control concrete. Rate shall be inclusive with damage and honey comb concrete, sealing any future hairline cracks because of its self healing nature as per manufacturer's specifications and as per technical specification etc complete. Work shall be carried out by approved applicator and as per method of waterproofing accepted by manufacturer. Work shall be guaranteed for 10 years against any leakages and guarantee shall be provided on Rs. 100/- stamp paper in approved proforma. Using PENETRON coating @ 0.7 Kg. per SqM per coat in two coats (within 15 to 20 days on wet concrete) or equivalent

1.0 Material

1.1 Water proofing compound shall conform to M-31.

2.0 Workmanship : Steps followed shall be as per the directions of the manufacturers and approval of the EIC. For guideline following steps may be followed.

2.1 Surface preparation: Clean the surface to remove dust, loose particles and laitance, treat the honey comb, construction joint, hair line crack with crystalline material.

2.2 Apply Hydrophilic Crystalline based waterproofing compound one / two coats at specified intervals as recommended by the manufacturer on concrete / plastered surface.

2.3 The application to be done from + ve (positive) side on a wet open pore green concrete surface at coverage of 0.8 to 1 Kg/ Sqmt as per manufacturer specification.

2.4 Application should be done on wet surface after 3-6 hours of casting of concrete.

3.0 Treatment shall be tested by ponding water about 250 mm high for 72 hours. Surfaces shall be examined for leakage seepage, dampness, sweating etc.

4.0 Mode of Measurement and Payment.

Measurements shall be in Cum of admixed concrete. Rates shall include all items right from cleaning of surface to completion and testing required against defects such as leakage, seepage, dampness, sweating etc.

5.0 TESTING

5.1 On completion of installation and prior to next operation or as directed by EIC work shall be tested by the contractor. Required water shall be arranged and disposed of by the contractor at his cost.
a) All openings, drains etc. shall be plugged.
b) Water shall be flooded about 200 mm over the Sunk portion. Water shall be kept for 72 hours.
c) Surfaces shall be observed critically and in case any leakage is observed areas shall be treated again and tests to be carried out again to the satisfaction of the EIC.

5.2 Approval of water test does not relieve the contractor of his obligation of providing installed water proofing guaranteed for 10 years as per contract.

5.3 All arrangement of material, labour etc. required including preserving and maintaining areas flooded shall be carried out by the Contractor at his cost.

6.0 GUARANTEE

6.1 All waterproofing systems described above are to be referred as guide-lines only. The contractor shall propose the system along with his tender, giving full descriptions.

6.2 The system shall be guaranteed for 10 years against all defects and liabilities thereof from the date of completion of project. The bank guarantee shall be on Stamp Paper of Rs.100/- in Performa to be approved by Employer/ EIC. (The contractor shall submit Performa to EIC for approval of Employer before being written on Stamp Paper.) The cost of Stamp Paper shall be to the contractor's account.

6.3 Work shall be carried through approved specialist agency as per method of working approved in writing by the EIC.

8.12 Providing and application of swellable type water stop of Penebar - SW 45 Type A (Expansive Nature) of penetron or equivalent at all the construction joints of the raft slab, retaining wall and at the junctions of raft slab with the retaining walls, around anchor locations, pipe penetrations, etc. after cleaning the surface by air blower/ mechanical means before application of suitable Primer. The material must capable of withstanding Hydrostatic pressure of 6 bar continuous exposure for 7 days. Must show and expansion of more that 200% in potable water. Swellable bar and primer shall be of same make.

Swellable type water stop shall be used as construction joint for underground and water retaining structure. Swellable type water stop shall be of approved make and type.

Relevant specification shall be followed as per manufacturer's specifications. Complete water proofing system shall be executed by only approved applicator.

Direction of Use
Application of swellable water stops on poured-in-place construction joints:

1) Carefully brush off all dust and debris. Apply a coat of primer on concrete surface. Primer shall be of same manufacturer and used as per manufacturer's specifications.
2) By using the heel of the hand and moderate pressure, press a bead of swellable water stop firmly into position on the standing structure. Make sure the product has bonded with the primed area.
3) Where required, splice ends to form a continuous, uninterrupted seal. For best results, cut each end at opposite 45° angles and tightly butt ends together. DO NOT OVERLAP ENDS. Gently knead the spliced ends creating an uninterrupted seal.
4) Peel the protective covering from the exposed side of the installed swell able water stop.
5) Follow standard concrete placing procedures from here onwards.
6) It may be necessary to utilize masonry nails or other mechanical means to hold the sealant in place on vertical surfaces.
7) Place swell able water stop so that it is no closer than 5 cm (2") from the outer surface of poured structure. If a Keyway is utilized, place the swell able water stop into the bottom of the formed Keyway area.

Rate shall be for actual length of swellable water stop laid in Rmt. No wastage shall be measured and paid.

9.01.a **Precast terrazzo (Marble/Mosaic) tiles with white, black or white and black marble chips of size upto 6 mm., laid in floors, treads of steps and landing, skirting, at all heights, for all floors, on bed of 35 mm - average thickness of CM 1:6 for floors, treads and landing and , joined with neat cement slurry mixed with pigment to match the shade of the tiles including rubbing , polishing and cleaning with oxalic acid complete, with precast tiles of : Light shades, using white cement. The tile should be of the size (a) 250 * 250 mm –avg thk 20 mm (b) 300 * 300 mm – avg. thk. 25 mm. The work should be done as per the drawing and shall be truly maintained and directed as required by the Architect and Engineer-in-charge. [NO WAXING SHALL BE PERMITTED].**

1.0 **Materials:** Water shall conform to M-1. Cement shall conform to M-3. Cement mortar shall conform to M-11. The precast terrazzo tiles of 20/25 mm. thick shall be of light shade using white cement and shall conform to M-47.

2.0 **Workmanship:**

2.1 The work shall be carried out as per IS : 1443-1972.

2.2 **Bedding:**

2.2.1 Before spreading the mortar, the sub-base of the floor shall be cleaned of all dirt, scum and loose materials and then shall be well wetted without forming any pools of water on the surface.

2.2.2 In case of R.C.C floors, all points of level for the finished surface shall be marked out. The cement mortar of proportion 1:6, as directed, shall be then evenly and smoothly spread over the base. Bedding layer of mortar shall be not less than 25 mm. and average thickness of the bedding shall be 35 mm.

2.3 **Laying:**

2.3.1 Before laying the terrazzo (Marble/Mosaic) tiles, the tiles shall be thoroughly wetted with water. Neat cement grout of required consistency at 4.4 Kg. cement/m^2 shall be spread on the mortar bed. The tiles shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slope. There shall be no hollows left. The joints shall be of uniform thickness and in straight line as per the pattern.

2.3.2 The surface of flooring shall be checked frequently with a straight edge atleast two meters long so as to obtain a true surface with required slope.

2.3.3 While laying, any chiseling which may be required for making the skirting or dado flush with the plaster and/or other finishes shall be done. Necessary grooves of required size in cm., between plaster and/or other finishes, dado or skirting (if required) shall be provided. Forming machine-cut/rounded edges, gutters, sills, platforms, channels, curbing, etc. if any, if required, shall be provided as per the drawing and design.

2.3.4 In places where full tiles cannot be fixed, the tiles shall be cut properly to the size by mechanical cutter machine and smoothened at edge to give straight and true joints. The edges of the tile should be embedded in the periphery of the wall, minimum by 5 mm.

2.3.5 After the tiles have been laid, the surplus cement slurry and the joints shall be cleaned and washed fairly deep before the cement hardens.

2.3.6 At the end of day's work, the joints shall be cleaned of all grey cement grout with a wire brush to a depth of about 5 mm. and then grouted with white cement, with or without pigment to match the shade of the topping of tiles. The same cement slurry shall then be spread over the whole surface, laid, in a thin coat to protect the surface from abrasive damage and to fill pin holes that may exist on the surface.

2.3.7 All necessary slopes, gradients and levels shall be truly maintained as required and directed by the Architect and Engineer-in-charge.

2.4 **Curing:** The flooring shall be kept wet with damp jute or water for seven days. It shall be kept undisturbed atleast for 14 days. The polishing shall normally be commenced after 14 days.

2.5 **Polishing:**

2.5.1 After the tiles are properly cured, first polishing shall be done with carborundum stone of 48 to 60 grade grit fitted in the machine. Water shall be properly used during polishing. When the chips show up and the floor has been uniformly rubbed, it shall be cleaned with water. It shall than be covered with a thin coat of white cement mixed with or without pigments to match the colour of the topping of the tiles. Pin holes if any, shall be filled after proper cleaning. This grout shall be kept moist for a week. Thereafter, second polishing shall be started with carborundum of 120 grit. Grouting and curing shall follow again. Final grinding shall be done when other works are finished. The

machine shall be fitted with carborundum of grit 220 to 350, and grinding shall be started using water in abundance. The floor shall then be washed with clean water. Oxalic acid powder shall then be dusted at 33 grams per square meter on the surface and the surface shall be rubbed with a machine fitted with hessian bobs or rubbed hard with a pad of woolen rags. The floor shall then be washed clean and dried with a soft cloth or linen. The finished floor shall not sound hollow when tapped with a mallet. Mopping should be done for 15 days after the polishing.

2.5.2 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.

2.5.3 Testing of the tiles shall be carried out by the Contractor at his own cost as per I.S. requirement for all the mentioned tests.

3.0 Mode of Measurements and Payment:

3.1 Terrazzo tiles flooring shall be measured in $m^{2.}$ for visible area of work done.

3.2 No deductions shall be made or extra paid for any opening in the floor area upto 0.1 m^2. Nothing extra shall be paid for use of cut tiles or for laying the floors at different levels in the same room or courtyard. Mosaic tiles laid in floor borders and bands etc. shall be measured in the same item and nothing extra shall be payable on account of these or similar bands formed of half or multiples of half size standard tiles/ or other uncut tiles.

3.3 The treads of stairs and steps paved with tiles without nosing shall also be measured under this item.

3.4 The rate shall include the cost of all materials (inclusive of all taxes, levies, and delivery at site), labour, polishing & sundry involved in all the operations, at all floors, at any height and level, as described above. It shall also include for breakage and wastage. Floating materials and margin of profit shall also be included. All material samples shall be approved by the Architect/Engineer-in-charge before placing orders.

3.5 No extra shall be paid for any small quantities like narrow widths, mitred & returned ends, rounds & cutting, fixing and making good upto & around pipes, fittings and fixtures etc.

3.6 The rate shall include for fixing the flooring in composite pattern as per the drawings, using different materials and sizes. The measurements of the different materials shall be taken category-wise separately and paid accordingly.

3.7 The basic rate, if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

3.8 The rate shall be for an unit of one m^2.

9.01.b Precast terrazzo (Marble/Mosaic) tiles with white, black or white and black marble chips of size upto 6 mm. in risers of steps, dado etc. with 12 mm. thick cement mortar 1:3 (1 cement: 3 coarse sand), jointed with neat cement slurry, including rubbing and polishing complete, with tiles of light shades using white cement. The work should be done as per the drawing and shall be truly maintained and directed as required by the Architect and Engineer-in-charge. [NO WAXING SHALL BE PERMITTED].
The tile should be of the size
(a) 250 x 250 mm –avg thk 20 mm
(b) 300 x 300 mm – avg. thk. 25 mm.

1.0 Materials: Water shall conform to M-1. Cement Mortar shall conform to M-11. The precast terrazzo (Marble/Mosaic) tiles of light shades using white cement, 20/25 mm. thick shall conform to M-47.

2.0 Workmanship:

2.1 **Laying:** The work shall be carried out for skirting, risers of steps & stairs and dado. Before fixing precast terrazzo (Mosaic/Marble) tiles of the shade and size as specified, the surface shall be prepared by heavy scraping, raking joints etc. to the required line, level and plumb. The surface shall be thoroughly wetted before commencing the laying work. Thereafter, about 10 mm. thick backing of cement mortar in specified proportion shall be applied on the surface, in true line and level, generally as per specification of the relevant plaster item. (Section 7.00)

2.2 **Fixing:** The back of each tile to be fixed shall be smeared with cement paste of matching colour and the mosaic tiles shall then be gently tapped against the surface, with a wooden mallet. The skirting shall be done only after the flooring is completed. Any pipes coming out of the wall through the dado or skirting shall only be at the intersections of the horizontal and vertical joints. The tiles shall not have staggered joints. The joints shall be true to entire line both ways and vertical joints shall be in line with joints of flooring. Tiles shall be fixed as close as possible to the adjoining tiles and any difference in the thickness of the mosaic tiles shall be evened out in the cement paste so that all the

tiles faces are set in conformity with one another. The skirting shall project uniformly and not more than 6 mm. thickness beyond the finished surface above. Top of skirting or dado shall be truly horizontal. The risers of steps, skirting or dado shall rest on top of treads of flooring wherever required. The tiles shall be cut (sawn) and thin edges smoothened before use.

2.3.3 The rate shall include for any chiselling which may be required for making the skirting or dado flush with the plaster and/or other finishes. It shall include for a groove of required size in cm., between plaster and/or other finishes, dado or skirting (if required). It shall also include for forming machine-cut/rounded edges, gutters, channels, curbing etc. if required.

2.3 **Curing:** Curing shall be done for 7 days continuously.

2.4 **Finishing:** Skirting and dado shall be hand polished to have an even smooth and shining surface. In case of skirting only, 10 mm. x 10 mm. groove shall be provided at the junction of cement plaster and cement tiles.

3.0 Mode of Measurements and Payment:

3.1 The terrazzo tiles with light shade using white cement base shall be paid under this item. The length shall be measured along finished surface of the riser, skirting or dado, correct to a centimeter height measured from finished or treads or floor to the top (under side of treads in case of steps)

3.2 The rate shall include the cost of all materials (inclusive of all taxes, levies, and delivery at site), labour & sundry involved in all the operations, at all floors, at any height and level, as described above. It shall also include for breakage and wastage. Floating materials and margin of profit shall also be included. All material samples shall be approved by the Architect/Engineer-in-charge before placing orders.

3.3 No extra shall be paid for any small quantities like narrow widths, mitred & returned ends, rounds & cutting, fixing and making good upto & around pipes, fittings and fixtures etc.

3.4 The rate shall include for fixing in composite pattern as per the drawings, using different materials and sizes. The measurements of the different materials shall be taken category-wise separately and paid accordingly.

3.5 The basic rate, if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

3.6 The rate shall be for an unit of one m^2.

9.02.a Providing and laying 30 x 30 cm. of 25 mm. thick mosaic tiles flooring and skirting (to be measured in m^2.) in composite pattern, if any, best quality, approved manufacturer, white/coloured tiles of desired shade, made from approved source first quality Chhota Udaipur (Gujarat) marble chips or equivalent, in grading no. 4 & 5, in desired proportion, laid over an average 35 mm. thick cement mortar 1:6 bedding, topped with cement slurry, including closed joints, pointing, curing, machine polishing and cleaning with oxalic acid, as directed. (Waxing will not be permitted.)

The relevant specification of item.no. 9.02.a shall be followed except that white/coloured tiles of desired shade shall be laid on cement mortar bedding, average 30 mm. thick in CM 1:6. Waxing will not be permitted.

9.02.b Providing & laying 30 x 30 cm. and 25 mm. thick grey mosaic tiles flooring & skirting (to be measured in m^2.) in composite pattern, if any, best quality, approved manufacturer, of desired shade of grey colour, made from approved source, such as kankroli (Gujarat) marble chips or equivalent, in grading no. 0, 1 & 2, in desired proportion, laid over an average 35 mm. thick cement mortar 1:6 bedding, topped with cement slurry, including closed joints, pointing, curing, machine polishing and washing, as directed.

The relevant specification of item no. 9.02.a shall be followed except that plain cement tiles, of desired shade of grey are to be used as specified in item and the size of the tile shall be as mentioned in the item and the bedding thickness shall be 30 mm.

9.03 Providing and laying in position, ceramic tiles, of approved make and light colours, of first quality as per design, set in cement slurry (3.3 kg. cement/m^2.) over a minimum 25 mm. thick cement mortar 1:3 bedding and laid to proper slope and level. Finishing should be done with flush pointing in white cement and pigment with residue and skirting, including curing, polishing and cleaning with mild oxalic acid etc. complete, as shown and specified, for flooring, or channel work etc. complete, as directed by Architects and Engineer-in-charge. The sizes which can be used are:

a) 200 mm x 200 mm b) 300 mm x 300 mm
c) 400 mm x 400 mm d) 450 mm x 450 mm

1.0 **Materials:** Water shall conform to M-1. Cement mortar shall conform to M-11. White and coloured glazed tiles shall conform to M-55 and 55A , from the list of approved make and of first quality.

2.0 **Workmanship:**

2.1 **Bedding:**

2.1.1 The sub-grade shall be cleaned, wetted and mopped. The bedding shall then be laid evenly over the surface, as described above, tamped and corrected to desired level and allowed to harden enough to offer a rigid cushion to tiles and to enable the mason to place wooden planks across and squat on it.

2.1.2 The white/coloured vitrified/ceramic tiles shall then be laid on the cement mortar bedding of 25 mm. thickness, in CM 1:3. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of the bedding. The base shall be cleaned and well wetted, before laying. The mortar shall then be spread in thickness not less than 18 mm. at any place and average 25 mm. thick. The proportion of the cement mortar shall be as specified in the item.

2.2 **Fixing tiles :**

2.2.1 The tiles before laying shall be soaked in water for atleast two hours. Neat grey cement grout at 3.3 Kg./Cement/$m^{2.}$ of honey-like consistency shall be spread over the mortar bedding as directed. The edges of the tiles shall be smeared with neat cement slurry. The tiles shall then be well pressed and gently tapped with a wooden mallet till they are properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints between the tiles shall be as thin as possible in straight line or as per pattern.

2.2.2 The tiles shall not have staggered joints. The Nahni trap coming in the flooring shall be so positioned that its grating shall replace only one tile as far as possible. Where full size tiles cannot be fixed, they shall be cut (Sawn) to the required size and the edges rubbed smooth to ensure straight and true joints. The outlets for drainage shall be marked as per drawing and tile fixing shall be carried out accordingly after laying and testing the drainage lines. After the tiles are laid, the joints shall be cleaned of grey cement grout with a wire brush to a depth of about 5 mm. and then grouted with white cement/polymer based grouting of approved make like BAL with or without pigment to match the shade of the topping of tiles. The same cement slurry shall then be spread over the whole surface in a thin coat to protect the surface from abrasive damage and to fill up pinholes that may exist on the surface. White cement with or without matching pigment shall be used for pointing the joints. After fixing the tile finally in an even plane the flooring shall be kept wet and allowed to cure undisturbed for 7 days.

2.2.3 While laying, any chiselling which may be required for making the skirting or dado flush with the plaster and/or other finishes shall be done. Necessary grooves of required size in cm., between plaster and/or other finishes, dado or skirting (if required) shall be provided. Forming machine-cut/rounded edges, gutters, sills, platforms, channels, curbing, etc. if any, if required shall be provided as per the drawing and design.

2.2.4 All necessary slopes, gradients and levels shall be truly maintained as required and directed by the Architect and Engineer-in-charge.

2.3 **Cleaning:**

2.3.1 the surplus cement grout that may have come out of the joints shall be cleared off before it sets. Once the floor has set, it shall be carefully washed and cleaned by oxalic acid and dried. Proper precautions and measures shall be taken to ensure that the tiles are not damaged in any way till the completion of the construction.

2.3.2 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.

3.0 **Mode of Measurements and Payment:**

3.1 The work done shall be measured in m^2. for the visible area of work done in floor . The length and width of the flooring shall be measured between the faces of skirting or dados or plastered face of walls as the case may be. The paving under dado or skirting shall not be measured. No deduction shall be made or extra paid for any opening in the floor of area upto 0.1 $m^{2.}$ Nothing extra shall be paid for laying the floors at different levels in the same room. The dado will be measured from the finish floor level to the top of tile fixed.

3.2 The rate shall include the cost of all materials (inclusive of all taxes, levies, and delivery at site), labour & sundry involved in all the operations, curing etc complete, at all floors, at any height and level, as described above. It shall also include for breakage and wastage. Floating materials and margin of profit shall also be included. All material samples shall be approved by the Architect/Engineer-in-charge before placing orders.

3.3 No extra shall be paid for any small quantities like narrow widths, mitred & returned ends, rounds & cutting, fixing and making good upto & around pipes, fittings and fixtures etc.

3.4 The rate shall include for fixing the flooring in composite pattern as per the drawings, using different materials and sizes. The measurements of the different materials shall be taken category-wise separately and paid accordingly.

3.5 The basic rate, if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

3.6 The rate shall be for an unit of one m^2.

9.04.a **Providing and laying vitrified floor tiles in 600mm x 600mm size (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours, shades, texture/ finish (matt/ anti skid/ satin/ polished/ glossy) in flooring and skirting, laid over a minimum 20 mm thick cement mortar 1:4 (1 cement : 4 coarse sand) bedding on 40 mm wired finish screed 1:2:4 and laid to proper slope and level. Finishing to be done with flush pointing in white cement and approved pigment including curing and cleaning with mild oxalic acid etc. complete for all floor all height as directed by Architects and Engineer-in-charge. Rate shall be inclusive of protection of flooring until the handling of the project. (Only flooring area should be measured and paid.)**

The sizes that can be used as per drawing:

1.0 **Materials :** The vitrified floor tiles shall conform to M-57. Cement mortar shall conform to M-11.

2.0 **Workmanship :** The relevant specification of item no. 9.03 shall be followed except the work shall be for vitrified floor tiles.

3.0 **Mode of Measurements and Payment :** The relevant specification of item no. 9.03 .shall be followed.shall be measured in

3.1 Rate shall be inclusive for the protection of the tile by laying plastic sheet & Plaster of Paris until the handing over .The plastic sheet & Plaster of Paris shall be removed & flooring shall be cleaned at the time of handing over the sheets.

9.04.b **Providing and laying Vitrified tiles in 600mm x 600mm size (thickness to be specified by the manufacturer), with water absorption less than 0.08% and conforming to IS: 15622, of approved brand & manufacturer, in all colours, shade and texture/ finish (matt/ anti skid/ satin/ polished/ glossy), in wall tile/ dado, skirting, riser of steps, laid on masonry/ plaster/ RCC/ gypsum board with suitable cement based high polymer modified quick set tile adhesive (water based) conforming to IS: 15477, in average 6 mm thickness.**
Rate shall be inclusive of vitrified tile (as per approved sample), adhesive for fixing etc complete.

1.0 **Materials :** The vitrified floor tiles shall conform to M-57. Cement mortar shall conform to M-11.

2.0 **Workmanship :** The relevant specification of item no. 9.03 shall be followed except the work shall be for vitrified floor tiles.

3.0 **Mode of Measurements and Payment :** The relevant specification of item no. 9.03. shall be followed.shall be measured in

9.05 **Providing and laying in position, glazed tiles, in dado, of approved make and colour, of first quality as per design, set in cement slurry (3.3 kg. cement/m^2.) over an average 12 mm thick cement sand mortar 1:3 on wired plaster fixed with 1:1 cement sand mortar of average 6 mm thickness behind the tiles and fixed to proper slope and level. Joints shall be grouted in white cement and jointed with white cement and pigment with residue as per drawing and approved by Engineer-in-charge or Architect complete. Rate shall be inclusive of cost of 12 mm thick wired plaster in CM1:3.The sizes, which can be used, are:**
a) Up to 300 mm x 300 mm
b) Above 300 mm x 300 mm and up to 450mm x 450mm

1.0 **Materials:** Water shall conform to M-1. Cement mortar shall conform to M-11. White and coloured glazed tiles shall conform to M-55 and 55A , from the list of approved make and of first quality.

2.0 **Workmanship:**

2.1 Wired Plaster:

2.1.1 The sub-base/wall shall be cleaned, wetted. The plaster in the proportion of 1:3 cement sand mortar as per the relevant specification of wired plaster shall be applied. The plaster shall be cured for 7 days. After curing , The string marking of the glazed tiles with blue or white lime shall be done on the wall after wired plaster is completed as per drawing in such a way that opposite walls shall be mirror image. The outlets for plumbing shall be marked as per drawing and plumbing work shall be carried out accordingly and tested for pressure as instructed by engineer –in-charge. The tiles shall be fixed after testing the water supply lines and laying the electrical conduits and boxes.

2.2 Fixing tiles:

2.2.1 The tiles before laying shall be soaked in water for atleast two hours. Neat grey cement slurry at 3.3 Kg. Cement/$m^{2.}$ of honey-like consistency shall be spread over the wired plaster as directed. Cement sand mortar of 1:1(cement : fine sand) shall be evenly spread behind the tiles and thereafter tiles shall be be well pressed and gently tapped with a wooden mallet till they are properly bedded and in level with the adjoining tiles. The edges of the tiles shall be smeared with neat cement slurry. There shall be no hollows in bed or joints. The joints between the tiles shall be as thin as possible in straight line or as per pattern.

2.2.2 The tiles shall not have staggered joints. Where full size tiles cannot be fixed, they shall be cut (Sawn) to the required size and the edges rubbed smooth to ensure straight and true joints.. After the tiles are laid, the joints shall be cleaned of grey cement grout with a wire brush to a depth of about 5 mm. and then grouted with white cement with or without pigment to match the shade of the topping of tiles. The same cement slurry shall then be spread over the whole surface in a thin coat to protect the surface from abrasive damage and to fill up pin holes that may exist on the surface. White cement with or without matching pigment shall be used for pointing the joints. After fixing the tile finally in an even plane the dado shall be kept wet and allowed to cure undisturbed for 7 days.

2.2.3 While laying, any chiselling which may be required for making the skirting or dado flush with the plaster and/or other finishes shall be done. Necessary grooves of required size in cm., between plaster and/or other finishes, dado or skirting (if required) shall be provided. Forming machine-cut/rounded edges, gutters, sills, platforms, channels, curbing, etc. if any, if required shall be provided as per the drawing and design.

2.2.4 All necessary slopes, gradients and levels shall be truly maintained as required and directed by the Architect and Engineer-in-charge.

2.3 Cleaning:

2.3.1 The surplus cement grout that may have come out of the joints shall be cleared off before it sets. Once the floor has set, it shall be carefully washed and cleaned by oxalic acid and dried. Proper precautions and measures shall be taken to ensure that the tiles are not damaged in any way till the completion of the construction.

2.3.2 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.

3.0 Mode of Measurements and Payment:

3.1 The work done shall be measured in m^2. for the visible area of work done in floor . The length and width of the flooring shall be measured between the faces of skirting or dados or plastered face of walls as the case may be. The paving under dado or skirting shall not be measured. No deduction shall be made nor extra paid for any opening in the floor of area upto 0.1 $m^{2.}$ Nothing extra shall be paid for laying the floors at different levels in the same room. The dado will be measured from the finish floor level to the top of tile fixed.

3.2 The rate shall include the cost of wired plaster and all materials (inclusive of all taxes, levies, and delivery at site), labour & sundry involved in all the operations, curing etc complete ,at all floors, at any height and level, as described above. It shall also include for breakage and wastage. Floating materials and margin of profit shall also be included. All material samples shall be got approved by the Architect/Engineer-in-charge before placing orders.

3.3 No extra shall be paid for any small quantities like narrow widths, mitred & returned ends, rounds & cutting, fixing and making good upto & around pipes, fittings and fixtures etc.

3.4 The rate shall include for fixing the dado in composite pattern as per the drawings, using different materials and sizes. The measurements of the different materials shall be taken category-wise separately and paid accordingly.

3.5 The basic rate, if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

3.6 The rate shall be for an unit of one m^2.

9.06 **Providing and laying in position, ceramic tiles, in dado, of approved make and colour, of first quality as per design, set in cement slurry (3.3 kg. cement/m^2.) over a minimum 10 mm. thick cement mortar 1:3 bedding on wired plaster fixed with 1:1 cement mortar behind the tiles and laid to proper slope and level. Pointing should be done in white cement and jointed with white cement and pigment with residue as per drawing and approved by Engineer-in-charge or Architect complete. The sizes, which can be used, are:**
for ceramic
a) 200 mm x 200 mm
b) 300 mm x 300 mm
c) 400 mm x 400 mm
d) 450 mm x 450 mm
The relevant specification of 9.05 shall be followed except that the ceramic tiles shall be used instead of glazed tiles

9.07 **Providing and laying in position, vitrified tiles, in dado, of approved make and colour, of first quality as per design, set in cement slurry (3.3 kg. cement/m^2.) over a minimum 10 mm. thick cement mortar 1:3 bedding on wired plaster fixed with 1:1 cement mortar behind the tiles and laid to proper slope and level. Pointing should be done in white cement and jointed with white cement and pigment with residue as per drawing and approved by Engineer-in-charge or Architect complete. The sizes, which can be used, are:**
a) 300 mm x 300 mm
b) 400 mm x 400 mm
c) 450 mm x 450 mm
d) 600 mm x 600 mm
e) 900 mm x 900 mm
The relevant specification of 9.05 shall be followed except that the vitrified tiles shall be used instead of glazed tiles.

9.08.a **Providing material and labour for laying average 25mm thick machine cut polished Kota stone slab of required size, approved quality, selected and sorted for uniform color & texture, in flooring, otta, Sill, skirting over 40mm (Average) thick base of cement mortar 1:5 (1-cement : 5-coarse sand) laid over and jointed with grey cement slurry mixed with pigment to match the shade of slab including curing, rubbing and polishing (semi mirror polish) at all floors any heights, any lead and lift in any shape and pattern etc complete as directed by Engineer In charge. Sample shall be approved before execution. Kota stone shall be in uniform shade of required size. Sample and mockup shall be approved before procurement of material.**

1.0 **Materials:** Water shall conform M-1.. Cement mortar shall conform to M-11. Polished kotah shall conform to M-49 and shall be of reasonably uniform colour.

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 thus dressed shall have full contact if laid along a straight edge. The sides shall be table rubbed with coarse sand, before paving. All angles and edges of the slabs shall be truly square and free form chipping and shall give a plane surface. The thickness of the slab 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 the kotah slab flooring shall be of cement mortar 1:6 (1 cement : 6 coarse sand) of average thickness 35 mm. as given in the description of the item. Sub grade shall be cleaned, wetted and mopped. Mortar of the specified mix and thickness shall be then be spread on an area sufficient to receive one kotah slab. The slab shall be washed clean before laying. It shall be laid on top pressed, tapped gently to bring it in level with the 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 a bit. Over this surface, cement slurry of honey-like consistency shall be applied. The slab shall then be gently placed in position and tapped with wooden mallet till it is 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 wall shall enter not less than 10 mm. under the plaster, skirting or dado. 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 While laying, any chiselling which may be required for making the skirting or dado flush with the plaster and/or other finishes shall be done. Necessary grooves of required size in cm., between plaster and/or other finishes, dado or skirting (if required) shall be provided. Forming machine-cut/rounded edges, gutters, sills, platforms, channels, curbing, etc. if any, if required, shall be provided as per the drawing and design.

2.4 In places where full tiles cannot be fixed, the tiles shall be cut to the size and smoothened at edge to give straight and true joints.

2.5 All necessary slopes, gradients and levels shall be truly maintained as required and directed by the Architect and

Engineer-in-charge.

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

2.7 **Polishing** shall be normally commenced after 14 days of laying the slab. Semi mirror finish polishing shall be done on surfaces with different grades of Emery from 40 no (one coat) 60 no (two coats) 120 no (1coat), gutaka(1 coat),Black Chapadi(1 coat) and 1 coat of polishing with 120 no synthetic emery stone &buffing with tinoide shall be carried out.. Water shall be properly used during polishing. The flooring shall then be washed clean with oxalic acid. Daily moping for 15 days shall be done after polishing or up to the satisfaction of client and engineer-in-charge. All works shall be carried out as directed by the Architect and as specified in the item, no waxing will be permitted. If semi mirror polish is to be carried out.

2.8 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.
2.8 The holes required for Nahni traps, pipes any other fittings shall be made without any extra cost.
2.9 Matching Pigment shall be added in the cement for joints to have parity with the stone colour.

3.0 Mode of Measurements and Payment :

3.1 Kotah slab flooring shall be measured in $m^{2.}$ for visible area of work done.

3.2 No deductions shall be made or extra paid for any opening in the floor area upto 0.1 m^2. Nothing extra shall be paid for use of cut tiles or for laying the floors at different levels in the same room or courtyard. Kotah slabs laid in floor boarders and bands etc. shall be measured in the same item and nothing extra shall be payable on account of these or similar bands formed of half or multiples of half size standard tiles/or other uncut tiles.

3.3 The treads of stairs and steps paved with tiles without nosing shall also be measured under this item.

3.4 The rate shall include the cost of all materials (inclusive of all taxes, levies, and delivery at site), labour & sundry involved in all the operations, at all floors, at any height and level, as described above. It shall also include for breakage and wastage. Floating materials and margin of profit shall also be included. All material samples shall be approved by the Architect/Engineer-in-charge before placing orders.

3.5 No extra shall be paid for any small quantities like narrow widths, mitred & returned ends, rounds & cutting, fixing and making good upto & around pipes, fittings and fixtures etc.

3.6 The rate shall include for fixing the flooring in composite pattern as per the drawings, using different materials and sizes. The measurements of the different materials shall be taken category-wise separately and paid accordingly.

3.7 The basic rate, if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

3.8 The risers of steps, skirting or dado shall be measured in m^2. Length shall be measured along the finished faces of risers, skirting or dado. Height shall be measured from finished level of treads or floor to top. Lining of pillars shall be measured under this item.

3.9 The rate shall be for a unit of one m^2.

9.08.b Providing & laying average 25 mm. thick hand dressed/machine cut green polished kotah of approved quality, selected and sorted for uniform colour, in floor, otta etc., in required sizes upto 60x60 cm Hand dressed/machine cut and as per design with diagonal pattern as per drawing, including cement mortar 1:6 bedding of required thickness, joints & pointing as specified, three or more coats of polishing (with oxalic acid) upto semi mirror finish surfaces with different grades of Emery, curing, daily moping with water & kerosene as directed for atleast 15 days or upto the satisfaction of the Architect & Engineer-in-charges etc. complete, with selected brown kotah to form bands etc. complete. (NO WAXING WILL BE PERMITTED).

1.0 Materials & Workmanship: The relevant specifications of item no. 9.08.a shall be followed except that the size of shall be upto 60x60 cm. only. Waxing shall not be permitted. The flooring shall be carried out in diagonal pattern, with or without bands of selected brown kotah etc. as per detailed drawings and as directed by the Architect.

2.0 Mode of Measurements and Payment: The relevant specifications of item no. 9.08.a shall be followed. The rate shall be for an unit of one $m^{2.}$

9.08.c As per item no 9.08 a but for kotah stone up to 60X45cm (unfinished size.)

9.08.d **As per item no 9.08 a but for kotah stone up to 750 mm X1250 mm (unfinished size.)**

9.09.a **Providing & laying 25 mm thick hand dressed/machine cut green polished kotah of approved quality, selected and sorted for uniform colour, in floor, otta, sill, dado etc., in required sizes above 60 cm and upto 100 cm, in normal pattern and as per design and drawing, including cement mortar 1:6 bedding of required thickness, joints & pointing as specified, three or more coats of polishing (with oxalic acid) upto mirror finish surfaces with different grades of Emery, curing, daily moping with water & kerosene as directed for atleast 15 days or upto the satisfaction of the Architect & Engineer-in-charge etc. complete. (NO WAXING WILL BE PERMITTED).**

1.0 **Materials & Workmanship:** The relevant specifications of item no. 9.08.a shall be followed except that the size of the kotah shall be above 60 cm. Waxing shall not be permitted. The flooring shall be laid in normal pattern, with or without bends of selected brown kotah etc., as per the details.

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.08.a shall be followed. The rate shall be for an unit of one m^2.

9.09.b **Providing & laying average 25 mm. thick green polished kotah approved quality, selected and sorted for uniform colour, in floor, otta, sill, skirting, dado etc., in required sizes above 60 cm and upto 100 cm. in diagonal pattern and as per design and drawings, including of cement mortar 1:6 bedding of 35 mm thk, joints & pointing as specified, three or more coats of polishing (with oxalic acid) upto mirror finish surfaces with different grades of Emery, curing, daily moping with water & kerosene as directed for atleast 15 days or upto the satisfaction of the Engineer-in-charge, with selected brown kotah to form bands etc. complete. (NO WAXING WILL BE PERMITTED)**

1.0 **Materials & Workmanship:** The relevant specifications of item no. 9.08.a shall be followed except that the size of the kotah shall be above 60 cm. only. Waxing shall not be permitted. The flooring shall be laid in diagonal pattern, with or without bends of selected brown kotah etc. as per the details.

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.08.a shall be followed. The rate shall be for an unit of one m^2.

9.10.a **Providing & laying average 25 mm. thick hand dressed/machine cut brown polished kotah of approved quality, selected and sorted for uniform colour, in floor, otta, sill, dado etc. in required sizes upto 60 cm. and as per design and drawings, to form bands within mosaic/green kotah or any other flooring, including cement mortar 1:6 bedding of required thickness, joints & pointing as specified, three or more coats of polishing (with oxalic acid) upto mirror finish surfaces with different grades of Emery, curing, daily moping with water & kerosene as directed for atleast 15 days or upto the satisfaction of the Architect and Engineer-in-charges etc. complete. (NO WAXING WILL BE PERMITTED).**

1.0 **Materials & Workmanship:** The relevant specifications of item no. 9.08.a shall be followed except that the kotah shall be of brown colour. The size of the kotah shall be upto 60 cm. only.
Waxing shall not be permitted.

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.08.a shall be followed. The rate shall be for a unit of one m^2.

9.10.b **Providing & laying average 25 mm. Thick hand dressed/machine cut brown polished kotah of approved quality, selected and sorted for uniform colour, in floor, otta, sill, dado etc., in required sizes above 60 cm. and upto 100 cm. as per design and drawing, to form bands within mosaic/green kotah or any other flooring, including cement mortar 1:6 bedding of required thickness, joints & pointing as specified, three or more coats of polishing (with oxalic acid) upto mirror finish surfaces with different grades of Emery, curing, daily mopping with water & kerosene as directed for atleast 15 days or upto the satisfaction of the Architect etc. complete. (NO WAXING WILL BE PERMITTED).**

1.0 **Materials & Workmanship:** The relevant specifications of item no. 9.08.a shall be followed except that the kotah shall be of brown colour and its size shall be above 60 cm. Waxing shall not be permitted.

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.08.a shall be followed. The rate shall be for an unit of one m^2.

9.11 **Providing & laying 25 mm thick machined cut/ hand dressed rough kota with river wash finish of approved quality, selected and sorted for uniform colour, in floor, otta, sill, skirting, tread, riser etc., in required sizes up to 600 mm (unfinished) and as per design and drawings (with or without grooves), including cement mortar 1:6 bedding of required thickness, average 35 mm, joints, pointing and making grooves as specified, including curing up to the satisfaction of the Architect & Engineer-in-charges etc. complete.**

1.0 **Materials and Workmanship:** Water shall conform to M-1. Cement shall conform to M-11 and Rough kotah shall conform to M-48. The relevant specifications of item no. 9.08.a shall be followed except that Rough kotah shall be used and the size of the kotah shall be upto 60 cm. only.

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.08.a shall be followed. The rate shall be for an unit of one m^2.

9.11.a **Providing & laying 25 mm thick machined cut/ hand dressed rough kota with river wash finish of approved quality, selected and sorted for uniform colour, in floor, otta, sill, skirting, tread, riser etc., in required sizes up to 600 mm x 1200 mm (unfinished) and as per design and drawings (with or without grooves), including cement mortar 1:6 bedding of required thickness, average 35 mm, joints, pointing and making grooves as specified, including curing up to the satisfaction of the Architect & Engineer-in-charges etc. complete.**

2.0 **Materials and Workmanship:** Water shall conform to M-1. Cement shall conform to M-11 and Rough kotah shall conform to M-48. The relevant specifications of item no. 9.08.a shall be followed except the size. (The size shall be as per above specification).

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.08.a shall be followed. The rate shall be for an unit of one m^2.

9.12.a **Providing & fixing green double polished kotah of average 25 mm. thick of uniform size and colour for platforms, staircases, sinks, shelves, morry etc. in floor, dado or facia etc. upto 1.0 m. long, including necessary machine-cut edges (uniform thickness) rounded edges, necessary cement mortar bedding in CM 1:3 of required thickness., average 20 mm. Cement joints and pointing as specified with polishing (with oxalic acid), curing, daily mopping with water and kerosene as directed for atleast 15 days or upto the satisfaction of the Architect & Engineer-in-charge etc. complete.**

1.0 **Materials & Workmanship:** The relevant specifications of item no. 9.08.a shall be followed except that the thickness of kotah shall be 25 mm. and the kotah shall be double polished. The size of the kotah shall be from 57 cm to 100 cm only. Waxing shall not be permitted. The polishing shall be done manually instead of machine polishing and bedding shall be in CM 1:3.

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.08.a shall be followed. The rate shall be for an unit of one m^2.

9.12.a **Providing material and labour for laying average 25 mm thick machine cut polished Green kota stone slab of size up to 2.1mt length with uniform thickness for tread, riser, window jambs & sills, coping over 20 mm (average) thick base of cement mortar 1:5 (1 cement : 5 coarse sand) laid over and jointed with gray cement slurry including pencil sharped exposed edges, polishing (semi mirror polish), rubbing, curing, finishing, buffing after final polishing, maintaining up to handling over the project etc complete as directed by engineer in charge. All Expose edges of stone shall be pencil sharped and in even thickness and polished at all floors any heights, any lead and lift etc complete. as directed by Engineer In charge. Sample and mockup shall be approved before procurement of material.**

1.0 **Materials & Workmanship:** The relevant specifications of item no. 9.12.a shall be followed. The size of the kotah shall be upto 2.1 m. Waxing shall not be permitted.

3.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.12.a shall be followed. The rate shall be for an unit of one m^2.

9.12.c **Providing & fixing green double polished kotah of average 50 mm. thick of uniform size and colour, for sills floor etc., in required sizes from 1.0 m. to 1.5 m. long, including necessary machine-cut edges (uniform thickness), rounded edges, necessary cement mortar bedding in CM 1:3 of required thickness, average 20 mm. Cement joints and pointing as specified with polishing (with oxalic acid), curing, daily mopping with**

water and kerosene as directed for atleast 15 days or upto the satisfaction of the Architect & Engineer-in-charge, complete.

1.0 **Materials & Workmanship:** The relevant specifications of item no. 9.12.a shall be followed. The size of the kotah shall be from 1.0 meter to 1.5 m. only. Waxing shall not be permitted. The polishing shall be done manually instead of machine polishing.

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.12.a shall be followed. The rate shall be for an unit of one m^2.

9.12.d **Providing & laying average 40 mm. thick green polished kotah approved quality, selected and sorted for uniform colour, otta,in required sizes 1500x300 and as per design and drawings, including of cement mortar 1:6 bedding of required thickness, joints & pointing as specified, three or more coats of polishing (with oxalic acid) upto mirror finish surfaces with different grades of Emery, curing, daily moping with water & kerosene as directed for atleast 15 days or upto the satisfaction of the Engineer-in-charge, with selected brown kotah to form bands etc. complete. (NO WAXING WILL BE PERMITTED)**

The relevant specifications of item no. 9.12.a shall be followed. The rate shall be for an unit of one m^2.

9.12.e **Providing and laying 75mm thk. Machine cut edges polished kota stone size upto 1.5m.x 0.60 m.**

The relevant specifications of item no. 9.12.a shall be followed. Except that the thickness of the stone shall be 75 mm with machine cut and polished edges. The rate shall be for an unit of one m^2.

9.13 **Providing roughened strip 2.5 cm wide to form antiskid surface on treads of stairs in any type of stone including forming straight deep curved ghisi (groove), 6 mm wide & 4 mm deep on two sides of the roughened strip, etching/ blasting/ hammering/ chiseling between two groove, polishing the edges, sides and bottom of ghisi etc. complete as per sample approved. Only one-time length of tread of stair shall be measured for payment.**

1.0 **Workmanship:**

Making roughened strip 2.5 cm wide to form antiskid surface on treads of stairs in any type of stone including forming straight deep curved ghisi (groove), 6 mm wide & 4 mm deep on two sides of the roughened area, etching/ blasting/ hammering/ chiseling between two groove, polishing the edges, sides and bottom of ghisi etc. complete as per sample approved.

2.0 **Mode of Measurement and Payment:**

Rate shall be for unit of One Rmt. Only one-time length of tread of stair shall be measured for payment.

9.14.a **Indian Patent:**
Providing and laying 40 mm. thick cement concrete flooring for I.P.S 1:2:4 (for Indian Patent) (1 cement: 2 coarse: sand : 4 graded aggregate 20 mm. nominal size), laid in one layer finished with a Trowel finish, including curing etc. complete.

1.0 **Materials:** Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Aggregate 20 mm. nominal sizes shall conform to M-12. Cement concrete 1:2:4 proportion measured by volume shall conform to relevant specification of ordinary grade 1:2:4 concrete.

2.0 **Workmanship:**
2.1 **Preparation of Surface:** Before the operation for laying the topping is started, the surface of the base concrete shall be thoroughly cleaned of all dirt, loose particles, caked mortar droppings and laitance, if any, by scrubbing with coir or steel wire brush. Where the concrete has hardened so much that roughening of surface by wire brush is not possible, chipping or hacking at close intervals shall roughen the surface. The surface shall then be cleaned with water and kept wet for 12 hours and surplus water shall be removed by mopping before the topping is laid.

2.2 **Laying:**
2.2.1 The screed strips shall be fixed over the base concrete dividing it into suitable panels (not more than 1.8 m). Before placing the concrete for topping, neat cement slurry at 3.3 kg/m2 shall be thoroughly brushed into the prepared surface of the base concrete just ahead of the finish. Concrete of specified proportion and thickness shall be laid in alternate panels to required level and slope and thoroughly tamped and cement concrete 1:2:4 shall conform to

relevant specifications of section 2.00.

2.2.2. The cement concrete flooring of 40 mm. thick (Average) is to be laid as per the site condition. The concrete shall be mixed in a mechanical mixer at the work. Hand mixed may however be allowed for smaller quantities of work and in case of failure of machines or as permitted by the Architect. It shall carried be out on a watertight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However, in such cases 10% more cement than otherwise required shall have to be used without any extra cost. The mechanical mixing shall be done for a period of 1.5 to 2 minutes. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose. Flooring of specified thickness shall be laid in accordance with approved pattern or as directed. Finishing operation shall start shortly after the cessation of beating and shall be spread over a period of one to six hours depending upon the temperature and atmospheric conditions. The surface shall be left for some time till moisture disappears from it. Fresh quantity of cement shall be mixed with water to form thick slurry and spread over the surface while the concrete is still green. Use of dry cement or cement and sand mixture sprinkled on this surface to stiffen the concrete or absorb excessive moisture shall not be permitted. The cement slurry shall then be properly pressed twice by means of iron floats, once, when the slurry is applied and the second time when cement starts setting and is to be finished smooth. The surface shall be marked with string or B.R.C. fabric jali to make the surface non-slippery as and when directed. The junction of floors with wall plaster, dado or skirting shall be rounded off where so required upto 25 mm. radius. Flooring in lavatories and bathrooms shall be laid after fixing of water closet and squatting pans and floor traps, which shall be plugged while laying the floors and opened after the floors, are completed. Any damage, done to water supply or sanitary fittings during execution of work shall be made good.

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

2.2.4 The form work shall be provided if necessary as directed by Architect. Concreting shall be done as per alternate bay method with necessary centering either by mastic or cement mortar as directed.

2.3 Finishing the Surface:

After the concrete has been fully compacted it shall be finished by trowelling or floating with neat cement rendering. Finishing operations shall start shortly after the compaction of concrete and the surface shall be trowelled three times at intervals so as to produce an uniform and hard surface. The satisfactory resistance of floor to wear and tear, depends largely upon the care with which trowelling is carried out. The time interval allowed between successive trowelling is very important. Immediately after placing cement rendering, only just sufficient trowelling shall be done to give a level surface. Excessive trowelling in the earlier stages shall be avoided as this tends to bring a layer in cement to the surface. Sometime, after the first trowelling, the duration depending upon the temperature and atmospheric conditions and the rate of setting of the cement used, the surface shall be retrowelled to close any pores in the surface and to bring to surface and to scrape off any excess water in concrete or any laitance. **No dry cement shall be used directly on the surface to absorb moisture or to stiffen the mix**. The final trowelling shall be done well before the concrete has become too hard but at such a time that considerable pressure is required to make any impression on the surface.

If directed by the Architect & Engineer-in-charge, approved mineral non-fading pigment shall be added to the cement for coloured IPS. And the same shall be properly mixed dry thoroughly in mechanical mixer. this dry mixer shall be used to carry out the coloured IPS as mentioned above. Extra shall be paid for coloured IPS if specified in schedule of quantities**.**

The topping shall be rendered with 1:1, (1 part cement with a suitable mineral pigment (if directed), 1 part sand), instead of cement only to fill up the pin-holes etc.

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Wherever floor hardener(non-metallic) are to be used ,they shall be used as per the suppliers specifications and shall be approved by engineer-in-charge before using. The same shall be paid extra if it is specified in SOQ.
Wherever the fibres are to be used it shall be approved by the engineer-in-charge and shall be used by suppliers specifications.
Wherever the patent flooring is used as a finishing on roof, the joints shall be filled with an approved bitumastic filler in a workman-like manner.

Ironite Topping: Instead of finishing the top with rendering coat of 1:1 cement mortar, the top shall be finished with ironite topping. Unless, otherwise specified, one part of ironite and four parts of ordinary cement by weight shall be

mixed dry thoroughly. This dry mixture shall be mixed with grit 6 mm. (1/4") and down size or as otherwise directed in the ratio of 1:2 by volume and well turned over. Just enough water shall be added to this dry mix and mixed thoroughly well and laid to uniform thickness of 12 mm. and compacted. After the initial set has started the surface shall be finished as directed.

3.0 Mode of Measurements and Payment :

3.1 The rate shall include the cost of all materials and labour involved in all the operations described above. No deduction shall be made or extra paid for any opening upto 0.1 $m^{2.}$ in area, in the floor, nothing extra shall be paid for laying the floor at different levels in the same room or the courtyard.

3.2 The rate shall be for an unit of one m^2.

9.14.b Providing and laying 50 mm. thick cement concrete flooring for IPS 1:2:4 (for Indian Patent) (1 cement : 2 coarse: sand : 4 graded aggregate 20 mm. nominal size), laid in one layer finished with a floating coat of neat cement slurry, including curing etc. complete.

1.0 Materials & Workmanship : The relevant specifications of item no. 9.14.a shall be followed except that the thickness of concrete flooring shall be 50 mm.

4.0 **Mode of Measurements and Payment :** The relevant specifications of item no. 9.14.a shall be followed. The rate shall be for an unit of one m^2.

9.14.c Providing and laying Cement concrete coloured pavement 40 mm. thick I.P.S (Indian Patent) 1:2:4 (1 cement : 2 coarse sand : 4 graded aggregate 20 mm. nominal size), laid in one layer finished with floating coat of neat cement,nonfading pigment approved by engineer-in-charge. etc. complete.

Relevant specification of 9.14.a shall be followed

9.14.d Providing and laying Cement concrete coloured pavement 50 mm. thick I.P.S (Indian Patent) 1:2:4 (1 cement : 2 coarse sand : 4 graded aggregate 20 mm. nominal size), laid in one layer finished with floating coat of neat cement,nonfading pigment approved by engineer-in-charge. etc. complete.

Relevant specification of 9.14.b shall be followed

9.14.e Extra over and above for providing and laying floor hardener on 40/50 mm. thick I.P.S (Indian Patent) 1:2:4 (1 cement : 2 coarse sand : 4 graded aggregate 20 mm. nominal size), laid in one layer finished with floating coat of neat cement etc as per supplier s specification and approved by engineer-in-charge.

Relevant specification of 9.14.a, 9.14.b , 9.14.c , 9.14.d shall be followed . It shall be measured and paid in MT or Kg.

9.14.f Providing & laying M20 grade concrete with cement not less than 350 kg per cu.m in floors, well compacted mechanically vibrated, finished to required levels, dewatered by VDF or tremix floated with neat cement and power trowelled till get desired smooth finishing over layer of leveling course. Suitable size of panel should be 3.5m x 20.0m. The contraction/sawed joints to be formed at every 5 m distance by grooving with mechanical saw. The width of 3mm and depth of the groove sawed joint should as shown in drawing, operation should be carried out as soon as concrete is ready to accept the saw cut with trowelling. The joints are to be filled with epoxy based sealant to the top 10mm depth. Over the green over the green concrete surface application of ironite#3 metallic coloured powder @ 4 kg per sq.m is to be sprinkled over green concrete surface 1/3rd of the dry shake shall be broad casted in first pass and same is floated with power float, remaining 2/3 rd of dry shake is sprinkled over next pass thus the floor laid is floated & trowelled to acquire smooth finish.

Relevant item of 9.14.a and 9.14.b shall be followed. Only top 12 mm layer shall be measured and paid. Bottom layer shall be measured and paid as per relevant items.

9.14.g Providing and laying non-metallic integral polyester fibres of approved make such as recron or equivalent etc in IPS of 40/50 mm thick. as per supplier's specification and approved by architect and engineer-in-charge.

Relevant items of 9.14.a, 9.14.b , 9.14.c , 9.14.d shall be followed. It shall be measured in kg.

9.14.h **Providing and laying 12mm thk. In situ terrazzo of Birla White or equivalent flooring with white cement, calcite powder and marble chips in 2.5 : 1 : 7 ratio, laid in one layer with approved pattern and design, placing the homogenous mix in alternate panels, and panels being formed with glass strips and finishing the panels with suitable colour pigments and Polishing the panels upto mirror finish with different emery stones including cleaning with oxalic acid or as directed by engineer in charge.**
Relevant items of 9.14.a, 9.14.b, 9.14.c, and 9.14.d shall be followed. It shall be measured in Sq.m.

9.15.a **Cement concrete pavement 50 mm. thick with 1:2:4 (1 cement : 2 coarse sand : 4 aggregate 20 mm. nominal size), including giving broom finish with a floating coat of 1:1 cement mortar using, complete.**

1.0 **Materials & Workmanship :** The relevant specifications of item no. 9.14.a shall be followed except that the thickness of concrete flooring shall be 50 mm. and the topping shall be rendered giving a broom finish, in the proportion specified in the item.

2.0 **Mode of Measurements and Payment :**

2.1 The relevant specifications of item no. 9.14.a shall be followed except that thickness shall be measured correct upto 1 mm. Flooring laid in borders, margins and treads of steps, shall be measured under this item or flooring, in respect of its width.

2.2 The rate shall be for an unit of one m^2.

9.15.b **Cement concrete pavement 50 mm. thick with 1:2:4 (1 cement : 2 coarse sand : 4 aggregate 20 mm. nominal size), including giving fluted finish with a floating coat of 1:1:2 cement mortar using grit, complete.**

1.0 **Materials & Workmanship :** The relevant specifications of item no. 9.14.a shall be followed except that the thickness of concrete flooring be 50 mm. and the topping shall be rendered giving a fluted finish, in the proportion specified in the item.

2.0 **Mode of Measurements and Payment :**

2.1 The relevant specifications of item no. 9.14.a shall be followed except that thickness shall be measured correct upto 1 mm. Flooring laid in borders, margins and treads of steps, shall be measured under item or flooring, in respect of its width.

2.2 The rate shall be for an unit of one m^2.

9.16 **Providing & laying broken white china mosaic flooring for plain and curved surfaces, comprising of 20 to 25 mm. size broken pieces of ceramic/glazed tiles (one or more colours, as directed), laid over cement mortar 1:6 bedding including applying cement slurry at the rate of 2.75 kg per sq.m. , on plain or sloped surfaces. and filling joints with white cement. The flooring shall be tampered to bring the mortar cream up to the surface, including rounding of the junctions and extending them upto 15 cm. along the parapet wall. The rate shall include bands, if different colour is used, any pattern or design as per drawing and direction, curing, cleaning with water and oxalic acid, etc. complete. (Wall to wall measurement will be considered only including vata upto 150mm height)**

1.0 **Materials:**

Water shall conform to M-1. Cement mortar shall conform to M-11. China mosaic shall be from white glazed tiles of rejected quality or from broken pieces of white glazed tiles. White cement shall conform to relevant standards.

2.0 **Workmanship:**

1) The size of the broken pieces of white glazed tiles shall not be more than 20-25mm.
2) Triangular china mosaic pieces shall not be used. Rectangular or square pieces shall only be used.
3) The broken pieces shall be soaked in water for 24 hr before using.
4) The sub-grade shall be cleaned, wetted and mopped. The cement slurry @2.75kg/sqm (with watreproofing compound) shall be applied on the sub-grade evenly. The bedding (average 25mm) shall then be laid evenly over the surface in CM 1:6 in the desired slope as mentioned in the drawing. The bedding shall be tamped and corrected to desired level with wooden patti. The bedding shall be allowed to harden enough to offer a rigid cushion to the tile pieces and to enable the mason to place wooden planks across and squat on it.
5) The broken china pieces are laid manually as close as possible over the specified **bedding (before it sets/ gets hard)**, which shall be laid to the required slope and gradient.

6) While laying the broken glazed tiles, neat cement paste shall be applied over the bedding.
7) After china mosaic is arranged, the entire surface shall be tampered by wooden piece with a wooden mallet so that tile piece are properly embedded and leveled in the mortar and slurry starts oozing from the joints.
8) Vatta shall be done along with the floor, keeping machine cut edges at the top end of the vatta.
9) At the end of day's work, the entire work shall be cleaned with the minimum quantity of water and moped with the cotton cloth.
10) The joints shall be grouted firmly with white cement paste with the help of steel trowel.
11) The entire work shall be cured for 7 days by ponding.
12) After curing period is over, china mosaic shall be cleaned with water & rubbing by plastic brush to remove the dirt, excess cement etc
13) The surface shall then be cleaned with water and very-very mild oxalic acid

3.0 Mode of measurement and payement:

1) The rate shall be for a unit of one sqm and shall be measured wall to wall in plan. No extra measurement shall be given for rounding off upto 15cm.

9.17.a Providing & laying approved quality white (light and/or dark green Ambaji or of approved origin) marble 18 mm. thick, as per design and in required sizes and shapes (size not exceeding 0.6 x 0.6 m.), including necessary cement mortar bedding of 1:3 proportion and white cement pointing in joints, semi mirror polishing, curing etc. complete. (Only finished marble work shall be measured). The work will be carried out in diagonal pattern with motifs (with inlays) as per detailed drawings and direction.

1.0 Materials : Water shall conform to M-1.. Cement mortar shall conform to M-11. Marble slab 20 mm. thick shall conform to M-51.

Marble slabs shall be of the best Indian marble of white or other approved colour as specified in the item. They shall be hard, dense, uniform and homogeneous in texture. They shall have crystalline grain and shall be free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface and edges shall be machine-cut, true to square. The rear face shall be rough enough to provide a key for the mortar.

No slab shall be thinner than the specified thickness at its thinnest part. The sizes of the slabs shall be as specified in the respective items.

2.0 Workmanship :

2.1 **Dressing of slabs :** Every shall be cut to the required size and fine chiselled, dressed to give a smooth and even surface on all sides, to the full depth. A straight edge laid along the sides of the slab shall be fully in contact with it. Chisel dressing shall also be done on the top surface to remove any waviness. The sides and top surface of the marble slabs shall be machine rubbed or table rubbed with coarse sand before using. All angles and edges of slabs shall be truly square and free from chipping.

2.2 The thickness of the slab shall be 18 mm. The allowable tolerance shall be 2 mm. The tolerance shall be 15 mm. in length and breadth.

2.3 **Bedding :** Bedding of marble slabs shall either be in cement mortar 1:3 (1 cement : 3 coarse sand) of average thickness 35 mm. as given in description of the item. Minimum thickness at any place shall not be less than 20 mm.

2.4 **Laying :** The surface of 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 marble slab. The slab shall be washed clean before laying. It shall be laid on top, pressed and tapped gently to bring it in level with other slabs. It shall then be lifted and laid aside. The 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 and over this surface, white cement slurry of honey-like consistency at 4.4 Kg.cement/$m^{2.}$ is spread. The edges of slabs already paved shall be buttered with white cement. The slab shall then be gently placed in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slab. The joints shall be as fine as possible. Surplus cement on the surface of the slabs shall be removed. The slab fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster, skirting or dado. The junction between the walls and floors shall be finished neatly. The finished surface shall be true to level and slopes as directed.

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

2.6 **Polishing and finishing :** Unevenness at the meeting edges of slab shall be removed by fine chiselling. Finishing etc. shall be done as per relevant specifications of item no. 9.08.a of terrazzo tiles flooring except that cement slurry

with/or without pigments shall be applied on the surface before each polishing.

3.0 Mode of Measurements and Payment :

3.1 Marble flooring with various kinds of marble shall be measured in m^2. The length and breadth shall be measured between the finished face of skirting or dado or wall plaster. No deduction shall be made nor extra shall be paid for any openings in the floor of area upto 0.05 m^2. Nothing extra shall be paid for laying at different levels in the same room. Treads and steps of stairs paved with marble slabs shall also be measured under this flooring.

3.2 The rate shall be considered as per the relevant specifications of item no. 9.08.a. The rate shall be for an unit of one m^2.

9.17.b Providing & laying approved quality green (dark green Baroda or of approved origin) marble 18 mm. thick, as per design and in required sizes and shapes (size not exceeding 0.6 m. x 0.6 m.), including necessary cement mortar bedding of 1:3 proportion and white cement pointing in joints, polishing, curing etc. complete. (Only finished marble work shall be measured). The work will be carried out in diagonal pattern with motives and to form bands as per detailed drawings and direction.

1.0 Materials, Workmanship, Mode of Measurement : The relevant specification of item no. 9.17.a shall be followed same except that green marble shall be used, as specified in the item.

9.17.c Providing & laying approved quality green (dark Baroda kesariyaji green or of approved origin) marble 18 mm. thick, as per design and in required sizes and shapes (size not exceeding 0.6 m. x 0.6 m.), including necessary cement mortar bedding of 1:3 proportion and white cement pointing in joints, polishing, curing etc. complete. (Only finished marble work shall be measured). The work will be carried out in diagonal pattern with motives and to form bands as per detailed drawings and direction.

1.0 Materials, Workmanship, Mode of Measurement : The relevant specification of item no. 9.17.a shall be followed same except that green marble shall be used, as specified in the item.

9.18 Extra for providing special mirror finish polish on kotah and marble flooring over normal polishing using synthetic carborandum stone of grade 120,220,400,600,1200 and 5x, polishing in six stages and final finishing with 2000 grit, tin oxide and felt pads. All work to be carried out with polishing machine with vibration free rubber lined mounting wheels.

The relevant specification of polishing of item no. 9.08.a shall be followed except that the mirror polished finish shall be obtained as specified in the item, using the specified emery.

9.19.a Providing & laying, machine cut single polished red "Dholpur" 30 mm. Thick, 550 mm x 550 mm and 550 mm x 850 mm in flooring, as per design and drawing (with or without grooves) in cement mortar 1:6 bedding of average 35 mm thickness, pointing with pigment and white cement in joints or grooves, curing etc. complete. The rate shall also include for normal polishing (without scratches and marks of emries) with different grade of emery, filling of grooves with 1:1 cement sand mortar etc. complete. The work shall be carried out as per the approval of architect and engineer-in-charge.

1.0 Material: Dholpur shall conform to M-50 and shall be single polished red Dholpur (sandstone) of 30 mm. thickness. The relevant specification of item no 9.08.a shall be followed same.

2.0 Mode of Measurement & Payment: The rate shall be paid on m^2. basis for visible work done, alongwith the relevant specifications of item no. 9.08.a.

9.19.b Providing & laying, dressed single polished white "Dholpur" 30 mm. thick in flooring as per design and drawing (with or without grooves), in mortar 1:6 bedding of 35 mm thickness, pointing with pigment and white cement in joints or grooves, curing etc. complete. The rate should also include for normal polishing (without scratches and marks of emries) with different grades of emery, filling of grooves with 1:1 cement sand mortar etc. complete. The work shall be carried out as per the approval of architect and engineer-in-charge.

The relevant specification of item no.9.19.a shall be followed except that White Dholpur shall be used and the sample shall be approved by the architect and engineer-in-charge.

9.19.c Providing & laying, dressed single polished pinkish "Bansipahadpur" 30 mm. thick in flooring of required sizes as per design and drawing (with or without grooves), in mortar 1:6 bedding of 35 mm thickness,

pointing with pigment and white cement in joints or grooves, curing etc. complete. The rate should also include for normal polishing (without scratches and marks of emries) with different grades of emery, filling of grooves with 1:1 cement sand mortar etc. complete. The work shall be carried out as per the approval of architect and engineer-in-charge.

The relevant specification of item no.9.19.a shall be followed except that pinkish bansipahadpur shall be used and the sample shall be approved by the architect and engineer-in-charge.

9.19.d **Providing & laying, dressed single polished "AGRA RED" 30 mm. thick of approved size in flooring as per design and drawing (with or without grooves), in mortar 1:6 bedding of 35 mm thickness, pointing with pigment and white cement in joints or grooves, curing etc. complete. The rate should also include for normal polishing (without scratches and marks of emries) with different grades of emery, filling of grooves with 1:1 cement sand mortar etc. complete. The work shall be carried out as per the approval of architect and engineer-in-charge.**

The relevant specification of item no.9.19.a shall be followed except that Agra Red shall be used and the sample shall be approved by the architect and engineer-in-charge.

9.19.e **Extra for river finish treatment on Dholpur stone (including acid wash treatment or acid etching treatment).**

9.20.a **Providing and fixing in position, 25 to 38 mm. thick acid and alkali resisting Red Mandana stone of approved size and shape, for flooring, skirting and dado, including two coats of acid and alkali preventive primer, fixing on average 37 mm. thick cement mortar bedding 1:3 (1 part of cement and 3 part of coarse sand) with acid proof powder, keeping the joints 6 mm. to 10 mm. wide all around and filling the same with epoxy resin and hardner, including hand/machine polishing, wax polishing etc. complete, as directed.**

The relevant specification of item no. 9.08a shall be followed except that Red mandana stone shall be used instead of kotah as specified in the item. Approved quality of acid and alkali preventing primer shall be applied uniformly in two coats over the slab or concrete surface on which the flooring is to be laid. Acid-alkali proof powder shall be mixed with cement as per the manufacturer's specifications, to prepare the cement mortar for bedding. The cement-powder mix and sand shall be mixed in the proportion of 1:3 and the mortar shall be prepared. The stones of desired size shall be laid on the mortar bed of thickness 35 mm. for flooring and 15-20 mm. for dado/skirting, in proper line and level with joints of even thickness of 6 to 8 mm., all around.

The joints shall then be raked to 10 to 12 mm. deep and filled with epoxy-based resin. The resin shall be mixed with quick drier and acid-alkali proof powder. The stones shall be either hand polished or machine polished and cleaned with oxalic acid and then wax polished.

9.20.b **Reduction in item no 9.20.a for not providing and filling in position epoxy resin all around the joints.**

Relevant specification fo 9.20.a shall be followed except that the flooring shall be laid without groove. The rate shall be as per item no 9.20.a but after deducting the cost of providing and filling epoxy resin and hardner in the groove.

9.21 **Providing & laying, hand dressed or machine cut single polished Jesalmer yellow, 18 mm. thick in flooring and shapes (size not exceeding 0.6 x 0.6 m.), as per design and drawing, in mortar 1:3 bedding and pointing in joints in white cement with pigment, curing etc. complete. The rate should also include for semi mirror polishing with different grades of emery, daily moping with water etc. complete. The work will be carried out in diagonal pattern with motifs(with inlays) as per detailed drawings and direction.**

The relevant specification of item no.9.17.a shall be followed except that Jesalmer yellow shall be used.

9.22.a **Providing & laying approved quality mirror finished light and/or dark grey, black or brown granite of approved shade, thickness 18 mm., in floor, otta, sill, skirting, dado etc. in required sizes (not exceeding 1.2 m. x .6 m.) and shapes, including necessary cement mortar bedding in 1:2. (Only finished granite work shall be measured). The rate includes rounding, champhering and mirror polishing of edges.**

The relevant specification of item no. 9.17.a except that light and/or dark grey, brown or black granite shall be used instead of marble as specified in item. The finishing shall be mirror finish. The bedding shall be in CM 1:2 with grey cement. Granite shall conform to M-52.

9.22.a.1 **Extra charges over and above the rate quoted for the itmem no 9.22.a for giving flame finish and riverwash treatment to granite as approved by Architect / EIC.**

9.22.b **Providing & laying average 20 mm thk. Flame finish granite (lakha red) of approved quality, selected and sorted for uniform colour in floor, otta, sill, skirting, dado etc. in required size (not exceeding 1.2 m. x .6 m.) and as per drawings, including C.M 1:6 bedding of 35mm thk., joints & pointing as specified or directed by engineer in charge.**

The relevant specification of item no. 9.17.a except that light and/or dark grey, brown or black granite shall be used instead of marble as specified in item. The finishing shall be mirror finish. The bedding shall be in CM 1:2 with grey cement. Granite shall conform to M-52.

9.23 **Providing and laying chequered terrazzo tiles 25 mm. thick with marble chips of sizes upto 6 mm., for floors, on 35 mm. thick bed of CM 1:6, jointed with neat cement slurry mixed with pigment to match the shade of the tiles, including rubbing and normal polishing with different grades of emries and cleaning etc. complete. (Dark shade tiles using ordinary cement) as approved by Architects & Engineer in- charge. The sizes which can be used are-**

A) 250 mm x 250 mm
B) 300 mm x300 mm

1.0 **Materials & Workmanship:** The relevant specifications of item no. 9.01.a shall be followed except that chequered tiles or dark shade tile using ordinary cement shall be used.

2.0 **Mode of Measurements and Payment:** The relevant specifications of item no. 9.01.a shall be followed. The rate shall be for an unit of one m^2.

9.24 **Providing and fixing cobbler stone manufactured by Designer Paving and tiles Pvt. Ltd., Bangalore or equivalent, as per design and drawing, with 50 mm coarse sand bedding over compacted sub-base (in required slope and of specified thickness), sample to be approved by the Architect & Engineer-in-charge and site engineer. The rate shall be inclusive of the following.**

1) **50 mm thick coarse sand shall be laid as cushioning layer for arranging the cobbler stone. Joints of the cobbler stone shall be filled with the sand**
2) **The cobbler stone shall be laid properly on the prepared sub-base as per manufacturer's specification and as per Architect and Engineer-in-charge's instruction.**

The relevant specifications of roadwork shall be used for preparing the sub grade. The relevant specifications of item no. 9.08.a shall be followed for laying cobbler stones.

9.25 **Providing and laying Chequered tiles/Super rock tiles for external paving such as pavements, garages, pathways, swimming pools, decks, compounds etc of, of approved make such as Super tiles and marbles pvt ltd or equivalent. Bedding with CM 1:6 of thickness 35 mm, including pointing of joints with white cement and approved colour pigment (if required), finishing, curing as per drawing etc complete, and sample shall be approved by architect and engineer-in-charge.**

Sizes

a) **Super chequered tiles 250 mm x 250 mm – 25 mm thick**
b) **Super chequered tiles 300 mm x 300 mm – 30 mm thick**
c) **Super chequered tiles 400 mm x 400 mm – 35 mm thick**
d) **Super tera rock glossy tiles –25 mm thick**
e) **Super terra rock tiles 400 x 400 mm – 40 mm thick**

Materials: Water shall conform to M-1. Cement mortar shall conform to M-11. Chequered tiles shall confirm to **IS code 13801-1993** specifications. **Test results for compressive strength and abrasion value shall be submitted and should meet with required IS code**.

The relevant specifications of 9.01.a shall be followed

9.26 **Providing and laying shot blasted interlocking/ Non- interlocking Colored paver blocks of high density 60 mm thick M-40 grade for footpath, parking areas, service lanes and other areas as mentioned in the drawing. Including providing and laying 50 to 80 mm thick average bedding layer of coarse sand below paver block as per required grading and specification. Laid paver block shall be mechanically compacted. The work of the paving blocks shall be executed in line and level by skilled mason of flooring work only. It should be laid in such a way that the no cutting of the paver block to be necessary. Cutting of paver block**

by machine cut only and laying to be done by skilled flooring mason. The Finished surface of the Paver Block shall have Coarse Sand Texture Finish. Paver blocks shall be compacted and shall be re-laid if necessary.

1.0 **Material & workmanship** :
Paver block – of approved make, shade and size
50 mm to 80 mm thick average coarse sand shall be laid as cushioning layer for arranging the paver blocks. Joints of the paver blocks shall be filled with the sand

1.1 **The paver blocks shall be laid properly on the prepared sub-base as per manufacturer's specification and as per Architect and Engineer-in-charge's instruction.**

1.1 The strength of the blocks shall be not less than
For M 35 – 45 mm thick
For M 40 – 60 mm thick
For M 50 – 80 mm thick

1.2 The variation in thickness shall not be less than ± 3 mm. Any undulations shall be levelled by the plate compactor or removing and relaying the same.

1.3 The average abrasion value of the same shall not be more than 2.00mm & for individual shall not vary more than 2.5mm. The water absorption shall not be more than 5.%

1.4 M40 Blocks shall be abrasion resistant for medium traffic of pedestrians & vehicles.

1.5 The blocks shall be laid in coarse sand bedding as per drawing & to the gradient in line & level .

Mode of Measurement –

3.1 The rate shall be in sq mts. Clear visible area shall be measured and paid without wastage.

3.2 The rate shall be inclusive of cutting with cutting machine & filing the grooves between Blocks & curbing/wall as per sample approved etc complete.

9.27 **Providing and laying brick-on-edge flooring, laid dry, grouted with CM 1:6 (1 cement : 6 coarse sand), including finishing the joints and flush pointing, curing as per drawing etc. complete, and sample shall be approved by architect and engineer-in-charge.**

1.0 **Materials :** Water shall conform to M-1. Cement mortar shall conform to M-11. Burnt brick shall conform to M-15.

2.0 **Workmanship :**

2.1 The flooring shall be laid on concrete sub-grade where so provided. The slope in the floor shall be provided in the sub-grade. Where sub-grade is not provided, the earth below shall be properly slopped, watered, rammed and consolidated. Before laying the flooring, it shall be moistened. Plinth masonry offsets shall be depressed so as to allow the sub-grade concrete to rest on it.

2.2 **Laying :** The brick shall be laid in plain, diagonal, herring bond or any other pattern as directed by the Architect and Engineer-in-charge. The brick shall be dry, laid properly and set home by gentle tapping. On completion of a portion of flooring, the vertical joints shall be grouted with CM 1:6 and all joints shall be finished flush. The joints shall be as fine as possible and not exceeding 10mm thickness. These joints shall be filled with cement mortar 1:6.The bricks shall be cleaned after grouting cement mortar with water and red colour brickbat.

2.3 **Curing :** The brick paving shall be cured for 7 days.

3.0 **Mode of Measurements and Payment :**

3.1 The length and breadth shall be measured correct to a centimeter between skirting, dado or wall plaster. No deductions shall be made nor extra paid for any opening upto 0.1 $m^{2.}$ in area in the floor. Nothing extra shall be paid for laying the floors at different levels in the same room or courtyard.

3.2 The rate shall be for an unit of one m^2.

9.28 **Providing and fixing upto 900 mm x 600 mm partitions of marble/mirror polished granite/polished green kotah stone, in walls in CM 1:2, including making zaris 25 mm. deep, fixing and making good all around and both side mirror polishing to marble/kotah stone, complete as per drawing and directed by engineer and architect. The rate includes rounding, champhering and polishing of edges.**

a) Marble
b) Polished green kotah stone
c) Mirror polished granite

1.0 **Materials :**

Water shall conform to M-1. Cement mortar shall conform to M-11. relevant stones specification shall be followed.

Marble slabs shall be of the best Indian marble of white or other approved colour as specified in the item. They shall be hard, dense, uniform and homogeneous in texture. They shall have crystalline grain and free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface on both sides and edges machine cut true to square or any other shape desired.

No slab shall be thinner than the specified thickness at its thinnest part. The sizes of the slabs shall be as specified in the respective items.

2.0 **Workmanship:**

2.1 **Dressing of slabs :** Every shall be cut to required size and fine chisel dressed to give a smooth and even surface on all sides to the full depth. Chisel dressing shall also be done on both the surfaces to remove any waviness. The sides and top and bottom surfaces of marble slabs shall be machine rubbed or table rubbed with coarse sand before using. All angles and edges of slabs shall be true, square and free from chipping.

2.2 The thickness of shall be 20 mm. The allowable tolerance shall be 2 mm. allowable. The tolerance shall be 15 mm. in length and breadth.

2.3 **Fixing:** A minimum 25 mm. deep zari shall be made in the wall where the partition is to be fitted. The thickness of the zari will be slightly more than the thickness of the marble slab. The zari shall be cleaned and well watered before grouting in the CM 1:2. The marble slab shall then be pushed in firmly in true plumb. All the excess mortar shall be pressed into the sides as much as possible before flushing the junction. After the mortar has harden a little, the joint at the junction of the wall and marble slab shall be raked and pointed with white or pigmented neat cement slurry, to match the colour of the partition slab.

2.4 **Curing :** Curing shall be done for atleast 7 days.

2.5 **Polishing :** Hand polishing shall be done after the curing period to give a good polished appearance.

3.0 **Mode of Measurements and Payment :**

3.1 The rate shall be for an unit of m^2. and clear visible area shall be measured.

3.2 The rate shall include for all materials, labour and sundry involved in operation of the above specified item.

9.29 **Providing and laying in position, SHON tiles of first quality approved make and colours(one or more colours) for plain and sloped/curved surfaces, as per design, after applying cement slurry (3.3 kg. cement/m^2.) over wired plaster with minimum 5 mm. thick cement mortar(cement with fine sand) 1:1 bedding and laid in line and level in dado. Finishing shall be done by tampering the tiles for bringing mortar cream up to surface. Flush pointing in white cement and pigment with residue and skirting, including curing and cleaning with oxalic, as shown and specified etc. complete, shall be done as directed by Architects and Engineer-in-charge.**

The relevant specification of item no. 9.05 shall be followed except that shon tiles are to be used. The shon tiles shall be of approved colour, size and manufacturer and the dado shall not be polished but cleaned with water and oxalic acid.

9.30 **Providing and laying in position, SHON tiles, of approved make and colours (one or more colours), for plain and sloped/curved surfaces, of first quality as per design, set in cement slurry (3.3 kg. cement/m^2.) over a**

minimum 25 mm. thick cement mortar 1:3 bedding and laid to proper slope and level in flooring or terraces. Finishing shall be done with flush pointing in white cement and pigment with residue and skirting, including tampering, curing, rounding of junctions and extending them upto 15 cm and cleaning with oxalic as shown and specified etc. complete, as directed by Architects and Engineer-in-charge.

The relevant specification of item no. 9.06 shall be followed except that shon tiles are to be used. The shon tiles shall be of approved colour, size and manufacturer and the floor shall not be polished but cleaned with water & oxalic acid acid.

9.31 **Providing and laying in position grill having thickness upto 50 mm. made out of sandstone like Bansipahadpur, Hindon or Karoli, having colour pink, white or red as specified, having size not more than 1.5 m. x 0.6 m., of any pattern and design as approved by the Architect and Engineer-in-charge. The same shall be fixed with white cement, Araldite and coloured pigment in required proportion with necessary scaffolding and finishing at all heights with necessary scaffolding and curing etc. complete.**

1.0 **Materials :** Sandstone grills shall conform to M-89. Dholpur (Sandstone) shall conform to M-50. Cement mortar shall conform to M-11.

The grill having a size not more than 1.5 m. to 0.6 m. shall be carved from sandstone upto 50 mm. thick. The grill shall have uniform colour and thickness. The carving shall be done as per detailed design, drawing and direction of the Architect and Engineer-in-charge. The sandstone shall be like Bansipahadpur, Hindon or Karoli red as approved by the Architect and Engineer-in-charge.

2.0 **Workmanship and Mode of Measurements and Payment :** The relevant specification of item no. 2.09.d.1 shall be followed except that white cement shall be used instead of grey cement. The grill shall be fixed in position by using white cement, colour pigment and araldite in required proportion.

The engraving shall be done on approved in design of approved pattern. The work shall be done in best workman-like manner and very neatly.

This includes necessary scaffolding, finishing at all heights required for satisfactory completion of work.

The rate shall be for an unit of one m^2. of actual area of grill provided without any tolerance.

9.32.a **Providing and laying PVC/Vinyl flooring of 2 mm thickness, using Wonderfloor vinyl flooring, Indag vinyl floor tiles, LG vinyl tiles, Classic vinyl flooring or equivalent, as approved by the Architect, in desired pattern and design, in required shade and finish, with proper rubber based adhesive solution, such as Dunlop S-758 , pidilite SR or equivalent. The rate includes making seamless joints and cleaning the flooring etc. complete, as directed.**

1.0 **Material :** PVC/Vinyl flooring/floor tiles shall conform to M-53. The adhesive solution shall be rubber based, such as Dunlop S-758 , pidilite SR or equivalent.

2.0 **Workmanship :**

2.1 The sub-grade shall be even, hard, cleaned and well dried, before the commencement of laying, so as to provide good adhesion.

2.2 A coat of approved base binding agent, a rubber based adhesive solution of thickness as specified by the Manufacturer, shall then be spread evenly over the bedding/subgrade. The tiles/roll shall be then fixed to the floor, in the pattern and colour arrangement indicated in the Architect's drawing or as instructed by the Engineer-in-charge. The joints shall be jointed with the same adhesive solution. After allowing it to become sufficiently dry, the tiles/roll shall be pressed down with even pressure until it adheres well to the bed material. During application of pressure, if the adhesive solution rises from the joints, it shall be removed. Thermo welding with vinyl chord or cold sealant welding ensures seamless waterproof surface. The flooring shall be laid in accordance with approved manufacturer's directions.

2.3 The floor shall be cleaned with the tile finish wax and polished with muslin cloth, to the satisfaction of the Engineer-in-charge. The flooring shall be inspected after 30 days for any adjustments, repairs or replacement.

3.0 **Mode of Measurements and Payment :**

3.1 The clear visible area of work done, flooring, skirting and dado, shall be measured and paid. The rate shall include all materials, labour, tools,wastage and equipments etc. required for satisfactory completion of the item.

3.2 The rate shall be for an unit of one m^2.

9.32.b **Providing and fixing 3.5mm thk., 2m wide in roll form Artoleum graphic monolithic floor to be laid & fixed over the leveled surface strictly as per manufacturers specification. Method & materials for joining the artoleum sheets are to be fusion welded and should not appear visually, requisite levelling course for fine leveling is to be provided as per manufacturer specification. All the characteristic of product should match with manufacturer specification; equivalent product subject to Engineer approval and matching the artoleum specification can be used. Adhesive to be used subjected to manufacturers recommendation should only to be used. Before procurement sample of the product is to be approved by Engineer.**

The relevant specification of item no.9.32.b shall be followed except that artoleum graphic monolithic floor to be used.

9.33 **Providing and laying, Sintered tiles from Kera or equivalent, as approved by the Architect, in desired pattern and design, in required size and shade, including bedding of CM 1:3 or bitumen as the requirement is, pointing, jointing, cleaning etc. complete, as directed.**

1.0 **Material :** Sintered tiles shall conform to M-61. Cement mortar shall conform to M-11. Bitumen shall be as per the tile manufacturer's instruction.

2.0 **Workmanship :** Over a clean, dry and levelled surface, provide 16 to 20 mm. thick bedding of CM 1:3 mix, in case the tiles are to be laid in laboratory buildings, on heavy duty factory floors, work shops or in dado. Over this the tiles are laid with a closed joint or joint of 1 to 2 mm. In case, the tiles are to be laid in battery rooms, water and effluent treatment plants, chemical storage tanks. acid pits etc., then 2 coats of bitumen primer shall be provided as a bedding, over which 6 mm. thick bitumen mastic mortar bedding, topped with 6 mm. thick acid resistant silicate mortar bedding is provided. Over this the tiles are laid leaving a minimum joint of 5 mm. between the tiles.

Pointing shall be done, flush in neat cement slurry, in case the bedding is of CM 1:3 and using resin based Epoxy mortar/CNSL, resin mortar/sulphur mortar as per the requirement.

3.0 **Mode of Measurements and Payment:** The clear visible area of work done shall be measured and paid. The rate shall be for an unit of one m^2.

9.34 **Providing & grouting in joints of vitrified /ceramic tiles with polymer based coloured cement grouts of BAL or equivalent upto 3-5 mm thickness and depth as per supplier's specification. The grouting material shall be approved by architect and engineer-in-charge before usage.**

Workmanship:
The grouting material shall be filled only after proper cleaning of the grooves, which are to be grouted.
The grouting of the grooves shall be carried out as per the supplier's specifications. On completion of the work the cleaning shall be done properly to have a neat finished surface.

Mode of Measurement:
The work shall be measured and paid on sqm basis.

9.35 **Providing & grouting in joints of vitrified /ceramic tiles with epoxy resin and hardner of approved colour and make like ceba or equivalent. The thickness should be minimum 6 mm x 6 mm. The grouting material shall be approved by architect and engineer-in-charge before usage.**

Workmanship:
The grouting material shall be filled when the grooves are completely dry and only after proper cleaning of the grooves.
The grouting of the grooves shall be carried out as per the supplier's specifications with usage of non-adhesive abro tapes on the side of edges of the grooves. On completion of the work the cleaning shall be done properly to have a neat finished surface.

Mode of Measurement:
The work shall be measured and paid on sqm basis.

9.36 **Providing and fixing glazed /ceramic / vitrified tiles in dado with polymer based adhesives like BAL instead of grey cement sand mortar over smooth mala finish plaster in place of wired plaster. The material and workmanship shall be carried out as per the supplier's specifications and approved by architect and engineer-in-charge.**

The relevant specification of 9.05 shall be followed except that mala plaster shall be done in place of wired plaster and the approved adhesive shall be used instead of cement sand mortar.

9.37.a **Providing and fixing of fully polished vitrified floor tiles like Granamite or equivalent, in floor and dado , in desired colour and size, as approved by Engineer-in-charge, scratch hardness, minimum 7 on Moh's scale with a density of 2.2 to 2.3, and bonding strength of 250 kg/sqcm. also chemical resistance should be meet ASTM & DIN Standards as per manufacturer's specifications. The tiles shall be fixed with Adhesive mortar like bal endura, proportion and application is to worked out as per the manufacturers specification etc. complete.**

The relevant specification of 9.06 shall be followed except that the approved adhesive shall be used instead of cement sand mortar.

9.37.b **Providing and fixing un polished vitrified floor tiles like Granamite or equivalent, in floor and dado, in desired colour and size, as approved by Engineer and Engineer-in-charge, scratch hardness, minimum 7 on Moh's scale with a density of 2.2 to 2.3, and bonding strength of 250 kg/sqcm. Also chemical resistance should be meet ASTM & DIN Standards as per manufacturer's specifications. The tiles shall be fixed with Adhesive mortar like bal endura, proportion and application is to worked out as per the manufacturers specification etc. complete.**

The relevant specification of 9.06 shall be followed except that the approved adhesive shall be used instead of cement sand mortar.

9.38 **Providing & laying broken white china mosaic flooring for plain and curved surfaces, comprising of 12 mm to 20 mm. size broken pieces of glazed tiles (one or more colours, as directed), laid over cement mortar 1:6 bedding including applying cement slurry at the rate of 2.75 kg per sq.m. , on plain or sloped surfaces. And filling joints with white cement. The flooring shall be tampered to bring the mortar cream up to the surface, including rounding of the junctions and extending them upto 15 cm. along the parapet wall. The rate shall include bands, if different colour is used, any pattern or design as per drawing and direction, curing, cleaning with water and oxalic acid, etc. complete.**

1.0 **Materials:**

Water shall conform to M-1. Cement mortar shall conform to M-11. China mosaic shall be from white glazed tiles of rejected quality or from broken pieces of white glazed tiles. White cement shall conform to M-4.

2.0 **Workmanship:**

2.01 The size of the broken pieces of white glazed tiles shall not be more than 12-20mm.Triangular china mosaic pieces shall not be used. Rectangular or square pieces shall only be used. The broken pieces shall be soaked in water for 24 hr before using.

2.02 The sub-grade shall be cleaned, wetted and mopped. The cement slurry @2.75kg/sqm (with polymer based waterproofing compound) shall be applied on the sub-grade evenly. The bedding (average 25mm) shall then be laid evenly over the surface in CM 1:6 in the desired slope as mentioned in the drawing. The bedding shall be tamped and corrected to desired level with wooden patti. The bedding shall be allowed to harden enough to offer a rigid cushion to the tile pieces and to enable the mason to place wooden planks across and squat on it.

2.03 The broken china pieces are laid manually as close as possible over the specified bedding (before it sets/ gets hard), which shall be laid to the required slope and gradient. While laying the broken glazed tiles, neat cement paste shall be applied over the bedding.

2.04 After china mosaic is arranged, the entire surface shall be tampered by wooden piece with a wooden mallet so that tile piece are properly embedded and leveled in the mortar and slurry starts oozing from the joints.

2.05 Vatta shall be done along with the floor, keeping machine cut edges at the top end of the vatta.

2.06 At the end of day's work, the entire work shall be cleaned with the minimum quantity of water and moped with the

cotton cloth. The joints shall be grouted firmly with white cement paste with the help of steel trowel.

2.07 The surface shall be cured for 7 days by ponding. After curing period is over, china mosaic shall be cleaned with water & rubbing by plastic brush to remove the dirt, excess cement etc**. The surface shall then be cleaned with water and mild oxalic acid (NO ACID OTHER THAN OXALIC ACID SHALL BE USED).**

3.0 Mode of measurement and payment:

3.01 The rate shall be for a unit of one sqm and shall be measured wall to wall in plan. No extra measurement shall be given for rounding off upto 15cm. The rate of white cement is included in the item even if grey cement is supplied by the client.

9.39 Providing and fixing best quality glass mosaic like Bissaza or equivalent in walls as dado/floor in line, level and gradient at all levels and heights in any shape. Tiles of size 25mm x 25mm is to be fixed as per manufacturers recommendation. Shade, gradation etc. is to be approved by Engineer before procurement of glass mosaic tiles. Fixing of tiles through chemicals / bonding materials recommended by manufacturers and later filling up the joints with the help of white cement or as directed by manufacturers including necessary cleaning with oxalic acid, sample of material and pattern is to be approved by Engineer in-charge.

Workmanship:
The material shall be from Bissaza (I) Pvt. Ltd. or equivalent company. Sample of the tiles for shade and finish to be approved prior to procurement and after one sample of laying of tiles to be prepared for the approval prior to execution.

Mode of Measurement:
The work shall be measured and paid on sqm basis.

9.40 Providing and fixing homogenous wood floor of 14mm thk. Of Tarkett or equivalent to be used. Laminated wood floor will not be considered in this item. rate shall be inclusive of all the accessories like edge strip, joining strip, quarter strip , moulding strip etc. floor to be laid over the sound levelled, dry and clean floor, damp proof membrane and foam either of cellco or tarco or any other equivalent to be used underlayed.sample is to be approved by Engineer prior to procurement.. following two types

1) Flooring

Workmanship:
The material shall be from trakett floor with monolithic floor or equivalent company.. Laminated wooden floor should not be used. Sample for shade and finish to be approved prior to procurement and after one sample of laying of tiles to be prepared for the approval prior to execution.

Mode of Measurement:
The work shall be measured and paid on sqm basis.

2) Accessories: Skirting and Reducers

The material shall be from trakett floor with monolithic floor or equivalent company.. Laminated wooden floor should not be used. Sample for shade and finish to be approved prior to procurement and after one sample of laying of tiles to be prepared for the approval prior to execution.

Mode of Measurement:
The work shall be measured and paid on rmt basis.

9.41 Providing, Fixing & laying AMP based (with Crucifex) AMP safety surface recycled rubber tiles, of make REPHOUSE (playfex) or any other equivalent in exterior flooring, with desired colour, size & thickness of AMP 65 as approved by engineer in charge, tiles procured should comply with EN 1177 standard and should meet all the standards catered by the code. Rubber tiles procured should be fixed with the help of urethane based adhesive over firm concrete base, or strictly according to manufacturers instruction guidelines, before laying the tiles, surface should be neat, clean from dirt or other inert material. Requisite levelling course for fine leveling is to be provided as per manfacturers specification. All the characteristic of product should match with manufacturers specification, equivalent product subject to Engineer approval and matching the REPHOUSE specification can be used.

Workmanship:
The material shall be from Rephouse or equivalent company. Sample of the tiles for shade and finish to be approved

prior to procurement and after one sample of laying of tiles to be prepared for the approval prior to execution.

Mode of Measurement:
The work shall be measured and paid on sqm basis.

9.42 **Providing and fixing best quality American pine sleeper wood flooring from the sections size of 100 to 150 mm thick, 200 to 300 mm wide and upto 3.0 m. length. It should be properly planned and smooth but anti slippery surface finish. Fixing of the sleeper to be done with at least 150 mm inset in the concrete surface below it. At least three nos. brass bolts of 16 mm dia. full threaded to be fixed with counter sunk on top and it shall be sealed with similar wood piece fixed with araldite. Telpani finishing to be provided for weatherproofing. Only finished dimensions will be considered for the measurement.**

Workmanship:
The material shall be natural seasoned American pinewood free from knots and cracks. Sample of the wood full size for shade and finish to be approved prior to procurement and after one sample of laying of tiles to be prepared for the approval prior to execution.

Mode of Measurement:
The work shall be measured and paid on cum basis.

9.44 **Providing and laying cement concrete smooth finish floor 100 –150 mm. thick with M25 concrete including giving a floating coat of 1:1 cement mortar, with nominal temperature steel or steel fibres/Graded PP fibres/ Polyester fiber of Reliance etc. complete.as specified by the Architect/Engineer-in-charge.The rate shall be exclusive of reinforcement steel /Graded PP fibres/ Polyester fiber of Reliance and the same shall be paid in relevant tender items.Rate shall be inclusive of concrete (to be laid in alternate panels) with steel channel formwork.**

The relevant specifications of item no. 2.04 of civil section - 2.00 shall be followed. The rate shall be for an unit of one m^3.

9.45 **Extra for carrying out vaccum dewatering & Power floater treatment in floors, well compacted, mechanically vibrated, finished to required levels, floated with neat cement and power trowelled to get desired smooth finishing/broom finish, over a levelling course, including MS shuttering, curing for 10 days with gunny bags etc complete. The reinforcement for Tremix floor to be installed as shown shall be paid in relevent item. The suitable size of panel should be approximately 3.75 x 5.0 m or as directed by Engineer. The Construction joints to be formed at every 5m distance by grooving with mechanical saw within 48 hrs. Groove/sawed joints shall be made of 6mm width and 25 mm depth min (1/3 rd depth of the pavement) as shown in the drawing and shall be filled with same with grey color PU sealant 6mm X 8mm Minimum of Sikka or equivalent with PU baker rod of Supreme as a filler etc complete . The sawing operation should be carried out as soon as concrete is ready to accept the saw cut without trowelling etc as directed by Architect and Engineer-in-charge. The construction joint is formed by square edge and painted with bitumen. The rate shall be inclusive of labour, grooves, sealant and machinery cost.**

Material and Workmanship:

1.1 **General**
The Contractor shall improve the quality of all concrete floor slabs by placing the concrete according to the Trimix system as indicated on the drawings and as specified herein.

1.2 **Technical Assistance/Training of Labour**
During the placement of concrete, the Contractor shall have a minimum of one person present at all times who has been adequately trained by a representative of the equipment manufacturer. This person shall be experienced in the vacuum dewatering process, and in the operation of all related equipment and shall direct all concrete dewatering work performed. The Contractor shall provide the services of a representative from the manufacturer of the vacuum dewatering equipment on site for a period of time of at least eight (8) hours. The manufacturer's representative shall proved technical assistance for the vacuum dewatering process on the initial day of operation.

1.3 **Equipment for compacting, placing, vacuum processing and finishing of slab**
All process equipment to be used shall be of a design representative of the state of the art, and shall be subject to the approved of the engineer. Equipment shall be Trimix or approved equal. System shall have a

demonstrated five years history of performing such work. The vacuum pumps shall be able to generate a minimum vacuum of 609mm (24 inches) of mercury (0.80 atmospheres) in actual operation using the maximum number and size of suction mats required for this work.

The Contractor shall have at the job site sufficient equipment (vacuum pumps, mats, fitter pads and accessories) to ensure that the vacuum dewatering process continues uninterrupted to completion. Stand by equipment is sometimes required.

1.4 Mix Design

The Contractor is responsible for the mix designs of the class as called for on the drawings and must submit the mix proposed for use in the contract before any work is started. All mix parameters must conform to the values specified in Trimix recommendations and design mix report.

The Contractors shall utilise a knowledgeable and experienced concrete technician for the design and production of mix (mixes) meeting all the requirements of the specifications.

Do not deliver any concrete to the construction site until all the approvals have been obtained.

1.5 Quality Control

The Contractor has the responsibility for achieving the quality of concrete specified by controlling the concrete mixes, placing, vacuum process finishing and curing. The concrete technician in charge must be present at the site when work is in progress.

The Contractor shall be responsible for mix adjustments, performing necessary tests, correcting deficiencies and trouble shooting in general.

The Contractor shall be required to maintain control charts showing individual test results for aggregate gradation, slump, air content, cement content and compressive strength.

1.6 Planning of Placing

The Contractors shall submit for review shop drawings for floor slabs detailing the location of all construction joints and the sequence of the slab placement and manufacturer's literature describing the equipment to be used. In addition to the shop drawings, the Contractor shall indicate the quantity of each piece of dewatering equipment that will be located at the construction site and shall include the dimensions of all suction mats.

Before concreting is started the work should be planned with a view to determine areas to be placed daily, the required amount of equipment, size of vacuum mats, length of vacuum hoses, arrangement of rails, if any, or screeds etc. Crew required for the vacuum process is two men to handle the mats and the pump. Note that placing, vibration, vacuum treatment and floating follow immediately behind each other.

Check position of vacuum pump in relation to vacuum mat location to find whether extra vacuum hoses are required.

2.1 Concrete Materials

Note: All concrete mix design shall meet the requirements of this section and section TRIMIX concrete mix design recommendations.

2.1.1 Cement

Portland cement of normal grinding fineness, which corresponds to a specific surface of 2600-3500 cm2/g, is required. Cement of higher grinding fineness, e.g. rapid-hardened Portland cement of larger specific surface's shall be avoided especially in concrete mixes with a cement content 590 lb/sq.yd. Recommended content is 421 to 590 LB/sq.yd.

3.1 Equipment Specification Trimix System

Poker vibrator with high frequency preferably 335 hz (20 000 vibr/min) dia.1 to 1 1/2".

Surface vibrator type double beam with beam spacing 12".

Preferably one piece beam in full length exceeding bay width 8" to 24". Beam should easily be adjusted to absolute straightness and controlled every morning before placing of concrete starts.

Suction mat type RM 60. 100% tight plastic material weight 650 gram/m2. Width same as bay size and length 20' for capacity and flexibility.

Filter Pad type RD 12 weight 600 g/m2, width 4' length-bay width-minus 8".

Vacuum Pump P 4001 8 with 10 HP engine and specially designed pump unit with heavy duty chrome housing and sealing. Adjustable vacuum by valve on top of tank for ease of operation with different mix designs.

Skim floater type G 900/G 700 with disc which allows direct floating of dewatered concrete. Weight maximum 90kg (200 pounds) for 40"(W.disc.) Finishing is done with G 900, using blades only and is normally done with 30 minutes intervals between passes.

The above equipment specified should be used for the production of quality concrete floors according to the Trimix System. Inter-changeability of equipment is not recommended.

4.1 Execution Trimix System

4.1.1 General

The work shall be planned and executed so that there is no delay between the placement, screeding, dewatering and floating of the concrete. Concrete to be vacuum dewatered shall be handled and placed so as to prevent segregation. The concrete shall be internally vibrated prior to screeding.

4.1.2 Levelling

Immediately following placement, the concrete shall be levelled with a vibrating screeding running on a true surface, set at the proper elevation required to provide the specified finished elevation. The concrete surface shall be screeded high by 2% of the slab's thickness to compensation for the compaction caused by the vacuum dewatering process. (Slabs to have an aggregate hardener shall have compensation made to maintain elevation). The vibrating screed shall be moved forward as rapidly as proper consolidation allows. The proper surcharge of concrete must be maintained in front of the leading edge of the screed.

4.1.3 Vacuum

Immediately after levelling, the concrete shall be covered with filter pads and suction mats in strict accordance with the recommendation of the manufacturer to have the slab fully dewatered. The suction mat shall extend 4 inches beyond the edge of the filter pad on all sides. The pads shall extend to within 4" of the edge of concrete slab, and the mats shall cover entire slab. Before connecting the hose on the suction mat to the vacuum pump, the edges of the mat shall be smoothed to enable an airtight seal to be created. A vacuum shall then be applied to the mat. After a minute the gauge on the vacuum pump should indicate a minimum vacuum of 0.70 atmospheres (24.0 in. Hg) and if not, the mat must be checked for leakage. For concrete that dewaters readily the vacuum should then be maintained awt 0.70-0.80 atmospheres (24.0-25.5 in. Hg.) For concrete which dewaters less efficiently (e.g. air-entrained concrete) the vacuum shall then be reduced to 0.50-0.60 atmospheres (15.0-18.0 in. Hg). After approximately 10 minutes the vacuum can then be increased to 0.80 atmospheres.

The vacuum shall be maintained for at least 3 minutes per inch of concrete thickness at 0.80 atmospheres. (Where aggregate hardeners are specified, sufficient moisture shall be maintained to meet manufacturer's requirements). The suction mats and filter pads shall then be removed and moved to the next section in leapfrog manner.

Stop the vacuum dewatering when light footprints only are left in the concrete when stepped upon. A suitable suction time can also be checked with a Proctor-apparatus, which should show 1.5-2 kp/cm2.

4.1.4 Floating

Upon removal of the suction mats and filter pads the concrete surface shall be power-floated without delay until all imprints from the vacuum process are removed. If crusting occurs, the floating operation must be delayed till the concrete carries the machine.

The higher speed is recommended for the floading operation. Two passes with the floating disc should be made in the junction of two mats in order to avoid risk for cracking.

4.1.5 Finishing

The waiting time after the floating operation depends on concrete temperature and humidity and varies from 10 minutes to 2 hours.

The trowelling operation cannot take place before the concrete has hardened enough to carry the machine, i.e. the trowelling blades will not leave any marks on the concrete. Repeated trowelling. With intervals between the passes, which are adapted to the setting of the concrete, greatly improves the surface characteristics. The surface will be more wear resistant and less dusty.

At least two passes are recommended for floors, which are not to be covered.

4.1.6 Curing

Vacuum dewatered concrete should be cured like any other quality concrete in order to achieve a good final result with ponding.

5.0 Mode of measurement:

The item shall be measured and paid in sqm excluding cost of concrete & steel. The cost of steel & concrete shall be measured & paid separately under relevant items. Rate of shuttering with MS channels & cutting of grooves is inclusive. The cost of Joint filler shall included in the rate.

9.46 Providing & laying sandwich platform comprising of

1. Sandwich of 18 mm thk Granite of approved shade and sample on top and 25 mm thk polished kota in bottom with 30 mm thk screed of (1:2:4) in between

2. At centre vertical sandwich supports of 25 mm thk two kota stone on sides, screed (1:2:4) in between and at both end walls vertical supports of 18 mm thk granite.

3. 75 mm raised platform at bottom with kota on top and screed (1:2:4) at bottom, kota stone skirting as per design and approved sample.

The rate includes rounding, champhering and mirror polishing of edges, facias of granite, including necessary bonding adhesive (if required) of approved make or equivalent. Rate shall be also inclusive of making holes & cutouts for SS sink, Oval wash basin, Piller tap / Bib tap etc. as directed by engineer in charge. (Only finished single side granite work/ plan area of platform with facia shall be measured & paid for).

Relevant specifications shall be followed as per CPWD vol-1, clause no-8.1.3, 8.2, 8.3, 8.4, 8.5, 8.7 for stone, except type, color, size, thickness, pattern and finishing of stone shall be as per item description and Stones shall be laid over average 25mm thick cement mortar (1:4) in between b) At centre vertical sandwich supports of 30 mm thick two kota stone on sides and 20mm CM (1:4) in between and at both end walls vertical supports of 18 mm thick double side granite. c) 75 mm raised platform at bottom with kota on top and 50mm CM (1:4) at bottom, kota stone skirting as per design and approved sample. The rate includes rounding, champhering and mirror polishing of edges, facias of granite, MS support including necessary bonding adhesive (if required). Rate shall be also inclusive of making holes & cutouts for SS sink, Oval wash basin, Piller tap / Bib tap etc. as directed by engineer in charge but fixtures shall be paid in relevant tender items. (Only plan area shall be measured & paid for).

For kota stone Relevant specifications shall be followed as per item no. 9.08.a.
Rate shall be inclusive of bedding mortar, pigment, cutting with wire cut machine and all type of wastage.
Rate shall be for unit of One Sqm.

10.01 **Providing, fabricating, assembling, hoisting/ erecting and fixing in position at all heights/ all levels/ all floors/ all shapes & sizes with all leads & lifts using MS Rolled Steel Sections, Hollow/ Tubular sections, all type of sheet/ plate, Bright Bars, deep threaded MS bolts, threaded J bolts, insert plate, support plate etc as per drawing. all confirming to latest relevant IS codes for the work of steel structures like builtup section, staircases, railings, handrail, jali, gates, grills, bracings, grating, corner guard, platforms, brackets, monkey ladder, cattle trap, pipe rack, rungs, false ceiling frame work, Roof canopy, fencing posts, frame work for Screen/ facade etc. including straightening, cutting, bending, bolting and welding the members all as per structural drawings and as per detailed specifications (for materials & workmanship) including necessary scaffolding/ staging etc. complete in the situations described hereinafter and comprising of : i) Profile Cutting of components to required length/ width and shape/ profile; ii) Smooth grinding/ machining of edges/ faces/ all welding joints; iii) Necessary welding (electric arc welding) for required weld lengths and sizes. iv) Machine drilling of holes for joining/ anchoring (Standard measurements will be paid for as actual cut length used at site) The rate shall include dry sanding, degreasing (wet cleaning) & preparation of rustfree surface manually or mechanically, metal putty to make the surface even and smooth, 2 coat zinc chromate yellow oxide primer and 2 coat of enamel paint of approved shade of paint over all the surfaces of the steel sections or as specified in the drawing.**

Note: The contractor shall be submit fabrication drawings based on construction drawings (that may be issued during construction period) for approval by the Architect/ Engineer. The fabrication work shall start only after approval of the fabrication drawings submited by contractor. Any change required in the fabrication drawings shall be carried out at No extra cost. Fabrication shall be in a perfect architectural workmanship manner and as provided in section V & VI of IS 800 & IS 7215. Welding shall be carried out by qualified welders/ fabricators.It should also include the cost of necessary scaffolding/ staging, zinc coated nut-bolt as required for safety, structural stability of all works at site.

1.0 **Materials & Workmanship :**

1.1 Prior to fabrication, all rolled sections shall be cold straightened and freed from twists, wraps etc. Hot working shall be done only after prior permission of the Engineer-in-charge. The surface of the members to be welded shall even so that temporary fastening alignment should not allow passage of a 0.2mm. thick filler gauge more than 20mm. deep from the member's edge. All members shall be cut mechanically by saw or shear or by oxyacetylene flame.

1.2 Welding shall generally be done by electric process. Gas welding shall be restored to using oxyacetylene flame with specific approval. Gas welding shall not be permitted for structural steel work.

1.3 The work shall be done as shown in the shop drawings which should clearly indicate various details of the joints to be welded, shop and site welded as well as type of electrodes to be used. Symbol for welding on plans and shop drawing shall be according to I.S. 813-1961. As far as possible every effort shall be made to limit the welding that must be done after improper welding that is likely to be done due to heights and difficult position on scaffolding etc.

The welding work shall conform to I.S. 816-1969.

1.4 **Preparation of surface :** Surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. A coating of boiled linseed oil shall be permitted.

1.5 **Assembly for welding :** Before welding is commenced, the plates shall be first be brought together and firmly clamped or spot welded at specified distance. The temporary connection in form of tack welding, has to be strong enough to hold the plates accurately in place without displacement and shall be done keeping in view the finished dimensions of the structure.

1.6 **Precautions :** The operations connected with welding and cutting equipment shall conform to safety requirement given in I.S. 818-1968.

The following points shall be borne in mind during the process of welding :

(a) Welds shall be made in flat position wherever practicable.
(b) Arc length, voltage and amperage shall be suited to the thickness of material, type of groove and other circumstances of the work.
(c) The segments of welding shall be such that where possible, the members which offer the greatest resistance to compression are welded first.
(d) Proper care shall be taken while welding, for shrinkage and distortions, as the drawing dimensions are the finished dimensions of the structure.
(e) Cutting of plates shall be profile cut.
(f) Welding rod shall be of Ishab Corporation.
(g) The drilling is to be done with power drill or magnetic drill.

1.7 The defective welds which shall be considered harmful to the strength shall cut out and rewelded.

1.8 Finished welds and adjacent part shall be protected with clean boiled linseed oil and after all stag has been removed welds and adjacent parts shall be painted after the same are approved.

1.9 All the members shall be thoroughly cleaned of rust, cakes, dust etc. and given a priming coat of red lead paint before fixing them in position. All fabricated members shall be suitably packed to be protected from any damage while transportation, if any.

1.10 Grinding to the finished level is to be done, if directed by the Architects and Engineer in charge. All exposed weld shall be ground smooth. Welds which have not been ground shall be scrubbed with a 10% solution of Hydrochloric acid which shall be washed of with water before painting unless alkali resistant paint is used.

1.11 Erection in general, of the entire/part structure shall be carried out as per the requirement and approval of the Engineer-in-charge. Positioning and levelling of the structure, alignment and plumbing and fixing every member of the structure shall be in accordance with the relevant drawings and to the complete satisfaction of the Engineer-in-charge. The following checking and inspection shall be carried out before, during and after erection :
- Damages during transportation
- Accuracy of alignment of structures
- Erection according to drawings and relevant specifications
- Progress and workmanship

1.12 **Painting**

1.12.1 First priming coat of zinc chromate yellow oxide primer / PU primer is to be applied on the fresh steel arrived at site.

1.12.2 Once the cutting and fabrication is completed second coat of primer and first coat of synthetic enamel / PU paint (as per the manufacturer's recommended process - preferably light shade of the chosen color) is to be applied.

1.12.3 After paint has been already dried, erection is done as specified in the item or as directed by engineer-in-charge.

1.12.4 After the erection final coat or second coat of paint / PU paint is to be applied on the structural steel.

2.0 Mode of Measurement and Payment

2.1 All work shall be measured on the basis of finished dimensions, as fixed on site and measured net unless specified otherwise.

2.2 The weight of steel sections, steel strips in finished works shall be calculated from standard weight on the same basis on which steel is supplied to the Contractor by the Client or those given in relevant IS Codes, if steel is arranged by the contractor.

2.3 The weight of steel plates and strips shall be taken from relevant IS Codes, based on 7.85 kg/m² for every mm. sheet thickness, if steel is supplied by the Contractor, otherwise, the weight shall be calculated on the basis on which steel is supplied to the Contractor by the Client.

2.4 Unless otherwise specified weight of cleats, brackets, packing pieces, bolts, nuts, washers, distance pieces, separators, diaphragm gusset (taking over all square dimension) fish plates etc. shall be added to the weight of respective items.

2.5 In riveted work, allowance shall be made for weight of rivet heads. No deductions shall be made for rivet or bolt holes excluding holes for anchor or holding down bolts.

2.6 For forged steel and steel castings, weight shall be calculated on the basis of 7850 kg/m3

2.7 Unless otherwise specified an addition of 2.5% of the weight of structure shall be made for shop and site rivet heads in riveted steel structure.

2.8 Dimensions other than cross sections and thickness of plates shall be measured to nearest 0.001 m.

2.9 Mill tolerance shall be ignored when weight is determined by calculation.

2.10 Weight of only structural steel is considered and welding will not be considered in measurement.

2.11 The rate shall includes cost of all material, labour, erection, hoisting, scaffolding, safety measures and sundry required for proper completion of the item of work, at all heights. This shall also include conveyance and delivery, handling, loading, unloading and storing etc. required for completion the item described above including necessary wastage involved.

2.12 **The rate shall be for an unit of one Kg.**

10.02 **Structural steel work in riveted, bolted or welded in built up sections, trusses and framed work including supplying, fabricating, cutting, assembling, hoisting and fixing in position at all heights of all shapes and size with all leads and lifts for the work of sheds, canopy, trusses, space frame, cladding, skylight etc. It should be including necessary plates, rolled joists, channels, angles, tees, flats, square / rectangular / tubular hollow sections, position hip and jack lifters, purlins, etc. . confirming to latest IS 4923, IS 1161, IS 806 including cutting and welding the members as per detailed drawing and design. The rate shall include 2 coat of zinc chromate yellow oxide primer and 2 coats of synthetic enamel paint of approved make over all the surfaces of the steel sections. (Only standard measurements will be paid for as actual cut length used at site). Shop drawings for the connection details shall be prepared for the approval of the architect.**

Rate shall be inclusive of cutting, wastage, welding, bending (shop at site), bolting wherever necessary, in position welding of required length, grinding, finishing edges, filling the welded spots with metal putty. It should also include the cost of approved ISI make and size zinc coated nut-bolt and Anchor fasteners of Hilti or Fisher as approved by engineer-in-charge.

Contractor should submitted fabrications shop drawings for work involved based on construction drawings (that may be issued during construction period) for approval by Engineer-in-charge. The fabrication work shall start after approval by Architect of the fabrication drawings. Any change required in fabrication drawings shall be carried out at no extra cost over quoted rates. Fabrication works to be carried out as per relevant IS standards.

a **Plates, flats, angles, tees, channels, beams etc**
b **RHS and SHS**
c. **Tubular hollow sections**

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with rolled steel sections for the works as specified in the item.

10.03 **Structural steel work in riveted, bolted or welded in built up sections for Art trusses (indicative drawing is attached for reference only) and framed work including supplying, fabricating, profile cutting, assembling, hoisting and fixing in position using necessary hoisting machinery and equipments at all heights of all shapes and size with all leads and lifts It shall be including necessary plates, rolled joists, channels, angles, tees, flats, square / rectangular / tubular hollow sections, position hip and jack lifters, purlins, etc. confirming to latest IS 4923, IS 1161, IS 806 including wastage due to cut-outs, cutting and welding the members as per detailed drawing and design. The rate shall include 2 coat of zinc chromate yellow oxide primer and PU paint of as per the approved list to be applied as per the manufacturers recommended process over all the surfaces of the steel sections. (Only standard measurements will be paid for as actual cut length used at site). Shop drawings for the connection details shall be prepared for the approval of the architect.**

Rate shall be inclusive of cutting, wastage due to cut-outs, welding, bending (shop at site), bolting wherever necessary, in position welding of required length, grinding, finishing edges, filling the welded spots with metal putty. It should also include the cost of approved ISI make and size zinc coated nut-bolt and Anchor fasteners of Hilti or Fisher as approved by engineer-in-charge.

Contractor should submitted fabrications shop drawings for work involved based on construction drawings (that may be issued during construction period) for approval by Engineer-in-charge. The fabrication work shall start after approval by Architect of the fabrication drawings. Any change required in fabrication drawings shall be carried out at no extra cost over quoted rates. Fabrication works to be carried out as per relevant IS standards.

a **Plates, flats, angles, tees, channels, beams etc**
b **RHS and SHS**
c. **Tubular hollow sections**

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with rolled steel sections for the works as specified in the item.

10.04 **Providing and fixing weld mesh jali**

1.0 **Materials :** Weld mesh jali shall conform to M-34

2.0 **Workmanship :** The relevant specification of item 10.01 shall be followed except that the work of weld mesh jali shall be carried out as per detail drawings and instructions of Engineer-in-Charge and Architect. The MS Angles, MS Flats etc. shall be used as described in items. The rate also includes providing one coat of zinc chromate yellow oxide and two coats of enamel paint.

3.0 **Mode of measurement & payment:**
The rate shall be for unit of One sq.mt. Clear visible area of the shutter shall be measured.

10.05.a **Providing and fixing interlocking rolling shutters with push pull arrangement of approved make made of 80mm. wide M.S. Laths 18 gauge interlocked together through their entire length and jointed together at the end locks mounted on specially designed pipe shaft with bracket plates guide channels 10 gauge and out side locking with push-pull operation including the cost of Hood cover of 16 gauge and spring etc. complete. Guide rail shall be fixed to the wall with the help of continous angle of 25x25x4 mm and anchor fastners (Measurements considered for payments shall be clear size of opening plus guide channels on both the sides for width and 450mm on top for drum height.)**
a) with push and pull arrangement.
b) with mechanical device with a pair of handles.
c) shutter shall be partly grilled and partly panelled, and pull and push type.
d) shutter shall be partly grilled and partly panelled, mechanically operated with a pair of handles.

1.0 **Materials :** Rolling shutter shall conform to M-32, Enamel paint shall conform to M-44.

2.0 **Workmanship :** The top cover, spring, axles, tees, iron pulleys etc. shall be supported on strong MS / CI brackets which shall be fixed into the CC 1:2:4 of the lintel/beam as specified with rawl plugs, screws, bolts etc. The guide rails shall be fixed on to the sides of the opening as per the manufacturer's instructions. The lathe curtain (shutters) shall be laid on ground and the side-guide rails shall be bound with it with ropes etc. The shutter shall then be placed in position and top fixed with suspension shaft with bolts and nuts. The side-guide channels and the cover frame shall then be fixed to the walls through the plate welded to the guides. These plates and brackets shall be fixed by means of steel screw bolts and rawl plugs drilled in the wall. The plates and screw bolts shall be concealed in plaster to make their location invisible.

Fixing shall be done accurately so as to ensure easy and smooth operation of the shutter.

3.0 **Mode of measurement and payment :**

3.1 Measurement considered for payment shall be clear size of opening, between the jambs plus guide channels on both the sides for width and 450mm on top for drum height shall be added to the height of the opening, the clear distance between the sill and the soffit of the opening.

3.2 The rate shall include for all materials, its transportation at site, labour etc. involved in the operation described as above. It shall include for a primer coat and 2 coats of enamel paint.

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

10.05.b **Rolling Shutter**
Providing and fixing rolling shutters of approved make made of 80 mm wide M.S. laths inter-locked together through their entire length and jointed together at the ends by end locks mounted on pipe shaft with bracket plates, guide channels and arrangements for inside and outside locking with mechanical operation with handle including the cost of hood cover, bearing and spring etc. complete.
Shutters including 1 coat of epoxy or zinc rich primer and 2 coat of Hi-Gloss / Matt Finish PU Paint of approved make and shade over both surfaces of shutter including hood and guide channel etc. as directed

by Engineer in charge. Out to out dimension including guide channel andd hood cover shall be measured for payment.

Relevant specifications shall be followed as per CPWD clause No – 10.8 shall be followed except paint, size, finishing etc. shall be as specified in Item description.

The rate shall be unit of Sqm.
Rate shall be inclusive of epoxy primer and PU paint of approved make and shade on both side with guide channel and hood cover of rolling shutter.

Out to out dimension of shutter including guide channel and hood cover shall be measured for payment.

10.05.c **Providing and fixing in position, interlocking rolling shutter of approved make, of 18 gauge, 75mm wide cold rolled MS lath interlocked, including top cover, spring, axles, guide rails, tees, iron pulleys, bearings, handles, holding down bolts embedded in CC 1:2:4 including 1 coat of zinc chromate primer and 2 coats of synthetic enamel paint of approved make etc. as directed. (Measurements considered for payments shall be clear size of opening plus guide channels on both the sides for width and 450mm on top for drum height.)**
c) shutter shall be partly grilled and partly panelled and pull and push type.
The relevant specifications of item no. 10.05.a shall be followed except that the shutter shall be partly grilled and partly panelled, operated with pull and push type arrangement.

10.05.d **Providing and fixing in position, interlocking rolling shutter of approved make, of 18 gauge, 75mm wide cold rolled MS lath interlocked, including top cover, spring, axles, guide rails, tees, iron pulleys, bearings, handles, holding down bolts embedded in CC 1:2:4 including 1 coat of zinc chromate yellow oxide as primer and 2 coats of synthetic enamel paint of approved make etc. as directed. (Measurements considered for payments shall be clear size of opening plus guide channels on both the sides for width and 450mm on top for drum height.)**
d) shutter shall be partly grilled and partly panelled, mechanically operated with a pair of handles.
The relevant specifications of item no. 10.05.a shall be followed except that the shutter shall be partly grilled and partly panelled, operated with a mechanical device with a pair of handles.

10.12 **Providing, fabricating and fixing MS Grills of required Pattern as per approved drawing, design and direction of EIC to doors frames, window frames or to any other surfaces using flats, angles, tees, square / rectangular hollow sections etc to be fixed with Screws or required anchor fasteners (as specified in the drawing) including applying primer coat of zinc chromate yellow oxide and three coats of enamel paint etc. complete.**

1.0 **Materials :** The structural steel shall conform to M-22.

2.0 **Workmanship :**

2.1 The MS Grill shall be prepared as per the drawings or as directed by EIC.

3.0 **Mode of measurement & 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 unit of one Kg.

10.13 **Providing, fabricating and fixing 18 gauge MS Perforated sheet with 3 mm hole dimension and of standard pitch, etc. complete including cutting, and welding the members as per detailed drawing and design. The rate shall include for applying three coats of approved make synthetic enamel paint over a coat of zinc chromate yellow oxide as primer, as per instructions. (Only actual installed measurements will be paid for)**

1.0 **Material :**
Perforated sheets of approved gauge shall be used.

2.0 Workmanship :

2.1 Perforated sheets shall be cut of approved sizes and as per the dimensions given in the drawing.

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

3.0 **Mode of measurement & payment :**

3.1 No payment shall be made for screws, nuts, etc. Only rate for perforated sheets shall be paid.

3.2 The rate shall be for unit of one sqm.

10.21 Supplying and tying G.I. Barbed wire consisting of 2 ply line wire having nominal diameter of 2.5mm (Tolerance + OR - 0.8mm), point wire (Barbs_ of nominal diameter 2mm (Tolerance + OR - 0.8mm) with the barbs having four points, including tying in between fencing posts, stretching wires and providing diagonals, including tying to posts with G.I. wire of dia 1.6mm (16g) and fixing the wires to nib in the posts, etc complete all as per drawing and specifications. Note: 1. The G.I. barbed wire shall weigh minimum 10.8kg / 100mtr and maximum 12.5 kg/100mtr with barbs placed at 75mm c/c (Tolerance + OR - 12mm) and the barbed wire shall conform to IS 278 - 1978. 2.The length of each row and each diagonal row of barbed wire will be measured in running metre for payment. G.I. binding wire will not be measured for payment. Rate quoted should include cost of binding wire also). Other items such as angles, concrete shall be paid in relevant items.

1.0 Material & workmanship ;

1.1 The relevant specification of item 10.01a shall be followed for fabrication & erection of MS posts

1.1 The post shall be fabricated & erected in line level & plumb very precisely.

2.0 Mode of measurement;

1.1 The length of each row and each diagonal row of barbed wire will be measured in running metre for payment the wire shall be measured in rmt **.**

1.1 MS post as per drawing shall be fabricated & erected as per specifications of item no 10.01a & shall be measured and paid under same item separately in kg.

11.01.a **White wash with lime on any surfaces (3 coats with brush) to give an even shade at all heights and all levels., including thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter etc. complete.**

1.0 **Materials:**

1.1 **The clearcolle shall be made from glue and boiling water by mixing 1 Kg. of glue to every 15 litres of water. Mixture shall be suitably tinted where required for use under coloured distemper, if directed. Glue shall conform to IS: 852-1969 (Specifications for animal glue).**

1.2 Lime used shall be freshly burnt class `C' Lime (fat lime) and white in colour conforming to IS : 712:1973. Water shall conform to M-1. Best quality of gum (D.D.L) of Pidilite Industries Ltd. shall be used in the preparation of white wash. Ultramarine blue or Indigo: They shall conform to IS: 55-1970 for paints and shall be used for preparation of white wash. Pigments: Mineral colours, not affected by lime shall be used in preparing colour wash.

2.0 **Workmanship:**

2.1 **Preparation of white wash solution: Surface already white washed or coloured :** The fat lime shall be slaked at site and shall be mixed and stirred with about five litres of water for 1 Kg. of unslaked lime to make the mixture creamy. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 4 Kg. of gum or glue of Pidilite Co. (D.D.L.) dissolved in hot water shall be added to each cubic meter of lime cream. Small quantity of ultramarine blue (upto 3 gms. per kg. of lime) shall also be added to the last two coats of white wash solution, if directed and the whole solution shall be stirred thoroughly before use.

2.2 **Preparation of surface:**

2.2.1 The surface shall be thoroughly cleaned of all dust, dirt, mortar dropping and other foreign matter before white wash is to be applied.

2.2.2 The surface spoiled by smoke soot shall be scrapped with steel wire brushes or steel scrapers or shall be rubbed with over burnt surkhi or brick bats. The surface shall be then broomed to remove all dust and dirt and shall be washed with clean water.

2.2.3 Oil or grease spots shall be removed by suitable chemical. Smooth surfaces shall be rubbed with wire brushes.

2.2.4 All unsound portion of the surface plaster shall be removed to full depth of plaster in rectangular patches and plastered again after raking the masonry joints properly. Such portions shall be wetted and allowed to dry. Any crevices, at any level shall be cleaned and filled with the plaster mortar and cured as above. They shall then be given one coat of white wash.

2.2.5 All unnecessary nails shall be removed, the holes, cracks, patches etc. shall be made good with material similar in composition to the surface to be prepared.

2.3 **Scaffolding:** Wherever scaffolding is necessary, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be white or colour washed. A properly secured, strong and well tied suspended platform (Zoola) may be used for white washing. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the floors and walls. For white washing of ceilings, proper stage scaffolding shall be erected where necessary. Also, while painting the ceiling, the floor area shall be covered properly with plastic so that the flooring is not spoiled.

2.4 **Application of white wash:**

2.4.1 On the surface so prepared, white wash shall be applied with moon brush. The first stroke of the brush shall be from top to downwards, another from bottom to upwards over the first stroke and similarly one stroke from the right and another from the left over the first stroke of the brush before it dries. This will form one coat. Each coat shall be allowed to dry before next coat is applied. Number of coats as specified in the item shall be applied. It shall present smooth and uniform finish, free from brush marks and it should not come off easily when rubbed with a finger.

2.4.2 Splashing and droppings, if any on the doors and windows, ventilators, floors etc. shall be removed and the surface shall be cleaned.

2.4.3 Each coat shall be allowed to dry before next coat is applied. If additional coats are required then what have been specified and applied, the same shall be applied to obtain uniform and smooth finish. It shall be done at no extra cost. The finished dry surface shall not show any signs of cracking and pealing nor shall come off easily on the hand when rubbed.

2.4.4 Sample shall be approved by the Architect and Engineer-in-charge before execution of the work.

3.0 Mode of Measurements and Payment:

3.1 For mode of measurement latest version of IS 1200 shall be followed.All the work shall be measured in the decimal system as under :

(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 m^2.

3.2 All works shall be measured in sq.mt. In jambs, soffits, sills etc. and for openings not exceeding 0.5 ^{m2} each in area, for ends of joists, posts, beams, girders, steps etc. not exceeding 0.5 m^2 each in area and for openings exceeding 0.5 m^2 and not exceeding 3.0 m^2 each in area, deductions and additions shall be made as under :-

1) No deductions shall be made for ends of joists, beams, posts, etc. and for openings not exceeding 0.5 m^2 each. No addition shall be made for reveals, jambs, soffits, sills etc. of these openings nor for finish around ends of joists, beams, posts etc.
2) Deductions for openings exceeding 0.5 m^2 but not exceeding 3.0 m^2 each shall be made as follows and no addition shall be made for reveals, jambs, soffits etc. of these openings:
(a) When both the faces of walls are provided with the same finish, deduction shall be made for one face only.
(b) When each face of wall is provided with a different finish, deduction shall be made for that side of frame for door, windows, etc. on which width of reveals is less than that of the other side. Where width of reveals on both faces of wall are equal, deduction of 50% of area of opening on each face shall be made from total area of finish.
(c) When only one face of wall is treated and the other face is not treated, full deduction shall be made if when width of reveal on the treated side is less than that on the untreated side, but if the width of reveals is equal or more than on the untreated side neither deductions nor additions to be made for reveals, jambs, soffits, sills etc.
3) In case of area of openings exceeding 3.0 m^2 each, deduction shall be made for openings but jambs, soffits shall be measured.
4) No deductions shall be made for attachment such as casing, conduits, pipe, electric wiring and the like.

3.2 Corrugated surfaces shall be measured flat as fixed and not girth. The quantities measured shall be increased by the following percentage and the resultant shall be included with the general areas:

(a) Corrugated steel sheets ---------- 14%
(b) Corrugated A.C. Sheets ---------- 20%
(c) Semi corrugated A.C. Sheets ---------- 10%
(d) Nainital pattern roof (Plain sheeting with rolls) ---- 10%
(e) Nainital pattern roof (with corrugated sheets) ----- 25%

3.3 Cornices and other wall features, when they are picked out in a different finish/colour shall be girthed and included in the general area.

3.4 The rate shall include the cost of all materials, labour, scaffolding, protective measures etc. required for the above specified operation, at all floors, at any height, in any position. Priming and Alkali resistant treatments, scrapping of surface washing etc. surface spoiled by smoke soot, removal of oil and grease spots, treatment for infection with efflorescence moulds, moss, fungi, algae and lichen and patch repairs to plaster wherever done shall not be paid extra. This shall also include conveyance, delivery, handling, unloading, storing work etc.

3.5 The rate shall be for a unit of one m^2.

11.01.b White washing with white cement on any surfaces (3 coats with brush), to give an even shade at all height and level including thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter etc. complete.

The relevant specifications of item no. 11.01.a shall be followed except that White cement conforming to M-4 shall be used instead of Lime. No glue or gum shall be added. 1 part of white cement shall be added with 10 parts of water or as per the manufacturer's specifications whichever is less.

11.01.c **Colour washing with lime on any surfaces (3 coats), including priming coat of white wash to give even shade at all heights and levels, including thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter, etc. complete.**

1.0 **Materials:**

1.1 Clear-colle : This shall be made from glue and boiling water by mixing 1 Kg. of glue to every 15 liters of water. The mixing shall be suitably tinted to match with colour of colour washing as directed. Glue shall conform to IS : 852-1969.

1.2 Lime : Lime used shall be freshly burnt class `C' lime (fat lime) and white in colour conforming to IS : 712-1973.

1.3 Water : Water shall conform to M-1.

1.4 Gum : Best quality of gum (D.D.L) of Pidilite Industries Ltd. shall be used in the preparation of white or colour wash. The colour pigment of required tint and shade shall be mixed in lime cream. The mineral colour not affected by lime shall be used in preparing in the colour wash.

1.5 The relevant specifications for the material preparation, shall be as per item no. 11.01.a except that it shall be for colour wash.

2.0 **Workmanship:**

2.1 Sufficient quantity of colour washes enough for the complete job shall be prepared in one operation to avoid any difference in shade. The basic white wash solution shall be prepared in accordance with item 11.01.a. Mineral colours not affected by lime shall be added to the white wash solution. No colour wash shall be done until a sample of the colour has been approved. It shall be noted that small samples of colour appeals lighter in shade than when the same shades are applied precisely to large surface. The colour shall be of even tint, over the whole surface. If it is patchy or otherwise badly applied, it shall be rejected. Preparation of the colour wash with pigment shall be as under:

(a) With Yellow and Red Ocher: Solid lumps if any in the powder shall be crushed to powder and solution in water prepared and then added to white wash, sieving it through a coarse cloth, mixed evenly and thoroughly to white wash in small quantities till the required shade is obtained.

(b) With Blue Vitriol: Fresh crystals of hydrous copper sulphate (i.e. blue vitriol) shall be ground to fine powder and dissolved in small quantity of water. Sufficient quantity of solution enough to produce the colour wash of required shade shall be strained through a clean cloth, the filtrate being mixed evenly and thoroughly to the white wash.

(c) Colour wash from other colouring pigment/ stainer shall be prepared in accordance with the instructions of the manufacture. Stainers used shall be of approved make like Asian, Berger or Nerolac.

2.2 **Preparation of Surface:**

2.2.1 The surface shall be prepared by removing mortar dropping and other foreign matter and thorough cleaning with wire or fibre brush or any other suitable means as directed by the Engineer-in-charge or Architect. All Loose pieces and scales shall be scrapped off and holes/crevices filled with mortar.

2.3 For **Scaffolding and Application of colour wash**, relevant specification of item no. 11.01.a above shall be followed. And in addition the colour wash shall be applied as under :

2.3.1 "Application of white wash or colour wash on undecorated surface" - After the surface has been prepared, the first primary coat shall be of white wash and subsequent coats (minimum two) shall be of colour wash and the entire surface shall represent a smooth and uniform finish. To start with, a patch of 0.1 m^2 on prepared surface shall be colour washed with first coat of white wash and subsequent coats of colour wash solution in full numbers of coats as described in the item and the shade so obtained shall be examined before the entire work of colour washing is taken up in hand. It shall be noted that small areas of colour wash will appear lighter in shade than when the same shade is applied to the large surface.

2.3.2 "Application of colour wash on decorated surfaces"- After the surface has been prepared, a coat of white wash shall be applied for the patches and repairs. Then one coat or more of colour wash shall be applied over the entire surface, such that the colour washed surface shall present a uniform colour shade. No primary coat is needed for a decorated surface-bearing colour of same shade. On surface requiring change of colour, after the surface has been prepared as described above, two coats of white wash shall be applied before application of specified number (minimum two) of coats of colour wash of the new shade.

2.4 **Protective measure:**
The surface of doors, windows, ventilators, floors, furniture etc. and such other parts of the building not to be white/colour washed shall be protected from being splashed upon. Such surfaces shall be cleaned of with white/colour wash splashed, if any, immediately after completing the painting, at no extra cost.

3.0 Mode of Measurements and Payment:
3.1 The relevant specifications of item No. 11.01.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.02.a Painting (3 coats) with <u>oil bound washable distemper</u> of approved manufacturer like Asian, Berger, Nerolac or equivalent and of required shade, on newly dry plastered surface at all heights and levels, to give an even shade, including a priming coat with alkali resistant primer/cement(water or solvent based) primer and applying required coats(min two coats)of putty after thoroughly brushing the surface free from mortar dropping and other foreign matter and also including preparing the surface even and sand papered smooth etc., after applying every coat of putty, complete, as directed.

1.0 Materials:
1.1 Oil bound washable distemper and cement primer shall be of approved brand and manufacture. The distemper shall be of required colour and shade and the same shall conform to IS : 428-1969. Paint shall conform to M-44.

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 strong and well tied suspended platform (Zoola) 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 and the floor area shall be covered with plastic so that the flooring is not spoilt.

2.2 **Preparation of surface:**
The relevant specification of item no. 11.01.a shall be adopted and in addition,

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 atleast 2 months before applications of distemper or one coat of white wash with white cement shall be done prior to painting with distemper.

2.2.2 All unnecessary nails, hooks etc. shall be removed. Pitting in plaster shall be made good with plaster again and papered with a fine 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 applied. The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with IS : 2395 (Part-1)-1966. Before applying distemper, any unevenness shall be made good by applying putty made out of plaster of paris mixed with water, on entire surface, including filling up the undulation and then sand papering the same after it has dried.

2.3 **Priming coat:**
2.3.1 A priming coat of water based/solvent based cement primer of approved manufacture shall be applied over the papered surface in case of new work or undecorated surface. If the distemper priming is done after the plastered wall surface dries completely, the cement primer shall be avoided.

2.3.2 **Application of primer and putty** 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 one coat. The surface shall be finished as uniformly as possible leaving no brush marks. A coat of putty (lapi) shall be applied to the entire surface. Putty shall be used of readymade or brought of the company like Asian as directed by the Engineer-in-charge and Architect. The second coat of primer and putty shall then be applied and it shall thereafter be allowed to dry for atleast 48 hours before oil bound distemper or paint is applied.

2.3.3 It is not recommended to apply Oil bound distemper 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 mineral turpentine oil or any other prescribed thinner in a manner recommended by the manufacturer only. Sufficient quantity of distemper required for a day's work shall be prepared.

2.5 **Application of Distemper coat:**

2.5.1 On any surfaces, after the primer coat has dried for atleast 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the 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 2 consecutive coats to allow proper drying of the preceding 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 cannot be completed on the same day.

2.5.3 15-cm. double-bristled distemper brush shall be used. After a day's work, brushes 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 measure:**

2.6.1 The surface of doors, windows, ventilators, floors, articles of furniture etc. and such other part of the buildings which 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 and Payment:

3.1 Priming coat of distemper primer, scraping of surface spoiled by smoke soot, removal of oil and grease spots, treatment for infection of efflorescence, 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 this item as in place subject to the following limits 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 m^2.
All work shall be measured in m^2. No deductions shall be made for ends of joints, beams, posts etc. and openings, not exceeding 0.5 m^2. each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings nor for finish around ends of joints, beams posts etc.

3.3 Deductions of opening exceeding 0.5 m^2 but not exceeding 3.0 $m^{2,}$ 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 walls are provided with same finish, deductions shall be made for one face only.
(b) When each face of is provided with different finish, deduction shall be made for that side of frame for doors, windows etc. on which width of reveal 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 reveal 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 opening of area exceeding 3.0 $m^{2,}$ each, deduction shall be made for actual size of the openings and jambs, sills and soffits shall be measured and paid separately.

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

3.6 Corrugated surfaces shall be measured flat as fixed and not girth. The quantities measured shall be increased by the following percentage and the resultant shall be included with the general areas:

(a) Corrugated steel sheets	14%
(b) Corrugated A.C. Sheets	20%
(c) Semi corrugated A.C. Sheets	10%
(d) Nainital pattern roof (Plain sheeting with rolls)	10%
(e) Nainital pattern roof (with corrugated sheets)	25%

3.7 Cornices and other wall features, when they are picked out in a different finish/colour shall be girthed and included in the general area.

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

3.9 The rate includes cost of all materials, labours, scaffolding, protective measures etc. involved in all the operations described above, carried out at all floor heights, in any position, at all levels. This shall also include conveyance, delivery, handling, unloading, storing work etc.

3.10 The rate shall be for a unit of one m^2.

11.02.b **Distempering (3 coats) with <u>oil bound washable distemper</u> of approved manufacturer like Asian, Berger, Nerolac or equivalent and of required shade, on newly dry plastered surface at all heights and levels, to give an even shade, including a priming coat with alkali resistant primer/cement(water or solvent based) primer after thoroughly brushing the surface free from mortar dropping and other foreign matter ,complete, as directed and to the satisfaction of architect and engineer-in-charge.**
The relevant specification of 11.02.a shall be followed except that the putty shall not be used.

11.02.c **Distempering (3 coats) with <u>water bound washable distemper</u> of approved brand and manufacture and of required shade, on any surface to give an even shade, including a priming coat with alkali resistant primer and applying one coat of putty after thoroughly brushing the surface free from mortar dropping and other foreign matter and also including preparing the surface even and sand papered smooth etc. complete, as directed.**

1.0 **Materials:**
1.1 Water bound washable distemper and primer shall be of approved brand and manufacture. Further the relevant specifications for workmanship and mode of measurements and payment, of item no. 11.02.a shall be followed except that water bound distemper diluted with water or any other prescribed thinner shall be used instead of oil bound distemper. It shall conform to M-44.7.(G).

11.03 **Providing & applying three coats of External Cement paint like Snowcem or equivalent with brush on exterior surfaces at all heights & all places including scaffolding to give even shades including thoroughly brushing the surfaces free from mortar dropping and other foreign matter and sand papered smooth etc complete as per the manufacture's specification & to the satisfaction of Engineer in charge or Architect**

1.0 **Materials:**
1.1 The water shall conform to M-1. Cement water proofing paint shall conform to IS : 5410-1969, M-44.8.(H) and shall be of approved shade.

2.0 **Workmanship:**
2.1 **Scaffolding:** The relevant specifications of item No. 11.01.a shall be followed.
2.2 **Preparation of surface:**
The relevant specifications of item no. 11.01.a shall be followed except that the work white wash, colour wash shall be substituted with water proofing cement paint. The surface shall be thoroughly wetted with clean water before cement water proofing paint is applied.

2.3 **Preparation of paint:** cement paint shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brushable 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 cement paint drums shall be kept tightly shut 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 7^0C within 48 hours after application.

2.4.2 When weather conditions are such as to cause damage, the work shall be carried out in 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 The surface shall be treated with minimum three coats of water proof cement paint. Not less than 24 hours shall be allowed between two consecutive 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 preceding coat shall be slightly moistened before applying the subsequent coat.

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

2.4.6 The cement paint shall be applied with a brush with relatively short stiff hog or fibre bristles. The paint shall be brushed in uniform thickness and shall be free from excessively heavy brush marks. The lumps shall be well brushed out.

2.4.7 Water proof cement paint shall not be applied on surfaces already treated with white wash, colour wash, distemper dry or oil bound varnishes, paint etc. It shall not be applied on gypsum, wood and metal surfaces.

2.4.8 For smooth surfaces approved bonding agent by the supplier/manufacturer shall be used at no extra cost.

2.5 **Curing:** Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for atleast 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 **Protection measures** shall be taken as per item No. 11.02.a para 2.6.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item No. 11.01.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.04 Providing & applying Weather Shield External Acrylic Paint of Royal Apex Ultima of Asian or equivalent having VOC (Volatile Organic Compound) content less than 50 gm/ltr (minimum 2 coats) from following of desired shade (1 coat of exterior grade primer and 2 coats of paint) to give an even shade with brush on exterior sand faced plastered surfaces/ mala plastered surfaces/ textured surface or any other surfaces at all heights including scraping the existing painted surface (if required), thoroughly brushing the surfaces with sand paper to make it free from mortar dropping and other foreign matter, scaffolding etc. complete as per the manufacture's specification and up to the satisfaction of Engineer in charge. The rate shall also include the cost of filler for cracks on the surfaces. (Rate shall be inclusive of minimum coat of exterior grade primer).

1.0 Materials: Water shall conform to M-1 and acrylic paint shall conform to its supplier's specification

2.0 Workmanship:

2.1 **General**

2.1.1 The materials required for work of painting work shall be obtained directly from approved manufacturers or approved dealer and brought to the site in maker's drums, cage etc. with seal unbroken.

2.1.2 All materials not in actual use shall be kept properly protected, lid of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of water to prevent formation of skin. The materials, which have become stale or flat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also, the paint shall be continuously stirred in smaller container. No left over paint shall be put back into stock tins when not in use. The paint shall be stirred thoroughly in its container before pouring into small containers.

2.1.3 If for any reasons, thinning is necessary, water shall be added as per supplier's instructions

2.1.4 The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed parts of the work shall be carried out in wet, damp or otherwise unfavourable weather and all the surfaces shall be thoroughly dry before painting work is started.

2.2 **Scaffolding**: The relevant specification in item 11.01.a para. 2.3 shall be followed**.**

2.2 **Preparation of surface:**

2.2.2 All unnecessary nails, hooks etc. shall be removed. Pitting in plaster shall be made good with plaster again and

papered with a fine grade sand paper and made smooth. The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with IS : 2395 (Part-1)-1966.

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

2.4 **Application:**

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

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

2.4.3 On the newly plastered surface, the first coat shall be applied with 100% dilution and second and third coat shall be applied with 40 % dilution or as per the supplier's instructions The second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking of the brush being used.

2.5 **Precautions:**

(a) Old brushes if they are to be used with paints, shall be completely dried of turpentine or oil paint by washing in warm soap water. Brushes shall be quickly washed in water immediately after use and shall be kept immersed in water during break periods to prevent the paint from hardening on the brush.

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

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

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

2.6 **Protective measure:**

The surface of doors, windows, ventilators, floors, of furniture etc. and such other parts of the building not to be white/colour washed shall be protected from being splashed upon. Such surfaces shall be cleaned of white/colour wash splashed, if any, immediately after completing the painting, at no extra cost.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item No. 11.01.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.05.a Providing & applying Heritage surface texture – Flaked, of desired shade*(multicolourd/ mono coloured)* of Bakelite Hylam Ltd., on <u>interior</u> surfaces at all heights to give an even shade including thoroughly brushing the surface free from water mortar dropping and other foreign matter and sand paper smooth. The texture shall be applied on mala plaster finish, after applying a coat of primer and putty.

1) Heritage flakes regular
2) Heritage flakes metallix
3) Fine flakes heritage

1.0 Materials: Water shall conform to M-1. The Heritage surface texture - Flaked shall conform to M-44C.

2.0 Workmanship: The relevant specification of item no. 11.10 shall be followed except that Heritage surface texture - Flaked shall be applied on any interior surfaces. *The surface on which the texture is to be applied should be completely dry. The newly applied surface shall not be exposed to water except for curing of 7 days minimum.*

2.1 **Scaffolding:** The relevant specifications of item No. 11.01.a para 2.3 shall be followed.

1) Wherever scaffolding is required, it shall be erected with suitable supports and bracing. A properly secured strong and well-tied suspended platform shall also be provided. Where ladders are used, piece of old gunny bags shall be tied at top and bottom to prevent scratches to the floors and walls.

2.2 **Preparation of surface:** The relevant specifications of item No. 11.02.a Para 2.2 shall be followed.

1) The painting shall start only 2-3 months after the plastering (newly plastered) of the surface.

2) The surface to be finished should be free from chalking, dust, grease, loose paint, loose powdery particles, fungus/ algae etc. The surface shall be thoroughly cleaned, broomed to remove all foreign particles etc.
3) Oil or grease spots, algae or other foreign matter shall be removed by suitable chemical or water, by vigorous wire brushing. If the surface is cleaned with water then, it shall be allowed to dry before application of paint. IN NO CASE THE FINISHING SHALL BE ALLOWED ON DAMP SURFACE.
4) Cracks on the surface if any shall be filled with a cement and sand mortar in the ratio 1:2.

2.3 **Preparation of Mix:** This shall be done as per the manufacture's instructions. *The dry flakes are mixed with flakes bonding agent with recommended amount of water. The dough is then trowelled onto the substrate to be coated with average dry film in the range of 0.8-1.2 mm.*

2.4 **Application:**

1) The sample of the heritage surface work shall be approved by the Architect or Engineer-in-charge.
2) Samples shall be carried out for various finishes (granules, roller coat, flakes etc) as per instruction and satisfaction of the Architect or Engineer-in charge.
3) One coats of paint shall be applied on the surface with the help of trowel to give a uniform thickness of 0.8 to 1.2 mm No conventional primer or putty shall be applied on the exterior surface.
4) To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.
5) A gap of twenty-four hours shall be kept between two subsequent coats, if required for uniform finish. The finished surface shall be even and uniform in shape, without patches, brush marks, paint drops etc.
6) The surfaces of door, windows, floors, etc and other parts of the buildings shall be protected from paint being splashed upon. Such surfaces shall be cleaned properly after the completion of the work.
7) The application shall be done by trained applicators as per the manufacture's instruction and as per the approval of architect.
8) The application shall not be carried out in the rainy/ cloudy season. When rain is expected, the work shall not be commenced. Also the relevant specifications of item no. 11.01.a para 2.4 shall be followed.
9) **An additional top coat available in both glossy and matt finishes, is recommended for high traffic area applications like lifts, lobbies, corridors etc. this shall be measured and paid in relevant items.**

Also the relevant specification of item no 11.01.a shall be followed..

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item No. 11.01.a shall be followed. It shall be noted that the rate is inclusive of priming and putty coat.

3.2 The rate shall be for a unit of one m^2.

11.05.b Extra for providing & applying an additional top coat either in glossy, semi glossy or matt finishes on any type of Heritage surface (granule/flakes/granite/roller etc) of or approved Bakelite Hylam Ltd., on interior/Exterior surfaces, at all heights to give an even shade.

1.0 Materials:. Topcoat of Bakelite Hylam or appoved by Bakelite Hylam.

2.0 Workmanship:

Also the relevant specification of item no. 11.01.a/supplier's shall be followed except that Heritage surface texture - Lacquered shall be applied on any interior/exterior surfaces.

2.1 **Scaffolding:** The relevant specifications of item No. 11.05.a

2.2 **Preparation of surface:** The relevant specifications of item No. 11.05.a

2.3 **Preparation of Mix:**

This shall be done as per the manufacture's instructions. The thinning, if required shall be done as per the Manufacturer's instructions. The quantity of thinner to be added to shall also be as per manufacturer's instructions.

2.4 **Application:**

The relevant specifications of item No. 11.05.a Para 2.4 shall be followed.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item No. 11.05.a shall be followed. . It shall be noted that the rate is inclusive of priming

and putty coat.

3.2 The rate shall be for a unit of one m^2.

11.05.c **Providing & applying Heritage surface texture - Granuled, of desired shade of Bakelite Hylam Ltd., on <u>interior</u> surfaces, at all heights to give an even shade including thoroughly brushing the surface free from water mortar dropping and other foreign matter and sand paper smooth. The paint shall be applied over mala finish plaster, after applying a coat of primer and putty.**

1) Heritage granule regular
2) Heritage granules metallix
3) Fine granules heritage

1.0 **Materials:** Water shall conform to M-1. The Heritage surface texture - Granuled shall conform to M-44C.

2.0 **Workmanship:**
The relevant specification of 11.05.a shall be followed except that the heritage granuled finish shall be used instead of heritage flaked finish

The relevant specification of item no. 11.10 shall be followed except that Heritage surface texture - Granuled shall be applied on any interior surfaces.

2.1 **Scaffolding:** The relevant specifications of item No. 11.05.a para 2.3 shall be followed.

2.2 **Preparation of surface:** The relevant specifications of item No. 11.05.a shall be followed.

2.3 **Preparation of Mix:** This shall be done as per the manufacture's instructions.

2.4 **Application:**
2.4.1 The relevant specifications of item No. 11.05.a shall be followed.

3.0 **Mode of Measurements and Payment :**
3.1 The relevant specifications of item No. 11.05.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.05.d **Providing & applying two coats with brush, of Heritage surface texture - Granite flakes, of desired shade of Bakelite Hylam Ltd., on <u>interior</u> surfaces, at all heights to give an even shade including thoroughly brushing the surface free from water mortar dropping and other foreign matter and sand paper smooth. The paint shall be applied on mala finish plaster, after applying a coat of primer and putty.**

1) Heritage granite flakes

1.0 **Materials:** Water shall conform to M-1.The Heritage surface texture- Granite flakes shall conform to M-44C.

2.0 **Workmanship:**
The relevant specification of 11.05.a shall be followed except that the heritage granuled finish shall be used instead of heritage flaked finish

The relevant specification of item no. 11.10 shall be followed except that Heritage surface texture - Granite flakes shall be applied on any interior surfaces.

2.1 **Scaffolding:** The relevant specifications of item No. 11.05.a shall be followed.

2.2 **Preparation of surface:** The relevant specifications of item No. 11.05.a shall be followed.

2.3 **Preparation of Mix:** This shall be done as per the manufacture's instructions.

2.4 **Application:**
2.4.1 The relevant specifications of item No. 11.05.a para 2.4 shall be followed.

3.0 **Mode of Measurements and Payment:**

3.1 The relevant specifications of item No. 11.05.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.06.a **Providing & applying Heritage surface texture – Flaked, of desired shade of Bakelite Hylam Ltd., on <u>exterior</u> surfaces, at all heights to give an even shade/to the satisfaction of architect and engineer in charge including thoroughly brushing the surface free from mortar droppings and other foreign matter and sand papered smooth. The paint shall be applied on sand-faced smooth level of plaster.**

1) Heritage flakes regular
2) Heritage flakes metallix
3) Fine flakes heritage

1.0 **Materials:** Water shall conform to M-1. The Heritage surface texture - Flaked shall conform to M-44C.

2.0 **Workmanship:** The relevant specification of item no. 11.05.a shall be followed except that Heritage surface texture - Flaked shall be applied on any exterior surfaces.

2.1 **Scaffolding:** The relevant specifications of item No. 11.05.a shall be followed.

2.2 **Preparation of surface:** The relevant specifications of item No. 11.05.a shall be followed.

2.3 **Preparation of Mix:** This shall be done as per the manufacture's instructions. The thinning if required shall be done as per the Manufacturer's instructions. The quantity of thinner to be added to shall also be as per manufacturer's instructions.

2.4 **Application:**

2.5 **Protective measures:** The relevant specifications of item No. 11.04 shall be followed.

3.0 **Mode of Measurements and Payment:**

3.1 The relevant specifications of item No. 11.05.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.06.b **Providing & applying Heritage surface texture - Granuled, of desired shade of Bakelite Hylam Ltd., on <u>exterior</u> surfaces, at all heights to give an even shade to the satisfaction of architect and engineer in charge, including thoroughly brushing the surface free from mortar droppings and other foreign matter and sand papered smooth. The paint shall be applied on sand faced smooth level of mala finish plaster.**

1) Heritage granule regular
2) Heritage granules metallix
3) Fine granules heritage

1.0 **Materials :** Water shall conform to M-1. The Heritage surface texture - Granules shall conform to M-44C.

2.0 **Workmanship :** The relevant specification of item no. 11.05.a shall be followed except that Heritage surface texture - Granuled shall be applied on any exterior surfaces.

2.1 **Scaffolding :** The relevant specifications of item No. 11.05.a shall be followed.

2.2 **Preparation of surface :** The relevant specifications of item No. 11.05.a shall be followed.

2.3 **Preparation of Mix :** This shall be done as per the manufacture's instructions. The thinning if required shall be done as per the Manufacturer's instructions. The quantity of thinner to be added to shall also be as per manufacturer's instructions.

2.4 **Application :**

2.5 **Protective measures :** The relevant specifications of item No. 11.04 shall be followed.

3.0 **Mode of Measurements and Payment :**

3.1 The relevant specifications of item No. 11.05.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.06.c **Providing & applying Heritage surface texture - Granite flakes, of desired shade of Bakelite Hylam Ltd., on exterior surfaces, at all heights to give an even shade, including thoroughly brushing the surface free from mortar droppings and other foreign matter and sand papered smooth. The paint shall be applied over sand faced smooth level of mala finish plaster**

1) Heritage granite flakes

1.0 **Materials :** Water shall conform to M-1. The Heritage surface texture - Granite flakes shall conform to M-44C.

2.0 **Workmanship :** The relevant specification of item no. 11.05.a shall be followed except that Heritage surface texture - Granite flakes shall be applied on any exterior surfaces.

2.1 **Scaffolding :** The relevant specifications of item No. 11.05.a shall be followed.

2.2 **Preparation of surface :** The relevant specifications of item No. 11.05.a shall be followed.

2.3 **Preparation of Mix :** This shall be done as per the manufacture's instructions. The thinning if required shall be done as per the Manufacturer's instructions. The quantity of thinner to be added to shall also be as per manufacturer's instructions.

2.4 **Application :**

2.5 **Protective measures :** The relevant specifications of item No. 11.04 shall be followed.

3.0 **Mode of Measurements and Payment :**

3.1 The relevant specifications of item No. 11.05.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.07 **Providing and applying external finish of average 2 to 2.5mm thick acrylic polymer based texture and pattern with standard tool and applicator as specified by manufacturer on exterior surfaces at all heights including scaffolding to give even shades including thoroughly brushing the surfaces free from mortar droping and other foreign matter and sand paper smoothed etc. complete as per the manufacture specifications and up to the satisfaction of Engineer in-charge/ Architect. The rate includes making of grooves, pattas and finishing as directed by Architect/ EIC. Paint shall be measured and paid in separate tender item. (Item should be executed by approved applicator only.).**

1.0 **Materials:** Water shall conform to M-1. The Spectrum textured wall finishes shall be as per architect's approval.

2.0 **Workmanship:** The relevant specification of item no. *11.09.a* shall be followed except that Spectrum textured wall finish shall be applied on internal/external surfaces.

2.1 **Scaffolding:** The relevant specifications of item No. 11.01.a para 2.3 shall be followed.

2.2 **Preparation of surface:** The relevant specifications of item No. 11.02.a para 2.2 shall be followed.

2.3 **Preparation of Mix:** This shall be done as per the manufacture's instructions. The thinning if required shall be done as per the Manufacturer's instructions. The quantity of water for thinning, to be added, shall also be as per manufacturer's instructions.

2.4 **Application:** Spectrum wall finish is suitable for direct application to any surface like plastered, sandstone, plywood, etc. Roller finishes can be applied directly on bricks too.

This finish is applied in a single coat through the trained applicators of the company, who are attached with the dealers of the product.

2.5 **Protective measures :** The relevant specifications of item No. 11.01.a para 2.4 shall be followed.

2.5.1 The sample of the textured wall finish shall be approved prior to application by the architect.

3.0 Mode of Measurements and Payment :

3.1 The relevant specifications of item No. 11.01.a shall be followed.

3.2 The rate shall be for a unit of one m^2 measured flat.

11.08.a Providing & applying three coats (first two coats are with brush and final coat is with roller) of paint of desired shade for internal wall surface/internal door windows, including a priming coat with alkali resistant primer/cement (water or solvent based) primer and applying required coats (min two coats) of conventional putty (with whiting chalk and linseed oil of approved make, brand and manufacture, on any surfaces, at all heights, to give an even shade after thoroughly brushing the surface free from mortar dropping and other foreign matter and also including preparing the surface even and sand papered smooth etc., after applying every coat of putty, complete, as directed.

1.0 Materials: Water shall conform to M-1. The paint shall confirm to relevant IS codes.

2.0 Workmanship: The relevant specification of item no. *11.02.a* and 11.09.a shall be followed except that plastic emulsion paint shall be applied on any surfaces. For flat, enamel and soft sheen enamel paint, same specification shall be followed except that the type of paint shall be changed as per the direction of Architect and Engineer-in-charge, to give the desired finish.

2.1 **Scaffolding:** The relevant specifications of item No. *11.01.a para 2.3* shall be followed.

2.2 **Preparation of surface:** The relevant specifications of item No*. 11.02.a para 2.2* shall be followed.

2.3 **Preparation of Mix:** This shall be done as per the manufacture's instructions. The thinning of acrylic emulsion is to be done with water and not with turpentine. While, the thinning of enamel shall be done with turpentine. The quantity of thinner to be added to shall be as per manufacturer's instructions.

2.4 **Application:**

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

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

2.4.3 The paint shall be applied with brush for first two coats and final coat shall be done with roller only. The surface shall be treated with minimum two coats of water/solvent based primer for wall/wood primer for wood, zinc chromate yellow primer for MS and Bisan primer (two pack system) – itch primer shall be used for non ferrous metals. Conventional/ready mix (as specified) wall putty, knifing paste filler (KPF) of Asian or equivalent putty for MS door/windows/gates/grills and external wooden doors/windows shall be used as specified in relevant specification of workmanship of item no.11.02.a. The second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking of the brush being used.

2.4.4 The surface on finishing shall present relevant flat, velvety, smooth ,pearl luster (semi gloss) /matt and glossy finish, as specified in the item. It shall be even and uniform in shade without patches, brush marks, paint drops etc.

2.5 **Precautions:**

(a) Old brushes if they are to be used with emulsions paints, shall be completely dried of turpentine or oil paint by washing in warm soap water. Brushes shall be quickly washed in water immediately after use and shall be kept immersed in water during break periods to prevent the paint from hardening on the brush.

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

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

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

2.6 **Protective measures:** The relevant specifications of item No. *11.01.a para 2.4* shall be followed.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item No. *11.01.a* shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.08.b Providing and applying (Synthetic) Plastic emulsion paint (minimum 2 coats) having VOC (Volatile Organic Compound) content less than 50 gm/ltr on newly dry interior plastered surface including ceiling, roof etc.at all heights/ all levels/ all surfaces to give an even shade including applying required coats (min two coats) of white cement based putty after throughly brushing the surfaces free from mortar dropping and other foreign matter. Preparing the surface even and sand papered smooth, after applying every coat of putty complete. Priming coat of alkali resistant cement primer (water or solvent based) is to be applied over prepared smooth surface (undulation free) etc. complete as directed by engineer-in-charge. Sample to be approved before starting of the work by Architect/ EIC. The rate shall include the cost of filler for filling the cracks on surface, scraping the existing painted surface (if required), thoroughly brushing the surfaces with sand paper to make it free from mortar dropping and other foreign matter, scaffolding etc.

The relevant specification of item 11.08.a shall be followed except that the readymade wall putty shall be used instead of conventional putty.

11.09.a Applying priming coats (min one coat) to the satisfaction of engineer-in-charge/consultant over new steel and other metal surfaces after and including preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter and secured with brushes, fine steel wood scrapes and sand paper, with ready mixed priming paint of Asian, Berger ,Nerolac, ICI or equivalent

a) Red lead
b) Zinc chromate red oxide
c) Zinc chromate yellow oxide

1.0 Materials: The ready mixed primer shall match with the relevant IS code.

1.2 The thinner (linseed oil) shall conform to IS: 75-1973, if, for any reason, thinning is necessary. In case of ready mix paint, the brand of thinner recommended by manufacturer shall be used.

2.0 Workmanship:

2.1 **Preparation of surfaces:** The surfaces to be painted shall be cleaned of all rust, scale, dirt and other foreign matter sticking to it with wire brushes, steel wool, scrapers, sand paper etc. This surface shall then be wiped finally with mineral turpentine, which shall also remove grease and perspiration of hand marks. The surface shall then be allowed to dry.

2.2 **Application of primer:**

2.2.1 After the preparation of the surface, the priming coat shall be applied immediately. The brushing operations are to be adjusted to the spreading capacity advised by the manufacturer of the particular primer. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing alternately in opposite directions, two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

2.2.2 During painting, every time after the priming coat has been worked out of the brush bristles or after the brush has been unloaded of the primer, the bristles of the brush shall be opened up by striking the brush against portion of the unpainted surface with the end of the bristles, held at right angles to the surface, so that bristles thereafter will collect the correct amount of paint when dipped again into a paint container. The primary coat shall be allowed to dry completely before painting is started.

2.2.3 No hair marks from the brush or clogging of paint puddles in the corner or panels angles of mouldings etc. shall be left on the work.

2.2.4 Special care shall be taken while painting over bolts, nuts, rivets overlaps etc.

2.2.5 The container when not in use shall be kept close and free from air so that paint does not get thickened and also shall be kept guarded from dust.

3.0 **Mode of Measurements and Payment:**

3.1 The new steel and other metal surface (girth x length) shall be measured in sqm 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 herein after:
(a) Dimensions shall be measured to the nearest 0.01 m.
(b) Areas shall be worked out to the nearest 0.01 m^2.

3.3 No deductions shall be made for openings not exceeding 0.5 m^2 each and no addition shall be made for painting to beading, mouldings, edges, jambs, soffit etc. of such opening.

3.4 **if priming coat and oil paint is not included in structural steel item for providing fabrication and erection item then it shall be measured in m^2**. Compound girders, stanchions, lattices, girder and similar work, actual area shall be measured in m^2 and no 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 areas in accordance with the relevant I.S. code for payment.**

3.6 The rate shall include the cost of all materials, labour, scaffolding, protective measures etc. required for the above specified operation, at all floors, at any height, in any position. Scrapping of surface, washing etc. of surfaces spoiled by smoke, soot, removal of oil and grease spots, treatment for infection with efflorescence, moulds, moss, fungi, algae and lichen shall not be paid extra. This shall also include conveyance, delivery, handling, unloading, storing work etc.

3.6 The rate shall be for an unit of one m^2.

11.08.C **Paint on Gypsum surface**

Providing and applying (Synthetic) Plastic emulsion paint (minimum 2 coats) having VOC (Volatile Organic Compound) content less than 50 gm/ltr on newly dry interior plastered surface including ceiling, roof etc.at all heights/ all levels/ all surfaces to give an even shade. Priming coat of alkali resistant cement primer (water or solvent based) is to be applied over prepared smooth surface (undulation free) etc. complete as directed by engineer-in-charge. Sample to be approved before starting of the work by Architect/ EIC. The rate shall include the cost of filler for filling the cracks on surface, primer application, scaffolding etc.

The relevant specification of item 11.08.b shall be followed except that item shall be exclusive of wall putty and primer.

11.09.b **Applying priming coat over new wood and wood based surfaces after and including preparing the surface by thoroughly cleaning oil, dirt, grease, dust and other foreign matter, sand papering and knotting, ready mixed paint brushing wood primer pink etc. complete.**

1.0 **Materials:** The ready mixed paint, brushing wood primer pink like wooderite of Asian paints or equivalent, shall conform to IS: 3536-1966.

2.0 **Workmanship:**

2.1 **Preparation of surfaces:**

2.1.1 All wood work shall be dry and free from any foreign matter incidental to building operations. Nails shall be punched well below the surface to provide a firm key for painting. Mouldings shall be carefully smoothened with abrasive paper and projecting fibres shall be removed. Flat portion shall be smoothened off with abrasive paper used across the grain prior to painting and with the grain prior to staining, if the wood is to be left in its natural colour. Woodwork that is to be stained may be smoothened by scraping instead of by glass papering if so required.

2.1.2 Any knots, resinous or streaks or bluish sap wood that are not large enough to justify cutting out shall be treated with two coats of pure shellac knotting applied thinly and extended about 25 mm. beyond the actual area requiring treatment.

2.2 **Application of primer :**

2.2.1 The relevant specifications of item no. 11.09.a shall be followed for application of primer.

3.0 Mode of Measurements and Payment :

3.1 The relevant specifications of item no. 11.09.a shall be followed except that work done on new or other wood and wood based surfaces shall be paid under this item.

3.2 The rate shall be for a unit of one m^2.

11.09.c Applying priming coat over new wood and wood based surface after and including preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter sand papering and knotting, ready mixed paint brushing priming for enamel.

1.0 Materials: The ready mixed paint for brushing priming for enamel, on new or other wood/wood based surfaces shall conform to IS: 106-1962.

2.0 Workmanship: The relevant specifications of item no.11.09.b shall be followed except that ready mixed paint brushing priming for enamel shall be used instead of ready mixed paint brushing wood primer pink.

3.0 Mode of Measurements and Payment :

3.1 The relevant specifications of item no. 11.09.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.10 Providing and applying minimum two coats (excluding priming coat and putty) on new steel and other metal surfaces to the satisfaction of engineer-in-charge at all heights and all levels with premium enamel paint – Glossy/Pearl lustre (Semi glossy)/ Matt of approved manufacturer like Asian or equivalent as desired, brushing, to give an even shade, including cleaning the surface of all dirt, dust and other foreign matter.

1.0 Materials: The enamel paint shall conform *to M-44B*. or as approved by architect/engineer-in-charge.

2.0 Workmanship:

2.1 General

2.1.1 The materials required for work of painting work shall be obtained directly from approved manufacturers or approved dealer and brought to the site in maker's drums, cage etc. with seal unbroken.

2.1.2 All materials not in actual use shall be kept properly protected, lid of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of turpentine to prevent formation of skin. The materials, which have become stale or flat due to improper and long storage, shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also, the paint shall be continuously stirred in smaller container. No left over paint shall be put back into stock tins when not in use. The paint shall be stirred thoroughly in its container before pouring into small containers.

2.1.3 If for any reasons, thinning is necessary, the brand of thinner recommended by the manufacturer shall be used.

2.1.4 The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed parts of the work shall be carried out in wet, damp or otherwise unfavourable weather and all the surfaces shall be thoroughly dry before painting work is started.

2.1.5 For Glossy, Flat, Pearl lustre and Matt finish, painting of same specification shall be followed except that the type of paint shall be changed as per the direction of Architect and Engineer- in-charge, to give the desired finish.

2.2 **Application:**

2.2.1 Brushing operation are to be adjusted to the spreading capacity advised by the manufacturer of particular paint. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will

constitute one coat.

2.2.2 Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand paper and loose particles brushed off before next coat is applied. Each coat shall vary slightly in shade and shall be got approved from Architect & Engineer-in-charge before next coat is started.

2.2.3 Each coat shall be lightly rubbed down with sand paper of fine pumice stone and cleaned off dust before the next coat is applied. No hair marks from the brush or clogging of paint puddles in the corners of panels angles of mouldings etc. shall be left on the work.

2.2.4 Special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

2.2.5 Approved best quality brushes shall be used.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item no. 11.09.a shall be followed for mode of measurements and payment. The rate is excluding priming coat.

3.2 The rate shall be for a unit of one m^2.

11.11 Providing & applying minimum two coats (including priming coats and KPF putty) on (external wooden door window/ metal door windows) to the satisfaction of engineer-in-charge (first coat with brush and final coat with roller) of Glossy, flat, pearl lustre and Matt enamel paint of desired shade, of approved make, shade, brand and manufacture, on any surfaces, at all heights, to give an even shade, including thoroughly brushing the free from mortar droppings and other foreign matter and sand papering smooth. The paint shall be applied after applying a coat of primer (wood primer or zinc chromate yellow metal primer) and required number (min one coat) of putty.(KPF – Knifing paste filler putty)

1.0 Materials: Glossy, Flat, Pearl Lustre and Matt enamel paint shall conform to IS: 1932-1964 and M-44B. Wood primer or zinc chromate yellow metal primer

2.0 Workmanship: The relevant specifications of item no. 11.07.a/11.07.b/11.10 shall be followed except that the paint described in item shall be used.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item no. 11.9a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.12 Polishing with French polish on new wood and wood based surface to give an even surface, including cleaning the surface of all dirt, dust and sand papered smooth and including a coat of wood filler.

1.0 Material: 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) Chadras, (iii) Shellac (iv) Pigment. The French polish so prepared shall conform to IS : 348-1968 and M-45.

2.0 Workmanship:

2.1 **Preparation of surface:**

2.1.1 All unevenness shall be rubbed down smooth with sand paper and the surface shall be well dusted. The pores in the wood shall be filled up with filler made of paste of whiting chalk in water or methylated spirit (with suitable pigment like burnt sienna or umber if required), otherwise the French polish will get absorbed and a good gloss will be difficult to obtain.

2.1.2 In case a surface is to be repolished, the old polish shall be thoroughly scrapped off by very fine sand paper and if required shall be washed off by Luke warm water mixed with caustic soda powder to remove stains.

2.2 **Application:**

2.2.1 A polishing pad of soft woollen cloth/absorbent cotton covered by a fine cloth shall be used to apply the polish. The

pad shall be moistened with polish and rubbed in quick light strokes along the grain, overlapping the former stroke thus, applying the polish sparingly but uniformly over the entire area to give an even surface. A trace of linseed oil on the face of the pad may be added which shall facilitate this operation. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean fine cloth, slightly damped with methylated spirit and rubbed lightly and quickly with circular motions. The finished surfaces shall present a uniform texture and high gloss.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item no. 11.09.a shall be followed for mode of measurements and payment.

3.2 The rate includes cost of wood filler etc. complete.

3.3 The rate shall be for a unit of one. m^2.

11.13 Providing and applying wax polish on new wood work and wood based surfaces with bee's wax polish in proportion 2:1.5 :1:0.5 (2 Bees Wax : 1.5 linseed oil : 1 Turpentine oil : 0.5 Varnish by weight) to give an even surface, including cleaning the surface off all dirt, dust and sand papered smooth etc. complete.

1.0 Materials: Bee's Wax shall conform to IS: 1504 1968 linseed oil shall conform to IS: 75-1967. Turpentine shall conform to IS: 83-1950. Varnish shall conform to IS: 337-1952. Wax polish shall conform to M-45A.

2.0 Workmanship:

2.1 Preparation of bees wax:

2.1.1 Incase of bee's wax, it shall be prepared locally with following specifications:

2.1.2 Pure bee's wax free paraffin or bee's adulterants shall be used. The polish shall be prepared from mixture of bees wax, linseed oil, turpentine and varnish in proportion 2 : 1.5 : 1 : 0.5 by weight. The bee's wax and boiled linseed oil shall be heated over a slow fire. When the wax is completely dissolved the mixture shall be cooled till it is just warm and turpentine and varnish shall be added to it in the required proportions and entire mixture shall be well stirred.

2.0 Preparation of surface:

2.2.1 The surface to be waxed shall be prepared to produce a smooth dry, neat surface, previous coat of paint or stain if any, shall be allowed to dry and be rubbed down, lightly wiped off and allowed to dry. All dust and dirt shall be removed from the surface to be waxed, and also from the neighbourhood. Damp atmosphere and draughts shall be avoided. For waxing, normal dry day shall be chosen.

2.3 Application:

2.3.1 The wax shall be applied evenly with clean soft pad of cotton cloth in such a way that the surface is completely and fully covered. The surface shall then be rubbed continuously for half an hour. After well rubbing in one coat of wax polish, the work shall be covered with dust proof sheet (cloth for preventing dust falling on the work. Subsequent coat shall be applied after the surface is quite dry and shall be rubbed off with soft flannel until the surface has assumed a uniform gloss and in dry showing no sign of sickness.

2.3.2 The final wax polish depends largely on the amount of rubbing which shall be continuous and with uniform pressure with frequent changes in the direction.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item no. 11.09.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.14 Providing and applying matt /semi gloss/glossy finish melamine polish, in interiors, of approved make as per manufacturer's specification and as per shade approved by the Architect and Engineer-in-charge for NEW Wooden door and window. The final coat should be sprayed by gun with pressure as per requirement.

1.0 Material: The melamine polish shall be of best quality and make as approved quality such as Asian or equivalent and shall conform to M-45B.

2.0 Workmanship:

2.1 The relevant specification of item no. 11.16 shall be followed. The melamine polish shall be applied on doors and windows or any woodwork or wood based surfaces with the help of spray gun. The work shall be carried out as per instruction of Engineer-in-charge and to the satisfaction of Architect or engineer incharge. Sample shall got

approved before full scale application

Directions of use on new surface:

1) Sand the surface along the grains with Emery paper no 180 or with a suitable grade of sand paper. Brush the surface free of loose dust.

2) Fill the wood using Apcolite wood filler. Remove excess filler immediately after applications. Allow 2-3 hrs of drying, before sanding with Emery paper no 180 followed by 320. ensure complete removal of filler from the surface.

3) Apply a coat of Apcolite Natural wood finish clear sealer. After overnight drying, smooth sand with emery paper no 320 and wipe the surface free of loose dust. Clear sealer is a two-component system consisting of base and hardner. These should be mixed in the recommended ratio. The two components should be mixed in a glass,plastic, or enamelled container. Allow the mixture to stand for 30 mins and then apply by brushing or spraying using the recommended thinner for consistency adjustment. The mixture of base and hardner should be used within 8 hrs. Compressed air used for spray application should be free from oil and water.

4)if instructed by the engineer-in-charge apply apcolite wood stains by ragging after filling step or mix it in apcolite natural wood finish upto 20% by volume and apply by spraying after sealer coat. In application by ragging allow a drying time of 5-10 mins In between coats and 30-60 mins before over coating with finish coats.

5)Apply apcolite natural wood finish-clear matt/semi glossy/ glossy as follows. Apcolite natural wood finish- is a two-component system consisting of base and hardner. These should be mixed in the recommended ratio. The two components should be mixed in a glass,plastic, or enamelled container. Allow the mixture to stand for 30 mins and then apply by brushing or spraying using the recommended thinner for consistency adjustment. The mixture of base and hardner should be used within 8 hrs.

6)Apply two coats of Apcolite Natural Wood finish-clear matt/semi glossy/ glossy by spraying with a overnight time gap in between coats.

For pre-polished wood-

1) Sand the surface along the grains with emery paper no 100 or 180 followed by no 320 to get a smooth uniform surface. If staining is desired,completely remove the old finish. Wipe the surface free of loose dust.

2) If instructed apply apcolite wood stains by ragging or mix it in apcolite natural wood finish upto 20% by volume and apply by spraying after sealer coat. Staining is optional

3) Apply a coat of apcolite natural wood finish-clear sealer. After overnight drying smooth sand with emery paper no 320 and wipe the surface free of loose dust.

4) Apply a coat of apcolite natural wood finish-matt/semi glossy/glossy by brushing or spraying with a overnight time gap in between coats.

5) Compressed air used for spray application should be free from oil and water.

3.0 Mode of measurement and payment:

3.1 The relevant specification of item no. 11.12 shall be followed except the work of melamine polish shall be paid under this item.

3.2 The rate shall be for a unit of one m^2.

11.15 Providing and Applying Varnish of approved make, on new wood and wood based surface to give an even surface, including cleaning the surface of all dirt, dust and sand papered smooth and including a coat of wood filler.

1.0 Material: Varnish for the finishing coat shall be of superior quality spar copal or as stipulated in the item and for under coat it shall be flatting varnish of the same approved manufacturer.

2.0 Workmanship:

2.1 **Preparation of surface:**

2.1.1 New wood work shall be finished smooth with a carpenter's plane. Knots shall be cut to a slight depth; cracks and holes shall be cleaned of dust and then filled with approved quality wood putty. The surface shall then be rubbed down perfectly smooth with medium and fine-grained sand paper and wiped clean and dry.

2.1.2 Sizing or transparent wood filler from the same manufacturer shall then be applied with a brush or rag and allowed to dry. Finally it shall be rubbed with fine sand paper or emery paper. This will seal the pores in the wood and prevent absorption of oil in the varnish.

2.2 **Application:**

2.2.1 An under coat of flatting varnish shall be applied. It shall dry hard and brittle and when rubbed down shall produce a smooth surface, enhancing the gloss of the finished varnish.

2.2.2 Varnish shall be applied liberally with a full brush and spread evenly with short light strokes to avoid frothing.

Rubbing down with fine sand paper and flatting the surface shall be done after each coat except the final coat. The surface shall be allowed to dry and the finished surface shall present a uniform, fine glossy surface free from streaks, blisters etc. Special fine haired varnishing brushes only, shall be used for the work.

2.2.3 Varnishing, like painting should be avoided on stormy and rainy seasons. Varnishing is generally recommended or prescribed for interior works, whereas painting for exposed situations. A good varnish should become surface dry in not more than 6 to 8 hours and hard dry in not more than 18 hours.

3.0 Mode of Measurement and Payment:

3.1 The relevant specification of item no. 11.9a shall be followed except the work of varnishing shall be paid under this item.

3.2 The rate shall be for a unit of one m^2.

11.16 Polishing with Lacquer polish of superior quality, on interior surfaces, of approved make and brand , on new wood and wood based surface to give an even surface, including cleaning the surface of all dirt, dust and sand papered smooth and including a coat of wood filler.

1.0 Materials: Lacquer polish shall conform to its relevant specification

2.0 Workmanship:

Relevant specification of item no 11.14 of melamine polish shall be used except that the Asian NC clear wood finish is to be used instead of melamine polish

2.1 **Preparation of surface:**

2.1.1 Prepare the surface by proper sanding, filling and priming as per the conventional method in polishing wood surfaces.

2.1.2 Incase, surface previously polished with French polish is to be re polished, the surface is sandpapered with emery paper no. 180 along the grains, thoroughly. This should be followed by emery paper no 320 or 400 and cleaning of the surface to remove loose dust.Apply 1 to 2 coat of Asian NC clear sanding sealer and allow it to dry for 1.5 to 2 hrs. smooth sand the surface with emery paper no 180 followed by emery paper no 320 or 400 and cleaning of the surface to remove loose dust.

2.2 **Application:**

2.2.1 for making sanding sealer, mix 1 part by volume Asian NC clear sanding sealer with 1.5 to 2 parts by volume of Asian NC thinner. For clear glossy/matt, mix 1 part by volume Asian NC clear glossy / matt with 1 part by volume of Asian NC thinner. For semi glossy surface mix 1 part by volume of both Asian NC clear glossy and matt with 1part of thinner.use spray method for application. With 2.2 to 2.8 kg/cm2 pressure. The recommended thinner is Apca NC thinner 249 from asian.

2.2.2 for optimum performance Asian NC clear wood finish must be applied at temperatures between 20 degrees and relative humidity not above 75%. At a very high humidity, the lacquer surface can appear whitish due to excessive quick evaporation.

2.2.3 After complete drying, buffing will enhance the gloss of the finish substantially. Buffing is not recommended for matt finish.

2.3 Precautions

Store in a cool and dry place
Avoid skin contact contains volatile organic solvents.
Wear protective clothing like overalls,gloves and goggles.
Dispose in land filling. Do not dispose in any drain or water channel.
Base and hardner must be consumed within one week of opening the base and hardner containers.the containers are sensitive to moisture so they should be tightly closed after use.

3.0 Mode of Measurements and Payment:

3.1 The relevant specification of item no. 11.9a shall be followed except the work of polishing with lacquer polish shall be paid under this item.

3.2 The rate shall be for a unit of one m^2.

11.17 Providing and applying clear matt /semi gloss/glossy finish Touch wood polish of approved make as per

manufacturer's specification and as per shade approved by the Architect and Engineer-in-charge for NEW wooden door and windows. The final coat shall be sprayed by gun with pressure as per requirement.

1.0 **Materials-** Touch wood polish shall confirm to its relevant material specification as per the standards given by the supplier or manufacturer.

3.0 **Workmanship:**
Relevant specification of item no 11.14 of melamine polish shall be used except that the touch wood polish shall be used instead of melamine polish.
For new wood surfaces-
1) Touch wood clear matt/semi glossy/ glossy is to be applied on filled wooden surfaces, which have been smooth, sanded along the grains with emery paper no 320. staining with Apcolite wood stains is optional.
2) Ensure that the surface to be coated is free from all loose dust. Touchwood is a single pack system. The contents should be well stirred and strained through a clean muslin cloth prior to use. It can be brushed or sprayed using the recommended thinner.
3) The first coat of touchwood should be allowed to dry for 6-8 hrs prior to sanding and recoating. To enhance the effect and decorative appeal, two or three coats of finish application are recommended. Containers shall be well capped after use.

For pre-polished surface
1) Sand the surface along the grains with emery paper no 180 followed by no 320 to get a smooth uniform surface. If staining is desired, completely remove the old finish. Wipe the surface free of loose dust.
2) If instructed by the engineer-in-charge, apply apcolite wood stains by ragging. Staining is optional
3) Apply two/three coats of touchwood by brushing or spraying and give a time gap of 6-8 hrs between subsequent coats.

3.0 **Mode of Measurement:**
Rate shall be in sqm.

11.18 **Providing and applying Silicone paint over exposed concrete and brick surfaces and plastered surfaces, as directed with a minimum 5 years guarantee on stamp paper to the employer directly. (The Contractor should specify the % concentration of silicone while quoting the rate.)**

a. Solvent based
b. Water based

1.0 **Materials:** Silicone paint shall be of approved quality like Wacker, GE silicon, Pidilite, Dow Corning, or equivalent (water repellent paint) as approved by the Architect and Engineer-in-charge. It shall conform to M-74.

2.0 **Workmanship:**
2.1 The silicone paint shall be diluted with water/solvent (benzene or toluene) in proportion as per manufacturer's specifications; The paint shall be sprayed with spray gun as directed. As far as possible ready mix paint shall be used.
2.2 Concentration of silicon content shall be in proportion so that after the application, surface is clear and as it is. The sample shall be approved by architect. Normally 5% concentration is sufficient for not to have change in parent color.

2.3 Before applying silicon paint, the brick surfaces should be thoroughly cleaned of dust, dirt, concrete slurry or any other foreign material or efflorescence from within the brick if any, using method like pressurized water jets or rubbing with gunny bags and soft brush etc. as approved by the EIC. Pressurized water jet shall be applied in such a way that the surface on which it is applied does not get damaged.

2.4 Before applying the specified coats of silicon paint the efflorescence of the exposed brick work should be removed in the following manner:
1) Apply solution of - mixer of liquid ammonia and soft water (1:6) on brick surface using brush OR Alternatively, before applying the silicon paint, Baysilone - Impregnating Emulsion WA of GE or equivalent product of Wacker shall be used.
2) After required / specified time interval the surface treated as mentioned in 1 above should be washed with soft water using brush or spray.

2.5.1.1.1 The concrete surfaces should also be thoroughly cleaned of dust, dirt, rust, concrete slurry or any other foreign material sing appropriate method so as not to damage the RCC work, as approved by the EIC.

2.6 Rate shall be inclusive of moping, cleaning, masking the door windows/floor/plants etc during and after the execution for protection

2.5 A guarantee bond on appropriate stamp paper, shall be given by the Contractor to the Client in the manner form prescribed below:

FORM OF GUARANTEE BOND

"I/We .....(Contractor) hereby guarantee that work will remain unaffected and will not be in any way damaged by water or any other humid conditions, for a period of 5 years after completion of the work of Silicone painting as per the terms and conditions of the contract and Contractor hereby indemnifies and agrees to save the Institute from any loss and or damage that might be caused on account of exposure to water and hereby Guarantees to make good any loss or damages suffered by the Institute and further guarantee to redo the affected work without claiming any extra cost."

2.5 This guarantee shall remain force for the period of 5 years from the completion of the work under the contract and it shall remain binding to the Contractor for period of 5 years.

3.0 Mode of Measurements and Payment:

3.1 The relevant manufacturer's specification followed.

3.2 The deposit at the rate of 50% of the cost of this item from the running and final bills shall be recovered and retained for the first one year after completion of the work and 10% of shall be retained for the balance of defects liability period and shall be refunded only after the completion of the defects liability period.

3.3 The rate shall be for a unit of one m^2. measured flat.

11.19 Providing & applying four coats (first two coats of sealer and then 2 coats of asian wood opal finish) of Polyurethane paint of desired shade, on the exteriors, of approved make such as MRF Durodec or equivalent, on any surfaces, at all heights to give an even shade, including thoroughly brushing the surface free from mortar droppings and other foreign matter and sand papered smooth. The paint shall be applied after applying a coat of primer and putty.

1.0 Materials: Water shall conform to M-1. The Polyurethane paint shall conform to M-44D.

2.0 Workmanship: As with conventional paints, polyurethane coating system shall also be applied in three-coat build-up. The relevant specifications of item no. 11.14 and 11.16 shall be followed. In addition to the two coats of sealer, 2 coats of Asain wood opal finish coats shall be applied. An interval of 4 hrs is recommended between two coats On exteriors, putty shall be avoided. The manufacturer's instructions shall be followed.PU thinner recommended is PU thinner 338 from Asian.(15 to 30 parts by volume)

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of 11.01.a shall be followed.

3.2 The rate shall include the cost of all materials, labour, scaffolding, protective measures etc. required for the above specified operation, at all floors, at any height, in any position.

3.3 The rate shall be for a unit of one m^2.

11.20 Providing & applying three coats with brush, of 'Suraksha' from Nerolac or 'Ace' from Asian or equivalent on exterior surfaces, at all heights to give an even shade, including thoroughly brushing the surface free from mortar droppings and other foreign matter and sand papered smooth.

The relevant specification of 11.04 shall be followed, except that semi acrylic paints shall be used instead of 100% acrylic paints. First coat is of 100% dilution and second and third coat is of 40% dilution.

11.21 Powder coating with Powder paints such as Berger, Hawcoplast or equivalent, as approved by the Architect, on all metal surfaces of minimum 50 micron, including all operations required for satisfactory work.

1.0 Materials: Powder paints shall conform to M-91.

2.0 Workmanship:

2.1 Powder coating shall be provided using powder paints, with an Electrostatic spray gun or by Fluidized bed, as per the manufacturer's instructions. The work shall be carried out in the best workman-like manner.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item no. 11.09.a shall be followed.

3.2 The rate shall be for a unit of one m^2.

11.22 Providing and applying two coats with brush, of Sandtex matt paint from Snowcem or equivalent on exterior surfaces, at all heights to give even shades, including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand papered smooth etc. complete.

The relevant specification of item no. 11.03 shall be followed except that sandtex matt paint shall be used instead of cement paint.

11.23 Providing and applying oil and water finish polish to all wood and wood based surfaces as specified, directed and approved by the EIC.

Material and Workmanship : All wood and wood based surfaces to e polished shall be properly grinded with sand/roll paper of required no.

The grinded surface shall be cleaned with cotton and applied with first coat of double boiled CAT brand linseed oil and water in proportion of 1:1.5 or linseed oil and turpentine in equal proportion as approved by architect/engineer-in-charge. After 24 hrs the surface shall be grinded again with roll paper/ sand paper of no 100. The second coat shall be same as mentioned above. Last coat shall be applied after 48 hrs. The surface shall be cleaned with cotton so that the surplus oil is removed. No colour pigment or powder shall be used in the application

Mode of Measurements and Payment:

The rate shall be of unit of 1 sqm. The oil and water finish polishing will be measured in same unit and paid separately.

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Plumbing Works

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PROJECT: **Tender for Extension of wing in Block E at PDEU campus, Gandhinagar**

DOCUMENT: **GENERAL & TECHNICAL SPECIFICATIONS FOR PLUMBING WORKS.**

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1: GENERAL SPECIFICATIONS FOR PLUMBING WORKS

1.1 SCOPE OF WORK

1.1.1 Work under this contract shall consist of furnishing all labour, materials, equipment, and appliances necessary and required to completely furnish all the plumbing and other specialized services as described hereinafter and as specified in the schedule of quantities and/or shown on the plumbing drawings.

1.1.2 Scope of Work generally shall include the area shown in the drawings attached.

1.1.3 Over & above Clause 0.1.1, the plumbing installation may include but not limited to the following:

a) Sanitary & CP Fixtures with all accessories.
b) Internal & External Water supply & Distribution
c) Internal & External Sewerage Disposal Network
d) Electro-mechanical equipment/accessories required for Plumbing Installation
e) All hardware, supports, hangers required for complete installation
f) Civil work related to Plumbing Installation
g) Instruments, meters, gauges, required for the installation
h) The scope of work also includes all minor details of construction which are obviously and fairly intended, and which may not have been referred to in these documents but are essential for the entire completion in accordance with standard Engineering practice.

1.2 SPECIFICATIONS

1.2.1 The detailed specifications given hereinafter are for the items of works described in the schedule of quantities and shall be guidance for proper execution of work to the required standards.

1.2.2 It may also be noted that the specifications are of generalized nature, and these shall be read in conjunction with the description of item in schedule of quantities and drawings.

1.2.3 Work under this contract shall be carried out strictly in accordance with specifications attached with the tender.

1.2.4 Item / s not covered under these specifications due to any ambiguity or misprints, or additional works, the work shall be carried out as per the latest applicable standards with latest amendments as applicable in the contract or as directed by Engineer-in-charge.

1.2.5 Unless specifically otherwise mentioned, all the applicable codes and standards published by the Bureau of Indian Standard Institution and all other standards which may be published by them before the date of receipt of tenders, shall govern in all respects of design, workmanship, quality and properties of materials and methods of testing, method of measurements etc.

1.2.6 Wherever any reference to any Indian Standard Specification occurs in the documents relating to this contract, the same shall be as per the latest amendments issued there to or revisions thereof, if any, up to the date of receipt of tenders.

1.2.7 In case there is no I.S.I. specification for the particular work, such work shall be carried out in accordance with the instructions in all respects and requirements of the Engineer-in-Charge.

1.2.8 For the items not covered under any of the specifications stated above, the work shall be executed as per manufacturers specifications/ General good engineering practice/ or as per direction of Engineer in charge and shall be carried out in a manner complying in all respects with the requirement of relevant byelaws of municipal corporation/ Development Authority etc. under the jurisdiction of which the work is to be carried out.

1.2.9 In case of any difference or discrepancy between specifications & the description of Bill of Quantities, the specification mentioned in the Bill of Quantities shall take precedence.

1.2.10 In case of any difference or discrepancy between specification and drawings, the drawings shall take precedence.

1.2.11 In case any difference or discrepancy between the specifications for civil works and specification for Public Health Engineering works, specifications for civil works shall take precedence.

1.2.12 In case of any dispute arising out of the interpretation of any tender condition, the decision of Engineer-In-Charge shall be final and binding on the contractor.

1.2.13 Detail specification for Sanitary & CP fittings like model / makes shall be selected by Architect / Owner and the same shall be binding for execution.

1.2.14 All electrical installation shall comply with the requirements of relevant Indian Standards, Indian Electricity rules, ECBC Norms, Internal Electric Code & Indian Electricity Act amended up to date & local bye laws.

1.2.15 Wherever required the Engineer-in-charge may ask for a Factory Acceptance Test Certificate, and for this may ask to arrange for a factory visit. The contractor shall provide all possible support for arranging for the factory visit and providing the required Factory Acceptance Test Certificate.

1.3 CONTRACTOR'S RATES

1.3.1 Rates quoted in this tender shall be inclusive of cost of materials, labour, supervision, erection, tools, plant, scaffolding, service connections, transport to site, GST, octroi and levies, breakage, wastage, excavation, refilling, bedding, encasing, transportation of lifts / leads, insurance and all such expenses as may be necessary and required to completely do all the items of work and put them in a working condition.

1.3.2 Rates quoted are for all heights and depths as required for this work.

1.3.3 All rates quoted must be for complete items inclusive of all such accessories, fixtures and fixing arrangements, nuts, bolts, hangers as are a standard part of the particular item except where specially mentioned otherwise.

1.3.4 All rates quoted are inclusive of cutting holes and chases in walls and floors and making good the same with cement mortar/ concrete of appropriate mix and strength as directed by Architect/ Engineer in Charge.

1.3.5 Rates quoted shall be inclusive of cost incurred in testing, and commissioning of works and materials.

1.3.6 Rates quoted shall be inclusive of any rework to be carried in the system installation due to the instructions given by Statutory/ Approval authority.

1.3.7 All rates quoted by the contractor under this contract shall include bailing or pumping out of all the water which may accumulate during the progress of work either through seepage, springs, rain or any other cause.

1.3.8 All rates quoted by the contractor shall include all miscellaneous civil work related to Plumbing work like excavation, refilling, timbering, bedding, encasing, etc. required as per actual site condition.

1.3.9 For all the items / equipment supplied free of cost by the Owner, the contractor's rate shall take care of transportation to the site, storage at site, installation, testing & commissioning of those items/equipment.

1.3.10 In case of discrepancy/ calculation error between rate & amount quoted by the contractor, the quoted rate shall be considered as final to derive the amount.

1.4 DRAWINGS

1.4.1 Plumbing drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made, shall be in conformity with the Architectural and services drawings.

1.4.2 Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.

1.4.3 Contractor shall verify all dimensions at site and bring to the notice of the Architect/ Engineer in Charge all discrepancies or deviations noticed. Architect/ Engineer in Charge decision shall be final.

1.4.4 Civil related details like tanks, sumps, channels, plant room, etc. to be read in conjunction with structure drawings. In case of any discrepancies, Contractor shall co-ordinate with other agencies & execute as per the best practices.

1.4.5 Large scale details and manufacturers dimensions for materials to be incorporated shall take precedence over small-scale drawings.

1.4.6 Any drawings supplied with the tender shall be returned in good conditions along with the tender.

1.4.7 Any drawings issued by the Engineer-in-charge for the works are the property of the Engineer-in-charge and shall not be lent, reproduced, or used on any works other than intended without the written permission of the Engineer-in-charge.

1.5 EXECUTION OF WORK

1.5.1 The contractor must get acquainted with the proposed site for the works and study specifications and conditions carefully before execution.

1.5.2 The work shall be carried out in conformity with the plumbing drawings and within the requirements of Architectural, HVAC, Electrical, Structural, and other specialized services drawings.

1.5.3 The work shall be executed as per program approved by the Architect/ Engineer in Charge. If part of site is not available for any reason or there is some unavoidable delay in supply of materials stipulated by the owner/ or due to any other issue not pertaining to the contractor, the contractor shall draw attention to the owner & as mutually agreed, the program of construction shall be modified accordingly, and the contractor shall have no claim for any extras or compensation on this account.

1.5.4 The contractor shall cooperate with all trades and agencies working on the site. The contractor shall ensure that all inserts, pipelines embedded in structural members, sleeves, cut outs, etc. are placed in position in coordination with civil work as and when required. All holes, sleeves, cut outs shall be filled with best quality sealant to make leak proof joint. Location & size of core cutting of the floor slabs in case of suspended plumbing shall be coordinated with civil contractor.

1.5.5 The contractor shall take instructions from the Engineer In charge regarding collection and stacking of material in any place with lockable arrangement. For damage/ theft of any material, Contractor shall be hold responsible. No Excavated earth or Building material shall be stacked on areas where other buildings, roads, services, compound walls, etc., are to be constructed.

1.5.6 The contractor shall maintain in perfect condition all works executed till the completion of the entire work allotted to him. Where Phased delivery is contemplated, this provision shall apply to each phase.

1.5.7 The installation of the sanitary fixtures and fittings shall be as per the shop drawings approved by the Architect/ Engineer in Charge/ Consultant. The fixtures in the trial assembly can be re-used for final installation without any additional payments for fixing or dismantling of the fixtures.

1.5.8 All gaps between wall/ floor and sanitary vessels shall be filled with sanitary grade sealant.

1.5.9 CP Brass or SS screws shall be used for fixing sanitary fixtures and accessories in toilet, bath, and pantry and kitchen area.

1.5.10 While carrying out pipeline work, in case the contractor encounters any Interference with other services, such as cable, conduits, etc. he shall take sufficient precautions in order to prevent any damage to them. If any damage occurs, it shall be rectified to its original condition at his own cost to the satisfaction of Engineer-In-Charge.

1.5.11 The contractor carrying out the construction work shall take effective measures to carefully open out all existing channels, culverts, bridges, pipelines, conduits, water courses, sewer, drains, electrical cables, transmission lines and their supports and all works buried or otherwise where such services have to be interfered with the purpose of the construction of the works. He shall provide and arrange all necessary temporary supports and diversions, if necessary, across/ under/ even through along sides of the trenches and all other parts of construction work for all such channels, culverts, bridges, pipelines, conduit.

1.5.12 The contractor shall arrange to carry out all works with least interference practicable with public footpath and vehicular traffic and with existing waste water or storm water drainage arrangements and provide all necessary road barriers, fences, notices, lights, gangways, access crossings, diversions for traffic, temporary drains, dewatering channels, chutes pumping or water lifting arrangements and all other facilities for the proper execution of the works to the approval and satisfaction in all respects of the Engineer-in-Charge. Any work carried out by the contractor in this connection shall be deemed as temporary works incidental to the construction work.

1.5.13 For any free issue items by Engineer-in-charge, the contractor shall maintain the same properly & install as per good engineering practice.

1.5.14 No structural member shall be chased or cut without the written permission of the Engineer-in-charge.

1.5.15 The work shall be executed in a manner complying in all respects with requirements of relevant byelaws of the municipal corporation/ Development Authority/ Applicable Statutory Authority the jurisdiction of which the work is to be executed or as directed by the Engineer-In-Charge.

1.5.16 All plumbing services shall be handed over to Engineer-In-Charge complete in all respects. Incomplete work will not be taken over. Any loss or damage to these services due to any reasons by anybody whatsoever before handing over will be at contractors' risk and cost. Any damage to any structural, finishing work done during the testing or rectification shall be made good by the contractor at his own cost and risk.

1.6 MATERIALS & WORKMANSHIP

1.6.1 All materials used in the works shall conform to latest Indian Standard Codes and shall be from the list of approved vendors in tender specifications.

1.6.2 A sample library of all approved materials shall be maintained at site till the completion of work.

1.6.3 As far as possible materials bearing I.S. certification marks shall be used with the approval of the Architect/ Engineer in Charge.

1.6.4 Wherever required the Engineer-in-charge may ask for a Factory Acceptance Test Certificate, and for this may ask to arrange for a factory visit. The contractor shall provide all possible support for arranging for the factory visit and providing the required Factory Acceptance Test Certificate.

1.6.5 Unless otherwise specified and expressly approved in writing by the Architect/ Engineer in Charge, materials of makes and specifications mentioned with tender shall be used. In case of any items, list of approved vendors is not given; the contractor shall submit his recommendation to Engineer in charge with proper technical back up justifying the selection.

1.6.6 Workmanship and general finish shall be of first class quality and in accordance with best workshop practice. All similar items of the Plant and their component parts shall be completely interchangeable.

1.6.7 Spare parts shall be manufactured from the same materials as the originals and shall fit all similar items.

1.6.8 All equipment shall operate without excessive vibration and with minimum noise.

1.6.9 All revolving parts shall be truly balanced both statically and dynamically so that when running at normal speeds at any load up to the maximum there shall be no vibration due to lack of balance.

1.6.10 All parts which can be worn or damaged by dust shall be totally enclosed in dust proof housings

1.6.11 All materials selected in the work shall be most suitable for duty concerned, free from imperfections, selected for long life and minimum maintenance.

1.6.12 All necessary accessories required for satisfactory and safe operation of the Plant shall be supplied by the Contractor unless it is specifically excluded from his scope.

1.6.13 All valves shall be closing on clockwise rotation of the hand wheel. The effort required to close/ open under all operating conditions shall be limited to 7 kg. The direction of opening/ closing shall be cast on the hand wheel.

1.6.14 All flanges shall be drilled in accordance with requirements of IS: 1538. All flanges shall be full or spot faces on the back side. The flange thickness shall be uniform throughout. Flange outside periphery shall be concentric with the bore. Flanges shall be finished smooth on periphery also Castings and fabricated materials shall be finished smooth all over.

1.7 INSPECTION AND TESTING OF MATERIALS

1.7.1 Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of materials supplied to him.

1.7.2 The tests carried out shall be as per the relevant Indian standards.

1.7.3 Testing charges including incidental charge and cost of sample for testing shall be borne by the contractors for all mandatory tests.

1.7.4 Wherever required the Engineer-in-charge may ask for a Factory Acceptance Test Certificate, and for this may ask to arrange for a factory visit. The contractor shall provide all possible support for arranging for the factory visit and providing the required Factory Acceptance Test Certificate.

1.7.5 In case of non-I.S. materials, it shall be the responsibility of the contractor to establish the conformity of material with relevant I.S. specification by carrying out necessary tests. Testing charges including incidental charge and cost of sample for testing shall be borne by the contractors for such tests.

1.7.6 The materials should pass all tests and tolerance in dimensional, chemical, physical properties should be within the limit as stipulated in relevant I.S. for acceptance. Such materials will be accepted as standard.

1.7.7 Payments shall be restricted to standard unit mass, or as specified in the bill of quantities, without making any cost adjustment towards mass or any other properties provided the material pass all the tests and tolerance are within the specified limit.

1.7.8 All such equipment shall be tested for calibration at any approved laboratory, if required by the Engineer in Charge.

1.7.9 All testing equipment shall be preferably located in a special room meant for the purpose.

1.8 MOCK UP

1.8.1 The contractor shall install all pipes, fixtures, clamps, and accessories and fixing devices in mock-up shaft or room, so constructed as directed by Architect/ Engineer in Charge without any cost. The materials used in the mock-up may be reused in the works if found undamaged.

1.8.2 The contractor shall have to assemble at least one set of each type of sanitary fixtures and CP fittings in order to determine precisely the required supply and disposal connections. Relevant instructions from manufacturers shall be followed as applicable. This trial assembly shall be developed to determine the location of puncture holes, holding devices etc. which will be required for final installation of all sanitary fixtures and fittings. The above assembly shall be subject to final approval by the Architect/ Engineer in Charge.

1.8.3 Any tiles or finished surfaces or floors damaged by the contractor while doing his work shall be made good with new tiles or other finishing material. No payment shall be admissible for such repairs. The Architect / Engineer in Charge may, at his discretion get the damaged work repairs to the contractor.

1.9 MATERIALS SUPPLIED BY ENGINEER-IN-CHARGE

1.9.1 The contractor shall verify that all materials supplied by the Engineer-in-charge conform to the specifications of the relevant item in the tender. Any discrepancy found shall be brought to the notice of the Engineer in charge.

1.9.2 If any materials issued to the contractor, free of cost, are damaged or pilfered during storage, transportation, and installation, the cost of the same shall be recovered from the contractor on the basis of actual cost to owner which shall include all freight and transportation, excise duty, sales tax, octroi, import duty etc.

1.10 REFERENCE POINTS

1.10.1 Contractor shall provide permanent benchmarks, flag tops and other reference points for the proper execution of work and these shall be preserved till the end of the work.

1.10.2 All such reference points shall be in relation to the levels and locations given in the Architect/ Engineer in Charge and plumbing drawings.

1.11 REFERENCE DRAWINGS

1.11.1 The contractor shall maintain one set of all construction drawings issued to him as reference drawings. These shall not be used on site.

1.11.2 All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion (as built) drawings. All changes to be made shall be initialed by the Engineer in charge.

1.11.3 One complete set of construction drawings shall be made available to the execution engineer & shall be maintained in good condition throughout the execution activities.

1.12 SHOP DRAWINGS

1.12.1 The contractor shall submit to the Architect/ Engineer in Charge four copies of the shop drawings.

1.12.2 Shop drawings shall be submitted under following conditions:

a) Showing any changes in layout in the plumbing drawings.
b) Foundation details, Nozzle Orientation, Equipment layout and piping, wiring diagram.

c) Manufacturers or contractor's fabrication drawings for any materials or equipment supplied by him.

1.12.3 The contractor shall submit the number of copies of catalogues, manufacturers drawings, technical data sheet, equipment characteristic data or performance charts as required by the Architect/ Engineer In Charge.

1.13 SITE CLEARANCE AND CLEANUP

1.13.1 The contractor shall, from time to time clear away all debris and excess materials accumulated at the site.

1.13.2 After the fixtures, equipment and appliances have been installed and commissioned, contractor shall clean-up the same and remove all plaster, paints stains, stickers and other foreign matter of discoloration leaving the same in a ready to use condition.

1.13.3 On completion of all works, contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done at contractor's risk and cost.

1.14 TESTING

1.14.1 Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.

1.14.2 Tests shall be performed in the presence of the Engineer in Charge. The engineer in charge shall issue a certificate for approved testing of all systems duly signed & stamped.

1.14.3 Wherever required the Engineer-in-charge may ask for a Factory Acceptance Test Certificate, and for this may ask to arrange for a factory visit. The contractor shall provide all possible support for arranging for the factory visit and providing the required Factory Acceptance Test Certificate.

1.14.4 All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.

1.14.5 Contractor shall perform all such tests as may be necessary and required by the local authorities to meet Municipal or other byelaws in force.

1.14.6 Contractor shall provide all labour, equipment, and materials for the performance of the test.

1.14.7 After completion of work and during the maintenance liability period of contract, the work shall be subjected to "Post construction and testing". In case, if the materials incorporated in the work are found to be inferior, though the sample collected from the materials might have been passed at the time of execution, it shall be the responsibility of the contractor to replace the same without any cost to the Owner failing which the Owner may rectify the same at the risk and cost of the contractor or the Owner may accept the same as substandard, and cost be adjusted from the outstanding security deposit as per the terms and condition of the contract for the work.

1.15 LICENSE AND PERMITS

1.15.1 Contractor must hold a valid plumbing license issued by the Municipal authority or other competent authority under whose jurisdiction the work falls.

1.15.2 Contractor must keep constant liaison with the Municipal authority and obtain approval of all drainage and water supply works carried out by him.

1.15.3 Contractor shall obtain, from the municipal authority, completion certificate with respect to his work as required for occupation of the building.

1.15.4 All inspection fees or submission fees paid by the contractor shall be reimbursed by the Owner on

production of valid official receipts

1.16 HANDING OVER DOCUMENTS

1.16.1 On completion of work, contractor shall submit one complete set of as built drawings in editable soft copy and two hard prints of 'as built' drawings to the Engineer in Charge.

1.16.2 The as-built drawings shall have the following information:

a) Ground and invert levels of all drainage pipes together with location of all manhole and connections up to outfall.
b) Location of all mechanical equipment with layout and piping connections & location of electrical panel for the same.
c) All technical data sheets for the mechanical equipment, such as pumps, solar hot water generators, air-to-water heat pumps, sump pumps, etc.
d) All technical data sheets for the electrical actuator operated butterfly valves, electronic flow meters, etc.

1.16.3 All 'warranty cards' given by the manufacturers shall be handed over to the Architect/ Engineer in Charge.

1.16.4 Contractor shall provide Operation and Maintenance manual of all major Electro-mechanical equipment.

1.16.5 All test certificates of materials & testing at manufacturer works shall be submitted in one set of hard copy.

1.16.6 All site performance test certificates approved by Engineer in charge shall be submitted in one set of hard copy.

2: LIST OF APPLICABLE CODES AND STANDARDS:

2.1 Plumbing system design shall conform to National Building Code– 2016 Part 9: Plumbing Services Section 1 Water Supply & Section 2 Drainage and Sanitation, and CPHEEO Manuals.

2.2 All equipment and material being supplied, erected, installed, tested and commissioned at site shall meet the requirements of Bureau of Indian Standards and other relevant standard and codes.

IS CODE	DESCRIPTION
NBC - 2016	National Building Code of India: Part-9 Plumbing Services
UPC - 2017	Universal Plumbing Code for Water Supply, Sanitation & Drainage for India by Indian Plumbing Association
IEC	International Electric Code – IE 60034 / 30 for Efficiency of Motors.
ECBC – 2017	Energy Conservation Building Code for Motors and Pumps
IS: 1172	Code of basic requirements for water supply, drainage and sanitation
IS: 1200 (Pt. 19)	Method of measurements for Water supply, plumbing and drains.
IS: 1239 (Pt I)	Specifications for Mild steel tubes
IS: 1239 (Pt. II)	Specifications for Mild Steel Tubular & other wrought steel pipe fittings
IS: 1701	Combination valve, mixing valves
IS: 1711	Self-closing taps.
IS: 1742	Code of Practice for Building Drainage
IS: 1795	Pillar Taps for water supply purposes
IS: 2065	Code of Practice for Water Supply in Buildings
IS: 2379	Colour Code for identification of pipes
IS: 2548 (Pt. I & II)	Plastic water closet seats and covers.
IS: 2556 (Pt. I to IX)	General & Specific requirements for Vitreous China Ceramic ware and sanitary appliances
IS: 2951 (Pt. I & II)	Recommendations for estimate of flow of liquids in closed conduits
IS: 3311	Waste plug & its accessories for sinks and wash basins
IS: 4736	Hot-dip zinc coatings on mild steel tubes.
IS: 4346	Washers for use with fittings for water services.
IS: 4854 (Pt. I to III)	Glossary terms for valves and their parts
IS: 5312 (Pt. I)	Swing check type reflux (non-return) valves – single door pattern
IS: 5329	Code of Practice for Sanitary pipe work above ground for building
IS: 5961	Specifications for C.I. grating for drainage purposes
IS: 6587	Specifications for Spun Hemp Yarn
IS: 7231	Specifications for Plastic Flushing Cistern for water closets and urinals
IS: 8931	Specifications for Copper Alloy Fancy Single Taps, Combination Tap assembly, and Stop Valves for water services
IS: 8934	Cast copper alloy fancy pillar taps for water services
IS: 9079	Specifications for Monoset pumps for clear, cold water for agricultural and water supply purposes.

IS: 9140	Method of Sampling vitreous & fire clay sanitary appliances
IS: 9338	Specifications for Cast Iron Screw Down Stop Valves and Check Valves for water works purposes.
IS: 9542	Horizontal Centrifugal Monoset pumps for cold, fresh water
IS: 10221	Code of practice for coating and wrapping of underground steel pipes.
IS: 10446	Glossary terms relating to water supply & sanitation
IS: 10500	Specification of Drinking Water
IS: 12469	Specifications for pumps
IS: 13095	Butterfly valves for general purposes
IS: 13114	Specification for forged brass gate, globe, & check valves for water works purposes
IS: 13592	Specifications for PVC Soil, Waste & Rainwater (SWR) including ventilation pipes
IS: 14735	Specifications for UPVC injection moulded fittings for UPVC SWR pipes

3: MAKE LIST FOR PLUMBING WORKS:

SR	ITEM DESCRIPTION	MAKE
	Sanitary Ware	
01	Vitreous China Sanitary ware	Hindware / Cera / Jaquar
	C.P. Brass Faucets & Fittings	
02	C.P. Brass Faucets	Hindware / Cera / Jaquar
03	C.P. Brass Fittings	Hindware / Cera / Jaquar
	Stainless Steel Ware, Fittings & Accessories	
04	Washroom accessories	Jaquar / Cera / Hindware
	Internal Drainage Pipes & Fittings	
05	PVC 6 kg/cm^2 & 10 kg/cm^2 Pipes	Astral / Supreme / Ashirvad
06	UPVC SWR Pipes of Type B class as per IS: 13592	Astral / Supreme / Ashirvad
07	Stainless Steel Floor Drain Covers with Cockroach Traps	Neer / Chilly / Equivalent
08	Brass / Nickel Floor Cleanout Plugs	Neer / Chilly / Equivalent
	Water Supply Pipes & Fittings	
09	G.I. Pipes & fittings	Jindal Hissar / Tata / Equivalent
10	Pipe Insulation	Astral / Supreme / Armaflex / Thermaflex
11	Gun Metal Ball Valve	Zoloto / Sant / Leader
12	Gun Metal Gate Valve	Zoloto / Sant/ Leader
13	Gun Metal Butterfly Valve	Zoloto / Sant / Leader
14	Gun Metal Non-Return Valve	Zoloto / Sant/ Leader
15	Cast Iron Y Strainer	Zoloto / Sant/ Leader
16	Air Release Valve	Zoloto / Sant/ Leader
17	Pressure Gauge	Zoloto / Sant / Equivalent
18	Pipe Clamps and Support	Intellotech / Fischer / Hitech / Hilti
	Equipment	
19	Water Coolers with Inbuilt UV filters	Power H2O / Blue Star / Voltas / Usha
20	Hydro-pneumatic Pumping Systems	Wilo / Xylem / Grundfos / Equivalent

4: WATER SUPPLY:

4.1 SCOPE OF WORK

4.1.1 Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install for water supply system (Cold Water Supply + Hot Water Supply) as required by the drawings, specified hereinafter and given in the Schedule of Quantities.

4.1.2 Without restricting to the generality of the foregoing, the water supply system shall include the following:

a) Domestic Water Main Distribution System from Individual building OHT.
b) All water supply lines to various parts of the building including connection to vertical stack/ main source line.
c) Pipe protection and painting.
d) Connections to all plumbing fixtures.
e) Ball valve/butterfly valve/non-Return valve/Pressure reducing valve/Air valve, etc.
f) Supports/ Clamps, Excavation& refilling of pipe trenches, required civil work.

4.2 GENERAL REQUIREMENTS

4.2.1 All materials shall be new and of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Project Manager.

4.2.2 Pipes and fittings shall be of fresh material & shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

4.2.3 Short or long bends shall be used on all main pipelines as far as possible. Use of elbows shall be restricted for short connections.

4.2.4 Pipes shall be laid in a manner that provides easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passage etc.

4.2.5 Valves and other appurtenances shall be located to provide easy accessibility for operations, maintenance, and repairs.

4.2.6 Pipe shall be securely fixed to wall and ceiling by suitable clamps at intervals specified.

4.2.7 Tender drawings indicate schematically the size and location of pipes. The contractor on the award of the work shall prepare detailed working drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and control valves, drain valves and all pipe support, structural supports. They must keep in view the specific openings in buildings and other structures through which pipes are designed to pass.

4.2.8 Pipe sleeves, 50 mm larger diameter than pipes, shall be provided wherever pipes pass through walls and slabs, and annular space filled with fibreglass and finished with retainer rings.

4.2.9 All pipe work shall be carried out in a workman like manner, causing minimum disturbance to the existing services, buildings, and structure. The entire piping work shall be organized in consultation with other agencies work so that the area work shall be carried out in one trench.

4.2.10 Cut outs in the floor slab for installing the various pipes are indicated in the drawings. Contractor shall carefully examine the cut outs provided and clearly point out wherever the cut outs shown in the drawings, do not meet with the requirements.

4.2.11 The contractor shall make sure that the clamps, steel structural supports brackets, clamp saddles and hangers provided for pipe supports are adequate.

4.3 SYSTEM TESTING

4.3.1 All pipes, fittings & valves shall be tested by hydrostatic pressure of 10 kg/cm2 or 1.5 times working pressure whichever is higher. Pressure shall be maintained for at least 2 hrs. A test register shall be maintained & all entries shall be signed & dated by contractor & engineer in charge.

4.3.2 In case of sectional testing carried out during construction, contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages & shall replace defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings to the building, furniture& fixtures shall be made good during defect liability period without any extra cost. All hot water supply & return piping shall be checked for proper insulation.

4.3.3 After completion the water supply system, contractor shall test each valve by closing & opening it many times to observe it's working. Valves which do not effectively operate shall be replaced by new ones at no extra cost & same shall be tested as above.

4.4 DISNFECTION/ STERILISATION OF PIPING & TANK

4.4.1 Before commissioning of water supply system, the contractor shall arrange to disinfect the entire system.

4.4.2 Water storage tanks & pipes shall first be filled with water & thoroughly flushed out. The storage tanks shall then be filled with water again & disinfecting chemical containing chlorine shall be added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water.

4.4.3 If ordinary bleaching powder is to be used, the proportion shall be 150 gm of powder in 1000 litre of water. The powder shall be mixed with water in storage tank. For any other chemical, the proportion shall be as recommended by the manufacturer. When the storage tank is full, the supply shall be stopped; all tapes on distributing lines shall be opened successively. Each tap shall be closed when water discharged shall begin to smell chlorine. The storage tank shall then be filled with supply pipe with more disinfecting chemicals in recommended proportion. The storage tank & pipe shall remain charged for at least 3 hours. Finally, tank & piping shall be thoroughly flushed out before water is to be used for domestic application.

4.5 PRE-COMMISSIONING

4.5.1 Ensure that all pipes are free from debris & obstructions.
4.5.2 Check all valves for effective on-off operation.
4.5.3 Ensure than all connections to branches are made.
4.5.4 Ensure connection of mains to UG tank, Pumps & OH tank as per requirement.
4.5.5 Water supply shall be available at underground tank.
4.5.6 Ensure that all line valves shall be closed.

4.6 COMMISSIONING

4.6.1 Disinfect Storage tanks & piping.

4.6.2 In case of borewell supply, start pump & fill underground water tank. Water shall first enter fire compartment & then fill domestic compartment.

4.6.3 Start domestic pump to fill OH tank. After filling the OH tank, drain the tank to its ¼ the capacity by opening the drain valve. This is to ensure removal of silt, mud, debris, etc. Again, fill OH tank to full.

4.6.4 Release water in each line by opening the line valves, flush out whole piping system & ensure clear water is now coming out of the system.

4.6.5 Observe valves for any leakage. Check the pressure at pump & at farthest utility points.

4.7 GI PIPES & FITTINGs as per IS: 1239

4.7.1 SCOPE

4.7.1.1 The item includes supplying of G.I. pipes with fittings including laying, fixing, cutting, joining, painting etc.

4.7.2 MATERIAL

4.7.2.1 Galvanised steel pipe shall conform to IS: 1239 of size & class as specified in bill of quantities. When Class is not specified, they shall be Heavy Class.

4.7.2.2 Fittings shall be of malleable cast iron galvanized of approved make. Each fitting shall have manufacturer's trademark stamped on it. Fittings for G.I pipes shall include couplings, bends, tees, reducers, nipples, unions, bushes etc. Fittings etc. shall conform to IS: 1879. (Part 1 to X) with latest edition.

4.7.3 JOINTING & FIXING

4.7.3.1 Pipes and fittings shall be jointed with screwed joints using Teflon tape suitable for water pipes. Care shall be taken to remove burr from the end of the pipe after cutting by a round file. All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. Necessary vents and drains shall be provided at all high and low points respectively. G.I pipes inside toilets shall be fixed in wall chases well above the floor. No pipes shall be run inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors and other areas as shown on drawings.

4.7.3.2 Piping shall be properly supported on or suspended from clamps, hangers as specified and as required. The contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency.

4.7.3.3 All pipe clamps, supports, hangers, pipe support shall be factory made galvanized MS steel or alternatively galvanized/ anti rust coating after fabrication to suit site requirement pipe supports. Pipe supports shall be adjustable for height where pipe and clamps are of dissimilar materials a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following:

Sr. No.	Pipe Size	Spacing between Supports
1	Up to 12 mm	1500 mm (1.5m)
2	15 to 150 mm	2000 mm (2.0 m)
3	150 mm & over	2500 mm (2.5m)

4.7.3.4 G.I pipes in shafts and other locations shall be supported by clamps of design approved by the Architect/ Consultants. Pipes in wall chases shall be anchored by iron hooks. Pipes at ceiling level shall be supported on structural clamps fabricated from MS structural steel. Pipes in shafts shall be supported on slotted angles/ channels as specified/ as directed.

4.7.3.5 Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars steel structural supports attached to pipe and with a 15 mm thick rubber pad or any resilient material. Where pipes pass through the terrace floor, suitable flashing shall be provided to prevent water leakage. Risers shall have a suitable clean out at the lowest point and air vent at the highest point.

4.7.3.6 Anchor Fasteners:
All pipes supports, hangers and clamps to fixed on RCC walls, beams, columns, slabs and masonry walls 230 mm thick and above by means of galvanised expandable anchor fasteners in drilled holes of correct size and model to carry the weight of pipes. Drilling shall be made only by approved type of power drill as recommended and approved by manufacturer of the anchor fasteners. Failure of any fastening devices shall be the entire responsibility and contractor shall redo or provide additional supports at his own cost. The contractor shall also compensate the owner for any damage that may be caused by such failures.

4.7.3.7 Unions:
Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock or check valve and on straight

runs as necessary at appropriate locations as required for easy dismantling and/ or as directed by Architect/ Consultants.

4.7.3.8 Flanges:
Flanged connections shall be provided on pipes as required for maintenance/ ease in dismantling or where shown on the drawings, all equipment connections as necessary and required or as directed by the Architect/ Consultants. Connections shall be made by the correct number and size of the GI nuts/ bolts as per relevant IS Standards and made with 3mm thick insertion rubber washer/ gasket. Where hot water or steam connections are made insertion gasket shall be of suitable high temperature grade and quality approved by the Architect/ Consultants. Hole diameter for bolt in flanges shall conform to match the specification for CI sluice valve as per relevant IS Gaskets shall conform to IS: 639.

4.7.3.9 Expansion joints shall be provided wherever necessary to take due care for expansion and contraction in the pipe

4.7.4 PAINTING

4.7.4.1 All pipes above ground shall be painted with one coat of red oxide and two coats of synthetic enamel paint of approved shade and quality. Pipes shall be painted to standard colour code specified by the Architect/Consultants.

4.7.5 PIPE PROTECTION

4.7.5.1 Where specified in the schedule of quantities all pipes in chase below ground shall be protected against corrosion by applying two coats of bitumen paint wrapping with polythene tape and finishing with one more coat of bitumen paint.

4.7.6 TESTING

4.7.6.1 The openings of the pipes shall be sealed for the section to be tested. All control valves shall be positioned open for the duration of the test and open end closed with watertight fittings. The testing pressure on completion of the work shall not be less than 1.5 times the working pressure of the pipes or 7.5 Kg/Sq.cm whichever more is.

4.7.6.2 Pressure shall be applied either by hand pump or power driven pump. Pressure gauges shall be calibrated, correctly positioned, and closely observed to ensure that at no time are the test pressure exceeded. The systems shall be slowly and carefully filled with water to avoid surge pressure or water hammer. Air vents hall be open at all high points so that air may be expelled from the system during filling.

4.7.6.3 When the system has been fully charged with water and air displaced from the line air vent shall be closed and the line initially inspected for seepage at joints and firmness of supports under load. Pressure is reached. Without any additional requirement of make-up-water the test pressure should not fall more than 0.02 MPa (0.2 kg./sq.cm) at the end of one hour test duration.

4.7.6.4 The water pressure shall be maintained for minimum of two hour with accurate pressure gauge. The engineer shall examine carefully all the joints for leakage. Any joint found leaking shall be redone, and all leaking pipes removed and replaced without extra cost.

4.7.7 RATES

4.7.7.1 G.I. Pipes and fittings of specified diameter & pressure class.
4.7.7.2 Laying and cutting the pipe wherever necessary and wastage.
4.7.7.3 Over ground installation with supports/clamps, accessories required.
4.7.7.4 Pipe & Fitting with insulation for water application if specified in schedule of quantities
4.7.7.5 Jointing & fixing material.
4.7.7.6 Making all damage good to original condition after completion of installation work.
4.7.7.7 Testing the entire system and rectification of defects if any.
4.7.7.8 Painting the pipeline for over ground installation as mentioned in schedule of quantities.
4.7.7.9 All necessary materials, labour, and use of tools.

4.7.8 MODE OF MEASUREMENT

4.7.8.1 The measurement shall be for unit running meter length of pipeline laid of fixed. The measurement shall be taken along the centre line of pipe. No measurement shall be recorded separately for fittings, making joint, supports, clamps & painting. It shall also include insulation for hot water application & civil work for underground installation if mentioned in schedule of quantities.

4.7.9 MODE OF PAYMENT

4.7.9.1 Mode of payment shall be Unit length of pipeline laid or fixed. No extra payment shall be made for fittings, making joint, supports, clamps & painting. It shall also include insulation for hot water application & civil work for underground installation if mentioned in schedule of quantities.

4.8 THERMAL INSULATION FOR WATER PIPE – NITRILE RUBBER OR CCCL WITH ALUMINIUM FOIL:

4.8.1 SCOPE

4.8.1.1 This specification covers the requirements for manufacture, supplying, applying, jointing, testing, and commissioning of pipe insulation with aluminium foil water conveyance & distribution system

4.8.2 MATERIAL & INSTALLATION

4.8.2.1 Insulation material for Pipe insulation shall be Closed Cell Elastomeric Nitrile Rubber or closed cell cross linked polyethylene foam with aluminium foil.

4.8.2.2 Thermal conductivity of elastomeric nitrile rubber shall not be less than 0.0382 W/mK at mean temp. of 26 C°. The product shall have temperature range of –40 C° to 105 C°.

4.8.2.3 Density of material shall not be less than 30 + 3 kg / M^3.

4.8.2.4 The insulation shall have fire performance such that it passes minimum CLASS 1 as per BS476 part 7 for surface spread of flame. Water vapor permeability shall not exceed 0.024 per inch (3 x 10-14 Kgs/ m. sec. Pa).

4.8.2.5 Thickness of the insulation shall be as specified for the individual application.

4.8.2.6 Each lot of insulation material delivered at site shall be accompanied with manufacturer test certificate for thermal conductivity values. Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for thermal conductivity and density at Contractor's cost.

4.8.2.7 All joints shall be sealed properly with adhesive, which shall provide similar vapor barrier as the original insulating material.

4.8.2.8 All water piping shall be insulated in the manner specified herein. Before applying insulation, all pipes shall be brushed and cleaned. Thermal insulation shall be applied as follows or as specified in drawings or schedule of quantity.

Pipe size (mm)	Thickness
15 mm to 65 mm	6 to 9 mm

4.8.2.9 Insulation for pipes in wall chase and for pipes in shaft / plant room.

a. Insulating material in tube form shall be sleeved on the pipes. On existing piping, slit opened tube from insulating material shall be placed over the pipe and adhesive (as recommended by the manufacturer) shall be applied as suggested by the manufacturer. Adhesive must be allowed to tack dry and then press surface firmly together starting from butt end and working towards centre.

b. Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. The insulation shall be continuous over the entire run of piping, fittings, and valves.

c. All valves, fittings, joints, strainers etc. in hot water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

4.8.2.10 All insulation work shall be carried out by skilled workmen specially trained in this kind of work. All insulated pipes shall be labelled (HWS/ HWR/ HWRR/CWS) and provided with 300 mm wide band of paint along circumference at every 1200 mm for colour coding. Direction of fluid shall also be marked. All painting shall be as per relevant BIS codes.

4.8.3 PROTECTIVE COATING OVER INSULATION

4.8.3.1 Aluminium Foil coating to provide mechanical strength and protection from damage all exposed pipe insulated with nitrile rubber as indicated in BOQ.

4.8.4 RATES

4.8.4.1 Insulation material with thickness as specified in schedule of quantities with required thermal conductivity & density.
4.8.4.2 Application of insulation with all jointing & fixing materials.
4.8.4.3 Making all damage good to original condition after completion of installation work.
4.8.4.4 Testing the entire system and rectification of defects if any.
4.8.4.5 All necessary materials, labour and use of tools.

4.8.5 MEASUREMENT & PAYMENT

4.8.5.1 Pipe Insulation shall be measured & payment shall be made in units of length along the centre line of the installed pipe, strictly on the same basis as the piping measurements. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers shall not be separately measurable by their number and size.

4.9 PRESSURE GUAGE

4.9.1 SCOPE

4.9.1.1 The item includes provision of Pressure Gauge of specified range as mentioned in the schedule with siphon tubing & SS isolation cock.

4.9.2 MATERIAL
4.9.2.1 The pressure gauge shall be constructed of die cast aluminium and stove enamelled.
4.9.2.2 It shall be weatherproof with an IP 55 enclosure.
4.9.2.3 It shall be a stainless-steel Bourdon tube type pressure gauge with a scale range from 0 to 16 Kg/cm² and shall be constructed as per IS:3524.
4.9.2.4 Each pressure gauge shall have a siphon tube connection. The shut off arrangement shall be by SS Ball Valve.

4.9.3 FIXING
4.9.3.1 It shall be fixed vertically in position on pipeline by means of screwed nipple, spool piece or as required or as directed by the Engineer-in-charge.

4.9.4 TEST
4.9.4.1 Calibration certificate shall be obtained and submitted for each pressure gauge.

4.9.5 RATES
4.9.5.1 Pressure Gauge with isolation valve & siphon tubing.
4.9.5.2 Making connection with piping with all accessories.
4.9.5.3 Making all damage good to original condition after completion of installation work.
4.9.5.4 Testing the entire system and rectification of defects if any.
4.9.5.5 All necessary materials, labour and use of tools.

4.9.6 MODE OF MEASUREMENT
4.9.6.1 The measurement shall be for each unit of Pressure Gauge of specified range fixed.

4.9.7 MODE OF PAYMENT

4.9.7.1 The contract rate shall be for each unit Pressure Gauge of specified range fixed.

4.10 FORGED BRASS BALL VALVES

4.10.1 SCOPE

4.10.1.1 The item includes provision of forged brass ball valves with hard chrome plated steel ball tested to a pressure not less than 15 kg/cm2 with threaded or flanged joints including fixing and testing.

4.10.2 MATERIAL

4.10.2.1 All ball valves shall be heavy duty of approved make.

4.10.2.2 Valves shall have suitable for pressure of PN 15.

4.10.2.3 Ball valves up to 80 mm shall have forged brass body, SS spindle & Teflon seat rings.

4.10.2.4 Ball valve shall conform to IS: 9890 or BS: 1868.

4.10.2.5 Full way lever operated forged brass ball of brass body with forged brass hard chrome plated steel ball tested to a pressure not less than 15 kg/cm2 with threaded or flanged joints. The weight of the full way valve shall be as per the table given below with a tolerance of 5 percent.

Diameter in mm	Flanged arch (Kg)	Screwed arch (Kg)
15	1.021	0.567
20	1.503	0.680
25	2.495	1.077
32	3.232	1.559
40	4.082	2.268
50	6.691	3.232

4.10.2.6 The valves shall have either screwed ends or flanged ends

4.10.3 FIXING

4.10.3.1 The valves shall be fixed in position in the pipeline as shown in the drawing or as directed with necessary socket or union, nuts, flanges, hardware, gaskets, tail piece, etc.

4.10.3.2 During installation, flow direction on the valve shall be checked.

4.10.3.3 Valves shall be preferably installed in horizontal position with adequate supports.

4.10.4 TESTING

4.10.4.1 The valves shall be body & seat tested at manufacturer's works as per the relevant standard & duly stamped. Test certificate shall be submitted for material & hydraulic testing.

4.10.4.2 After fixing in the pipelines, the system shall be hydraulically tested for 1.5 times working pressure or 22.5 kg/cm2 whichever is higher for minimum 4 hrs without any pressure drop. In case of leakage, contractor shall rectify/replace valves at his own cost

4.10.4.3 Valves shall also be tested for its hand wheel / lever function by frequent on-off operation.

4.10.5 THE RATES ARE INCLUSIVE OF:

4.10.5.1 Forged brass Ball Valve of required type, size & pressure rating.

4.10.5.2 Fixing & jointing material.

4.10.5.3 Making all damage good to original condition after completion of installation work.

4.10.5.4 Testing.

4.10.5.5 All necessary materials, labour and use of tools.

4.10.6 MODE OF MEASUREMENT

4.10.6.1 The measurement shall be for each unit valve of specified diameter fixed.

4.10.7 MODE OF PAYMENT

4.10.7.1 The contract rate shall be for each unit of valve of specified diameter fixed.

4.11 FORGED BRASS / BRONZE GATE VALVES

4.11.1 SCOPE

4.11.1.1 The item includes supply, installation, testing and commissioning of Forged Brass / Bronze Gate valves of type, size & pressure class as mentioned in the schedule of quantities.

4.11.2 MATERIAL

4.11.2.1 Gate valves shall be as per IS 13114 / BSEN 12288 / BS 5154
4.11.2.2 The body and wedge of the gate valves shall be of bronze material as per IS: 318 – Gr. LTB2.
4.11.2.3 Gate valves shall be screwed female ended as per IS 554 / BS 21
4.11.2.4 Gate valves shall have Forged Brass / Bronze bonnet and check nut as per IS: 6912 – Gr. FLB / IS: 318 – Gr. LTB2.
4.11.2.5 Gate valves shall have a non-rising forged brass stem as per IS: 6912 – Gr. FLB.
4.11.2.6 Gate valves shall have powder coated sheet metal handwheel for a firm grip and convenient operation.
4.11.2.7 All globe / gate valves shall be heavy duty of approved make.
4.11.2.8 Gate valves shall have suitable for pressure of Shell: 2.5 MPa (25 kg/cm^2).
4.11.2.9 Gate valves shall be of Forged Brass / Gun Metal unless otherwise specified.
4.11.2.10 Gate valves shall have and Integral Seat and premium quality PTFE gland packing.
4.11.2.11 Suitable for Water & Oil.
4.11.2.12 Screw / Bolt made of Carbon Steel (Zinc Plated).
4.11.2.13 Washer made of Carbon Steel (Zinc Plated).
4.11.2.14 Forged Brass Gland & Gland Nut as per IS: 6912 – Gr. FLB.
4.11.2.15 The gland packing shall be made of PTFE material as per BSEN 12086 – 1.

4.11.3 FIXING

4.11.3.1 The valves shall be fixed in position in the pipeline as shown in the drawing or as directed with necessary socket or union, nuts, flanges, hardware, gaskets, tail piece, etc.
4.11.3.2 During installation, flow direction on the valve shall be checked.
4.11.3.3 Valves shall be preferably installed in horizontal position, except butterfly valves which can be fixed in the vertical position.
4.11.3.4 Screwed valves after few turns shall be applied with Teflon tape over the threaded ends to obtain complete water tightness. Flanged joint shall be fixed with non-corrosive bolts & nuts with suitable thickness asbestos fibre gasket conforming to IS 638 for water tightness.

4.11.4 TESTING

4.11.4.1 The valves shall be body & seat tested at manufacturer's works as per the relevant standard & duly stamped. Test certificate shall be submitted for material & hydraulic testing.
4.11.4.2 After fixing in the pipelines, the system shall be hydraulically tested for 1.5 times working pressure or 10 kg/cm2 whichever is higher for minimum 4 hrs without any pressure drop. In case of leakage, contractor shall rectify/replace valves at his own cost
4.11.4.3 Valves shall also be tested for its hand wheel/ lever function by frequent on-off operation.

4.11.5 RATES

4.11.5.1 Valve of required type, size & pressure rating.
4.11.5.2 Fixing & jointing material.
4.11.5.3 Painting.
4.11.5.4 Making all damage good to original condition after completion of installation work.
4.11.5.5 Testing.

4.11.5.6 All necessary materials, labour and use of tools.

4.11.6 MODE OF MEASUREMENT

4.11.6.1 The measurement shall be for each unit valve of specified diameter fixed.

4.11.7 MODE OF PAYMENT

4.11.7.1 The contract rate shall be for each unit of valve of specified diameter fixed. No extra payment shall be made for fittings used in fixing of the valve.

4.12 FORGED BRASS / BRONZE PRESSURE REDUCING VALVE

4.12.1 SCOPE

4.12.1.1 The item includes provision of pressure reducing valve of specified diameter with all accessories as mentioned in the schedule including fixing.

4.12.2 MATERIAL

4.12.2.1 Pressure reducing valve is a device with suitable means of connection for insertion in a vertical pipeline for controlling the water pressure.
4.12.2.2 Each pressure reducing valve (PRV) set shall be installed with isolating valves on inlet & outlet, as mentioned in the water supply schematic layouts.
4.12.2.3 PRV shall be of brass housing, spring bonnet with adjustable opening having adjustable knob for pressure adjustment.
4.12.2.4 Valve shall be vertical flow type, conforming to IS: 9739-1981.
4.12.2.5 Each PRV shall contain loading neoprene diaphragm & a full floating, self-aligning, ignition resistant seat.
4.12.2.6 Valve shall be of single stage pressure reduction type.
4.12.2.7 Each pressure relief valve shall be of the fully enclosed type and fitted with hand easing gear.
4.12.2.8 Each pressure relief valve in a pressure reducing station shall have a flow capacity equal to that of the pipeline flow.

4.12.3 FIXING

4.12.3.1 The valve shall be fixed in position on the pipeline as shown in the drawing or as directed.
4.12.3.2 The screwed or flanged joint shall be made to obtain complete watertight joint.
4.12.3.3 The force of the diaphragm shall operate against the force of an adjustable spring. The inlet pressure shall have no influence in either the opening or closing the valve, hence, the outlet pressure shall remain constant at all times.
4.12.3.4 Adjustment of Pressure:

The knob fitted on top of the PRV shall be turned toward (-) or (+) sign to reduce/ increase the outlet pressure as desired range.

Inlet pressure : 2.5 ~ 2.8 bar

Outlet pressure : 2.0 ~ 1.5 bar as mentioned in schematics

4.12.3.5 Valves shall be screwed ends with all required jointing/ fixing accessories like tail piece, hardware, Teflon tape, gaskets, etc.

4.12.4 TESTING

4.12.4.1 The joints shall be tested to a hydraulic pressure of 3MPa (30 kg/cm2) or 1.5 times working pressure whichever is higher along with testing of pipeline for a minimum duration of 2 hrs.

4.12.5 RATES

4.12.5.1 Pressure reducing valve.
4.12.5.2 Fixing & jointing material.
4.12.5.3 Making all damage good to original condition after completion of installation work.
4.12.5.4 Testing & commissioning.
4.12.5.5 All necessary materials, labour, and use of tools.

4.12.6 MODE OF MEASUREMENT

4.12.6.1 The measurement shall be for each set of valve of specified diameter fixed.

4.12.7 MODE OF PAYMENT

4.12.7.1 The contract rate shall be for each set of valve of specified diameter fixed.

4.13 GUN METAL AIR VALVE

4.13.1 SCOPE
4.13.1.1 The item includes supplying of single, double action or kinetic air Valve of specified diameter as mentioned in the schedule including fixing.

4.13.2 MATERIAL
4.13.2.1 Single air valve shall have single small or large orifice for releasing air during pipe filling and ventilating the pipe during emptying. Air valves up to 50 mm diameter directly shall be screwed on the main.
4.13.2.2 Double air valve shall have two ball chambers, on outlet of large capacity shall be provided for admission and release of bulk volume of air during emptying and filling of the main, another of small outlet type for the escape of smaller quantities of air accumulating under pressure. They shall be of flanged type.
4.13.2.3 Air valve body, bonnet, glands, caps, joints support rings shall be best grey iron of selected grade, 200 of IS-210-1978 specification for grey iron castings.
4.13.2.4 Ball guides of small orifice units and outlet bushes of large orifice valves shall be of gunmetal.
4.13.2.5 Nipples, spindles shall be machined from rolled, extruded or forged high tensile brass or aluminium bronze.
4.13.2.6 The balls shall be of rubber covered and vulcanite covered. The rubber shall have a smooth and solid surface. It shall be as per I.S. 638-1965 specification for rubber and insertion jointing.
4.13.2.7 Air valve shall be provided with isolation valve with IS certification mark and isolation valve.

4.13.3 FIXING
4.13.3.1 The Air Valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted by means of flange joints or screwed joint to the pipe line.

4.13.4 TESTING
4.13.4.1 The Air Valve and the joints shall be tested hydraulically to a minimum pressure of 10 kg/cm2 or 1.5 times working pressure whichever is greater for minimum 4hrs without any leakage.

4.13.5 RATES
4.13.5.1 Supplying and fixing Air Valve of specified diameter and type with isolation valve.
4.13.5.2 Fixing & Jointing material & specials.
4.13.5.3 Painting.
4.13.5.4 Making all damage good to original condition after completion of installation work.
4.13.5.5 Testing &commissioning
4.13.5.6 All necessary materials, labour and use of tools.

4.13.6 MODE OF MEASUREMENT
4.13.6.1 The measurement shall be for each unit of Air Valve fixed.

5.3.1 MODE OF PAYMENT

4.13.6.2 The contract rate shall be for each unit of air valve fixed.

4.14 CONNECTION TO PVC TANKS:

4.14.1 Inlets, outlets, interconnection sleeves & drain outlets for the reservoir shall be made through mild steel bath galvanized with couplings obtained from reputed manufacturers & to be inserted at suitable levels as indicated on the drawings.

4.14.2 The contractor shall be responsible for placing the inserts at required level well in advance & before making the final shuttering layout for casting the walls.

4.14.3 All sleeves and couplings must be fixed in true alignment & level to ensure further connection in proper order.

4.14.4 The necessary sleeve in the tank wall shall be provided for running the level controller wires/ probes.

4.14.5 The length of the sleeve shall be 600 mm minimum unless otherwise specified.

4.14.6 RATE

4.14.6.1 G.I. Pipe of 600mm length.

4.14.6.2 2 Flanges (at the inlet and outlet end of the pipe)

4.14.6.3 Couplings with rubber pads.

4.14.6.4 Grinder, smoothening paper, etc.

4.14.6.5 All necessary labour, material, and use of tools.

4.14.7 MODE OF MEASUREMENT

4.14.7.1 The measurement shall be for each unit set of coupling fixed.

4.14.8 MODE OF PAYMENT

4.14.8.1 The contract rate shall be for each unit set of coupling fixed.

5: SANITARY INSTALLATIONS:

5.1 <u>GENERAL REQUIREMENTS</u>

5.1.1 Sanitary fixtures shall be of the best quality confirming to specification and subject to the approval of the Architect/Consultants. Wherever particular makes are mentioned, the choice of selection shall remain with the Owner/Architect.

5.1.2 All Appliances, fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, specifications, and drawings. Accessories shall include proper fixing arrangement, brackets, nuts, bolts, screws and required connection pieces.

5.1.3 Fixing screws shall be half round head chromium plated brass screws with C.P. washers where necessary.

5.1.4 Porcelain sanitary ware shall be glazed vitreous china of first quality free from warps, cracks and glazing defects confirming to I.S. 2556.

5.1.5 Chromium plated fittings shall be cast brass chromium plated of the best quality approved by the Engineer-in-charge / Architects. Fixture Finishes like mirror/mat/or any other shall be as directed by Architect.

5.1.6 All materials shall be rust proof; materials in direct/ indirect contact shall be compatible to prevent electrolytic or chemical (bimetallic) corrosion.

5.1.7 Sanitary appliances, subject to the type of appliance and specific requirements, shall be fixed in accordance with the relevant standards/ best practices by skilled labours.

5.1.8 All Appliances, fittings and fixtures shall be fixed in a neat workmanlike manner true to level and heights shown on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, Filing Plaster, Paint, insulation, or terrace shall be made good by the

Contractor at his own cost.

5.1.9 CP Wall flanges shall be provided on walls, floors, etc. wherever supply/discharge pipes pierce through them. These flanges/fittings shall be large enough to cover punctures properly.

5.1.10 In case of free supply of sanitary wares & CP fittings by Client, the contractor shall be responsible for transportation of those items to the site, storage & proper handling till execution ends, installation/fixing of these materials with required hardware, testing & commissioning.

5.1.11 Contractor shall, during the entire period of installation and afterwards protect the appliances by providing suitable cover or any other protection to absolutely prevent any damage to the appliances until handing over. (The original protective wrapping shall be left in position for as long as possible).

5.1.12 The appliance shall be fixed in a manner such that it will facilitate subsequent removal if necessary.

5.1.13 All appliances shall be securely fixed. Manufacturers' brackets and fixing methods shall be used wherever possible. Compatible rust- proofed fixings shall be used. Fixing shall be done in a manner that minimizes noise transmission.

5.1.14 Pipe connections shall be made with demountable unions. Pipe work shall not be fixed in a manner that it supports or partially supports an appliance.

5.1.15 Appliances shall be fixed so that water falls to the outlet.

5.1.16 Appliances shall be fixed true to level firmly fixed to anchor or supports provided by the manufacturer and additional anchors or supports where necessary.

5.1.17 Fixtures shall be generally installed at following heights or as directed by Architect/Engineer in charge.

Water Closet	:	390 mm to top of bowl rim
Bidet	:	390 mm to top of bowl rim
Urinal	:	600 mm to top of bowl rim
Wash basin/ Sink	:	800 – 900 mm to top of bowl rim

5.1.18 Joints/ gaps between all sanitary appliances/fixtures & the floor/wall shall be caulked with an approved quality sealant, having antifungal properties, colour &shade to match that of the appliances/fixture & floor/wall to the extent possible.

5.1.19 Care shall be taken in fixing all approved CP fixtures & accessories so as not to leave any tool marks or damage on the finish. All fixtures shall be tightened with fixed spanner.

5.1.20 All fixtures shall be thoroughly tested after connecting the drainage & water supply system. All fixtures shall be thoroughly finished & any leakage in piping/valves/ waste fittings shall be corrected to the complete satisfaction of Engineer in charge.

5.1.21 Upon completion of work, all labels, stickers, plaster, etc. shall be removed from the fixtures & all fixtures shall be cleaned with soap & water to present a neat & clean toilet.

5.2 EWC (COUPLED CLOSET)

5.2.1 SCOPE

5.2.1.1 The item pertains for providing and fixing white or colour glazed vitreous chinaware European water closet coupled with cistern with seat and cover of size and colour as specified in the schedule or as directed by Architect including all accessories & fixing, testing &commissioning.

5.2.1.2 The ceramic flushing cistern of size, flow and colour as directed by Architect including all accessories & fixing, testing & commissioning for water closets & urinals.

5.2.1.3 The flushing cisterns shall be manually operated low level, dual flush flow, exposed and coupled as specified in schedule of quantities.

5.2.2 MATERIAL

5.2.2.1 European W.C. shall be wash down type single or double siphonic type, floor mounted set with integral 'S' Trap set & shall conform to IS 2556 (Part I & II).

5.2.2.2 Wall mount water closet shall be of white vitreous china conforming to IS: 2556 (Part 16).

5.2.2.3 The closet and cistern shall be of one-piece / two piece construction and shall have minimum two fixing holes of 6.5 mm diameter for fixing closet to wall.

5.2.2.4 The trap shall have minimum water seal of 50 mm.

5.2.2.5 Closet shall have integral flushing rims of self-draining type, and weep hole shall be provided at the flushing inlet of the wall mount water closet.

5.2.2.6 The flushing rim may be box or open rim type or a combination of both.

5.2.2.7 Each WC shall be provided with 110 mm (OD) Pan Connector connecting ceramic outlet of WC to soil pipe.

5.2.2.8 Each European W.C. set shall be provided with a solid plastic seat with cover in conformity to IS: 2548 Part I & II & of colour given in the schedule of quantities.

5.2.2.9 These shall be made of moulded from PP heavy duty material which shall be tough and hard with high resistance to solvents and shall be free from blisters and other surface defects & shall have rubber buffers and chromium plated hinges.

5.2.2.10 European W.C. shall be with coupled cistern directly mounted on WC with dual flow discharge fittings.

5.2.2.11 The cistern shall be mosquito-proof. It shall be deemed to be mosquito proof only when there is no clearance anywhere in it which would permit a 1.6 mm diameter wire to pass through.

5.2.2.12 The flush valve shall be securely connected to the cistern by means of a lock nut.

5.2.2.13 The cistern shall be provided with a removable single piece cover which shall fit closely and shall be secured against displacement. In designs, where the operating mechanism is attached to the cover, the cover and flush mechanism shall be sealed to prevent air / mosquito ingress.

5.2.2.14 No flush pipe is required for coupled cisterns.

5.2.2.15 Inlet and Overflow Holes

The cistern shall be provided with inlet and overflow holes, situated one at each end, which shall be capable of accommodating overflow pipe of not less than 20 mm nominal bore and a 15 mm size float valve. The holes shall be cleanly moulded or drilled and the adjacent surfaces shall be smooth.

5.2.2.16 Float Valve

The float valve shall be 15 mm nominal size and shall conform to IS 1703 or IS 12234 or IS 13049.

5.2.2.17 Operating Mechanism Lever

The operating mechanism shall not project beyond the side of the cistern.
Pneumatically operated flush push buttons are to be provided for operation of cistern.

5.2.2.18 Overflow Pipe

The overflow pipe shall be of not less than 20 mm nominal bore and shall incorporate a non-corrodible mosquito-proof device secured in a manner which will permit it to be readily cleaned or renewed when necessary. No provision shall be made whereby the overflow from the cistern shall discharge directly into the water-closet or soil pipe without being detected.

5.2.2.19 Finish

The surface of the cistern including cover shall be free from blisters and de-lamination and reasonably free from flow lines, streaking or colour variations. The cistern and cover shall be opaque to light.

5.2.3 INSTALLATION

5.2.3.1 It shall consist of white vitreous china extended wall mount WC of size as specified in the schedule of quantities, and of approved shape, brand, and cistern with dual flush fitting.

5.2.3.2 It pan shall be placed in position as shown in the drawing.

5.2.3.3 If the pan trap is damaged during handling or fixing, it shall be replaced by the contractor at his own cost.

5.2.3.4 It shall be securely installed to the wall using metallic corrosion resistant bolts and nuts.

5.2.3.5 The pan and soil pipe shall be jointed with appropriate solvent cement.

5.2.3.6 Joints between W.C. and flush pipe shall be made with a putty or white lead and linseed oil and caulked well or with an approved rubber joint.

5.2.3.7 The gap between W.C. and wall shall be finished with white/matching cement and sand as directed.

5.2.3.8 Seat and cover shall be fixed to the Pan by two corrosion resistance hinges with 65 mm shank and threaded to within 25 mm from of flange. Seat shall be fixed in level by providing the washers of rubber with nonferrous or stainless-steel washer to bolt. Plastic seat shall be so fixed that it remains stationary in

vertical position without falling on the W.C.

5.2.3.9 Each WC shall be fixed with coupled flushing cistern with dual manual flush fitting with required brackets, hardware &accessories.

5.2.4 RATES

5.2.4.1 European type water closet with an integral `P` or `S` trap & plastic seat cover, Coupled Cistern, etc.
5.2.4.2 Bracket, Screws, Hardware.
5.2.4.3 Jointing & fixing material.
5.2.4.4 Cutting slab/ beam etc. wherever required. And making all damages good to original condition after completion of work.
5.2.4.5 Painting all the metallic parts with two coats of flat oil paint over a coat of primer.
5.2.4.6 Testing the entire system and rectification of defect if any.
5.2.4.7 All necessary labour, material and use of tools.

5.2.5 MODE OF MEASUREMENT

5.2.5.1 The measurement shall be for each unit of W.C. with Flush Tank fixed.

5.2.6 MODE OF PAYMENT

5.2.6.1 The contract rate shall be for each unit of W.C. with Flush Tank fixed.

5.3 WALL HUNG WASH BASIN WITH WASTE COUPLING & BOTTLE TRAP

5.3.1 SCOPE

5.3.1.1 The item pertains to for providing flat back wash basin with half or full pedestal in white glazed vitreous china material of best quality, size, shape, and type, including making water and drain connections, with heavy duty type concealed M.S. wall brackets with 3 hole fixing and SS screws to support the basin or hi-tech supports, 32 mm dia. CP waste Coupling, 32 mm dia. CP bottle trap with extension pipe, specified in the Schedule of Quantities or as directed by Engineer in charge,

5.3.2 MATERIAL

5.3.2.1 Wash basin shall conform to IS 2556 (Part IV) and I.S. 771-1979 & shall be of one piece construction.
5.3.2.2 Wash basin shall be provided with single tap hole of size 30 mm rounded.
5.3.2.3 Half/ full Pedestal shall be of same glazing as that of wash basin.
5.3.2.4 Each basin shall be provided with 32mm diameter C.P. waste coupling with overflow, pop-up waste or rubber plug, and chain as given in the schedule of quantities, 32mm diameter C.P. Brass bottle trap with C.P. pipe to wall, flexible to angle cock and flange.
5.3.2.5 Waste Coupling shall confirm to IS 3311, and as specified in the item and of approved make. Waste fittings shall be of with thickness of coating not less than service Grade No.2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect to IS 2963 and shall sound, free from laps below, holes and fittings and other manufacturing defect. External and internal surface shall be clean and smooth. They shall be neatly dressed. The waste fitting for wash basin shall be of nominal size of 32 mm.
5.3.2.6 The bottle trap shall be as specified in the item and of approved make. The bottle-trap shall be provided with a CP brass extension piece to the wall flange on one hand and on the other with a rubber adopter for waste connection.
5.3.2.7 Bottle trap shall be of thickness of coating not less than service grade No. 2 of IS 4827 which can receive polish and will not easily scale off. The fitting shall conform in all respect of IS 2963 and shall be sound, free from laps below, holes and fittings and other manufacturing defects. External and internal surface shall be clean and smooth. They shall be neatly dressed and be truly machined so that nut smoothly moves on the body. The Bottle trap for wash basin shall be of nominal size of 32 mm.
5.3.2.8 PVC water inlet connection shall conform to IS specifications and shall be of standard pattern with flexible hose of minimum 450 mm long with CP brass check nut at both the end and shall be able to withstand the testing pressure of 1 MPa (10 kg/sq. cm.)

5.3.3 FIXING

5.3.3.1 Wash basin shall be wall bracket mounted with half / full pedestal as directed by Architect.
5.3.3.2 Wash basin shall be securely fixed to wall with R.S. or C.I. brackets and clips embedded in cement concrete (1:2:4) block of 100 x 75 x 150 mm.
5.3.3.3 The C.I. Bracket shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Architect/ Consultants.
5.3.3.4 The gap between wall & basin shall be finished with matching white cement.
5.3.3.5 Waste coupling shall be fixed to wash basin, sink or urinal as ordered with necessary specials. Jointing shall be done with a few turns of fine Teflon tape around the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof.
5.3.3.6 Bottle trap shall be fixed to wash basin, sink or urinal as indicated in the drawing with necessary specials or as ordered by the Engineer-in-charge.
5.3.3.7 Jointing shall be done with a few turns of fine Teflon tape around the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof.

5.3.4 RATES

5.3.4.1 Wash basin with/ without pedestal.
5.3.4.2 Brackets, Accessories & Hardware.
5.3.4.3 CP Waste Coupling, Bottle trap.
5.3.4.4 Jointing & fixing material.
5.3.4.5 Cutting hole / wall wherever required and making all damage good to original condition after completion of work.
5.3.4.6 Painting all the metallic parts with two coats of flat oil paint over a coat of primer.
5.3.4.7 Testing the entire system and rectification of defects if any.
5.3.4.8 All necessary materials, labour, and use of tools.

5.3.5 MODE OF MEASUREMENT

5.3.5.1 The measurement shall be for each unit of Wash basin fixed.

5.3.6 MODE OF PAYMENT

5.3.6.1 The contract rate shall be for each unit of Wash basin fixed.

5.4 URINAL

5.4.1 SCOPE

5.4.1.1 Providing and fixing white vitreous china urinal without inlet and waste outlet of selection as per architect.

5.4.2 MATERIAL

5.4.2.1 Urinal basin shall be flat back type lipped in front.
5.4.2.2 The vitreous china conforming to IS 2556 (Part VI). Urinal shall have and integral flushing rim and inlet or supply horn for connecting flush pipe.
5.4.2.3 Flushing rim and inlet shall be of the self-draining type at bottom of basin and outlet horn for connecting outlet shall be provided.
5.4.2.4 The inside surface of the urinal shall be uniform and smooth throughout to ensure efficient flushing.
5.4.2.5 They shall be of vitreous china conforming to IS:2556 (Part-VI) constructed in one piece with providing slot or alternative fixing arrangement at flat back and where the integral flushing rim is not provided, they shall be provided with ridges inside the bowl to divert towards the front line of the urinal.
5.4.2.6 The waste outlet shall be connected to waste pipe in the wall.

5.4.3 FIXING

5.4.3.1 Urinals shall be fixed to wall in position by using rawl plug / wooden plug, C.P screws etc.
5.4.3.2 These shall be fixed at height of 65 cm from the standing level to the top of the lip of urinal or as recommended by manufacturer or directed by the Engineer-in-charge.
5.4.3.3 The urinal shall be connected to waste pipe through CP bottle trap which shall discharge Urinal waste to the concealed waste pipe and there on to the floor drain.
5.4.3.4 The gap between the Urinal and the Wall / Tiles must be sealed with appropriate durable silicon sealant.
5.4.3.5 The complete installation should be checked for the operation of the flush valve, spread within the urinal, leakages, and gaps, and if found to be rectified.

5.4.4 RATES

5.4.4.1 Glazed Urinals.
5.4.4.2 Jointing &fixing materials.
5.4.4.3 CI brackets, Screws, Hardware.
5.4.4.4 Cutting hole wherever required and making all damage good to original condition after completion of work.
5.4.4.5 Testing the entire system and rectification of defects if any.
5.4.4.6 All necessary materials, labour and use of tools.

5.4.5 MODE OF MEASUREMENT

5.4.5.1 The measurement shall be for each Urinal fixed and tested.

5.4.6 MODE OF PAYMENT

5.4.6.1 The contract rate shall be for each Urinal fixed and tested.

5.5 URINAL PARTITIONS

5.5.1 SCOPE

5.5.1.1 Providing and fixing white vitreous china urinal partitions of size mentioned in the schedule of quantities and as per directed by the Engineer in charge.

5.5.2 MATERIAL

5.5.2.1 Urinal partitions shall be white glazed vitreous china or 25mm thick marble of size specified in the schedule of quantities or directed by Architect.

5.5.3 FIXING

5.5.3.1 Urinal partitions shall be fixed at proper heights with CP brass bolts, anchor fasteners and MS clips as recommended by the manufacturer and directed by the Architect/ Consultants.

5.5.4 RATES

5.5.4.1 Urinal partitions with fixing accessories.
5.5.4.2 Screws and Hardware.
5.5.4.3 Cutting hole wherever required and making all damage good to original condition after completion of work.
5.5.4.4 Testing the entire system and rectification of defects if any.
5.5.4.5 All necessary materials, labour, and use of tools.

5.5.5 MODE OF MEASUREMENT

5.5.5.1 The measurement shall be for each unit of urinal partition fixed.

5.5.6 MODE OF PAYMENT

5.5.6.1 The contract rate shall be for each unit of urinal partition fixed.

5.6 BIB TAP/ TWO WAY BIB COCK / STOP COCK/ ANGLE COCK / ANGLE VALVE

5.6.1 SCOPE

5.6.1.1 The item pertains for providing chromium plated Bib Tap/ Two Way Bib Cock/ Stop cock/Angular Stop cock/ Angle Valve type (i.e., Pressmatic or threaded) & size as specified in the schedule or as directed by Architect including all accessories & fixing, testing & commissioning.

5.6.2 MATERIAL

5.6.2.1 It shall be 15 mm. dia. brass screw-down type, with chromium plating, and shall conform to I.S. 781-1977. The taps shall be quarter or full threaded. The bib cock shall be best Indian make and quality as specified in item and approved by Architect/ Engineer in Charge.

5.6.2.2 A bib cock (stop tab) is a draw off tap with a horizontal inlet and free outlet and stop cock (stop tap) is a valve with a suitable means of connections for insertion in a pipeline for controlling or stopping the flow. They shall be of specified size and shall be of screw down type. The closing device should work by means of shuts against water pressure on a non-metallic washer, which shuts against water pressure on a seating at right angles to the exit of the threaded spindle, which operates it. The handle shall be either crutch or butterfly type securely seated pattern. The cocks (taps) shall open in anti-clockwise direction.

5.6.2.3 Brass bib taps and stop cocks and angle stop cocks shall conform to IS 781, they shall be polished bright. The minimum finished weight of different sizes of bib tap weight of 15 mm size bib tap and stop cock shall be as per table given below. They shall be sound and free from taps, blowholes, and fittings. Internal & External surface shall be clean, smooth, and free from sand and neatly dressed. Taps shall be nickel chromium plated and thickness of coating shall not be less than service grade No.2 of IS 4827 and plating shall be capable of taking high polish which shall not be easily tarnished.

5.6.2.4 Minimum finished mass of Bib Taps and Stop Valves as per IS: 781:1984 (Reaffirmed 2001).

Size	MINIMUM FINISHED MASS			
	Bib Taps	Stop valves		
		Internally threaded	Externally threaded	Mixed threaded
MM	KG	KG	KG	KG
8.0	0.250	0.220	0.250	0.235
10.0	0.330	0.330	0.350	0.325
15.0	0.400	0.330	0.400	0.365
20.0	0.750	0.675	0.750	0.710
25.0	1.250	1.180	1.300	1.250
32.0	-	1.680	1.800	1.750
40.0	-	2.090	2.250	2.170
50.0	-	3.700	3.850	3.750

5.6.3 FIXING

5.6.3.1 The body of stop cock of 15mm diameter with adjustable flange shall be as specified above shall be fixed on water supply line keeping the arrow in the direction of flow as per drawing or as directed.

5.6.3.2 Transition male/female adapter with shall be used on either side for PVC pipes.

5.6.3.3 The threaded portion shall be smeared with white or red lead and around with a few turns of fine spun

yarn/ Teflon tape round the screwed end of the cock.

5.6.3.4 On completion the of tiling work, the outer part of stop cock shall be fixed to the brass body

5.6.3.5 Every tap complete, with its component shall withstand an internally applied hydraulic pressure of 2 MPa (20 kg/sq.cm) maintained for a period of 2 minutes during the period it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof without any extra cost from contractor.

5.6.4 RATES

5.6.4.1 Bib Tap/Two Way Bib Cock/ Angle Valve/Stop cock as specified in Schedule of Quantities.
5.6.4.2 Wall flanges & Hardware.
5.6.4.3 Jointing &fixing material.
5.6.4.4 Testing the entire system and rectification of defects if any.
5.6.4.5 All necessary materials, labour and use of tools.

5.6.5 MODE OF MEASUREMENT

5.6.5.1 The measurement shall be for each unit of Bib tap/Stop Cock/Angle Valve fixed.

5.6.6 MODE OF PAYMENT

5.6.6.1 The contract rate shall be for each unit of Bib tap/Stop Cock/Angle Valve fixed.

5.7 HEALTH FAUCET

5.7.1 SCOPE

5.7.1.1 The item pertains for providing chromium plated Health Faucet as specified in the schedule or as directed by Architect including all accessories & fixing, testing & commissioning.

5.7.2 MATERIAL

5.7.2.1 The health faucet shall be brass chromium plated or plastic or as specified in schedule of quantities. The chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958.

5.7.2.2 Health faucet shall be provided with 1 Mtr long flexible PVC tube and CP brass wall hook etc.

5.7.3 FIXING

5.7.3.1 The health faucet Hook & health faucet shall be fixed in position as per drawings or as directed by Architect/ EIC.

5.7.3.2 The height shall be approx. 45cm from floor level if not mentioned in the drawing.

5.7.3.3 The one end of 1.0-meter-long pipe shall be connected to faucet & faucet & another end to the angle cock.

5.7.4 RATE

5.7.4.1 Health Faucet & flexible PVC hose/tube.
5.7.4.2 Accessories, Hardware, mounting hook.
5.7.4.3 Jointing &fixing material.
5.7.4.4 Testing the entire system and rectification of defects if any.
5.7.4.5 All necessary materials, labour, and use of tools.

5.7.5 MODE OF MEASUREMENT

5.7.5.1 The measurement shall be for each unit of Health Faucet fixed.

5.7.6 MODE OF PAYMENT

5.7.6.1 The contract rate shall be for each unit of Health Faucet fixed.

5.8 PRESSMATIC (AUTO-CLOSING) URINAL FLUSH VALVE WITH SPREADER

5.8.1 SCOPE

5.8.1.1 Providing and fixing in position CP brass Pressmatic Pillar cock lift type of approved make and quality, and as approved and directed by the Engineer-in-charge, including all necessary materials required for fixing.

5.8.1.2 The item pertains to provide chromium plated brass flush valve with push button with necessary accessories including fixing, testing & commissioning for Urinals.

5.8.2 MATERIAL

5.8.2.1 The Flush valve shall be of 15mm nominal diameter as specified in the schedule of quantities.

5.8.2.2 It shall be of C.P. brass approved and heavy quality and shall conform to I.S. 9758.

5.8.2.3 The flush valve shall have working pressure of 0.15 to 0.5 MPa.

5.8.2.4 The valve shall be tested to a Hydraulic pressure of 2 MPa for 2 minutes.

5.8.2.5 Flush valve shall have a single flow discharge with Stainless-steel connection pipe to connect to the top inlet of the Urinal.

5.8.3 FIXING

5.8.3.1 Flush value shall be fixed to the pipeline as indicated in the drawing with necessary special as required or as ordered by Engineer in charge.

5.8.3.2 Jointing shall be done with white zinc, spun yarn/ Teflon tape etc.

5.8.3.3 A few turns of fine hemp yarn dipped in linseed oil/ Teflon tape shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof.

5.8.3.4 Flush valve shall be fixed either exposed or concealed in shaft/wall with manual lever/push button/ plate operation or with infrared sensor.

5.8.4 RATE

5.8.4.1 Flush Valve of size, type & operation as mentioned in schedule of quantities.

5.8.4.2 Accessories & Hardware, wall flanges.

5.8.4.3 Jointing &fixing material.

5.8.4.4 Cutting hole– cut out in floor/wall wherever required and making all damage good to original condition after completion of work.

5.8.4.5 Painting all the metallic parts with two coats of flat oil paint over a coat of primer.

5.8.4.6 Testing the entire system and rectification of defects if any.

5.8.4.7 All necessary materials, labour, and use of tools.

5.8.5 MODE OF MEASUREMENT

5.8.5.1 The measurement shall be for each unit of flush valve fixed.

5.8.6 MODE OF PAYMENT

5.8.6.1 The contract rate shall be for each unit of flush valve fixed.

5.9 PRESSMATIC (AUTO-CLOSING) PILLAR COCK

5.9.1 SCOPE

5.9.1.1 The item pertains to provide chromium plated brass pillar tap of type, lever(spatula) operated or Pressmatic type as specified including fixing, testing& commissioning.

5.9.2 MATERIAL

5.9.2.1 The pillar tap shall be 15 mm nominal size or as specified in the schedule.
5.9.2.2 Fancy type pillar tap shall be of C.P. brass approved quality and shall conform to IS: 8931. Non-fancy pillar tap shall be chromium plated brass and shall conform to IS 1795.
5.9.2.3 Casting of Pillar tap shall be sound and free from laps, blow hole and pitting.
5.9.2.4 External and internal surface shall be clean, smooth, and free from sand and be neatly dressed.
5.9.2.5 All the parts fitted to pillar tap shall be axial, parallel, and cylindrical with surfaces smoothly finished.
5.9.2.6 The minimum of finish weight of Pillar tap shall not be less than 650 grams (bodyweight 250 Gms, washer plate loose valve 150 Gms and back nut 40 Gms.
5.9.2.7 Thickness of C.P coating shall not be less than service grade no.2 of IS 4827 and plating should be capable of taking high polish which shall not easily tarnish or scale.

5.9.3 FIXING

5.9.3.1 Pillar tap shall be fixed to the pipeline as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge.
5.9.3.2 Jointing shall be done with white zinc, spun yarn/Teflon tape etc. A few turns of fine hemp yarn dipped in linseed oil/ Teflon tape shall be taken over the threaded ends to obtain complete water tightness.
5.9.3.3 Pillar tap shall withstand and internally applied hydraulic pressure of 2 MPa (20kg/sq.cm) for period of 2 minutes during which period, it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof without any extra cost from the contractor.

5.9.4 RATE

5.9.4.1 Pillar Tap.
5.9.4.2 Wall flanges, Hardware & Accessories.
5.9.4.3 Jointing &fixing material.
5.9.4.4 Testing the system and rectification of defects if any.
5.9.4.5 All necessary materials, labour, and use of tools.

5.9.5 MODE OF MEASUREMENT

5.9.5.1 The measurement shall be for each unit of pillar tap fixed.

5.9.6 MODE OF PAYMENT

5.9.6.1 The contract rate shall be for each unit of pillar tap fixed.

5.10 TOILET PAPER HOLDER

5.10.1 SCOPE

5.10.1.1 The item includes providing white or colour glazed vitreous chinaware or chrome plated toilet roll holder of size as mentioned in the schedule including fixing.

5.10.2 MATERIAL

5.10.2.1 The toilet paper roll holder shall be of SS/ CP brass or vitreous china on specified and of size and design as approved by the Engineer in charge. Toilet paper roll holder shall conform as per IS standard and should have ISI mark.

5.10.3 FIXING

5.10.3.1 Toilet paper roll holder shall be fixed in position with C.P brass cover.
5.10.3.2
5.10.3.3 Vitreous china toilet paper roll holder shall fix into the wall with 1:2 cement mortar. The pocket shall be cut in wall for toilet paper roll holder if not left finishing the gap with white/matching cement.
5.10.3.4
5.10.3.5 Chrome plated Brass toilet paper roll holder can be surface mounted by means of CP/SS screws and rawl plug embedded in the wall.

5.10.4 RATE

5.10.4.1 Toilet paper roll holder.
5.10.4.2 Accessories & Hardware.
5.10.4.3 Cutting the pocket if they are not left in case of recessed fixing & drilling hole in wall in case of surface mounting.
5.10.4.4 Jointing &fixing material.
5.10.4.5 All necessary labour, material, and the use of tools.

5.10.5 MODE OF MEASUREMENT

5.10.5.1 The measurement shall be for each unit of toilet paper roll holder fixed.

5.10.6 MODE OF PAYMENT

5.10.6.1 The contract rate shall be for each unit of toilet paper roll holder fixed.

5.11 COAT AND HAT HOOK

5.11.1 SCOPE

5.11.1.1 The item pertains to provide SS/ chromium plated brass coat and hat hook including fixing.

5.11.2 MATERIAL

5.11.2.1 Coat & Hook shall be of three-way type of approved and heavy quality. Coat & Hat Hook shall be CP brass and three-way hook type or minimum six ways Patti type of 125 mm x 30 mm x 6mm size. CP coating shall not be less than service grade No.2 of IS 4827.

5.11.3 FIXING

5.11.3.1 The Coat and hat hook shall be fixed to proper line & level as indicated in drawing with CP brass screws.

5.11.4 RATE

5.11.4.1 Coat and hat hook with CP screws etc.
5.11.4.2 All necessary labour, material, and the use of tools.

5.11.5 MODE OF MEASUREMENT

5.11.5.1 The measurement shall be for each unit of coat and hat book fixed.

5.11.6 MODE OF PAYMENT

5.11.6.1 The contract rate shall be for each unit of coat and hook fixed.

5.12 TOWEL RING

5.12.1 SCOPE

5.12.1.1 The item includes providing Towel ring of size as mentioned in the schedule including fixing.

5.12.2 MATERIAL

5.12.2.1 Towel ring of SS/ CP brass with one CP brass bracket with thickness not less than Grade No.2 of IS 4827.

5.12.2.2 The diameter of the ring shall be 175 mm unless otherwise specified in the schedule. The diameter of ring rod shall not be less than 8 mm.

5.12.3 FIXING

5.12.3.1 The towel ring shall be fixed to proper line and level as indicated in drawing with CP brass screws, wooden raw plug, drilling hole etc. and making good the wall to original condition after fixing the towel rod.

5.12.4 RATE

5.12.4.1 Towel ring CP brackets & screws etc.
5.12.4.2 Fixing material.
5.12.4.3 All necessary labour, material, and the use tools.

5.12.5 MODE OF MEASUREMENT

5.12.5.1 The measurement shall be for each unit of towel ring fixed.

5.12.6 MODE OF PAYMENT

5.12.6.1 The contract rate shall be for each unit of towel ring fixed

5.13 STAINLESS STEEL GRAB BARS

5.13.1 SCOPE

5.13.1.1 The item pertains to supply & install Stainless Steel Grab bars / Hinge rail as specified in schedule of quantities including fixing, testing & commissioning.

5.13.2 MATERIAL & FIXING

5.13.2.1 Where specified in washroom facilities designed to accommodate physically handicapped, accessories should be provided as directed by the Project Manager.

5.13.2.2 Stainless steel grab bars / hinge rail of required size suitable for exposed mounting and non-slip gripping surface shall be provided in all washrooms as directed by the Project Manager.

5.13.3 RATES

5.13.3.1 Grab Bar / Hinge rail.
5.13.3.2 Accessories & Hardware.
5.13.3.3 Jointing & fixing material.
5.13.3.4 Making all damage good to original condition after completion of installation work.
5.13.3.5 Testing the entire system and rectification of defects if any.
5.13.3.6 All necessary materials, labour, and use of tools.

5.13.4 MODE OF MEASUREMENT

5.13.4.1 The measurement shall be for each set accessories like Grab Bar / Hinged rail fixed.

5.13.5 MODE OF PAYMENT

5.13.5.1 The contract rate shall be for each set accessories like Grab Bar / Hinged rail fixed.

5.14 STAINLESS STEEL GRATING & COCKROACH TRAP

5.14.1 SCOPE

5.14.1.1 The item includes supplying and fixing of Stainless Steel grating and cockroach trap of specified size including fixing in location with appropriate and durable sealant and making good the floor as per the direction of Engineer in charge.

5.14.2 MATERIAL

5.14.2.1 The floor drain cover, grating and cockroach trap shall be of Stainless Steel AISI 304 grade material with perforated or solid top, depending on application.
5.14.2.2 A perforated top grating shall be used for floor drains expected to receive surface water. The perforated top grating shall be free of any defects and shall have a uniform thickness.
5.14.2.3 A solid top cover shall be used for such applications where in the content of the waste water contains foul elements which would affect the local environment such as urinal discharge water which contains various ammonium based contaminations. The solid cover shall have a complete sealing on the floor drain and shall be openable for cleaning as and when required.
5.14.2.4 The solid top cover shall be free of any defects and shall have a uniform thickness with rounded edges.
5.14.2.5 The size of the perforated grating and the solid top cover shall be as mentioned in the schedule of quantities.
5.14.2.6 The trap shall have inlet & outlet as per the details mentioned in the schedule of quantities.
5.14.2.7 The size of the cockroach trap shall mentioned in the schedule of quantities.
5.14.2.8 The complete assembly of cover and cockroach trap shall be fixed in finished floor with watertight finishing & shall be firmly supported on structural floor.

5.14.3 FIXING

5.14.3.1 The floor drain cover grating shall of Stainless Steel AISI 304 grade material with perforated or solid top, depending on application.

5.14.4 RATES

5.14.4.1 Stainless Steel Floor Drain Cover Cockroach floor trap with Perforated Grating / Solid Top Cover.
5.14.4.2 Jointing & fixing material.
5.14.4.3 Making all damage good to original condition after completion of installation work.
5.14.4.4 Testing the entire system and rectification of defects if any.
5.14.4.5 All necessary materials, labor and use of tools.

5.14.5 MODE OF MEASUREMENT

5.14.5.1 The measurement shall be for each unit of Stainless Steel Floor Drain Cover Cockroach floor trap with Perforated Grating / Solid Top Cover fixed.

5.14.6 MODE OF PAYMENT

5.14.6.1 The contract rate shall be for each unit of Stainless Steel Floor Drain Cover Cockroach floor trap with Perforated Grating / Solid Top Cover fixed.

5.15 STAINLESS STEEL / CAST BRONZE FLOOR DRAIN CLEAN OUT

5.15.1 SCOPE

5.15.1.1

5.15.1.2 The item includes supplying of Stainless Steel / Cast Bronze solid cover suitable for 100mm and 150mm diameter drainpipes, with rubber lining floor clean out plug of specified size including fixing in location with appropriate and durable sealant and making good the floor as per the direction of the Engineer in charge.

5.15.1.3

5.15.2 MATERIAL

5.15.2.1 The floor clean out plug cover shall be of SS 304 Stainless Steel material with solid top.

5.15.2.2 The floor clean out shall be of Cast Bronze body with Male threaded insert and stainless steel screws.

5.15.2.3 The floor clean out plug cover shall be free of any defects and shall have a uniform thickness.

5.15.2.4 A solid top cover shall be used for such applications where in the content of the wastewater contains such foul elements which would affect the local environment, are prevented from entering the public area.

5.15.2.5 The solid cover shall have a complete sealing on the floor drain and shall be openable for cleaning as and when required.

5.15.2.6 The complete assembly of cover shall be fixed with a durable and appropriate sealant to the pipe, with watertight finishing & shall be firmly supported on structural floor.

5.15.3 RATES

5.15.3.1 Stainless Steel / Cast Bronze floor clean out plug with solid cover.

5.15.3.2 Fixing the assembly with all required material.

5.15.3.3 Making all damage good to original condition after completion of installation work.

5.15.3.4 All necessary materials, labour and use of tools.

5.15.4 MODE OF MEASUREMENT

5.15.4.1 The measurement shall be for each unit of floor clean out plug cover fixed.

5.15.5 MODE OF PAYMENT

5.15.5.1 The contracts rate shall be for each unit of floor clean out plug cover fixed

5.16 UPVC P-TRAP

5.16.1 SCOPE

5.16.1.1 The item pertains to provide Self Cleansing P traps in UPVC SWR (Type B) non-pressurized wastewater piping as per IS: 14735 of size 75mm x 75mm &110mm x110mm complete.

5.16.2 MATERIAL & FIXING

5.16.2.1 The trap shall be of UPVC AS PER is: 14735.

5.16.2.2 P trap shall have a water seal not less than 50 mm.

5.16.2.3 The trap shall have 75 / 100 mm floor inlet & 75 / 100 mm single outlet.

5.16.2.4 Wherever required, the necessary size cut out shall be made in the floor for the installation of the P Trap.

5.16.2.5 Each P-Trap shall be supported with appropriate size split clamp with rubber lining, and G.I. threaded rod, anchor fasteners, etc. or a support system as per the direction of the Engineer-in-charge.

5.16.3 RATES

5.16.3.1 UPVC P Trap.

5.16.3.2 Jointing &fixing material.

5.16.3.3 Cutting holes in the RCC floor slabs and making good all damages to original condition after completion

of installation work.

5.16.3.4 Testing the entire system and rectification of defects if any.

5.16.3.5 Supporting the P-Trap with Split clamps, threaded rod, and anchor fasteners, or as per the direction of the Engineer-in-charge.

5.16.3.6 All necessary materials, labour, and use of tools.

5.16.4 MODE OF MEASUREMENT

5.16.4.1 The measurement shall be for each unit of UPVC P trap fixed.

5.16.5 MODE OF PAYMENT

5.16.5.1 The contract rate shall be for each unit of UPVC P trap fixed.

5.17 PVC PIPES & FITTINGS

5.17.1 SCOPE

5.17.1.1 The item includes supplying of PVC pipes with fittings of specified diameter including laying, fixing, cutting, joining, painting etc. for vent, overflow, wastewater pipeline etc.

5.17.2 MATERIAL

5.17.2.1 The pipes and fittings shall conform to series IV of IS 4985, PVC pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule.

5.17.2.2 EXAMINING

Before laying the pipeline, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.

5.17.2.3 CLEANING

All the pipes and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil, or dirt inside and outside surfaces.

5.17.3 LAYING, FIXING & JOINTING

5.17.3.1 The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. The entire pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

5.17.3.2 The pipeline shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The pipe shall be fixed with G.I. clamps not less than 2 mm thick or with suitable PVC clamps, the clamps shall be fixed into the wall with G.I. nails not less than 40 mm long and wooden gutties. Spacing between clamps for fixing internal piping shall be as given below.

Pipe diameter	For Horizontal Runs
32 mm	825 mm
40 mm	975 mm
50 mm	975 mm

5.17.3.3 The jointing of pipes and fittings generally shall be done with approved make cement solvent including making surface rough. The pipe shall be cut to desired length. Care shall be taken that that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.

5.17.4 TESTING

5.17.4.1 The joints shall be tested by either smoke test for vertical stacks or 2.5 m head of water at the highest point of the section under test for horizontal drainage pipes. Smoke shall be pumped into the pipes at the lowest end from a smoke machine which consists of a below and burner. The material usually burnt is greasy cotton waste which gives out a clear pungent smoke which is easily detectable by sight as well as by smell, if there is leak at any point of the drain. The water head test shall be carried out by suitably plugging the lower end of the drain and the ends of the connection if any and filling the system with water. A knuckle bend shall be temporarily jointed to it so as to provide required test head, or the top may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitable for observation. The leaky joints shall be remade, and section re-tested at no extra cost.

5.17.5 RATES

5.17.5.1 Supplying of PVC pipes and fittings of specified diameter & pressure class.
5.17.5.2 Laying and cutting the pipe wherever necessary and wastage.
5.17.5.3 Fixing the pipeline with G.I. clamps not less than 2mm thick and 40mm screws, anchor fasteners, etc.
5.17.5.4 Making the solvent weld joints.
5.17.5.5 All civil work required for concealed piping
5.17.5.6 Testing of pipes.
5.17.5.7 Making all damage good to original condition after completion of installation work.
5.17.5.8 All necessary materials, labour and use of tools.

5.17.6 MODE OF MEASUREMENT

5.17.6.1 The measurement shall be for unit running meter length of pipeline laid of fixed. The measurement shall be taken along the centre line of pipe. No measurement shall be recorded separately for fittings, making joint, painting, civil work if specified in schedule of quantities and testing.

5.17.7 MODE OF PAYMENT

5.17.7.1 The contract rate shall be for unit running meter length of pipeline laid or fixed.

5.18 UPVC- SWR PIPING WORK

5.18.1 SCOPE

5.18.1.1 1.1 The item includes supplying of UPVC soil, waste, and rainwater (SWR) and ventilation pipes with fittings of specified diameter including laying, fixing, cutting, joining, painting if required etc.

5.18.2 MATERIAL

5.18.2.1 2.1 The pipes shall conforming to IS 13592, UPVC - SWR (Type ‘A’ or ‘B’ as specified) and fittings conforming to IS 13591 shall be free from cracks, flaws and defects and shall be U.V. stabilized and able to withstand a pressure as mentioned in the schedule of work. Rubber sealing rings conforming to IS: 5382 with lubricant for sliding socket joints as mentioned in the schedule of work.

5.18.2.2

5.18.2.3 2.2 EXAMINING

Before laying the pipeline, it shall be first examined for damages and cracks, no cracked or damaged pipe and fittings shall be used in the work, and they shall be removed from the site by the contractor at his own cost and charge.

5.18.2.4 2.3 CLEANING

All the pipes and fittings shall be thoroughly cleaned with brush and washed, if necessary, to remove any accumulated stone, soil or dirt inside and outside surfaces.

5.18.3 LAYING, FIXING & JOINTING

5.18.3.1 3.1 The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. The entire pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length. The entire length of pipe shall be evenly supported on bed of the trench throughout. Care shall be taken to prevent any sand, earth, or other materials from entering into the pipes during laying. At the end of day's work, the open end shall be suitably plugged.

5.18.3.2

5.18.3.3 3.2 The pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The pipe shall be fixed with G.I. clamps not less than 2.0 mm thick of with suitable UPVC clamps/ clips. The clamps/ clips shall be fixed into the wall with G.I. nails not less than 40 mm long and wooden gutties keeping the pipe about 15 mm clear of the wall.

5.18.3.4

5.18.3.5 3.3 The jointing of pipes and fittings generally shall be done with approved make cement solvent including making surface rough or rubber sealing rings with lubricant for sliding socket joints. The pipe shall be cut to desired length. Care shall be taken that that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.

5.18.4 DETACHABLE JOINT

5.18.4.1 Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and jointing shall be made by cement solvent.

5.18.5 PAINTING

5.18.5.1 In case of underground piping, the pipeline shall be painted with two coats of approved oil paint of matching colour over a coat of primer.

5.18.6 DEWATERING & CIVIL WORK

5.18.6.1 In case of underground pipes, the contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause. The rate shall also include for excavation, refilling, etc. civil work required if specified in schedule of quantities. Pipe shall be laid with suitable bedding, encasing as per actual site condition. For concealed piping, chasing, drilling holes in wall, etc. shall be covered under the rate.

5.18.7 TESTING

5.18.7.1 The joints shall be tested by either smoke test for vertical stacks or 2.5 m head of water at the highest point of the section under test for horizontal drainage pipes. Smoke shall be pumped into the pipes at the lowest end from a smoke machine which consists of a below and burner. The material usually burnt is greasy cotton waste which gives out a clear pungent smoke which is easily detectable by sight as well as by smell, if there is leak at any point of the drain. The water head test shall be carried out by suitably plugging the lower end of the drain and the ends of the connection if any and filling the system with water. A knuckle bend shall be temporarily jointed to it so as to provide required test head, or the top may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitable for observation. The leaky joints shall be remade, and section re-tested at no extra cost.

5.18.8 RATES

5.18.8.1 Supplying of UPVC-SWR pipes and fittings of specified diameter.
5.18.8.2 Laying and cutting the pipe wherever necessary and wastage.
5.18.8.3 Fixing the pipeline with G.I. clamps not less than 2mm thick and G.I. / M.S. nails length not less than 40mm or with UPVC clamps, screws, wooden gutties etc.
5.18.8.4 Making the solution joint and painting if mentioned in schedule of work the pipeline.
5.18.8.5 All civil work required for concealed piping.

5.18.8.6 In case of underground pipes, dewatering, if necessary, till completion of work, excavation, refilling, etc civil work if specified in schedule of quantities.
5.18.8.7 Testing of pipes.
5.18.8.8 Making all damage good to original condition after completion of installation work.
5.18.8.9 All necessary materials, labour, and use of tools.

5.18.9 MODE OF MEASUREMENT

5.18.9.1 The measurement shall be for unit running meter length of pipeline laid of fixed. The measurement shall be taken along the centre line of pipe. No measurement shall be recorded separately for fittings, making joint, painting, civil work if mentioned in schedule of work and testing.

5.18.10 MODE OF PAYMENT

5.18.10.1 The contract rate shall be for unit running meter length of pipeline laid or fixed.

5.19 PVC PIPING WORK

5.19.1 SCOPE

5.19.1.1 The item includes supplying of PVC pipes with fittings of specified diameter including laying, fixing, cutting, joining, etc. for rainwater disposal.

5.19.2 MATERIAL

5.19.2.1 The pipes and fittings shall conform to series IV of IS 4985, PVC pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure of 10 kg/cm^2 as mentioned in the schedule.

5.19.2.2 EXAMINING
Before laying the pipeline, it shall be first examined for damages and cracks, no cracked or damaged pipe and fittings shall be used in the work, and they shall be removed from the site by the contractor at his own cost and charge.

5.19.2.3 CLEANING
All the pipes and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil, or dirt inside and outside surfaces.

5.19.3 LAYING, FIXING & JOINTING

5.19.3.1 The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. The entire pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

5.19.3.2 The pipeline shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The pipe shall be fixed with G.I. clamps not less than 2 mm thick or with suitable PVC clamps, the clamps shall be fixed into the wall with G.I. nails not less than 40 mm long and wooden gutties. Spacing between clamps for fixing internal piping shall be as given below.

Pipe diameter	For Vertical Runs
100 mm	1460 mm

5.19.3.3 The jointing of pipes and fittings generally shall be done with approved make cement solvent including making surface rough. The pipe shall be cut to desired length. Care shall be taken that that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.

5.19.4 TESTING

5.19.4.1 The joints shall be tested by either smoke test for vertical stacks or 2.5 m head of water at the highest point of the section under test for horizontal drainage pipes. Smoke shall be pumped into the pipes at the lowest end from a smoke machine which consists of a below and burner. The material usually burnt is greasy cotton waste which gives out a clear pungent smoke which is easily detectable by sight as well as by smell, if there is leak at any point of the drain. The water head test shall be carried out by suitably plugging the lower end of the drain and the ends of the connection if any and filling the system with water. A knuckle bend shall be temporarily jointed to it so as to provide required test head, or the top may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitable for observation. The leaky joints shall be remade, and section re-tested at no extra cost.

5.19.5 RATES

5.19.5.1 Supplying of PVC pipes and fittings of specified diameter & pressure class.
5.19.5.2 Laying and cutting the pipe wherever necessary and wastage.
5.19.5.3 Fixing the pipeline with G.I. clamps not less than 2mm thick and G.I. / M.S. nails length not less than 40mm or with UPVC clamps, screws, wooden gutties etc.
5.19.5.4 Making the solution joint and painting if mentioned in schedule of work the pipeline.
5.19.5.5 Connection with existing vertical rainwater pipes.
5.19.5.6 All civil work required for concealed piping
5.19.5.7 Testing of pipes.
5.19.5.8 Making all damage good to original condition after completion of installation work.
5.19.5.9 All necessary materials, labour, and use of tools.

5.19.6 MODE OF MEASUREMENT

5.19.6.1 The measurement shall be for unit running meter length of pipeline laid of fixed. The measurement shall be taken along the center line of pipe. No measurement shall be recorded separately for fittings, making joint, painting, civil work if specified in schedule of quantities and testing.

5.19.7 MODE OF PAYMENT

5.19.7.1 The contract rate shall be for unit running meter length of pipeline laid or fixed.

6.0 PLANT AND EQUIPMENTS

6.1 HYDROPNEUMATIC SYSTEM

6.1.1 SCOPE

6.1.1.1 The item includes the Pumps (Vertical submersible centrifugal type), Pressure vessels, pressure switches, gauges, pressure transmitter on delivery manifold, pump suction & delivery piping, manifolds & valves, flexible bellows, Fixed speed / variable frequency drive, control panels, Microprocessor based operation) and all accessories including installation, testing & commissioning.

6.1.2 PUMP-MOTOR SET

6.1.2.1 DESIGN & CONSTRUCTION FEATURES

6.1.2.1.1 The pumps shall be vertical multistage submersible type centrifugal pumps – 2 nos. (1W + 1S).
6.1.2.1.2 Variable frequency drive shall be provided with all the pumps, with potential free contacts to monitor on/off status & trip status.
6.1.2.1.3 The pump motor set and shall be suitable for 1Ph or 3 Ph., 230 or 415 V, 50 Hz. AC power supply and having 1450/ 2900 RPM speed.
6.1.2.1.4 The pump shall be installed with isolation gate/ butterfly valve, non-return valve, etc.
6.1.2.1.5 The detailed specification for pump & motor is as below:
6.1.2.1.5.1 The design and manufacture of the pump shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed.
6.1.2.1.5.2 The pump shall develop required total head at rated capacity.
6.1.2.1.5.3 Impeller shall be closed type and shall be dynamically balanced.
6.1.2.1.5.4 The pump shall have non-overloading characteristics.
6.1.2.1.5.5 The casing shall be of rigid construction and shall have side suction and top delivery for vertical multistage pumps.
6.1.2.1.5.6 Impeller shall be of SS CF8 M.
6.1.2.1.5.7 The shaft shall be of S.S. and its surface shall be properly finished.
6.1.2.1.5.8 Shaft sleeves shall be provided to protect shaft from any damage.
6.1.2.1.5.9 Bearing shall be ball or roller type.
6.1.2.1.5.10 Mechanical seal shall be provided to avoid any leakage.
6.1.2.1.5.11 Pump shall be mounted on a concrete foundation, projecting at least 15 CM above finished floor level.
6.1.2.1.5.12 All the parts of the pumps that are in contact with water e.g. shaft, impeller etc. shall be of stainless steel construction.
6.1.2.1.5.13 Pumps shall be so selected that the design duty point is within 5% of the maximum efficiency point.
6.1.2.1.5.14 Shut off head shall be 120% of duty point head.
6.1.2.1.5.15 All pumps and motors shall be of minimum vibration and noise level during operation.

6.1.2.1.6 Facilities shall be provided to prevent starting of pumps when the water tank is at low water level.
6.1.2.1.7 An indicator for this low water level alarm shall be provided.
6.1.2.1.8 Facilities to select which pump to be duty pump and standby pump shall be provided and be interchangeable.
6.1.2.1.9 Pump shall be driven by directly coupled squirrel cage induction motor having TEFC enclosure, IP 67 protection & shall be of Class F insulation.
6.1.2.1.10 Pump motors above 7.5 kW shall be equipped with a spacer coupling which allows changing of shaft seals without removing the motor.
6.1.2.1.11 All poly-phase motors of (capacity >0.375 kW and operating hours >1500 hours/year) shall follow

6.1.2.1.12 minimum efficiency level as per IS 12615 for energy efficient motors.

6.1.3 INSPECTION & TESTING

6.1.3.1 The pump shall be offered for visual inspection before dispatch.
6.1.3.2 Material test certificates for the various pump components shall be furnished for purchaser's approval.

6.1.4 SYSTEM DESCRIPTION

6.1.4.1 The system operation will be such that the initial small water demand shall be met by the charged diaphragm pressure vessel. When the water demand continues, the system pressure will dip to a pre-set pump cut-in point when the lead pump starts to operate at reduced speed through the variable speed drive. However, if the system pressure be still below the pre-set value, the controller continuously increases pump speed to meet the system demand. When the lead pump is notable to meet the system pressure at full speed, the second pump also starts to operate.
6.1.4.2 At peak demand all the pumps operate, similarly, if there is a drop-in water demand the duty pump speed starts to reduce, then standby pumps cuts-off, followed by stopping of the duty pump.
6.1.4.3 The closed diaphragm pressure vessel shall be of NSF approved polyethylene material with a pressure gauge and isolating valve. The interior shall be of non-toxic lining suitable for use with potable water. The vessel shall be manufactured to conform to ASME pressure vessel code/standards.
6.1.4.4 The system shall be under the control of a microprocessor based control panel.
6.1.4.5 A pressure transmitter shall detect the pressure at the delivery manifold and feedback to the microprocessor control panel via control circuit.
6.1.4.6 The system shall incorporate a frequency converter or frequency converter motors on the pumps and the pressure transmitter shall register the actual pressure on the discharge side.
6.1.4.7 The variable frequency drive pumping system shall maintain a constant pressure regardless of the system demand. If there is a drop-in pressure outside the pre-set point, the Variable Frequency Drive (VFD) pump shall start to run until the pressure increases to the pre-set limit, or it will continue to increase the pump speeds to the upper limit of the frequency. If the water system demand still cannot be met, the second pump shall be called in to run, the VFD will then alter the pump speed to meet the pre-set pressure point. If the set point is still unable to be met, the third pump is then activated to run (in case of 3 pumps units).
6.1.4.8 This shall be achieved by continuously varying the motor speed of the duty pump according to the demand up to a maximum designed capacity.
6.1.4.9 Under decreasing hydraulic demand, the reverse sequence to the above description shall apply. Alternatively, pumping system shall be with fixed speed drive motor. By getting the signal from microprocessor based control panel through pressure transmitter, pumps will operate in sequence & vice a versa.
6.1.4.10 The frequency converter shall be linked to the motor of the duty pump for continuous speed adjustment and ultimately the water delivery shall be maintained at constant pressure at the pre-set value.

6.1.5 CONTROL PANEL

6.1.5.1 The motor control panel shall be equipped with all the necessary electrical components including a microprocessor control unit and a frequency drive. The control panel and the microprocessor shall cover the followings functions.
6.1.5.2 Flexibility and simplicity in allowing the necessary re-adjustment of the pumping system pre-set delivery pressure to operate the pumps within the specified maximum and minimum delivery ranges.
6.1.5.3 Automatic changeover of the pumps to be controlled by the microprocessor which dictates the duty and standby pumps.
6.1.5.4 When the system has not been operated for more than 24 hours, it shall automatically start the pumps for a few seconds/day to ensure the pumps readiness always. The standby pumps shall be activated upon failure of duty pump(s).
6.1.5.5 In event of control failure, the pumps shall be able to be start/stopped manually at the local panel by means of pressure switches.
6.1.5.6 The microprocessor control panel shall be able to cut-off the pumping system when excess pressure is registered in the discharge common manifold.

6.1.5.7 The system shall have the capability of receiving input signal concerning reduced water level in suction tanks and shall have control mechanisms to prevent the pumps from running dry.

6.1.5.8 Automatically starting the pumps when the water level is back to normal.

6.1.5.9 In case of pump failure due to motor overload, the standby pump is switched on automatically. Alarm signal is displayed on the LCD Display unit and alarm lights are activated.

6.1.5.10 Functions to limit the no. of start/stop of pumps per hour.

6.1.5.11 The system control panel shall incorporate LCD Display.

6.1.5.12 The system control panel shall be IBMS compatible, with potential free contacts having RS 485 ports for monitoring the on/off status.

6.1.6 OPERATION OF CONTROL PANEL

6.1.6.1 Auto mode

The desired delivery pressure within the range specified shall be set at the control panel. The differential pressure transmitter shall detect the delivery pressure continuously and give feedback to the microprocessor which will control the variable speed drive frequency converter for speed control of the duty pump. When demand increases, the subsequent pumps in the system will be activated to boost up the pressure. Ultimately the duty pump set shall be operated fully automatically to maintain the delivery pressure constantly at the desired set value.

6.1.6.2 Manual Mode

The on/off function of the pumps shall be manually adjusted at the microprocessor located at the local control panel.

6.1.6.3 Frequency Control By-pass Mode

All the pump sets shall be started/stopped automatically with the pump output at fixed maximum rotational speed. All the control and protection functions shall remain active. The cut in/cut out pressure shall be internally calculated by the microprocessor for each pump.

6.1.6.4 IBMS Compatibility:

The control panel shall be mounted on wall / floor, in a control cabinet with an IP 67 enclosure of suitable rating having Potential free contacts to monitor on/Off & Trip status with necessary sensors/switches.

6.1.7 ELECTRICAL COMPONENT

6.1.7.1 All circuit breakers, thermal overloads and contactors shall be of reputable make acceptable to the architect. Electrical supply to the pump controller shall be protected using an isolating circuit breaker.

6.1.8 METHOD OF STARTING

6.1.8.1 The panel shall be built to start the pumps in suitable starting modes, i.e., D.O.L., Star/Delta, or using Soft Starters.

6.1.9 PUMP PRESSURE VESSEL

6.1.9.1 Diaphragm type pressure vessels shall be provided as shown on the drawings. They shall be incorporated into the system so that during normal operation the pump shall not need start within 30 seconds of it switching off, to prevent the pump hunting.

6.1.9.2 The pressure vessel shall be of adequate capacity to accommodate a considerable fluctuation in water demand by the system with minimum start/ stop cycles of the pumps. The vessel shall be constructed of NSF approved Polyethylene / FRP material built to ASME Standards for Unfired Pressure Vessel. A rubber diaphragm shall be provided in the vessel for separating the water and pre-charge nitrogen. The pre-charge pressure shall be adjustable and charging port with non-return device shall be provided. The adjustable cut-in and cut-off pressure unit for the pumps shall be built-in at the vessel to suit the system.

6.1.10 ACCESSORIES

6.1.10.1 The system shall be provided with all accessories such as foot valves, pressure gauge, pressure switches, pressure transmitter, level indicator, isolation valve for pressure vessel, etc. all accessories required for proper and safe operation shall be furnished with the pumps.

6.1.11 SUCTION AND DELIVERY PIPE, FITTINGS, FLANGES & VALVES

6.1.11.1 All suction, delivery and header pipe shall be GI & shall conform to IS: 1239, heavy duty.
6.1.11.2 Fittings shall be as per the pipe thickness.
6.1.11.3 All pipes shall have flanges connection & pipe shall conform to BS 10, Table - D.
6.1.11.4 All hardware shall be zinc plated.
6.1.11.5 The system shall be equipped with suction & delivery valves flanged valves.
6.1.11.6 On delivery side ball/butterfly valves shall be provided.
6.1.11.7 Also, stainless-steel spring-operated check valves shall be provided on delivery side of each pump & on delivery header.
6.1.11.8 Flexible bellows shall be provided on suction &delivery side of each pump.

6.1.12 TESTING

6.1.12.1 Hydrostatic test shall be carried out at 1.5 times the maximum discharge pressure.
6.1.12.2 For electrical accessories, necessary tests shall be performed, or factory test certificate shall be furnished.

6.1.13 DRAWINGS

Following drawings shall be furnished by the vendor:
6.1.13.1 Overall dimensional drawing.
6.1.13.2 Pump performance curves.
6.1.13.3 Cross-sectional drawings.
6.1.13.4 Panel GA drawing.
6.1.13.5 Bill of Material and Material of Construction.

6.1.14 TECHNICAL DATA SHEET FOR HYDROPNEUMATIC SYSTEM

SR.	PARTICULAR	SPECIFICATIONS
1.0	**SYSTEM:**	
1.1	Application	Domestic water
1.2	System capacity	40 M^3 / Hr
1.3	System head	25 Mtrs.
1.4	Operating hrs.	10 hrs per day
1.5	Location	Terrace
2.0	**PRESSURE VESSEL**	
2.1	Capacity	100 litres.
2.2	No. of Unit	01
2.3	Material of Construction	Pressure vessel of non-corrosive FRP composite construction lined with NSF and/or FDA listed material
2.4	Shell thickness	Suitable for 8 Kg/cm2 pressure rating.
2.5	Dished end thickness	Suitable for 10 Kg/cm2 pressure rating.
2.6	Test Pressure	10 kg / cm^2 minimum
2.7	Painting	Epoxy
2.8	Type of Air Compressor	Oil free, Teflon coated / Inbuilt Air cell
2.9	Tank outlet size	As per Manufacture's configuration
3.0	**PUMPS**	
3.1	Type	Vertical Multistage Submersible Type
3.2	Number of Units	3 (2 working + 1 standby)
3.3	Design capacity / pump	20 M^3 / Hr
3.4	Total head at design capacity	25 Mtrs.
3.5	Suction Pressure at rated	Positive Suction

SR.	PARTICULAR	SPECIFICATIONS
	capacity (NPSHa)	
3.6	Speed	1450 / 2900 RPM
3.7	**PUMP – FEATURE OF CONSTRUCTION**	
3.7.1	Impeller	Closed S.S.
3.7.2	Shaft	Coupled S.S.
3.7.3	Drive Transmission	Direct
3.7.4	Seal	Gland Packing
3.7.5	Mounting	Common base plate
3.7.6	No. of stage	Multiple
3.7.7	Starter	VFD based.
3.7.8	Flange drilling	As per BS 10, Table D, flat face with off centre bolt holes
3.8	**PUMP - MATERIAL OF CONSTRUCTION**	
3.8.1	Base plate	S.S. AISI 304
3.8.2	Pump Casing	SS AISI 410
3.8.3	Impeller	SS CF 8 M
3.8.4	Shaft	S.S AISI 410
3.8.5	Wearing Ring	SS 316
3.8.6	Painting	Epoxy
3.8.7	Hardware in contact with water	Hot dipped galvanized
3.8.8	Companion flanges	M.S., BS 10, Table D
4.0	**INDUCTION MOTOR**	
4.1	Type	Squirrel cage Induction
4.2	Mfg. Standard	IS 2615
4.3	Rated Voltage	415 Volts, 3 Phase, 50 Hz., AC
4.4	Voltage and frequency variation	± 10% voltage variation ± 5% frequency variation
4.5	Speed in RPM	1450/2900 RPM
4.6	Class of Insulation	Class B
4.7	Degree of Protection	IP 55
5.0	**ACCESSORIES & SERVICES REQUIRED**	
5.1	Base Plate	YES
5.2	Foundation bolts	YES
5.3	Companion flanges	YES
5.4	Spare parts required	YES
5.5	Maintenance tools required	YES
5.6	Mounting anti vibration pads	YES
5.7	Pressure Gauges	YES, on delivery of each pump & on delivery header
5.8	Pressure Switches	YES, on delivery of each pump & on delivery header
5.9	Suction & delivery piping	65mm diameter GI Class C Pipe
6.0	Suction, delivery valves & header valves	Required, flanged Cast Iron valves with SS internal parts such as Ball / Gate valve on suction and Ball / Butterfly valve on delivery of each pump & non-slam, spring operated dual plate type check valve on delivery side of each pump & on header, and flexible bellows on suction & delivery side of each pump
7.0	Control Panel	VFD panel with Cascade operations. Power / control cable from starter to pump to be provided
8.0	Level Indicator	Required for 0-5 Mtr. Range and shall be panel mounted and interlocking with pump
9.0	Hardware	Zinc coated

6.1.15 RATES

6.1.15.1 Pump-Motor sets.

6.1.15.2 Pressure vessel with isolation valves, NRV, Pressure Sensor, Flow Sleeve, Cascading Panel.
6.1.15.3 Base plate, foundation bolts, anti-vibration pads.
6.1.15.4 Pump suction – delivery pipe & suction & delivery manifolds.
6.1.15.5 Pump delivery flexible bellows.
6.1.15.6 Pressure gauges, switches & panel mounted Pressure transmitter, level indicator to be interlocked with pump operation.
6.1.15.7 Microprocessor based control panel with all electrical components, protections, interlocks, cable from control panel to pump.
6.1.15.8 Variable frequency drives.
6.1.15.9 All electrical accessories.
6.1.15.10 All material like flanges, hardware, gaskets, etc. required for installation.
6.1.15.11 Installation, testing & commissioning.
6.1.15.12 Making all damage good to original condition after completion of work.
6.1.15.13 All necessary labour, material, and use of tools.

6.1.16 MODE OF MEASUREMENT

6.1.16.1 The measurement shall be for one set installed, tested, approved by Engineer-in-charge, and commissioned.

6.1.17 MODE OF PAYMENT

6.1.17.1 The contract rate shall be for one set installed, tested, approved by Engineer-in-charge, and commissioned.

6.2 WATER COOLER

6.2.1 SCOPE

6.2.1.1 The item pertains to provide water coolers of capacity as specified in schedule of quantities including fixing, testing & commissioning.

6.2.2 MATERIAL & FIXING

6.2.2.1 Water cooler shall be exterior stainless steel construction. It shall have PUF or suitable insulation to reduce power consumption.
6.2.2.2 Water cooler shall be with inbuilt R.O. if specified in schedule of quantities & shall be capable of supply water to the drinking standard i.e., IS: 10500 with its latest edition.
6.2.2.3 Compressor in the cooler shall be rugged & hermetically sealed for any leakages. Surge drums in the refrigerant circuit shall be well enough to prevent leakage in compressor unit.
6.2.2.4 The capacity shall be as per schedule of quantities.
6.2.2.5 Nominal cooling capacity through a drop of temperature shall conform to IS: 11475.
6.2.2.6 Cooler shall be provided with standard length electrical cable & a suitable plug.
6.2.2.7 Fixing of the water cooler shall be floor mounted with rubber mounted adjustable jack bolts as per the flooring.
6.2.2.8 UV unit shall be installed on drinking water discharge pipe.
6.2.2.9 It shall consist of reactor, cabinet housing, cabinet cooling, treatment chamber, electrical panel, temperature safety control, lamp out alert, UV radiometer along with UV monitoring system, Auto-wiper system, and UV monitoring readout panel.
6.2.2.10 The dis-infection chamber shall be constructed of SS 316L on all wetted parts.

6.2.2.11 UV Dosage:

DOSE REQUIREMENTS - COMMON MICRO-ORGANISMS

Species	Dose (mJ / cm^2)	Dose (µW – Sec / cm^2)
Bacillus subtilis (spore)	12.0	12000
Clostridium tetani	4.9	4900

E-coli	5.4	5400
Hepatitis A virus	11.0	11000
Hepatitis Polio virus	12.0	12000
Infectious pancreatic necrosis	60.0	60000
Legionella Pneumophilla	2.04	2040
Pseudo-nomas aeruginosa	5.5	5500
Saccharomyces cevisiae	6.0	6000
Streptococcus faecalis	4.5	4500

Based on the above, the UV Dosage should be > 60,000 µW – Sec /cm2.

6.2.2.12 The UV lamp:

a. Lamp shall be of low-pressure mercury vapour type fluorescent lamp with hard glass enclosure.
b. Low pressure lamps shall be a fluorescent lamp composed of fused silica quartz or vycor, with no phosphor coating.
c. The sockets shall be watertight & vibration resistant.
d. The lamp life shall be rated for 9000 hours. (Useful arc tube life between 4000 - 8000 hours depending on operating conditions.)
e. The access to the UV lamp shall be without the need to interrupt the ballast circuit.
f. The UV Lamp is a fused silica quartz tube, typically l5mm to 25mm diameter ranging from 100mm-1200mm long.
g. The low pressure lamps shall operate within specific wavelengths situated between 240 - 280 nanometres (referred to as nm) with a peak wavelength at 265 nm.
h. The UV Dosage should be > 60,000 µW – Sec /sq.cm.
i. Automatic cleaning arrangement for the quartz glass with the automatic wiper.
j. The unit shall be designed for the transmission for the 65% to 75% of the STP water complete with, lamp out alert circuit & UV radiometer with 4 – 20 mA output.

6.2.3 RATES

6.2.3.1 Water cooler with in-built UV filter.
6.2.3.2 Ultraviolet Filtration Tube with lamp.
6.2.3.3 Electrical cable & a plug.
6.2.3.4 Mounting pads, Brackets, Accessories & Hardware.
6.2.3.5 Making all damage good to original condition after completion of installation work.
6.2.3.6 Testing the entire system and rectification of defects if any.
6.2.3.7 All necessary materials, labor and use of tools.

6.2.4 MODE OF MEASUREMENT

6.2.4.1 The measurement shall be for each unit of Water Cooler with UV filter fixed.

6.2.5 MODE OF PAYMENT

6.2.5.1 The contract rate shall be for each unit of Water Cooler with UV filter fixed.

6.3 REVERSE OSMOSIS UNIT (DRINKING WATER)

6.3.1 SCOPE

6.3.1.1 Supplying & erecting 5 stage single reverse osmosis water purification system of 50 LPH capacity, with M.S. powder coated frame, prefilter housing with 'O' ring, pre-sediment filter, GAC filter, suitable booster DC pumps (2 nos.) of capacity 150 psi, with 40 psi inline type post carbon filter, auto low & high pressure switches, complete and erected as directed by Engineer-in-charge.

6.3.2 RAW WATER QUALITY CONSIDERATIONS:

6.3.2.1 The raw water quality considered for this system is:

a. Total Dissolved Solids: <700 ppm
b. Total Suspended Solids: Nil
c. pH: 7.50 to 8.00
d. Total Hardness: <350 ppm
e. Turbidity: < 1 NTU
f. SDI: <3
g. Heavy Metal: Nil
h. Organics & Bacteria: Nil
i. Residual Chlorine: Nil
j. Temperature (Deg C): <40
k. Colour: Colourless
l. Odour: Odourless

However, contractor to take samples and get the water sample laboratory tested, for the above parameters.

6.3.3 TREATED WATER QUALITY CONSIDERATIONS:

6.3.3.1 The treated water quality expected for this system is:
Total Dissolved Solids: <150 ppm

6.3.3.2 To achieve desired limit of TDS, R.O. plant shall be provided.

6.3.3.3 For R.O. treatment, raw water pumped by raw water pumps shall be first subject to chlorination to eliminate marine growth, fouling & to remove iron content; subsequently filtration through dual media filter is done, so as to achieve outlet water quality with turbidity less than 5 NTU.

6.3.3.4 De-chlorination shall be further done to prevent free chlorine from reaching the membrane.

6.3.3.5 Output water shall be dosed with anti-scaling solution in order to avoid any scale formation on R.O. membrane. The water after dosing shall be passed through a micron filter unit to deliver desired quality of water.

6.3.3.6 Pre-treated water shall be fed to R.O. through high pressure booster pumps which shall be covered under the scope of vendor. One working & one stand by unit shall be provided for booster pump.

6.3.4 TECHNICAL SPECIFICATIONS OF R.O. PLANT

6.3.4.1 Compliance on each parameter with detailed substantiation how the offered product meets the requirement. (Simply writing as YES/ Complied/ As per BIS/CE/ISO terms is not allowed)

6.3.4.2 The system should comprise of pre-treatment modules such as sand filter, activated carbon filter, water softener, 5-micron particulate filter, Reverse Osmosis Modules, and UV light Disinfection and Bacterial Filters (0.25 micron) Endotoxin retention filter is necessary / desirable for yielding high purity water.

6.3.4.3 All pre-treatment modules should have Auto backwash and regeneration facility.

6.3.4.4 These stages should be designed to handle water flow to support R O flow requirement. Generally, 50 -60 % more than permeate flow.

6.3.4.5 R.O. Unit should be compact in sleek cabinet, housing membrane, high pressure pump and bypass mechanism.

6.3.4.6 The control unit should be microprocessor/ microcontroller controlled.

6.3.4.7 The entire unit should have adequate monitoring permeate water conductivity, feed water pressure, and permeate and rejection flow rate.

6.3.4.8 The water distribution loop, booster pump and storage water tank should be made up of stainless steel.

6.3.4.9 Storage water tank should have capacity of at least 500 litres (or as mentioned in the schedule of quantities) with water level controller, outlet valves and easy cleaning provisions.

6.3.5 TREATMENT SCHEME

6.3.5.1 Raw Water Feed Pump: Raw water from raw water storage tank or nearby header will be pumped to Filtration plant with the help of centrifugal pump.

6.3.5.2 Pressure Sand Filter: Raw water is filtered with the help of Multigrade Sand Filter to reduce the suspended solids / turbidity to less than 1 NTU. The filter is operated at the flow rate of 1500 litres/hr and will be backwashed daily. Backwash flow rate for the filter is 4000 litres/hr. The sand filter is designed to operate at the velocity of 23.0 m/h. Filter vessel is of FRP construction. The filter media consists of specific quality of graded sand. To perform various operations of backwash and rinse, Auto backwash system to be provided.

6.3.5.3 Activated Carbon Filter To remove the chlorine present in the filtered water, we have considered one no. of Activated Carbon Filter. The filter is operated at the flow rate of 1200 litres/hr and will be backwashed once in a day. The MOC for vessel is FRP. To perform various operations such as Normal, Backwash and Rinse, Auto backwash system to be provided.

6.3.5.4 Micron filtration: The feed water will be passed through a cartridge filter of 5 micron rating before entering the reverse osmosis system. The micron filter is considered to prevent the membranes from choking. Micron filter is of PP construction. Necessary sampling valve and pressure gauges will be provided.

6.3.5.5 Reverse Osmosis Module. The filtered water will be pumped by means of a high-pressure pump through the R O Module consists of Pressure tubes & membranes. A minimum of 50 % of the feed water will be available as permeate or product water and balance 50 % will be reject stream, which will be the effluent from RO plant. However, recovery can be increase by reticulating reject water in feed flow.

6.3.5.6 RO purified water shall be transferred to the tank in the water cooler.

6.3.6 RATES

6.3.6.1 Raw Water Feed Pump.
6.3.6.2 All FRP Screens, diffusers,
6.3.6.3 Sand Filters, Carbon Filters, Multigrade filters, Micro-cartridge filters,
6.3.6.4 R.O. Membranes, R.O. Pressure Tubes, R.O. modules,
6.3.6.5 interconnecting pipes, isolation valves, flow regulation valves, etc.
6.3.6.6 Base plates, foundation bolts, anti-vibration pads.
6.3.6.7 Pump delivery & delivery manifold isolation valve &NRV & delivery flexible bellows.
6.3.6.8 Pressure gauges & level indicator to be interlocked with pump operation.
6.3.6.9 Electrical cable & a plug.
6.3.6.10 All internal wiring & cabling including lugs, glands, ferrules, cable ties, etc.
6.3.6.11 All material like flanges, hardware, gaskets, etc. required for installation.
6.3.6.12 Installation, testing & commissioning.
6.3.6.13 Making all damage good to original condition after completion of work.
6.3.6.14 All necessary labour, material, and use of tools.

6.3.7 MODE OF MEASUREMENT

6.3.7.1 The measurement shall be for one set of Reverse Osmosis Water Treatment Plant with all components, equipment, panels, cables, wires, interconnecting pipes, valves, etc. complete installed, tested, approved by Engineer-in-charge, commissioned, training, operations & maintenance manuals handed over to the Engineer-in-charge.

6.3.8 MODE OF PAYMENT

6.3.8.1 The contract rate shall be for one set of Reverse Osmosis Water Treatment Plant with all components, equipment, panels, cables, wires, interconnecting pipes, valves, etc. complete installed, tested, approved by Engineer-in-charge, commissioned, training, operations & maintenance manuals handed over to the Engineer-in-charge.

Electrical Works

BLANK

GENERAL INSTRUCTIONS

1.0 Scope of work:

1.1 The contractor's scope of work covers supply, installation, commissioning, and testing of the complete Electrical installation as specified in material specification, item specification, drawings and schedule of quantities.

2.0 Location:

2.1 The works are to be carried out inside the Office of PDEU, Gandhinagar**.** All electrical equipment and gear shall be designed for an average ambient of 50°C with a peak of 55°C and relative humidity 55%.

3.0 Drawings, Specifications & Deviations:

3.1 The drawings and specifications lay down minimum standards of equipment and workmanship. Should the tenderer wish to depart from the provisions of the specifications and drawings either on account of manufacturing practice or for any other reasons, he should clearly draw attention in his tender to the proposed points of departures and submit such complete information, drawings and specifications as will enable the relative merits of the deviations to be fully appreciated. In the absence of any deviations, it will be deemed that the tenderer is fully satisfied with the intents of the specifications and drawings and their compliance with the statutory provisions and local codes.

3.2 In case of discrepancy between the drawings and specifications, the tenderer shall assume the more stringent of the two and furnish his rates accordingly.

3.3 The Contractor shall prepare fabrication and working drawings and all work shall be as per the approved working drawings. Approval of drawings does not relieve the Contractor of his responsibility to meet with the intents of the specifications. All such drawings for approval shall be in duplicate.

3.4 Equipment data shall be submitted along with the filled tender. The contractor shall be responsible for any unfilled data of the data sheets and the same shall be executed according to the requirements of the Engineer in charge / Consultant without any extra cost.

3.5 All sundry fittings, assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections as required, and all other sundry items which are useful and necessary for proper assembly and efficient working of the various components of the work shall be deemed to have been included in the tender, whether such items are specifically mentioned in the tender documents or not.

4.0 Tools and Spare Parts:

4.1 All the tools, tackle, scaffolding, and staging require for erection and assembly of the equipment and installation covered by the contract shall be obtained and maintained by the contractor himself. All other materials such as foundation bolts, nuts, anchor fasteners etc. required for the installation of the plant shall also be supplied and included in the contract.

4.2 Tenderer should submit the spares recommended by him for two years operation of each type of equipment covered by these specifications on completion of work.

5.0 Testing & Handing over:

5.1 The contractor shall carry out tests on different equipment as specified in various sections in the presence of representatives of clients, Architects and Consulting Engineers in order to enable them to determine whether the plant, equipment and installation in general comply with the specifications.

5.2 All equipment shall be tested after carrying out necessary adjustments and balancing to establish equipment ratings and all other design conditions. At least six sets of readings shall be taken for each item tested and submitted.

5.3 The project shall be handed over after satisfactory testing along with six sets of documentation along with two sets of soft copy each consisting of :

i) Detailed equipment data as approved by the Consulting Engineers/Employer.

ii) Manufacturer's maintenance and operating instructions.

iii) Set of drawings, showing plant layouts, piping, ducting, cabling etc

iv) Approved Test reading & certificate of local authorities.

v) List of recommended spares.

5.4 Submission of the above documentation shall form a precondition for the final acceptance of the plant and installation and final payment.

6.0 Performance guarantee:

6.1 **All electrical equipment/items shall be suitable for Seismic Zone V.** All equipment and the entire installation shall be guaranteed to yield the specified ratings and design conditions plus/minus 3% tolerance. Any equipment found short of the specified ratings by more than the allowable tolerance as determined by the test readings shall be rejected.

7.0 Defects Liability:

7.1 All equipment and the entire installation shall be guaranteed against defective materials and workmanship for a period of 12 months reckoned after the plant is commissioned and handed over to the clients along with the 6 sets of completion documents. During the defect's liability period, the contractor shall rectify, repair or replace defective parts and components free of cost.

8.0 Statutory Inspections:

8.1 The contractor shall be fully responsible for meeting all the statutory obligations pertaining to the works carried out by them. The contractor should prepare all working drawings and obtain approval of competent authorities and also have the equipment and installation inspected and got approved. All statutory fees will be paid by the clients directly against demand in writing from the appropriate authority and all other expenses for submission and approval of the various and relevant statutory/bodies shall be embodied in the tender prices.

8.2 Getting approval from all concern authorities will be in scope of contractor, no extra charge shall be payable against liasoning work.

9.0 Payment to civil contractor.

The electrical contractor will have to pay to the civil contractor for any work done on behalf of the electrical contractor like laying of pipes, filling of zarries etc.

10.0 Temporary wiring

Whenever any temporary wiring is done, it has to be done so that all precaution for safety is taken and temporary wiring shall be also done so that, it is not hazardous to anybody. Any accidents happen because of temporary or permanent installation, it will be entire responsibility of contractor for all compensation to concern parties.

Employer, engineer in charge, consultants shall not be responsible for such accidents, mistake etc.

11.0 Completion Drawing:

The contractor shall to submit 4 sets of as built drawings showing all power and control circuit diagrams and

soft copy of the same.

12.0 GA Drawings

Successful tenderer shall submit General Arrangement drawings for approval of employer/consultant before manufacturing of any part of equipments.

13.0 Works to be done by the Contractor

13.1 The contractor shall also furnish 4 copies of detailed installation, operation and maintenance manuals of manufacturers for all items of equipment together with all relevant data sheet, spare parts catalogues, repairs, assembly and adjustment procedure etc.

13.2 The contractor shall furnish such facilities as will be necessary for inspection of the equipment before dispatch at the manufacturer's works and also for witnessing such tests, at the works, if so required by employer/consultant.

13.3 Copies of all documents for routine, acceptance and type test certificates of the equipment carried out at the manufacturers premise shall be furnished to the employer along with supply of equipment.

13.4 The contractor shall coordinate his work and cooperate with other agencies by exchange of all technical information like details of foundation, weight, overall dimensions, clearances and other technical data required for successful and proper completion of his portion of the work in relation to the work of others without any reservation. No remuneration shall be claimed for such cooperation.

13.5 Care shall be taken, while handling/installing the equipment to avoid damage to the building as well as equipment. On completion of installation, the contractor shall arrange to repair all damages to the building and equipment caused during installation so as to bring to the original condition without any extra cost.

13.6 Sealing of all floor openings provided for electrical pipes and cables, from fire safety point of view, after laying the same without any extra cost.

13.7 Testing and commissioning of completed installation.

13.8 All tools and tackles required for handling of equipments and material at site of work as well as for their assembly and erection and also necessary test instruments shall be the responsibility of the contractor.

13.9 The contractor shall co-ordinate with all other agencies involved in the building work so that the building work is not hampered due to delay in his work. Recessed conduit and other works, which directly affect the progress of building work, should be given priority.

13.10 No structural member in the building shall be damaged / altered, without prior approval. All openings provided by others for electrical services shall be grouted / filled by the contractor after installing the cables/conduits etc. as the case may be, by any suitable means as approved by the engineer in charge without any extra cost. All chases required in connection with the electrical works shall be provided and filled by the contractor at his own cost as per instruction of architect to the original architectural finish of the building.

13.11 All the electrical works shall be carried out in accordance with the provisions of Indian electricity act, 1910 and Indian electricity rules, 1956 amended up to date(date of call of tender).All components shall confirm to relevant Indian standard specifications, wherever existing, amended up to date.

13.12 For all kind of fabricated equipments, the contractor will first submit dimensional detailed drawings for approval before fabrication is taken up in the factory. Suitable stage inspection at factory also will be made to ensure proper use of materials, workmanship and quality control.

13.13 All testes prescribed in specification, to be done before, during and after installation, shall be carried out, and

the test results shall be submitted to the engineer in charge in prescribed Performa, forming part of the completion certificate.

13.14 Completion plan (AS BUILT) drawn to the scale to be submitted for each building with location of main switch board, distribution boards, panels, circuit diagram, conduit layouts, points, outlets, light fixtures etc complete in all respect as per instruction of engineer in charge.

14.0 Guarantee

The contractor shall guarantee the entire installation as per specifications. All equipments shall be guaranteed for one year from the date of acceptance against unsatisfactory performance or break down due to defective design, manufacture and installation. The installation shall be covered by the conditions that whole installation or any part there of found defective within one year from the date of taking over shall be replaced or repaired by the contractor free of charge.

15.0 After sales services

The contractor shall ensure adequate and prompt after sales services in the form of maintenance personnel and spares as and when required with a view to minimizing the break down period. Particular attention shall be given to ensure that all spares are easily available during the normal life of installation.

SPECIAL CONDITIONS OF CONTRACT

1. Equipment & Machinery on Work Site

   The contractor shall provide and maintain in working order power driven machines like welding, drilling machine, zarri cutters, meggar, multimeter, continuity tester etc. till the completion of work.

2. The quantity for measurement will be actual quantity used in electrification:

   I) The contractor shall bear all incidental charges for the storage and safe custody of the materials at site at his own responsibility.
   II) The contractor shall make arrangement at the site of works for safe custody of materials to protect from damage by rain, dampness, fire, theft etc.
   III) In case any materials get damaged the contractor shall replace the same at his own cost.
   IV) The contractor shall furnish to Engineer-in-Charge sufficiently in advance a statement showing his requirements of quantities of materials to be supplied by Owner if any and the time when he will require the same.
   V) A day-to-day account of the material supplied by Owner/Contractor shall be maintained by the contractor in the agreed Performa.

4. Engineer In charge/Employer will provide operative instructions on regular basis related to project during contract execution period, which are not covered in this tender document. Contractor and his staff at site shall comply all these instructions.

5. Client's approval will be final in all concerned matters.

6. All correspondences between contractor and architect will be through client/PMC.

7. The Electrical contractor must be licensed Electrical contractor.

8. The Electrical contractor must have available all kind of necessary equipments at site.

9. The Electrical contractor should get approval prior to appoint any sub agencies for specialized jobs. Client /Consultant/Architect have right to reject any contractor at any stage of project.

10. It is required that all insurance formalities & workman's compensation policy should be followed by the contractor.

11. All HT cable jointer should possess necessary license for HT cable jointing/termination and should be well experienced with similar work.

12. The contractor will have to provide senior Electrical site engineer during the execution of work

13. All wiring person must be in possession of wireman license.

14. Minimum Criteria for selecting Electrical Sub contractor.

1. The contractor must be government approved as "Class A" licensed Electrical contractor.

2. The Electrical contractor must have completed following kind of jobs under one project head in last 3 years.

   - SITC MV/LV Cabling and termination work.

- SITC of all M.V. Switch gear and power panels made by CPRI approved panel vendor.
- Internal wiring with PPI (Per Phase Isolation) type Distribution Boards.
- SITC of external lighting like poles, cables, Timers, cable trenches etc.

3. The Electrical contractor shall get approval prior to appoint any sub agencies for specialized jobs. Employer /Consultant/Engineer in charge has right to reject any contractor at any stage of project.

4. The contractor will have to provide:
   - Minimum one senior Electrical site engineer B.E. with more then 5 years experience.
   - All wiring person must be a supervisor level grade.

5. Emphasis shall be given to the sub contractor who has already completed similar kind & Magnitude of projects and has worked with renowned Employer / Consultant.

Basic Rates – Light Fixtures

Following rates shall be considered as basic rates for arriving at the tender rates by the bidder.

SR NO.	TYPE OF LIGHT FIXTURE	BASIC RATE	PRICE RANGE
1	Internal Light Fixtures Type A	Rs. 3,000/-per No.	Up to Rs.4,500
2	Internal Light Fixtures Type B	Rs. 6,000/-per No.	Above Rs.4,500 & up to Rs. 8,000
3	Internal Light Fixtures Type C	Rs. 10,500/- per No.	Above Rs.10,000

The above basic rates are inclusive of all types of taxes, levies, loading, transit insurance, transportation, unloading and delivery at site.

Contractor shall inform and get approval of the employer in writing about the purchase rates and source of supply of the items listed under basic rate before placing the order. Material shall be purchased directly from manufacturer or their authorized main stockist / supplier. The contractor shall get approval of such rates from engineer in charge at least minimum one month in advance of placing the order of the relevant material. Employer reserves the right to negotiate and finalize the rates of the items listed under basic rate items directly with the supplier / authorized dealer.

The approved rates shall be termed as **negotiated rates** (inclusive of all types of taxes, levies, loading, transit insurance, transportation, unloading and delivery at site) and the same shall be binding to the contractor for further process of execution. Contractor shall execute the relevant item considering the negotiated rates as final rate. The contractor shall prepare and submit the statement of basic rate difference for all relevant items (Performa of the statement is given below) with each running bills and final bill. The supporting documents like approved rate quotation, delivered quantities, invoice received from supplier, payment details etc. as required by engineer in charge shall be attached with this statement for Employer's verification and record. The amount of basic rate difference shall be claimed in every running bill. Final adjustment can be made during final bill after proper reconciliation of total executed quantities and material supplied quantities.

No other component of cost as stated in the Performa below shall be considered for payment or recovery of material listed under basic rate item. Refer table below for deriving amount of basic rate difference payable or recoverable.

Electrical contractor should quote considering only Installation, Testing & Commissioning (ITC) charges in addition of basic rate for Supply.

For selection of fitting, there must be one committee in which SE, Executive Engineer, Consultant, Architecture will be members. The consultant shall suggest minimum two models of fittings for each item with literature, Specification, drawings etc. While deciding the basic cost. consultant / contractor has to produce quotations of the fittings in the committee including GST, excise, custom duty etc. The basic cost will be the original cost of the manufacturer including said costs. However basic cost includes transportation, loading, unloading, storage charges etc. but for each and every charge, contractor have to submit the bills / supporting documents. Final decision of the basic cost will be decided by the committee. The contractor has to submit each and every Photocopy of the bills. Committee reserve the rights to negotiate the price directly with manufacturer / supplier / dealer etc.

If any type of fixture price shall be in running meter length than it will be operate as 1 meter = 1 no. also in similar

price range.

- **Final Rate will be decided as per following sample calculation table**

Sr. No	Item	Unit	Basic Rate as per tender (a)	Negotiated rates (b)	contractor Quoted Rate (assumed) (c)	Rate Difference (d) = b-a	% difference with basic rate (e) = d / a	Deduction in QR f= c x e	Final payable amount g=c+f (if 'f' is in negative figure) OR g=c+d(if f is NA)
				Example					
1	Internal	No	3000	3500	3500	500	+ 16.67%	NA	4000
2	Internal	No	6000	5000	5500	-1000	- 16.67%	-916	4590 (c+d)
2	Internal	No	10000	8500	9000	-1500	- 15.00%	-1350	7650 (c+d)
								Total	16,240

ELECTRICAL ITEM SPECIFICATION

SUMMARY PAGE

I. **Electrical Works** Page No

A. **Item Specifications**

Section – 1	1	HT Breaker	Not Applicable
Section – 2	2	Unitized Substation	Not Applicable
Section – 3	3	LT Bus duct	Not Applicable
Section – 4	4	Substation Equipment and Auxiliaries	Not Applicable
Section – 5	5	LT Switchgear & Power panels	02
Section – 6	6	LT Distribution Board	05
Section – 7	7	Cable Trench	06
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Section – 12	12	Light Fixtures and Fans	15
Section – 13	13	Earthing	17
Section – 14	14	Miscellaneous	18
Section - 15	15	Telephone and Comp. Data Distribution	Not Applicable
Section – 16	16	External Lighting	Not Applicable
Section – 17	17	Lightning Arrestor	Not Applicable
Section – 18	18	DG Set	Not Applicable
Section - 19	19	Television Distribution	Not Applicable

ELECTRICAL ITEM SPECIFICATIONS

1.0 HT BREAKER

1.1 Not Applicable.

2.0 UNITIZED SUB-STATION

2.1 Not Applicable.

3.0 LT BUS DUCT

3.1 Not Applicable

4.0 SUBSTATION EQUIPMENT AND SUBSTATION AUXILIARY

4.1 Not Applicable

5.0 LT SWITCH GEAR & POWER PANELS

5.1 Supplying, unloading at site, shifting to site, assembling, leveling, grouting, erecting, Testing, & Commissioning of L.T. panel board, fabricated from CRCA sheet & folded channel totally enclosed cubical type compartmentalized as per drawings. All energy meter are Post paid- Dual Source type as per specification.

1) Material

MV switch gear & power panel shall confirm E-5

2) Workmanship :

1) Main busbar should be electrolytic tinned copper type.
2) All internal wiring and all connection shall be with copper wires and strips as required. Use copper flexible wire for below 100 Amps and copper strips for 100 Amps and above ratings.
3) All component, frame etc shall be earthed. A common internal earth bar with two separate earthing leads to be provided.
4) Painting or powder coating to be done on all sheet metal works as required.
5) Panel should have MS base frame for floor mounting unless otherwise specified.
6) The board should be front operated and extensible type.
7) Compression type brass glands and crimping lugs for incomer and outgoing ends.
8) All ammeters to be provided with C.T.'s and selector switch and voltmeter with selector switch and control fuses.
9) Panel components shall be as specified
10) The design and location of all panels to be approved by the architect/consultant before fabrication and Installment.
11) All panels should be dust and vermin proof.
12) All panels should be fabricated out of 14 gauge sheet The door should be made from 14 gauge (2 mm) and the other parts should be made from 14 gauge sheet metal.
13) All meters should be digital type with communication port only unless and otherwise specified.
14) The metering on main panels shall be LOAD MANAGER with communication port unless and otherwise specified.
15) All the Switches used should be capable of withstanding the AC23 duty for motor operation. The Switches should have quick make quick break. The contacts should be silver plated double break type.
16) Main LT Panel, Bus coupler and APFCR panel should be fabricated in the approximate length of 1 meter and depth of 1 meter compartment.
17) The board should withstand the system prospective fault current
18) Engraved plastic labels shall be provided indicating the feeder details, capacity, cable size and load in KW and danger signs.

19) The entire panel board should be with adequate height width & depth as per relevant prevailing I.S. code and Installation include foundation bolts of suitable size as per requirement.
20) All compartment doors should be concealed hinged type & handles of feeders to be interlocked mechanically with the doors such that door cannot be opened when the switch is in 'ON' position & switch cannot be 'ON' when the door is in open position.
21) Provide suitable size CT shorting terminal for all CT's.
22) Provide suitable size Exhaust Fan for APFCR / RTPFC Panel.
23) All MCCB should be with breaking capacity of I_{cs}=100% I_{cw}

3) Mode of measurement:

The rate shall be for one unit of panel.

6.0 LT DISTRIBUTION BOARD

6.1 Supplying, assembling, grouting, levelling, installation, Connecting & testing D.B of specified make but without MCB / ELMCB/MCCB/ SPD etc. with all internal bus bar as per requirement.

6.1.1 TPN Distribution Board :

1) Material

Distribution board shall confirm to E-6

2) Workmanship :

1) All the D.B. should have separate neutral link per phase with main neutral link i.e. four neutral link of appropriate nos. of way.
2) The D.B. should be provided with 2 separate insulated earth links.
3) The D.B. should be concealed type having sheet metal enclosure with double door unless or otherwise specified..
4) The D.B. should be Powder coated.
5) The D.B. shall have top and bottom plates open able.
6) The D.B. shall be provided with necessary cable junction box

3) Mode of measurement

The rate shall be for one unit of D.B.

6.1.2 SPN Distribution Board

1) Material

As per item no 6.1.1.

2) Workmanship

As per item no 6.1.1 above.

3) Mode of measurement

As per item no 6.1.1 above.

6.1.3 VTPN Distribution Board

1) Material

As per item no 6.1.1.

2) Workmanship

As per item no 6.1.1 above.

3) Mode of measurement

As per item no 6.1.1 above.

6.2 MCB, ELMCB and its Accessories

Supplying, Assembling, leveling, connecting & testing MCBs/ELCBs/ELMCBs/Isolators of various rating in boards as specified in 6.1.

1) Material

M.C.B. shall confirm to E-6

2) Workmanship

Should mount all the MCBs/ELCBs/ELMCBs/Isolators and other accessories in the D.B. as per the MCB chart furnished by consultant and also do the necessary connections. Should check for any faulty connections and reconnect the same. Also check for the loading once complete installation of fixtures and other equipments is completed.

3) Mode of measurement

As per item 7.1 but for MCBs/ELCBs/ELMCBs/Isolators and accessories.

6.3 MCCB

Supplying, Assembling, leveling, connecting & testing following MCCB etc in boards as specified in 6.1.

1) Material

M.C.C.B. shall confirm to E-5

2) Workmanship

Should mount all the MCCBs and other accessories in the D.B. as per the chart furnished by consultant and also do the necessary connections. Should check for any faulty connections and reconnect the same. Also check for the loading once complete installation of fixtures and other equipments is completed.

3) Mode of measurement

As per item 6.1 but for MCCB.

6.4 Caution Board:

Providing and erecting metallic vitrified danger notice board for MEDIUM VOLTAGE installation to be erected as per IS

1) Material

Should Conform to E - 6

2) Workmanship

The plates shall be mounted on the D.B. as per the instructions from consultant.

3) Mode of measurement

Rate shall be considered for 1 no of plates.

6.5 Voltage Surge Protector

Supplying, Assembling, leveling, connecting & testing VSP of various rating in boards as specified in 6.1.

1) Material

VSP shall confirm to E-6

2) Workmanship

Should mount all the VSP and other accessories in the D.B. as per the DB Details furnished by consultant and also do the necessary connections. Should check for any faulty connections and reconnect the same. Also check for the loading once complete installation of fixtures and other equipments is completed.

3) Mode of measurement

As per item 7.1 but for VSP and accessories.

7.0 CABLE TRENCH

7.1 Excavation and back filling of cable trenches required for laying the cables directly buried in the ground. This includes supplying and providing cable markers at an interval of 10 meters. The depth shall be app. 0.9mtr and the width shall be as per requirement.

1) Material :

All the tools and tackles required for the excavation shall be provided by the contractor. Cable marker shall be provided.

2) Workmanship

Excavation shall be done as per the route specified in the plan of the consultant. Also the depth as specified in the item shall be strictly maintained. Cable markers shall be installed at length specified in the item.

3) Mode of measurement:

The item shall be paid in cubic Mtr. And the measurement shall be certified by the engineer in charge from the Clients side. Depth of the excavation shall be measured from average ground level given in drawing

7.2 Supplying and spreading fine sand for a thickness of 100 mm. and providing and laying bricks for protection on cable on all the three sides.

1) Material:

All the tools and tackles required for the spreading fine sand and back filling shall be provided by the contractor. Bricks of 2nd class or higher quality shall be used.

2) Workmanship

Bricks shall be laid on all the three sides of the cable as per the drawing of the consultant. Proper thickness for the fine sand as specified in the item shall be strictly maintained. After back filling proper leveling shall be done and lumps of soil should not be visible. The trench should give a leveled look.

3) Mode of measurement:

The item shall be paid in running Mtr. and the measurement shall be certified by the engineer in charge from the Clients side.

8.0 LT CABLING

8.1 Supply, testing and Laying XLPE steel/GI wire/flat armoured cable of 1100 V grade of Aluminum / Copper Conductor of following sizes in ready made trench or mounted on wall with necessary clamping arrangement or in pre-laid RCC hume pipe with necessary cable identification mark to be provided at distance of 25 mt. The vertical cable on wall shall be drawn in prelaid conduit for vertical mechanical support.

1) Material

Shall be confirm to E- 7,

2) Workmanship

Installation

A) 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 site and obtain the approval of the Architect/Consultant before laying the cable. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only.

B) Cables, running indoors shall be laid on walls, ceiling, inside shafts or trenches. Single cables laid shall be laid in GI/PVC pipe and not to fix on wall slab directly or drawn through GI / PVC pipes fixed on wall or ceiling and supported at not more than 500 mm. Where number of cables is run, necessary perforated cable trays shall be provided wherever shown. Perforated trays shall be mild steel or Aluminum as specified in the schedule of work and supported on mild steel frame work as shown on drawings or as approved. Cables laid in built-up trenches shall be on steel supports. Plastic / Aluminum identification tags shall be provided at every 30 m. All cables laid shall be properly dressed and at least 50 mm space shall be kept between the cables.

C) Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or in accordance with the manufacturer's recommendations whichever is higher.

D) In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion. Cables shall be protected with brick or cement tiles on all the three sides as shown on drawings. Width of excavated trenches shall be as per drawings. Back fill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall be provided with cables markers at every 20 meters and at all loop points.

E) The general arrangement of cable laying is shown on drawings. All cables shall be full runs from panel to panel without any joints or splices. Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid. cable termination for conductors upto 4 sq.mm. may be insertion type and all higher sizes shall have tinned copper compression lugs. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armoring shall be earthed at both ends.

F) In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall be laid in slant position. So, that no rain water may enter the building. After the cables are tested. The pipes shall be sealed with M. seal & then tarpaulin, shall be wrapped around the cable for making the entry of water light.

G) cables shall be provided with stainless steel/Aluminum cable identification tags at a maximum distance of 10m.

H) All cables to be laid should be properly dress and at least 50 mm space should be kept between the cables.

Testing:

A) MV cables shall be tested upon installation with a 500 V Meggar and the following readings established:
1) Continuity on all phases.
2) Insulation Resistance.

(a) Between conductors.
(b) All conductors and ground.

All test readings shall be recorded and shall form part of the completion documentation.

3) Mode of measurement

The cable shall be measured in per mt. Basis and the rates shall include;

1) Cables and clamps
2) Installation, Commissioning and testing.

Cable length shall be certified by engineer in charge from Clients side.

8.2 Supply and application of intumescent based coating on cables/ cable tray using CP 678 firestop cable coating of HILTI make or equivalent .The coating shall have a density in the range of 1.2 to 1.4 Kg/ L. The coating shall be non-toxic, asbestos and halogen free and shall have good mechanical strength. The coating shall comply with IEC 332 part 3 (1992).

1) Material

Shall be confirm to E- 7

2) Workmanship

Installation

A) Cables coating shall be done in prelaid cable in cable tray / Cable trench with usage of brush or ailless spray gun. Use 1 Mtr coating of cable & cable tray at each 6 Mtr distance and each end of cable and cable tray. And cable coating shall be use in full width and length in vertical mounted cable tray & cable.

Cable coating should be **Hilti make cat No CP678 or equivalent.**

3) Mode of measurement

The cable shall be measured in per Kg Basis and the rates shall include;

1) Installation, Commissioning and testing.

Usage of coating shall be certified by engineer in charge from Clients side.

9.0 CABLE TERMINATION

9.1 **Supplying & fixing double compression type Brass glands (single compression for indoor application and double compression for outdoor applications) & making joint with necessary bi metallic crimping socket of long nack type connecting the same to various equipment/panel/DB etc. for the following sizes:**

1) Material

Should conform to E – 8,

2) Workmanship

Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool.

3) Mode of measurement

Rate shall be considered for 1 no of joint.

10.0 CABLE TRAY

10.1 Supply & Installation of hot dip GI ladder type cable tray with all accessories like Anchor fastener, coupler, GI nut bolts, bend, tee, reducer etc as per specification and drawings complete with all required hardware :

1. **Material**

Shall confirm to E-9

2. **Workmanship**

As directed by engineer in charge.

3. **Mode of measurement**

Rate shall be considered for 1 mtr cable tray including all accessories.

10.2 Supply & Installation of hot dip GI Perforated type cable tray with all accessories like coupler, GI nut bolts, bend, tee, reducer etc as per specification and drawings complete with all required hardware :

1 **Material**

Shall confirm to E-9

2 **Workmanship**

As directed by engineer in charge.

3 **Mode of measurement**

Rate shall be considered for 1 mtr cable tray including all accessories.

11.0 INTERNAL WIRING

11.1 Point wiring

1) Material

Shall confirm to E – 10.

2) Workmanship

1) Installation

A) The size of conduit shall be selected in accordance with the number of wires permitted under table given below. The minimum size of the conduit shall be 25 mm. diameters unless otherwise indicated or approved. Size of wires shall not be less than 1.5 sq.mm. Copper.

Nominal Cross sec. Area	20 mm		25 mm		32 mm		38 mm	
(mm2)	S	B	S	B	S	B	S	B
1.50	4	3	10	8	15	9	--	--
2.50	4	2	9	6	10	8	--	--
4.00	2	2	6	4	9	6	--	--
6.00	1	--	5	4	9	6	--	--
10.00	1	--	3	3	7	5	6	5

S - runs of conduits which have distance not exceeding 4.25 m. between draw boxes & which do not deflect from the straight by an angle more than 15 degree.

B - runs of conduits which deflect from the straight by more than 15°.

B) Conduits shall be kept at a minimum distance of 100 mm. from the pipes of other non-electrical services. And maintain minimum 300 mm distance between telephone, TV & Computer piping.

C) Separate conduits/raceways shall be used for :

1. Normal lights and 5 A 3 pin sockets on lighting circuit.
2. Separate conduit shall be laid from D.B. to switch board or point.
3. Power outlets - 15 A 3 pin 20 A/30 A, 2 pin scraping earth metal clad sockets.
4. Emergency lighting.
5. Telephones.
6. Fire alarm system.
7. Public address system & Music system.
8. For all other voltages higher or lower than 230 V.
9. T.V. Antenna.
10. Water level guard.
11. Computer Wiring

D) Call bell wiring layout of conduits shall be generally as indicated on drawings and the layout shall be supplemented and complemented by contractor on site with the approval of the Engineer.

E) Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc., shall be installed in flexible conduits. Otherwise rigid conduits shall be used. No flexible extension shall exceed 1.25 m.

F) Conduits run on surfaces shall be supported on GI 12 mm. thick pressure saddles which in turn are properly

screwed to the wall or ceiling. Saddles shall be at intervals of not more than 500 mm. Fixing screws shall be with round or cheese head and of rust-proof materials. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building. Unseemly conduit bends and offsets shall be avoided by using fabricated mild steel unction/pull through boxes for better appearances. No cross-over of conduits shall be allowed unless it is necessary and entire conduit installation shall be clean and neat in appearance.

G) Conduits embedded into the walls shall be fixed by means of staples at not more than 500 mm. intervals. Chases in the walls shall be neatly made and refilled after laying the conduit and brought to the finish of the wall but final finish will be done by the building contractor.

H) Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the Engineer, 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.
Where conduit passes through expansion joints in the building, adequate expansion fittings shall be used to take care of any relative movement.

I) Inspection boxes shall be provided for periodical inspection to facilitate withdrawal and removal of wires. Such inspection boxes shall be flush with the wall or ceiling in the case of concealed conduits. Inspection boxes shall be spaced at not more than 12 meters apart or two 90° solid bends or equal. All junction and switch boxes shall be covered by 6 mm. clear Perspex / Acrylic plate truly cut and fixed with cadmium plated brass screws. These junction boxes with cover plate shall form part of point wiring or conduit wiring as the case may be including the cost of removing the Perspex / Acrylic cover for painting and re-fixing. No separate charges shall be allowed except where specially mentioned.

J) Conduits shall be free from sharp edges and burrs and the threading free from grease or oil. The entire system of conduits must be completely installed and rendered electrically continuous before the conductors are pulled in. Conduits should terminate in junction boxes of not less than 32 mm. deep.

K) An insulated earth wire of copper rated capacity shall be run in each conduit.

2) Lighting & Power Wiring:

A) All final branch circuits for lighting and appliances shall be flexible copper wire of appropriate size run inside conduits. The conduit shall be properly connected or jointed into sockets, bends, junction boxes.

B) Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.

C) All circuits shall preferably be kept in a separate conduit upto the Distribution Board. No other wiring shall be bunched in the same conduit except those belonging to the same phase. Each lighting branch circuit shall not have more than ten outlets or 800 watts whichever is lower. Each conduit shall not hold more than three branch circuits, of the same phase.

D) Flexible cords for connection to appliances, fans and pendants shall be 650/1100 V grade (three or four cores i.e with insulated neutral wire of same size) with tinned stranded copper wires, insulated, twisted and sheathed with strengthening cord. Colour of sheath shall be subject to the Engineer's approval.

E) Looping system of wiring shall be used. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors. No such joints shall be made unless the length of the sub-circuit, sub-main or main is more than the length of the standard coil.

F) Control switches shall be connected in the phase conductors only and shall be `ON' when knob is down. Switches shall be fixed in 3 mm. thick painted or galvanized steel boxes with cover plates as specified. Cadmium plated brass screws shall be used.

G) Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 25 mm. and wires not less than 2.5 sq.mm. Copper shall be used.

H) Every conductor shall be provided with identification ferrules at both ends (At DB & Switch Board end) matching the drawings.

I) Switch board module shall be as per consultant / architect detail. Dummy plate for switch board shall be part of point wiring rate.

J) 3 core flexible wires for point to Light fixture shall be considered in point rate.

3) Testing

The entire installation shall be tested for :
a) Insulation resistance.
b) Earth continuity.
c) Polarity of single pole switches.

General

All the wiring switch board, outlet points shall be done in a concealed manner in wall & slab in PVC conduit of minimum 25 mm dia. (medium guage) when laid in ground / floor the PVC pipe will be Heavy gauge & with 1100v grade PVC insulated flexible copper conductor wire. The switches should be modular with molded cover plates, blank plates for outlet boxes. The accessories, connectors, sockets, should be fixed with brass crome / cadmium plated machine screw. For fan points the rates should be inclusive of 300 W regulators as required to complete the point wiring. The wiring shall be as per IS: 732 and IS: 4648. The wiring shall be done in a looping manner so as to avoid junction boxes at any place. All the looping shall be done only in the switch board and outlet points. The size of the wire shall be as per the specification. Colour code shall be strictly followed. Heavy guage PVC pipe shall be laid for ground / floor.

The size of wires shall as follow:

10 Amps. Metal clad points:
Phase / Neutral 2.5 mm2
Earth 1.5 mm2

6 Amps. Out let points:
Phase / Neutral 2.5 mm2
Earth 1.5 mm2

Two nos. of 16 Amps. socket out let connected in parallel from DB to first outlet
Phase / Neutral 4.0 mm2
Earth 2.5 mm2

Two nos. of 16 Amp. socket out let connected in parallel from first outlet to second outlet.
Phase / Neutral 2.5 mm2
Earth 1.5 mm2

Light, fans, exhaust fan, 5 Amp. plug point, two way light point, bell point etc.
Phase / Neutral 2.5 mm2
Earth 1.5 mm2

6/16 Amp. Socket outlet for appliances / AC (Single Phase/Three Phase) / Geyser
Phase / Neutral 4.0 mm2
Earth 2.5 mm2

Separate pipes shall be laid for off wires and circuit mains.
Circuit mains of same phase shall be drawn in one pipe with prior permission/discussion with the consultant.
Separate phase, neutral and earthing wire of sizes recommended by consultant shall be drawn for each and every circuit mains.

3 **Mode of measurement**

The unit rate shall include:
1) Making zari in the wall & semi finishing the surface.
2) Ball and socket joints where ever required
3) Earthing of fittings
4) Electrical connection to the fixtures from the outlet point/ ceiling rose
5) Supply and Installation and interconnection of electronic regulators for ceiling fan
6) Circuit Mains shall not be paid extra. Rate for the point shall consist of wiring from the out let point to the switch board as required with a connector/ plate/ ceiling rose fan box with hook socket with switch. The point rate shall include in addition to phase and neutral wire a PVC insulated earth continuity wire from switch to outlet. The unit rate for the point shall consist of the circuit wiring form LDB / ELDB to outlet point through switch and/or socket, switch board as required and including the outlet points with connector, fan hook box or sockets. A point shall include in addition to phase and neutral wire a PVC insulated Earth continuity wire from LDB / ELDB to the final termination at outlet points. No extra rate shall be paid for circuit mains for looping switch board to switch board.
7) There may be few Emergency light points and SB for the same. For Emergency light points no Circuit Mains shall not be paid extra. Rate for the point shall consist of wiring from the out let point to the switch board as required with a connector/ plate/ ceiling rose fan box with hook socket with switch as mentioned above in #6.

11.2 MAINS:

A) The mains are considered from the meter/sub panel to the individual distribution boards.

1) Material :

As per item no 11.1 above

2) Workmanship

As per item no 11.1 above

3) Mode of measurement

The mains shall be paid on per mtr basis which shall include cost of wires, pipe, bends and junction and accessories for mounting and jarri work. The length shall be certified by the engineer in charge from Clients side.

11.3 RACE WAYS:

11.3.1 Supply and installation of 3 under floor metal trunking/race way with all accessories made out of hot dip pre galvanized metal coated steel sheet equivalent to MK Ega (novar) make. following size of dimensions and No of compartments (W x D x T)

- **225mm x 38mm x 2.0 mm with Three Compartments**
- **100mm x 38mm x 2.0 mm with Single Compartments**

1) Material

As specified in BOQ

2) Workmanship

As directed by engineer in charge

3) Mode of measurement

The rate shall be for 1 mtr of raceway with cover.

11.3.2 Supply and installation of 3 compartment Access outlet / service box of 250 x 250 x 60-75 mm with all accessories made out of high pressure die cast material suitable for above race ways equivalent to MK Ega (Novar) make.

1) Material

As specified in BOQ

2) Workmanship

As directed by engineer in charge

3) Mode of measurement

The rate shall be for 1 no of access outlet.

11.3.2 Supply and installation of 3 compatement 100 mm x 50 mm wall trunking/race way with cover and all accessories made out of PVC equivalent to MK (premier) make.

1) Material

As specified in BOQ

2) Workmanship

As directed by engineer in charge

3) Mode of measurement

The rate shall be for 1 no of access outlet.

12.0 LIGHT FIXTURES & FANS

12.1.1 & 2 Supplying, erecting, connecting, testing and commissioning of Following type Light Fixture with all necessary Hardware, Internal Wiring with Lamp, Ballast etc. all required accessories Complete in all respect. Cost includes wiring from outlet point to light fixtures and also wiring from first light fixtures to second light fixtures wherever provided on back to back (touching each other) arrangements.

1) Material

Shall confirm to E-11

2) Workmanship

The fixture shall be installed on wall / ceiling as directed and as per manufacturer's instruction, with necessary accessories for surface, concealed, suspended from ceiling, bracket mounting etc. The job also includes connection of fixture with respective outlet point with heat resistant wires through heat resistance sleeve and PVC connector. The exhaust fan shall be installed complete with M.S. angle iron mounting frame/ ring, G.I. louvers, wire mesh and plug at the end of the cord including wiring & earthing etc. Proper earthing shall be provided to the fixtures

3) Mode of measurement

The unit rate shall be considered for Supplying and fixing one fixture. The rate shall include following

a) All fixing accessories, mounting bracket, ballast condensers and control gear wherever applicable.
b) Supplying and fixing Ball and socket joints wherever required.
c) Earthing of fittings.
d) Electrical connections to fittings/fans from the junction box/ceiling rose.
e) Installation and interconnection of Electronic regulators for ceiling fans.

12.2 Providing and erecting Approved make 48" & 56" Dia Sweep Ceiling Fan with Fan Hook as per approved color & equivalent to Crompton make high speed type...

1) Material

As specified in BOQ

2) Workmanship

As directed by engineer in charge

3) Mode of measurement

The rate shall be for per no. of fan.

12.3 Supplying & erecting single phase approved make industrial exhaust fan suitable for medium duty ring mounted low noise operation suitable for medium duty having following dia size and maximum speed in RPM

1) Material

As specified in BOQ

2) Workmanship

As directed by engineer in charge

3) Mode of measurement

The rate shall be for per no. of fan.

13.0 EARTHING

13.1 Providing earthing stations for equipment earthing as shown and specified in drawing for equipment complete with :

1) Material

Shall be as per E - 12.

2) Workmanship

A) The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.

B) Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS : 3043, Code of Practice for Earthing Installation.

C) The earth conductors (Strips / Wires copper/ Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Mild Steel Zinc Passivated screws \ bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

D) The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

E) Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.

F) The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

G) The connection between strip and plate shall be through stainless steel bolts and washers.

Following tests shall be carried out:

A) The following earth resistance values shall be measured with an approved earth meager and recorded.

1) Each earthing station
2) Earthing system as a whole
3) Earth continuity conductor

B) Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 3 Ohm in each case.

C) Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.

D) All tests shall be carried out in presence of the Site Engineer & the test results shall be submitted in duplicate to the consultants & client with the signatures of the authorities present at the time of testing.

3) Mode of measurement

Rate shall be considered for one unit of pit complete.

13.2 Earth wire/strips:

Supply and laying cu. earthing required size strips for interconnecting the earthing stations, panels, DB's etc. in built up trenches, on walls/ceiling, buried in ground generally as specified and shown on drawings complete with :

a) Fixing accessories.
b) Corrosion protection of buried conductors with bituminous coating and covered with PVC tapes.

1) Material

Shall be as per E - 12. Copper strips of sizes specified in the BOQ. The strips shall not be corroded.

2) Workmanship

Copper strips shall be laid along with the cables and mains as instructed by the consultant and along the path of the cable. The strips shall be terminated at both the ends properly via brazing SS nut and bolts with double washer screws and nuts as instructed by the consultant. Strips shall not be bend to and extent that they go brittle.

3) Mode of measurement

The rate shall be considered on weight on Kg. basis

13.3 Earth Link:

Earth Link : 38mm x 6 mm 1ft Long Cu.earth link fixed by necessary screws on wall.

1) Material

Should conform to E - 12.

2) Workmanship

The links shall be done properly so that after the installation is complete they do not get detached. Proper screwing shall be done so as to avoid gaps and maximum area overlap is available.

3) Mode of measurement

The rate shall be for one unit of earth link complete with required screws / nut-bolts & washers.

14.0 MISCELLANEOUS

14.1 Supply & laying of 50 / 90 / 120 mm dia. Double wall corrugated(DWC) pre lubricated conduit for Fibre/Data Cable in ground but excluding cost of excavation and back filling

1) Material

As specified in BOQ

2) Workmanship

As specified in BOQ

3) Mode of measurement

The rate shall be for 1 mtr of DWC pipe

14.2 Supply, Installation, Testing & Commissioning of fire resistant, cement based mortar including its various components as given in the BOQ complete in all respect with all required accessories etc.

1.) Material

Should confirm E – 13.

2.) Workmanship

As per IS & instruction in BOQ / engineer in-charge / consultant. Proper finishing shall be done so as to avoid gaps and maximum area overlap is available.

3.) Mode of measurement

The rate shall be as specified in BOQ complete.

14.3 Supply, Installation, Testing & Commissioning of fire stop mineral wool, fire stop filler including its various components as given in the BOQ complete in all respect with all required accessories etc.

1.) Material

Should confirm E – 13.

2.) Workmanship

As per IS & instruction in BOQ / engineer in-charge / consultant. Proper finishing shall be done so as to avoid gaps and maximum area cover-up is available.

3.) Mode of measurement

The rate shall be as specified in BOQ complete.

14.4 Supply, Installation, Testing & Commissioning of fire stop versatile intumescent expanding foam including its various components as given in the BOQ complete in all respect with all required accessories etc.

1.) Material

Should confirm E – 13.

2.) Workmanship

As per IS & instruction in BOQ / engineer in-charge / consultant. Proper screwing shall be done so as to avoid gaps and maximum area overlap is available.

3.) Mode of measurement

The rate shall be as specified in BOQ complete.

15.0 Telephone and Comp. Data Distribution
15.1 Not Applicable.

16.0 EXTERNAL LIGHTING
16.1 Not Applicable.

17.0 Lightning Arrester
17.1 Not Applicable.

18.0 DG SET
18.1 Not Applicable.

19.0 Television Distribution
19.1 Not Applicable.

MATERIAL SPECIFICATION

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ELECTRICAL MATERIAL SPECIFICATION

E – 1 **HT BREAKER**
(Not Applicable)

E – 2 **UNITIZED SUBSTATION**
(Not Applicable)

E – 3 **LT BUS DUCT**
(Not Applicable)

E – 4 **SUBSTATION & AUXILIARY INSTALLATION**
(Not Applicable)

E – 5 **LT SWITCHGEAR & POWER PANEL**

1.1 Scope :

The scope covers supply, installation, testing and commissioning of power panels, incorporating circuit breakers, fuse units, busbars, interconnections, earthing etc., meeting the requirements shown in equipment schedule and the drawings.

1.2 **Standards :**

AS PER SCHEDULE OF INDIAN STANDARD; ATTACHED WITH THE DOCUMENT.
The PCCs & MCCs shall comply with the latest edition of relevant Indian standards and Indian Electricity rules and regulations. The following Indian Standards shall be complied with:

IS : 4237	:	General requirements for switch gear and control gear for voltage not exceeding 1000 v.
IS : 375	:	Switchgear bus-bars, main connection and auxiliary wiring, marking and arrangement.
IS : 2147	:	Degree of protection provided by enclosures for low voltage switch gear and control gear.
IS : 8197	:	Terminal marking for electrical measuring instrument and their accessories.
IS : 2557	:	Danger notice plates.
IS : 2516	:	Specification for AC circuit breaker.
IS : 1818	:	Specification for AC isolator and earthing switch.
IS : 3072	:	Code of practice for installation and maintenance of switchgear.
IS : 8623	:	Specification for factory built as symbolize of switch gear and control gear for voltage up to and including 1000v. A.C.& 1200 v. D.C.
IS : 8828	:	Miniature Circuit Breaker.
IS : 4064	:	Fuse switch and switch fuse unit.
IS : 9224	:	HRC fuse unit.
IS : 2705	:	Current transformer.
IS : 3155	:	Voltage transformer.
IS : 3231	:	Electrical relay for protection.
IS : 1248	:	indicating instrument.
IS : 722	:	Integrating instrument.
IS : 6875	:	Control switches & push buttons.
IS : 2959	:	Auxiliary contactor.

IS : 1822 : AC motor starters of voltage not exceeding 1000V.

1.3 TYPE OF LT SWITCH GEAR :

1.3.1 All the PCC's / PDB's / MCC's shall be metal clad, totally enclosed, rigid, floor / wall mounted, air - insulation, cubical type suitable for operation on three phase / single phase, 415 / 230 volts, 50 Hz. neutral effectively / Non effectively grounded at transformer and short circuit level not less than 30 MVA at 415 volts.

1.3.2 The PCC's / MCC's shall be designed the withstand and heaviest condition at site, with minimum expected ambient temperature of 55 degree celsius, 90 percent humidity and dusty weather.

1.3.3 Should confirm to Indian Electricity Act and rules. (as amended up to ate) & approval of FIA. of India.

1.4 STRUCTURE :

1.4.1 The PCCs, MCCs & PDBs shall be metal clad enclosed and be fabricated out of high quality CRCA sheet, suitable for indoor installation having dead front operated and floor mounting type.

1.4.2 All CRCA sheet steel used in the construction of PCCs / MCCs / PDBs shall be 2 mm thick and shall be folded and braced as necessary to provided a rigid support for all components. Joints of any kind in sheet shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal.

1.4.3 The PCCs / MCCs / PDBs shall be totally enclosed, completely dust and vermin proof and degree of protection being not less than IP-43 for Indoor panels & IP -54 for outdoor panels . Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be fully gasket with foam rubber and / or rubber strips and shall be lockable.

1.4.4 All panels and covers shall be properly fitted and secured with the frame, and holes in the panel correctly positioned. Fixing screw shall enter into holes taped into an adequate thickness of metal or provided with bolts and nuts. Self threading screws shall not be used in the construction of PCCs / MCCs / PDBs.

1.4.5 A base channel of 75 mm x 75 mm x 5 mm thick shall be provided at the bottom.

1.4.6 PCCs / MCCs /PDBs shall arranged in multi-tier formation. The PCCs / MCCs / PDBs shall be of adequate size with a provision of 20 percent spare space to accommodate possible future additional switch gear. The size of the PCCs / MCCs / PDBs shall be designed in such a way that the internal space is sufficient for hot air movement, and the electrical component dose not attain temperature more than 40 degree celsius. If necessary openings shall provided for natural ventilation, but the said openings shall be screened with fine weld mesh.

1.4.7 Knockout holes of appropriate size and number shall be provided in the PCCs / MCCs/ PDBs in conformity with number, and size of incoming and outgoing conduits / cables.

1.4.8 Alternatively the PCCs / MCCs / PDBs shall provided with removable sheet plates at top and bottom to drill holes for cable / conduit entry at site.

1.4.9 The PCCs / MCCs / PDBs shall be designed to facilitate easy inspection, maintenance and repair.

1.4.10 The PCCs / MCCs / PDBs shall be sufficiently rugged in design and shall support the equipment without distortion under normal and short circuit condition, they shall be suitable braced for short circuit duty.

1.5 PROTECTION CLASS :

All the indoor PCCs / MCCs / PDBs shall have protection class as IS.

1.6 PAINTING :

All sheet steel work shall undergo a process of decreasing pickling in acid, cold rinsing, phosphating, pesivating and then sprayed with a high corrosion resistant primer. The primer shall be backed in an oven. The finishing treatment shall be by application. Three coats of synthetic enamel paint of approved colour shall be applied by spray and stoves in dust free atmosphere or the panel shall be powder coated.

1.7 CIRCUIT COMPARTMENT :

1.7.1 Each circuit breaker and switch fuse units shall be housed in separate compartments and shall be enclosed an all sides. Sheet steel hinged lockable door shall be duly inter locked with the breaker / switch fuse units in ON and OFF position. Safety interlocks shall be from being drawn out when the breaker is in ON position.

1.7.2 The door shall not form as integral part of the drawout position of the circuit breaker. All instruments and indicating lamp shall be mounted on the compartment door. Sheet steel barriers shall be provided between the tires in a vertical section.

1.8 INSTRUMENT COMPARTMENT

Separate and adequate compartment shall provided for accommodating instruments, indicating lamp, control contactors, relays and control fuses etc. These components shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, switch fuse units, busbars and connections.

1.9 BUSBARS

1.9.1 The busbar shall be air insulated and made high quality, high conductivity, high strength copper and as per relevant IS code. The busbar shall of three phases and neutral system with separate neutral and earth bar. the busbar and interconnection between busbar and various components shall be of high conductivity, hard drawn, electrolytic copper. the busbar shall be of rectangular cross section designed to withstand full load current for phase busbar and full rated current for neutral busbar and shall be extensible type on either side. The busbar shall be rated for the frame size of the main incoming breaker but in any case not less than 200 amp capacity. The busbar shall have uniform cross section through out the length.

1.9.2 The busbar and interconnection shall be insulated with heat shrinkable PVC sleeves and be colour coded in red, Yellow, Blue and Black to identify the three phases and neutral of the system. The busbar shall be supported on unbreakable, non hygroscopic DMC insulated supports at sufficientevely close interval to prevent busbar sag and shall effectively withstand electromagnetic stresses in the event of short circuit capacity of 50 KA RMS symmetrical for one second and a peak short circuit withstand of 105 KA minimum.

1.9.3 The busbar shall be housed in a separate compartment. The busbar shall be isolated with 3 mm thick bakalite sheet to avoid any accidental contact. The busbar shall be arranged such that minimum clearance between the busbar are maintained as per below.

Between phases	:	27 mm min.
Between phases and neutral	:	25 mm min.
Between phases and earth	:	25 mm min.
Between neutral and earth	:	23 mm min.

1.9.4 All busbar connection shall be done by drilling holes in busbars and connecting by chromium plated brass bolt and nuts. Additional cross section of busbar shall be provided in all PCCs / MCCs / PDBs to cover-up the holes drilled in the busbars. Spring and flat washers shall be used for tightening the bolts.

1.9.5 All connection between busbar and circuit breaker / switches and between circuit breaker/ switches and cable terminals shall be through solid copper strips of proper size to carry full rated current. These strips shall be insulated with insulating strips.

1.9.6 Busbar shall be of sufficient cross section so that a current density of 160 A/ Sq.cm (1000 A/ sq. inch) is not exceeded at nominal current rating for copper bus bars.

1.10 ELECTRICAL POWER & CONTROL WIRING CONNECTION

a) Terminal for both incoming and outgoing cable shall be suitable for 1100 volts grade, aluminum/copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solder less sockets for the cable size as indicated on the appended drawing for the PCCs, MCCs, PDBs.

b) Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.

c) Both control and power terminals shall properly be shrouded.

d) 10% spare terminal shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block so that not more than one outgoing wire connected per terminal.

e) Terminal strip for power and control shall preferably be separated from each other by suitable barriers of enclosures.

f) Wiring inside the module for power, control protection and instrument etc. shall be done with use of 660/1100 confirming to IS 694 and IS 8130. Power wiring inside the starter module shall be rated for full current rating of contactor, but not less than 4 sq mm cross section area. **For current transformer circuits, 2.5 sq mm copper conductor wire shall be used.** Other **control wiring shall be done with 2.5 sq mm copper conductor wires**. Wires for connections to the door shall be flexible. All conductors shall be crimped with solder less sockets at the ends before connections are made to the terminals.

i) Control power for the motor starter module shall be taken from the respective module switchgear outgoing from R phase and Neutral. Control wiring shall have control fuse (HRC type).

j) Particular care shall be taken to ensure that the layout of wiring neat and orderly. Identification ferrules shall be filled to all the wire termination for ease of identification and to facilate and testing.

k) "CUPAL" washers shall be used for all copper and aluminum connections.

k) Final wiring diagram of the PCC, MCC, PDB power and control circuit with ferrules number shall be submitted along with the PCC/MCC/PDB as one of the documents.

1.11 TERMINALS

The outgoing terminals and neural link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformer for instrument metering shall mounted on the disconnecting type terminal blocks. No direct connection of incoming and outgoing cables to internal components connection of the distribution board is permitted, only one conductor may be connected in one terminal.

1.12 WIREWAYS

A horizontal PVC wire way with screwed covers shall provided at the top to take interconnecting control wiring between different vertical sections.

1.13 CABLE COMPARTMENT

Cable compartment of adequate size shall be provided in the PCCs, MCCs, PDBS for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate support shall be provided in the cable compartment shall be brought out to terminal blocks in the cable compartment.

1.14 EARTHING

a) Copper earth busbar of 25 mm x 3 mm shall be provided in the PCCs, MCCs, PDBS for the entire length of panel. The frame work of the PCCs, MCCs, PDBs shall be connected to this earth busbar. Provisions shall be made for connection from earth busbar to the main earthing bar coming from the earth pit on both side of the PCCs, MCCs, PDBs.

b) The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar. The armour shall be properly connected with earthing clamp and the clamp shall be ultimately bounded with the earth bar.

1.15 LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.

1.16 NAME PLATE

a) A name plate with panel designation in bold letter shall be fixed at top of the central in panel. A separate name plate giving feeder giving feeder details shall be provided for each feeder module door.

b) Inside the feeder compartment, the electrical component, equipments, accessories like switchgear, contactor, lamp, relays etc. shall suitably be identified by providing stickers.

c) Engraved name plates shall preferably be of 3 ply, (red-white-red or black-white-black) lamicold sheet. However black engraved perplex sheet name plates shall also be applicable. Engraving shall be done with square groove cutters.

d) Name plate shall be fastened by counter sunk screws and not by adhesives.

1.17 DANGER NOTICE PLATE

a) The danger plate shall be affixed in a permanent manner on operating side of the panel.

b) The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.

c) The danger notice plate in general shall meet to requirements of local inspecting authorities.

d) Overall dimension of the danger notice plate shall be 200 mm wide and 150 mm high. The danger notice plate shall be made from minimum 1.6 mm thick mild steel sheet and after due pretreatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.

e) The letter, the figure, the conventional skull and bones shall etc. shall be positioned on the plate as per recommendations of IS : 2551-1982.

f) The said letter, the figure and the sign of skull and bones be painted in single red colour as per IS : 5-1978.

g) The danger plate shall have rounded corners. Locations of fixing holes for the plate shall be decided to suit design of the panel.

h) The danger notice plate, if possible, be of ISI certification mark.

1.18 INTERNAL COMPONENTS

a) The PCC / MCC / PDB shall be equipped complete with all type of required number of air circuit breakers, switch fuse unit, contactor, relays, fuses, meters, instruments, indicating lamps, push buttons, equipment, fittings, busbar, cable boxes, cable glands etc. and all the necessary internal connections /wiring as required and as indicated on relevant drawings. Components necessary for proper complete functioning of the PCC / MCC / PDB but not indicated on the drawings shall be supplied and installed on the PCC / MCC / PDB.

b) All part of the PCC / MCC/ PDB carrying current including the components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the acceptable values of the relevant specifications at any part of the PCC / MCC / PDB.

c) All units of the same rating and specifications shall be fully interchangeable.

1.19 INSPECTIONS

Each equipment should inspect and witness by client & consultant.

a) The PCC / MCC / PDB shall be inspected and checked as per inspection manual of the PCC / MCC / PDB manufacturer.

b) Various electrical components and accessories of the PCC / MCC / PDB shall be checked as per drawing for the respective PCC / MCC / PDB.

c) The PCC / MCC / PDB shall be checked for rigid mounting, earthing connections, proper rating and size of components, internal wiring, etc.

d) All mechanical fasteners and electrical connections shall be checked and tightened before installation.

e) Type test certificates for all ACB for similar rating shall be submitted.

f) Test :

a) Prior to dispatch of the PCC / MCC / PDB following tests shall be carried out.
b) Mechanical endurance test shall carried out by closing and opening of all the ACB's, MCB's switches etc.
c) Over voltage and Insulation resistance test shall be carried out between phases and between phase to earth bus, keeping the isolating switch in ON position. Similar test shall be carried out keeping the isolating switch in closed position.
d) All the interlocks, controls and tripping mechanism of the switch gears shall be tested for their proper functioning.

1.20 COMPONENTS :

A) GENERAL

a) The type, size, and rating of the components shall be as indicated on the relevant drawings.

b) While selection od the capacity of the components resulting from the prevailing conditions like room temperature shall be allowed for the Thermal and magnetic trip rating shall be compensated for the ambient temperature.

c) The rating indicated on the drawings are rating anticipated at prevailing site condition.

B) Fuse Switch Units : Not required

C) MINIATURE CIRCUIT BREAKER

Miniature circuit breakers shall be quick make and break and break type conform with British standard BS : 3871 (Part-I) 1965 and IS :8825 (1996). The housing of MCBs shall be heat resistant and having a high impact strength. The fault current of MCBs shall not be less than 10000 amps, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "ON" and "OFF" indications.

The circuit breaker dollies shall be of trip free pattern to prevent closing the breaker on a faculty current.

The MCB contact shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger relay 3 as for over current and short circuit protection. The over load or short circuit devices shall have a common trip bar in the case of DP and TPN miniature circuit breakers. All the MCB's shall be tested and certified as per Indian Standard, prior to Installation.

D) FUSE:-

Fuses shall be of high rupturing capacity (HRC) fuse links and shall be in accordance with IS : 2000-1962 and having rupturing capacity of not less than 35 MVA at 415 Volts. The backup fuse rating for each motor / equipment. HRC fuses shall be of English Electric make or approved equal.

E) AIR CIRCUIT BREAKER

The ACB shall meet with IS : 2516 part I, II and III. Each pole of the ACB's shall be equipped with and over current, earth fault and short circuit release. The ACB's shall be equipped with under voltage trip also. The trip devices shall be direct acting.

Disconnecting devices of approved type shall be provided to facilitate the removal of the circuit breakers from the housing for test and maintenance purpose.

The ACB's shall have an are quenching device on each pole. The ACB's shall have an auxiliary contacts for signaling, interlocking etc. The ACB's shall have slow close facilities for checking contact operation and contact gap adjustment.

All contacts subject to arcing shall be tipped with arc resisting material. main contacts shall be silver plated, multi-finger and spring loaded type. Facilities shall be provided to isolate the circuit breaker for inspection purpose.

Interlocks shall be provided to :
Prevent the breaker from being isolated unless it is in the "OFF" position.

Prevent the breaker from being racked in to the service position unless it is in the "OFF" position.
Prevent the breaker from being accidentally pulled completely "OFF" the guide rail. Safety shutters of an insulation material shall be provided to prevent access to all live contacts, when the breaker is in the inspection position or completely withdrawn.

Facilities shall be provided for earthing the circuit breaker.

Air circuit breaker shall be capable of clearing the maximum fault current which can occur.

The breaker plates shall have an ON-OFF indicators, spring charge indicators, provision to padlock manual handle and provision to lock drawout mechanism. Electrically operated breaker shall have provision for emergency manual closing by inserting a tool through the fuse plate. A control isolating switch shall be provided on the fuse plate to isolated the supply to the charging motor.

F) MOULDED CASE CIRCUIT BREAKER

The MCCB shall be air break type and having quick make quick break with trip free operating mechanism.

Housing of the MCCB shall be of heat resistant and flame retardant insulating material.

Operating handle of the MCCB shall be in front and clearly indicate ON / OFF / TRIP positions.
The electrical contact of the circuit breaker shall be of high conducting non deteriorating silver alloy contacts.

The MCCB shall be provided with thermal / magnetic type bi-metal over load release and electro-magnetic short circuit protection device. All the releases shall operate on common trip busbar so that in case of operation of any one of the releases in any of the three phases, it will cut off all the three phases and thereby single phasing of the system is avoided.

The MCCB whenever called for in the appendix drawings shall provide an earth fault relay.

The MCCB shall provide two sets of extra auxiliary contacts with connections for additional controls at future date.

The electrical parameters of the MCCB shall be as per the descriptions given in the appended drawings. All MCCB should be with breaking capacity of I_{cs}=100% I_{cw}

G) CONTACTORS :

The contactor shall meet with the requirements of IS : 2959 and BS : 775.

The contactors shall have minimum making and breaking capacity in accordance with utilization category AC 3 and shall be suitable for minimum class II intermittent duty.

If the contactor forms part of a distribution board then a separate enclosure is not required, but the installation of the contactor shall be such that it is not possible to make an accidental contact with live parts.

H) LOAD MANAGER:

The load manager should be 192 x 144 mm size having facility to read voltage current harmonics power parameters. It should contain real time clock. The meter should be field programmable and to generate high / low profile for all power parameters with date & time, also able to store previous period integrated data. The meter should have RS 485 port for networking purpose. All the programming should be pass word protected.

I) CURRENT TRANSFORMER

Where ammeter are called for, CT's shall provided for current measuring. Each phase shall be provided with separate CT of class I accuracy and suitable VA burden for operation of associated metering and controls. Current transformer shall be in accordance with IS : 2705 - 1964 as amended up to date.

J) PUSH BUTTON :

The push button unit shall comprise of the contact element, a fixing holder , and push button actuator. The push button shall be momentary contact type. The contacts shall be of silver alloy and rated at 10 Amps. continuous current rating. The actuator shall be of stranded type and colour as per its usage for ON, OFF and Trip.

K) INDICATING LAMP :

Indicating Lamp shall be transformer operated low voltage rated and shall supplied complete with translucent covers to diffuse the lamp light.

Colour shade for the indicating lamps shall be as below :

ON indicating lamp	:	Red
OFF indicating lamp	:	Green
TRIP indicating lamp	:	Amber
PHASE indicating lamp	:	Red, Yellow, Blue.

M) Technical Specifications for Single Phase & Three phase Electronic Energy Meter of Class 1.0 Accuracy

1.0 SCOPE

This specification covers the design, engineering, manufacture, testing and calibration at manufacturer's works before dispatch, packing, supply and delivery of Class 1.0 accuracy, electronic energy meter, suitable for connection to LT
A)single phase 2 wire 240V system
B)Three phase 3-phase, 4- wire 415V system
The static whole current electronic meter shall offer current range of 5-30 A, 10-60A (first digit indicates the Basic Current & second digit indicates the Maximum Current of the respective meters) for tariff purposes, as per requirement given in this specification.

2.0 STANDARDS APPLICABLE

Unless specified elsewhere in this specification, the performance & testing of the meters shall conform to the following Indian/International standards, to be read with upto-date and latest amendments/revisions thereof.

S. No.	Standard No.	Title

1	IS 13779 read with its latest amendments	Specification of AC Static Watt hour meters class 1.0 & 2.0
2	CBIP Report No.88 (revised July 1996) read with latest amendments	Specification for AC Static Electrical Energy Meters

3.0 CLIMATIC CONDITION

The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions. Meters shall be capable of maintaining required accuracy under hot, tropical and dusty climate.

i) Maximum Ambient Air Temperature in shade : 50oC
ii) Minimum Ambient Air Temperature : -10oC.
iii)Relative Humidity 100% : 95% (non-condensing)
Iv) Minimum Relative Humidity : 100%

4.0 SUPPLY SYSTEM

System	1 Phase 2 Wire	3 Phase 4 Wire
Rated voltage (Vref)	240 V – Phase to Neutral	433 V – Phase to Phase
Rated Basic Current (Ib)	Basic current 5/10/10 Amps (Ib), Maximum current 30/60/100 Amps (I max)	Basic current 5/10/10 Amps (Ib), Maximum current 30/60/100 Amps (I max)
Rated Frequency	50 Hz	50 Hz

5.0 POWER SUPPLY VARIATION

The meter should be suitable for working with following supply system variations.

System	1 Phase 2 Wire	3 Phase 4 Wire
Specified range of operation	70% to 120% of reference Voltage i.e. 240 V	70% to 120% of reference Voltage i.e. 415 V
Frequency	50Hz+/-5%	50Hz+/-5%

6.0 ACCURACY

Class of accuracy of the meter shall be 1.0. The accuracy shall not drift with time.

7.0 POWER CONSUMPTION

7.1 Voltage Circuit: The active and apparent power consumption in each voltage circuit including the power supply of meter at reference voltage, reference temperature and reference frequency shall not exceed 1.5 Watt and 8 VA respectively

7.2 **Current Circuit:** The apparent power taken by each current circuit at basic current, reference frequency and reference temperature shall not exceed 4 VA.

11.0 GENERAL & CONSTRUCTIONAL REQUIREMENTS

11.1 Meters shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However, the following should be ensured.
a)Personal safety against electric shock
b)Personal safety against effects of excessive temperature.
c)Protection against spread of fire
d)Protection against penetration of solid objects, dust & water

11.2 The meter shall be designed with application specific integrated circuit and shall be manufactured using SMT (Surface Mount Technology) components. Power supply and voltage divider circuits may be of PTH technology.

11.3 All insulating material used in the construction of meters shall be non-hygroscopic, non-ageing and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion during operating life by providing suitable protective coating.

11.4 The meter shall conform to the degree of protection IP 51 for protection against ingress of dust, moisture and vermin's.

11.5 The meter shall be capable of providing phase to phase protection upto 450V.

11.6 The meter shall be supplied with a transparent extended terminal block cover (ETBC). The ETBC shall not be easily detachable from the base and preferably be secured to the base using a hinging arrangement.

11.7 The meter-base, meter cover, terminal block and ETBC shall be made of unbreakable, high grade, fire resistant, reinforced, non-flammable, polycarbonate or equivalent high grade engineering plastic.

11.8 The meter cover shall have a fully transparent window. The window shall be of transparent, high grade UV stabilized engineering plastic for easy reading of all the displayed values/parameters, and observation of operation indicator. The window shall preferably be an integral part of meter cover.

11.9 The meter cover shall be sealable to the meter base with at least 2 nos. seals. Also terminal cover shall have provision for sealing with at least one seal.

11.10 The terminal block shall be made of high grade non-hygroscopic, fire retardant, low tracking, fire resistant, reinforced poly-carbonate or equivalent high grade engineering plastic with terminal holes of minimum dia 8.5 mm and shall be suitable to accommodate the insulation of the conductors, meeting the requirement of IS 13779 /CBIP technical report-88.

11.11 The manner of fixing the conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Meter shall have 2 screws in each terminal for effective clamping of cables. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. The clearance and creepage distance shall conform to relevant clause of IS 13779/CBIP technical report No.88.

11.12 The meter shall be compact in design. The entire construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.

11.13 The meter shall have 3 fixing holes, one at top and two at bottom. The top hole shall be such that the holding screw is not accessible to the consumer after fixing the meters. The lower fixing screws shall be provided under the sealable terminal cover.

12.0 ANTI-TAMPER FEATURES

The meter registration shall be immune to reversal in current direction. The meter shall have anti-tamper features

13.0 DISPLAY

13.1 The measured value(s) shall be displayed on a Liquid Crystal display (LCD) register. The height of the digit shall be minimum 8.5 mm. The KWh energy registration shall take place with 6 complete digits. The display shall have backlit capability for easy reading.

13.2 The data should be stored in non-volatile memory (NVM). The non-volatile memory should retain data for a period of not less than 10 years under un-powered condition. Battery back-up memory will not be considered as NVM.

13.3 The register shall be able to record and display starting from zero, for a minimum of 1500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.

13.4 In addition to providing serial number of the meter on the display plate, the meter serial number shall also be programmed into meter memory for identification through communication port for CMRI/meter reading print out.

14.0 DISPLAY SEQUENCE

The meter shall display the required parameters in two different modes as follows:

A) **Auto Display Mode:**

The following parameters hereinafter referred to as "Billing Parameters" (B.P) shall be displayed in an auto-cycle mode, in the following sequence:-

LCD Test
Real Time
Date
Cumulative Active energy (forwarded) reading (kWh)
Instantaneous Load (KW)
Billing period counts

Each parameter shall be on meter display for 10 seconds and the time between two auto-cycles shall be 120 seconds.

B) **Push Button Mode:-**

In addition to the auto display mode parameters, the following parameters shall be displayed on pressing the push button

C) **LCD Test**
Real Time
Date
Instantaneous voltage, current
The meter shall also be capable of offering a high resolution display which shall enable conducting of dial testing by the user in the shortest possible time and as a minimum, the meter shall be capable of offering a resolution of 4 digits after decimal (and 2 digits before decimal) for the high resolution KWh display.

15.0 COMMUNICATION PORT

The meter should have a galvanically isolated optical communication port for data communication . Adequate sealing provision shall be provided.

16.0 MARKING OF THE METER

The marking on the meter shall be in accordance with relevant clauses of IS 13779.

The basic marking on the meter nameplate shall be as follows:

a) Manufacturer's name & trade mark
b) Type Designation
c) No. of phases & wires
d) Serial number
e) Year of manufacture
f) Reference Voltage
g) Rated Current
h) Principal unit(s) of measurement
i) Meter Constant (imp/kwh)
j) Class index of meter
k) "Property of _____"
l) Purchase Order No. & Date

17.0 CONNECTION DIAGRAM & TERMINAL MARKINGS

The connection diagram of the meter shall be clearly shown on terminal cover.

18.0 OUTPUT DEVICE

The meter shall have a test output accessible from the front and capable of being monitored with suitable testing equipment while in operation at site. The test output device shall be provided in the form of LED output.

E – 6 L T DISTRIBUTION BOARDS

1.1 Scope :

It includes Supply, Installation, Testing and Commissioning of Distribution Boards standard company fabricated or to be fabricated by fabricator.

1.2 Standards :

IS : 8623 : Distribution Boards

1.3 Distribution Boards :

a) Distribution boards along with the controlling MCB's/Fuse or Isolator as shown shall be fixed in an M.S. Box with hinged door suitable for recessed mounting in wall. Distribution boards shall be made of minimum 18 SWG steel sheet duly rust inhibited through a process of de-greasing, acid pickling, phosphating and powder coated to an approved color of adequate micron rating duly approved by architect/consultant.

Three phase boards shall have phase barriers and a wire channel on three sides. Neutral bars shall be solid tinned copper bars with tapped holes and chase headed screws. For 3 phase DB's, 3. independent neutral bars shall be provided for per phase isolation in addition to main neutral links.

b) Conduit knockouts shall be provided as required/shown on drawings and the entire board shall be rendered dust and vermin proof with necessary sealing gaskets. The top and bottom side of DB should be detachable.

c) All DB's shall be internally pre-wired using copper insulated Busbars of appropriate rating. Bus bars shall be suitable for the incoming switch rating and sized for a temperature rise of 35° C over the ambient. Each board shall have two separate earthing terminals. Circuit diagram indicating the load distribution shall be pasted on the inside of the DB as instructed. Two earthing terminal for single phase and two terminals for 3 phase DB's shall be provided with one earth strip connecting the studs and the other earth link should be provided with base insulator in such a way that link should in contact with body of distribution board.

1.4 RCCB/RCBO:

a) The RCCB/RCBO should suffices all the requirements of IS as per code IS - 12640 (Part I) - 2000. The RCA should be current operated and not on line voltage.

a) The RCCB/RCCO should ensure mainly the following functions.

1) Measurement of the fault current value.
2) Comparison of the fault current with a reference value.

c) The RCCB/RCBO should have a torroidal transformer witch has the main conductors of primary (P - N) which check the sum of the current close to zero. All metal parts should be inherently resistant to corrosion and treated to make them corrosion resistant. It should be truly current operated. It should operate on core balance torroidal transformer. It's accuracy should be ± 5 %.It should operate even in case of neutral failure. It should trip at a present leakage current within 30 M.S.It's enclosure should be as per IP 30.It's mechanical operation life should be more than 20,000 operations. It should provide full protection as envisaged by IE rules - 61-A, 71 - ee, 73 - ee, 1985 and also rule 50 of IE rule1956.It should conform to all national and international standards like IS, BS 4293 - 1983, CEE 27 (International commission Rules for the approved of electrical equipment).

1.5 MCB/ Isolators:

Miniature circuit breakers shall be quick make and break and break type conform with British standard BS : 3871 (Part-I) 1965, IEC 898-1995 and IS :8828 (1996). The housing of MCBs shall be heat resistant and having a high impact strength. The fault current of MCBs shall not be less than 10000 amps, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "ON" and "OFF" indications.

The circuit breaker dollies shall be of trip free pattern to prevent closing the breaker on a faculty current. Tightening torque at terminals shall be not less than 2.5 Nm.Power losses should not be more than as specified in IEC 898-1995.

The MCB contact shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger relay 3 as for over current and short circuit protection. The over load or short circuit devices shall have a common trip bar in the case of DP and TPN miniature circuit breakers. All the MCB's shall be tested and certified as per Indian Standard, prior to Installation.

For protection of electric circuits with equipment that does not cause surge current (i.e. lighting and socket outlet circuits)'B' curve MCB to be used in which magnetic releases operates between 3 and 5 In.

For protection of electric circuits with equipment that cause surge current (i.e. inductive and motor circuits) 'C' curve MCB to be used in which magnetic releases operates between 5 and 10 In.

For protection of electric circuits with equipment that cause surge current (i.e. transformer, heavy start motors circuits) 'D' curve MCB to be used in which magnetic releases operates between 10 and 15 In.

Isolators shall confirm to IS 13947-3 and IEC 60947-3.

1.6 Voltage Surge Protector Devices (SPDs):

SPDs (Surge Protection Devices) shall be of Type II for DB level internal Protection (Class S, 8/20 microseconds waveform, UP-1.4KV, Imax 15KA) and DIN-rail type (Unless & otherwise specified).

SPDs shall be tested in accordance with the requirements of IEC 61643-1.

SPDs shall be suitable for TT, TNC, TNS or TNC-S earthing systems.

SPDs shall provide protection between line to earth (common mode), neutral to earth (common mode) and line to neutral (differential mode).

SPDs shall be of the "withdrawable cartridge" type. The base of the SPDs shall be able to accept cartridges of different discharge ratings of Imax: 15kA, 20kA, 40kA & 65kA (8/20 microseconds waveform).

Optional auxiliary contacts for remote indication shall be integrated in the base of the SPDs to eliminate possibility of wrong installation.

SPDs shall limit the transient let-through voltage of not more than 1.4kV in accordance to IEC 60364.

Protection against SPDs short-circuit (in the event of end-of-life of SPDs or/and short circuit at 50hz like neutral disconnection, inversion of Neutral /line,…) shall be provided by a dedicated miniature circuit breaker that has been tested to co-ordinate with the manufacturer's SPDs in accordance to IEC 60364.

Type 1 for Increased protection at Panel level(Class I, 8/20 microseconds waveform, UP-1.2KV, Imax 40KA) SPDs shall be installed in the All Floor panel of installation/building fitted with a lightning rod. Type 1 SPDs shall be rated Limit of 40kA per phase in accordance to IEC 61643-1 appendix A & IEC 62066 clause 12.3.2.1.

E – 7,8 L T CABLING AND TERMINATION

1.1 Scope :

The scope consists of Supply, laying, testing and commissioning of L.T. XLPE Cable and its termination.

1.2 Standards :

AS PER SCHEDULE OF INDIAN STANDARDS; ATTACHED IN THE DOCUMENT

1.3 Cables :

A) LV POWER CABLES will be 1100 Volts grade single / multicore standard aluminum conductor extruded XPLE insulated with extruded PVC inner sheath outer sheath made of FRLS PVC compound conforming to IS-7098 part-1. single core will be used for DC application. Cables in buried insulation shall be Armoured type.

B) Control cables will be 1100 Volts grade multicore minimum 2.5 sqmm cross section standard copper conductor minimum 7 strands PVC insulated inner extruded sheathed and other sheath made of extruded FRLS PVC compound conforming to IS-1554 part-1. . Cables in buried insulation shall be Armoured type.

C) All cables shall be new without any kind or visible damage. The manufacturers name, insulating material, conductor size and voltage class shall be marked on the surface of the cable at every 600 mm centers.

1.4 Cable joints and termination :

A) Connectors :

Cable terminations shall be made with copper/Aluminum Heavy duty long nack copper crimping lugs only crimped type solderless lugs for all aluminum cables and stud type terminals. For copper cables copper crimped solderless lugs shall be used.

Crimping shall be done with the help of hydraulically operated crimping tool. All cable lugs should be long neck type only.

B) Cable Glands :

Cable glands shall be of heavy duty brass single compression type as specified. Generally single compression type cable glands shall be used for indoor protected locations and double compression type shall be used for outdoor locations. Glands for classified hazardous areas shall be CMRS approved.

C) Ferrules :

Ferrules shall be of self sticking type and shall be employed to designate the various cores of the control cable by the terminal numbers to which the cores are connected, for ease in identification and maintenance.

D) Cable joints :

Kit type joint shall be done and filled with insulating compound. The joint should be for 1.1 KV grade insulation.

1.5 HEAT / FIRE RESISTANT COATING OF CABLE

Supply and application of intumescent based coating on cables/ cable tray using CP 678 firestop cable coating of HILTI India Pvt Ltd, along the horizontal runs at every 6 mtr for 1 mtr and full length in case of vertical runs .The coating shall have a density in the range of 1.2 to 1.4 Kg/ L. The coating shall be non-toxic, asbestos and halogen free and shall have good mechanical strength. The coating shall comply with IEC 332 part 3 (1992)

Cable coating should be **Hilti make cat No CP678 or equivalent.**

E- 9 CABLE TRAY

9.1 Ladder type cable tray

The cable tray shall be fabricated out of 2 mm thick slotted/ perforated MS sheets as channel sections, single or double bended. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanized or painted as specified.

9.1.1 The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler and cable tray shall be scraped and removed before the installation.

9.1.2 The permissible uniformly distributed load for various type of cables trays and for different supported span shall be as per IS.

9.1.3 The width of the cables tray shall be chosen so as to accommodate all the cables In one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 1000mm.

9.1.4 Factory fabricated bends, reducers, tee / cross junction. Etc shall be provided as per good engineering practice. The radius of bends, junctions etc. shall be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.

9.1.5 The cable tray shall be suspended from the ceiling slab with the help of 10 mm dia MS round or 25 mm x 5 mm flats at specified spacing. Flat type suspenders may be used for channels up to 450 mm width bolted to cable trays. Round suspenders shall be threaded and bolted to the cable trays or to independent support angle 50 mm x 50 mm x 5mm at the bottom and as specified These shall be grouted to the ceiling slab at the other and through an effective means, as approved by the Engineer – in – charge, to take the weight of the cable tray with the cables.

9.1.6 The entire tray (except in the case of galvanized type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.

9.1.7 The cable tray shall be bonded to the earth Terminal of the switch bonds at ends.

9.1.8 The cable tray shall be measured on unit length basis, along the center line of the cable tray, including bends, reducers, tees, cross joints, etc, and paid for accordingly.

9.1.9 The ladder type of cable tray shall be fabricated of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a center to center spacing of 250 cm as per IS.

9.2 Perforated type cable tray

The cable tray shall be fabricated out of slotted/ perforated MS sheets as channel sections, single or double bended. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanized or painted as specified. Alternatively, where specified, the cable tray may be fabricated by two angle irons of 50mmx50x6mm as two longitudinal members, with cross bracings between them by 50mmx5mm flats welded/bolted to the angles at 1 m spacing . 2mm thick MS perforated sheet shall be suitably welded/bolted to the base as well as on the two sides.

9.2.1 The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler and cable tray shall be scraped and removed before the installation.

9.2.2 The maximum permissible uniformly distributed load for various all the cables trays and for different supported span are given in Table IV. The sizes shall be specified considering the same.

9.2.3 The width of the cables tray shall be chosen so as to accommodate all the cables In one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 800mm.

9.2.4 Factory fabricated bends, reducers, tee / cross junction. Etc shall be provided as per good engineering practice. The radius of bends, junctions etc. shall be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.

9.2.5 The cable tray shall be suspended from the ceiling slab with the help of 10 mm dia MS round or 25 mm x 5 mm flats at specified spacing (based on table III) Flat type suspenders may be used for channels up to 450 mm width bolted to cable trays. Round suspenders shall be threaded and bolted to the cable trays or to independent support angle 50 mm x 50 mm x 5mm at the bottom and as specified These shall be grouted to the ceiling slab at the other and through an effective means, as approved by the Engineer – in – charge, to take the weight of the cable tray with the cables.

9.2.6 The entire tray (except in the case of galvanized type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.

9.2.7 The cable tray shall be bonded to the earth Terminal of the switch bonds at ends.

9.2.8 The cable tray shall be measured on unit length basis, along the center line of the cable tray, including bends, reducers, tees, cross joints, etc, and paid for accordingly.

9.3 Hot Dip GI Wire cable tray

9.3.1 **Surface treatments for wire cable trays and related accessories:**

9.3.1.1 HOT DIP GI Wire, min. dia of GI wire should be 4.5mm dIa. it shall be manufactured "T-welded “safety edge. Trays shall be constructed with 50 x 100 mm mesh configuration.

9.3.1.2 Trays should be match with Standard EN ISO 1461: at least 360 h of SST.

9.3.2 **Performance Level:**

9.3.2.1 All trays shall be arranged and positioned on the site itself in accordance with the Manufacturer’s instructions.

9.3.2.2 The deflection of the wire cable tray must be no more than 1/200th of the distance between two supports and tested in accordance with the standard IEC 61537.

9.3.2.3 Wire cable trays must be designed with an optimum span of 1.5 m, taking into account the maximum carrying capacity authorized by the manufacturer.

9.3.2.4 The positive contribution made by the wire cable tray in terms of reducing electromagnetic interference must be demonstrated by tests certificates performed by COFRAC certified independent laboratories.

9.3.2.5 The reliability of the wire cable tray for Category 6 communication cables must be demonstrated by tests certificates of an independent laboratory.

9.3.2.6 Assemblies with specific fire-resistant properties must have an E30-E90 certificate issued by an approved laboratory in accordance with the tests described in the standard DIN 4102-12

9.3.3 **Couplers:**

9.3.3.1 For the purpose of assembling the various wire cable tray, only fast coupling systems or screw-based (CE25/CE30) systems must be used. These must be designed, mechanically tested and supplied by the wire cable tray manufacturer.

9.3.3.2 The electrical resistance of the joints must not exceed 50 mΩ and must be tested in accordance with the procedure described in the standard IEC 61537

9.3.4 **Supports:**

9.3.4.1 Only supports, brackets or hangers designed, mechanically tested and supplied by the wire cable tray manufacturer must be used. The loading capacities of the brackets and the hanger torques must be tested in accordance with the standard IEC 61537.

9.3.5 **Earthing:**

9.3.5.1 To enable earthing every 15 m, bimetal terminals or tin-plated aluminum connectors must be used. These must be recommended and tested by the manufacturer.

9.3 Anchor Fastener

Anchor fastener shall be Hilti make and it will be install as per standard instruction from supplier / manufacturer and install in proper manners.

For Slab / RCC : Hilti make – Cat No. HKD-E M10/40 or HSV M8/75 or equivalent as per requirements
For Wall / Bricks : Hilti make – Cat No. HRD-UGT 10x80/10

9.3.1 All installation of Anchor fastener has been approved by Hilti Technical staff and certified the same.

9.3.2 If require, 1% of total quantity Pull out test will be carried out at site.

9.3.3 Electrical contractor has to submit Material Test Certificate / Material Safety Data Sheet (MSDS) for all material to be used for hanging of cable tray.

E – 10 INTERNAL WIRING

1.1 Scope:

The scope covers supply, laying, testing and commissioning of wiring in rigid PVC pipes , Switches, Sockets and accessories.

1.2 Standards:

AS PER SCHEDULE OF INDIAN STANDARDS, ATTACHED IN THE DOCUMENT

1.3 Rigid and Flexible conduits:

A) All conduits shall be rigid PVC having minimum wall thickness of medium gauge 1.6 to 1.8 approved by F.I.A. & I.S.I. All rigid pipe and its accessories shall be of suitable material complying with IS:3419-1989 and IS :9537 (Part 5) 2000 for flexible conduits.
The conduits shall be circular in cross-section and designated by their nominal outside diameter. Minimum thickness of walls shall be as follows:

a) Up to 38 mm. diameter - minimum 1.8 mm. wall thickness.
b) Above 40 mm. diameter - minimum 2.2 mm. wall thickness.

The maximum number of PVC insulated copper conductor cables of 650/1100V grade confirming to IS:694-1990 that can be drawn in one conduit of various sizes shall be as specified.

B) Flexible conduits shall be formed from a continuous length of spirally wound interlocked steel strip with a fused zinc coating on both sides. The conduit shall be terminated in brass adapters.

1.4 Accessories:

A) PVC conduit fittings such as bends, elbows, reducers, chase nipples, split couplings, plugs etc. shall be specifically designed and manufactured for their particular application. All conduit fittings shall conform to IS:2667-1964 and IS:3857-1966. All fitting associated with galvanized conduit shall also be galvanized.

1.5 Wires:

A) All wires shall be single core multi-strand/ flexible copper or single strand Copper FRLS type PVC insulated as per IS:694 and shall be 660 V\1100 V grade.

B) All wires shall be colour coded as follows:

Phase	Colour of wire
R	Red
Y	Yellow
B	Blue
N	Black
Earth	Green (insulated)
Control (If any)	Grey
All off wires	Same as Phase wire

C) Both end of wires should be terminated with adequate size copper crimping type lugs and ferrules as per instructions of engineer in charge.

1.6 Outlets switches & Sockets:

A) Switches shall be moulded plate type flush piano type with silver-coated contacts. Sockets shall be multipin pin with switch and plate type cover. Combination of multiple switch units and sockets should be used to minimize the switch boxes. All screws shall be brass – chromium plated and shall be counter sunk type with half round head or flat headed.

B) For heavy duty, metal clad sockets with M.C.B/ Isolator mounted in a galvanized steel box shall be provided.

C) The switch boxes shall be made of either rigid PVC moulidng or mild steel or cast iron on all sides except at the front. PVC boxes shall comply with the requirements laid down in IS :14772-2000. These boxes shall be free from internal roughness. Wall thickness of PVC boxes shall not be less than 2 mm. Clear depth of the box shall not be less than 60 mm and this shall be increased suitably as per requirements. An earth terminal with stud and washer shall be provided in each MS boxes for termination of protective conductors.

D) All the fan boxes shall be of cast iron type only with minimum wall thickness of 3 mm.

1.7 Additional requirements

1.7.1 Making Chase

The chase in the wall shall be neatly made and of ample dimensions to permit the conduit to be fixed in the manner desired. Chase shall be done with machine cutter only. In the case of building under construction, the conduits shall be buried in the wall before plastering and shall be finished neatly after erection of conduit. In case of exposed brick/ RCC work, special care shall be taken to fix the conduit and accessories in position along with the building work.

1.7.2 Fixing conduits in chase

The conduit pipe shall be fixed by means of staples, J-hooks, or by means of saddler, not more than 60 cm apart or by any other approved means of fixing. All threaded joints of conduit pipes shall be treated with some approved preservative compound to secure protection against rust.

1.7.3 Fixing conduits in RCC work (slab / wall / floor etc.)

The conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same. Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with a long radius, which will permit easy drawing in of conductors.Location of inspection/ junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.
At either side of the bends, saddles/staples shall be fixed at a distance of 15 cm from the center of the bends.

1.7.4 Fixing of inspection boxes

As far as possible inspection boxes shall be avoided or to be minized as much as possible. If necessary suitable inspection boxes to the minimum sizes shall be provided to permit inspection and to facilitate replacement of wires with prior approval of engineer in charge. These shall be mounted flush with the wall or ceiling concrete with minimum depth of 65 mm for slab and as per IS : 2667 – 1988 for other places.

1.7.5 Fish Wire

To facilitate subsequent drawing of wires in the conduit, GI fish wire of 1.6mm /1.2mm (16/18 SWG) shall be provided along with the laying of the recessed conduits.

1.7.6 Earthing

A protective earth conductor shall be drawn inside the conduit in all distribution circuits to provde for earthing of non current carrying metallic parts of the entire installtion. These shall be terminated on the earth terminal in the switch boxes, and/or earth terminal blocks at the distribution boards. Gas or water pipes shall not be used as protective conductors (earth medium). Every sub main will hae earth continuity conductor to run along with sub main wiring. Every circuit will have its earth continuity conductor to run along with circuit wiring. In case of 3 phase sub mian wiring two earth continuity conductor shall be provided.

E – 11 LIGHT FIXTURES AND FANS

1.1 Scope :

The scope covers supply, installation, testing and commissioning of different types of light fixtures, fans and exhaust fans.

1.2 Standards :

AS PER SCHEDULE OF INDIAN STANDARDS.

1.3 Type of fixtures :

1.3.1 General Requirement:

1.3.1.1 All fixtures shall be complete with accessories necessary for installation whether so detailed under fixture description or not.

1.3.1.2 Fixture housing, frame or canopy shall provide a suitable cover for the fixture outlet box or fixture opening.

1.3.1.3 Fixtures shall be installed at mounting heights as detailed on the drawings or instructed on site by the Architects/Consultants.

1.3.1.4 Fixtures and/or fixture outlet boxes shall be provided with hangers to adequately support the complete weight of the fixture. Design of hangers and method of fastening other than shown on the drawings or herein specified shall be submitted to the Architect/Consultant for approval.

1.3.1.5 Pendant fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation as per Architect's/Consultant's instructions.

1.3.1.6 Flush mounted and recessed fixtures shall be installed so as to completely eliminate light leakage within the fixture and between the fixture and adjacent finished surface.

1.3.1.7 Fixture mounted on outlet boxes shall be tightly secured to a fixture stud in the outlet box. Extension pieces shall be installed where required to facilitate proper installation.

1.3.1.8 Fixture shall be completely wired and constructed to comply with the regulations and standards for Electric Lighting Fixtures, unless otherwise specified. Fixtures shall bear manufacturer's name and the factory inspection label unless otherwise approved.

1.3.1.9 Wiring within the fixture and for connection to the branch circuit wiring shall be not less than 1.0/1.5 sq.mm. copper for 250 volt application. Wire insulation shall suit the temperature conditions inside the fixture and wires bypassing the choke shall be heat protected with a heat resistant sleeve.

1.3.1.10 Metal used in lighting fixtures shall be not 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 metal parts of the fixtures shall be completely free from burrs and tool marks. Solder shall not be used as mechanical fastening device on any part of the fixture.

1.3.1.11 Ferrous metal shall be bonderized and given a corrosion resistant phosphate treatment or other approved rust inhibiting prime coat to provide a rust-proof base before application of finish.

1.3.1.12 Non-reflecting surfaces such as fixture frames and trim shall be finished in baked enamel paint.

1.3.1.13 Light reflecting surface shall be finished in baked white enamel having a reflection factor of not less than 80%. All parts of reflector shall be completely covered by finish and free from irregularities. After finish has been applied and cured, it shall be capable of withstanding a 6 mm radius bend without showing sign of cracking, peeling or loosening from the base metal. Finish shall be capable of withstanding 72 hours exposure to an ultraviolet sun lamp placed 10 cm from the surface without discoloration, hardening or warping and retain the same reflection factor after exposure. Test results shall be furnished for each lot of fixtures.

1.3.1.14 Fixture with visible frames shall have concealed hinged and catches. Pendant fixtures and lamp holders shall be provided with ball type Algiers or similar approved means. Recessed fixtures shall be constructed so as to fit into an acoustic tile ceiling or plaster ceiling without distorting either the fixture or the ceiling plaster rings/flanges shall be

provided for plaster ceiling. Fixtures with hinged diffuser doors shall be provided with spring clips or other retaining device prevent the diffuser from moving.

1.3.1.15 Detailed catalogue cuts for all fixtures, or, if so required by the Architect/Consultant sample fixtures shall be submitted for approval to the Architect/Consultant before orders for the fixtures are placed. Shop drawings for non-standard fixture types shall be submitted for approval to the Architect/Consultant.

1.3.1.16 Recessed fixtures shall be constructed so that all components are replaceable without removing housing from the ceiling.

1) Lamps shall be supplied and installed in all lighting fixtures furnished under this contract. All lamps shall be rated for 250 volts.

2) Lamps used for temporary lighting service shall not be used in the final lighting of fixtures units.

3) Lamps shall be of wattage and type as shown on the drawings and schedule. Where not shown, the details shall be ascertained from the Architect/Consultant before procurement.

4) Lamps for permanent installation shall not be placed in the fixtures until so directed by the Architect/Consultant, and this shall be accomplished directly before the building portions are ready for occupation.

1.3.2 Fluorescent fittings :

1.3.2.1 Only single and/or two lamp ballast shall be used in any one fixture. Ballast shall be completely enclosed inside sheet steel casing and shall have a corrosion - resistant finish. Ballast 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 ballast shall be of high power factor compensated to above 0.9PF. Ballast temperature and sound rating shall be specified by the manufacturer and guaranteed. Ballast shall be for operation at the voltages and frequencies indicated and under temperature conditions prevailing in the various locations of the premises. Tapped ballast are preferred.

1.3.2.2 All fluorescent fixtures shall be provided with separate wiring channel with cover plate and an earth terminal. All screws shall be chromium brass screws. Lamp and starter holders shall be out of tough moulded plastic with spring loaded rotor type contactors rendered shock and vibration proof. Condensers shall be low loss paper impregnated hermetically sealed complying with IS 1969-196 . Internal wiring shall be neatly clipped and where by passing the ballast, a suitable heat resistant barrier or sleeve shall be provided.

1.3.2.3 Surface mounted fixtures longer than two feet shall have one additional point of support besides the outlet box fixture stud when installed individually. Pendant individually mounted fixtures four feet long and smaller shall be provided with twin stem/conduit hangers. Stems shall have ball aligners or similar devices and provided for a minimum of 25 mm vertical adjustment. Stems shall be of appropriate length to suspend fixtures at required mounting height.

1.3.2.4 Lamps shall have bi-pin bases and a minimum approximate rated and guaranteed life of 6000 hrs. Colour spectrum of light shall be equivalent to `Philips White'. Lamp starter and ballast shall match the lamp.

1.3.3 Incandescent fittings :

1.3.3.1 Incandescent fittings shall be of the type generally specified on the drawings. Contractor should have sample approved by Architects/Consultant before procurement.

1.3.3.2 Incandescent fixtures shall be equipped with porcelain, medium base, screw type sockets for lamps upto and including 200 watt and mogul screw type pin type base for lamps 300 watt and over.

1.3.3.3 Re-lamping the fixture shall be possible without having to remove the fixture from its place.

1.3.3.4 Incandescent lamps shall be inside frosted/or clear type as required by the Architect/Consultant.

1.3.4 Ceiling Fans :

1.3.4.1 Ceiling fans shall be complete with fan suspension stem canopies and regulators. 30 cm suspension stem shall be standard accessory and stems shall be heavy duty galvanized steel tubes to IS 1239- 1958.

1.3.4.2 Fans shall be mounted on a pre-embedded hook with hard rubber isolator. Regulators shall be no-step type mounted in the switch box. The box in all such cases shall be large enough to accommodate the regulator and switches. One sample box with top cover shall be got approved before procurement.

E – 12 Earthing

1.0 SCOPE OF WORK :

The scope of work shall cover supply, laying, installation, connecting, testing and commissioning of:

1.1 copper/galvanized/aluminium/chemical or Electrode type Earthing station.

1.2 Earthing G.I./Aluminum/copper strips from earthing station to equi-potential bar.

1.3 Earthing G.I./ Aluminum/ copper strips/ wires from equi-potential bar to lay feeder mains and circuit to connect power panels, DBs, switchboards etc.

1.4 Bonding of Non-current carrying parts, and metallic parts of the electrical installation.

1.5 Provide inter connection between all earth pits of same type.

2.0 STANDARDS

2.1 The following standards and rules shall be applicable:

1) IS: 3043 - 1966 Code of practice for Earthing.
2) Indian Electricity Act and Rules

2.2 All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the British Standard Codes of Practice in absence of Indian standard.

3.0 GENERAL

All the non-current carrying metal parts of the electrical installation and mechanical equipments shall be earthed properly. The metal conduits, trucking, cables armoured and sheath, electric panels boards, lighting fixtures, ceiling and exhaust fan and all other parts made of metal shall be bonded together and connected by means of specified earthing system.

An earth continuity conductor shall be installed with all the feeders and circuits and shall be connected from the earth bar of the panel boards, to the conduit system, earth stud of the switch box, lighting fixture, earth pin of the socket outlets and to any metallic wall plates used. All the enclosures of motors shall be also connected to the earthing system.

4.0 TYPE OF EARTHING STATION

4.1 PLATE EARTHING STATIONS

4.1.1 The earthing station shall be as shown on the drawing IS:3043.

4.1.2 The earth resistance shall be maintained with suitable soil treatment as shown in the drawing.

4.1.3 The resistance of each earth station should not exceed the limit specified in IS : 3043.

4.1.4 The earth lead shall be connected to the earth plate through copper/brass bolts in case of copper earth plate and shall be hot dip galvanized iron for G.I. plate earth plate as shown on the drawing.

4.1.5 The earthing grid and the earthing conductors shall be of copper strip in case of copper earth plate and hot dip galvanized iron strip in case of G.I. earth plate of size as mentioned on the drawing.

4.1.6 G.I. pipe with funnel with filter of approved quality shall be used for watering the earthing electrodes \ stations.

4.1.7 The block masonry chamber with Cast Iron hinged cover of 300 x 300 mm shall be provided for housing the funnel and the pipe for watering the earthing electrodes \ stations.

4.2 PIPE EARTHING STATIONS

4.2.1 The substation earthing shall be with GI Pipe earthing station and equipment earthing grid shall be with hot dip galvanized iron earthing station.

4.2.2 The Pipe electrode shall 38mm dia GI pipe for earthing

4.2.3 The earthing station shall be as shown on the drawing.

4.2.4 The earth resistance shall be maintained with suitable soil treatment as shown in the drawing.

4.2.5 The resistance of each earth station should not exceed 4 ohms.

4.2.6 The earth lead shall be connected to the earth plate through copper/brass bolts in case of copper earth plate and shall be hot dip galvanized iron for G.I. Pipe earth as shown on the drawing.

4.2.7 The earthing grid and the earthing conductors shall be of hot dip galvanized iron strip of size as mentioned on the drawing.

4.2.8 The block masonry chamber with Cast Iron hinged cover of 300 x 300 mm shall be provided for housing the funnel and the pipe for watering the earthing electrodes \ stations.

4.2.9 The hardware and other consumable for earthing installation shall be of copper/brass in case of copper earth plate and shall be hot dip galvanized iron material in case of G.I. Pipe , as per details shown in the drawing .

4.3 ELECTRODE / CHEMICAL TYPE EARTHING STATIONS:

4.3.1 The substation earthing and equipment earthing shall be done with details given in earthing scheduled in BOQ & Drawing.

4.3.2 The earthing station shall be as shown on the drawing.

4.3.3 The earth resistance shall be maintained with suitable soil treatment as shown in the drawing.

4.3.4 The resistance of each earth station should not exceed the limit specified in IS : 3043.

4.3.5 The earthing grid and the earthing conductors shall be of copper strip of size as mentioned on the drawing.

4.3.6 The block masonry chamber with Cast Iron hinged cover shall be provided for housing the termination block as shown in the drawing.

4.3.7 The hardware and other consumable for earthing installation shall be of copper/brass, as per details shown in the drawing.

4.3.8 GROUNDING: The grounding system shall incorporate the following individual components or a combination of the following:

- Deep driven copper bonded steel core ground rod/ Copper Plate / Copper Rod as central injection point for flow of fault current which is securely connected to the lower end of the down conductor.
- The use of ground resistance improvement material shall be applied in order to reduce the resistivity levels of the grounding system and maintain a constant low resistivity. The grounding system shall be maintenance free.

Maintenance Free Earthing System consist of following material:
- Copper Bonded Earth Rod- Length 1.5Mtr/3Mtr Dia. 5/8”
- Ground Rod Clamp – For Earth Termination.
- Ground Resistance Lowering Compound.

The Copper bonded earth rods are made in accordance with national and international standards such as BS6651, BS7430 and UL467. Threads are rolled onto the rod ensuring an even copper covering which eliminates the risk of chipping whilst driving.

Description: Threaded Copper bonded Earth Rod

Material: Carbon steel rod bonded with Copper

Length: 1.5Mtr./3Mtr

Rod Diameter (Actual): 5/8”

Weight: 1.92kg / 4Kg.

A low resistance, non corrosive earth enhancing compound designed for use in standard soil conditions is to be used for these earthings. This compound shall have following characteristics:

- Will not dissolve or leach away with time
- Maintains constant resistance for the life of the earthing system.
- Effective in normal soil conditions.
- No maintenance required

Ground Resistance Improvement Powder to be used which shall not wash away under seasonal conditions and therefore provides a permanent presence in working to improve and maintain the integrity of the earthing system.

U-Bolt Rod Clamp.

Suitable for clamping earth rods to tape or round conductor.

Description:
Suitable for
Rod Diam. : 5/8” & Copper Tape Size: 25mm x 3mm
Weight: 90 grm.

5.0 INSTALLATION AND CONNECTION :

5.1 The plate \ pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 2.5 M below finished ground level.

5.2 The plate \pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall \ column.

5.3 The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.

5.4 G.I. pipe for watering, shall run from top edge of the plate \ pipe electrode to the mid level of block masonry chamber.

5.5 Top of the pipe shall be provided with G.I. funnel and screen for watering the earth \ ground through the pipe.

5.6 The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing.

5.7 The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.

5.8 Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS : 3043, Code of Practice for Earthing Installation.

5.9 The earth conductors (Strips / Wires copper/ Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Mild Steel Zinc Passivated screws \ bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

5.10 The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

5.11 Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.

5.12 The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

6.0 EARTH LEADS AND CONNECTIONS :

6.1 Earth lead shall be bare copper or galvanized steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. Galvanized steel buried in the ground shall be protected with bitumen and Hessian wrap or polytene faced Hessian and bitumen coating. At road crossing necessary hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface.

6.2 The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

7.0 EQUIPMENT EARTHING :

All apparatus and equipment transmitting or utilizing power shall be earthed in the following manner. Copper/G.I. earth strips/wires shall be used unless other wise indicated in the Schedule B.

8.0 POWER TRANSMISSION APPARATUS

8.1 Metallic conduit shall not be accepted as an earth continuity conductor. A separate insulated / bare earth continuity conductor of size 50 % of the phase conductor subject to the minimum and maximum shall be provided.

	Copper	**Aluminum**	**G.I.**
Minimum(sqmm)	2.5	4.0	6
Maximum(sqmm)	75	100	200

The earth continuity conductor be drawn inside the conduit shall be insulated.

8.2 Non metallic conduit shall have an insulated earth continuity conductor of the same size as for metallic conduit. All metal junction and switch boxes shall have an inside earth stud to which the earth conductor shall be connected. The earth conduct or shall be distinctly coloured (Green or Green/Yellow) for easy identification.

8.3 Armoured cable shall be earthed by two distinct earth connections to the armouring at both the ends and the size of connection being as for the metallic conduit.

8.4 In the case of Unarmoured cable, an earth continuity conductor shall either be run outside along with the cable or should form a separate insulated core of the cable.

8.5 Three phase power panel and distribution boards shall have two distinct earth connections of the size correlated to the incoming cable size. In case of single phase DB's a single earth connection is adequate.

9.0 UTILIZING EQUIPMENT :

9.1 Three phase motors and other three phase apparatus shall have two distinct earth connections of the size equal to 50% of the connecting cable subject to the following:

	Copper	Aluminum	G.I.
Minimum(sqmm)	6.5	10	20
Maximum(sqmm)	75	10	200

9.2 For single phase motors and apparatus, the single earth connection shall be provided of the above size. For all light fittings and fans a single earth connection with 1.5 sqmm copper or equivalent size shall be provided.

9.3 All street light poles shall have an earth stud and shall be connected to the cable armouring using 6.5 sqmm copper or equivalent unless shown otherwise. For street lighting poles planted in ground, 2.4 M long 10 SWG bare copper wire shall be coiled and buried with every fourth pole in addition to connection to cable armouring.

9.4 An equipment earthing grid shall be established as shown in the drawing. All earth connections to all panels, DB's and equipment shall be connected to the nearest point of the earthing grid.

10.0 TEST :

10.1 The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS : 3043.

10.2 The following earth resistance values shall be measured with an approved earth meggar and recorded.

1) Each earthing station
2) Earthing system as a whole
3) Earth continuity conductors

10.3 Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 Ohm in each case. This is responsibility of contractor to get the final value for resistance.

10.4 Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.

10.5 All tests shall be carried out in presence of the consultant..

11.0 METHOD OF MEASUREMENT :

11.1 Provision of earthing station complete with excavation, plate, earth lead upto chamber, earth link in the chamber, electrode, GI watering pipe, Salt, Charcoal, soil treatment to achieve the earth resistance less than 4 ohm, masonry chamber with cast iron cover etc. shall be treated as one unit of measurement.

11.2 The following items of work shall be measured and paid per unit length covering the cost of the earth wires/strips, clamps, labour etc.

a) main equipment earthing grid and connection to the earthing stations.
b) Connection to the power panels, DB etc.

11.3 The cost of earthing the following items shall become part of the cost of the item itself and no separate payment for earthing shall be made.

a) Light fittings - form part of installation of the light fitting.
b) Conduit wiring, cabling - should form part of the wiring or cabling.
c) Street lighting - should form part of the street light poles.

E-13 Miscellaneous (Fire Stop system Material)

1.0 Scope :

1.1 The scope of work covers the supply, installation and testing of Fire Stopper as specified in BOQ.

2.0 Standards :

As per Applicable standard Specification of Fire stopper material suppler.

All installation of Anchor fastener has been approved by Hilti Technical staff and certified the same.

3.0 Material :

a) Fire Resistant Mortar

fire resistant, cement based mortar with thermal insulating properties from admixed perlite CP 636 of HILTI India Pvt Ltd or Equvalrent .The product shall be tested for withstanding Zone 4 earthquake when tested in accordance with acceleration time history waveform VERTEQII as per IEC 60068 and Telcordia Technologies GR-63-Core 2006-03. The product shall be age tested for 30 years as per Dafstb and DIBT standards. The product shall be tested and approved by third party agencies such as UL, FM and LPCB. The product shall bear the UL and FM approval logo on the packing.

b) Fire Stop System

Providing & Supplying Passive Firestop system using HILTI Mineral wool board along with CP 670 coating of 1 mm DFT and CP 606 Firestop filler or Equivalent system. Fire barrier coating of 1 mm thickness should be apply on Mineral wood board (density min. 150 kg/cu. meter) and fill the remaining gap around entrants with suitable filler of depth same as mineral wool panel thickness to provide 2 hour fire rating on solid structure (wall- min. 80 mm, floor- min. 150 mm thickness) when subject to test conditions of BS 476: part 20:1987 and after age testing to DafStb guidelines. Cables and cable tray should be coated with above same coating up to minimum length of 300 mm to prevent spread of fire. Fire barrier coating and filler should be approved to international test standard like BS 476 and tested by FM, LPC, BRE, and WFRC. For wall opening the Board system should be used on both sides of the wall and for floor opening it should be used only on one side.

c) Fire Stop System

Providing and supplying versatile intumescent expanding foam CP 620 of HILTI India Pvt Ltd.The product shall be tested for withstanding Zone 4 earthquake when tested in accordance with acceleration time history waveform VERTEQII as per IEC 60068 and Telcordia Technologies GR-63-Core 2006-03. The product shall be age tested for 30 years as per Dafstb and DIBT standards. The product shall provide water tightness when tested for W rating as per UL standards and shall be tested for providing a sound insualtion of 50 when tested in accordance with ASTM E 90. The product shall be tested and approved by third party agencies such as UL, FM and LPCB. The product shall bear the UL and FM approval logo on the packing.

4.0 Mode of measurement :

As specified in BOQ.

E – 14 ELV SERVICE & COMPONENTS

1. TELEPHONE AND DATA DISTRIBUTION

1.1. SCOPE OF WORK:

a) Complete installation shall be done in accordance with installation practices for a well structured cabling system, using components from a single vendor to ensure consistent and assured performance. The structured cabling distribution network shall serve as a vehicle for transport of data, video and voice telephony signals throughout the network.
b) Installation, termination and identification of wiring between station outlets, Telecom Rooms and the Equipment Room shall be considered part of the contractors work.
c) Wiring utilized for data and voice communications shall originate at owner provided hubs and concentrators either wall mounted, in vertical free standing equipment racks, and/or enclosed wall mounted vertical equipment racks located at the Telecommunications Equipment Room (ER), the Main Cross-connect (MC) , the Intermediate cross-connect (IC), and/or the Telecommunications Room (TR) location(s). Wiring, terminations and patch bays between these designated demarcation points and outlet locations designated on the plans shall be considered part of the contract. Telecommunication Outlets (TO) shall be furnished, wired and installed by the structured cabling distribution network system contractor.
d) The system shall utilize a network of unshielded twisted pair, riser, tie and station cables. Cables and terminations shall be provided and located as shown and in the quantities indicated on the drawings.
e) All cables and terminations shall be identified at all locations.
f) All cables shall terminate in an alphanumeric sequence at all termination locations.
g) All balanced twisted pair cable terminations shall comply with, and be tested to TIA/EIA568-B standards for Category 3, Category 5e, Category 6 & Category 6 installations.
h) The contractor carrying out the SITC shall make the system entirely operational for its intended use, by addition of components specific to its make/model even if not specifically mentioned in the BoQ. Also most current versions of software and applications shall be provided by the contractor, as applicable at the time of execution and commissioning.
i) The Contractor has to furnish working drawings and as-built drawings, which shall be an essential component of commissioning.

Supported Applications, but not limited to:

a) Ethernet Applications
b) IEEE 802.3af Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI)
c) Fiber Channel Applications
d) IEEE 802.11a/b/g Wireless LAN Applications
e) Digital Subscriber Loop (DSL) Applications
f) Voice, Video and ISDN Applications
g) Building Automation Systems (BAS) Applications

References & Standards, but not limited to:

a) TIA / EIA
b) International Electro technical Commission (IEC)
c) European Committee for Electro technical Standardization (CENELEC)
d) National Fire Protection Association (NFPA) / UL Listed

It shall be the responsibility of the installer and OEM manufacturer to ensure that:

a) The Passive Components of structured cabling distribution network will be free from manufacturing defects in material and workmanship under normal and proper use;

b) All Passive Components in the structured cabling distribution network meet or exceed the relevant component specification of the TIA 568-B series and ISO/IEC 11801: 2002 standards;

c) The structured cabling distribution network compliant channels will meet or exceed the Guaranteed Channel Performance as per relevant standards in the structured cabling distribution network Performance Specifications in effect at the time of installation.

d) The Application Assurance covers the structured cabling distribution network compliant channels to support operations of the application(s) that the system was designed to support.

e) The site will be duly certified by OEM for a period of Twenty years from the date of issuance of the registration certificate or installation, whichever is earlier.

The Items, and the Specifications for the same in this section, applies to the following:

a) Jelly Filled Armoured Telephone Cable

b) Category 6 Data Networking UTP Cable and associated components such as CAT6 patch panels – 16/24/48 ports, IOs/RJ45 jacks, CAT6 patch cords, Face plates & SMBs

c) Single mode / Multimode Outdoor/Indoor Optic Fiber Cable and accessories such as – Light Guide Interface Unit (LIU), wall mount and rack mount, pigtail, splices, couplers, patch cords, splicing kit and splice trays

d) Networking Racks – for termination of networking cables

e) GPON/FTTX Racks - for termination of GPON/FTTX Cables

f) Equipment Racks – for servers and hardware

g) Wire-Less Access Point

h) Networking Switches – Simple Manageable, Layer 2 & Layer 3 inclusive of their options such as uplinks, transceivers for fiber transmission

Installation:

a) The installation of conduits shall generally be as specified under section `CONDUIT WIRING'.
b) All cables shall be on cable racks and neatly stitched together.
c) The connection at the tag blocks shall be silver soldered of IDC type so as to achieve minimum contact resistance gas tight connection.
d) The final branch connections with single pair cables in conduits and the maximum number of cables in each conduit shall be as follows :

Conduit Diameter	Inch/mm.	Max. No. of cables
1"	25	3 Nos. Of CAT6 & CAT6A Cables
1"	25	Single run for FAS, PA Services
1½"	40	6 Nos. Of CAT6 & CA6A cables, Single run of Riser and Fiber Cabel

Mode of measurement:

a) The main telephone/data cables shall include supply and laying of multi pair cables on ceiling/wall/on cable trays/racks including all supports and shall be measured and paid on running length basis. Cable trays/racks shall be paid for separately.
b) The multi pair tag blocks shall consist of two telephone connector's strips, jumper interconnections silver IDC terminated soldered enclosure etc. and shall be measured and paid as one unit.
c) The conduit wiring for telephone/data shall include single pair 0.6 diameter cable in heavy duty rigid, PVC conduits and shall include junction boxes, pull boxes, 2 pair 2 A connector in GI box, Perspex cover etc. and shall from one point.

1.2. CONDUITS

a) Conduits shall be as given below :
b) The conduit shall generally be as specified under section `Telephone and Data Distribution'.

1.3. TELEPHONE/DATA NETWORKING

1.3.1. CATEGORY 6 MODULAR PATCH PANEL, (24 PORTS – 1U)

SR.No	Minimum Specifications / Functionalities / Capabilities

	UTP Jack Panel UL listed, Unloaded with 24 nos. UTP ports for PCB based IO Jacks (RJ45, TIA-568C Category-6, Installation and Termination of all 24 nos. Catergory-6 UTP Cable
1	**Minimum Specifications**
1.1	Shall be unloaded with individually replaceable 24 nos. Category-6 I/O Jacks complying with TIA-568.C.2
1.2	Shall be 19" rack mountable , angled and of 1U height & complete with all mounting accessories, UL listed
1.3	Shall have labels for identification of ports
1.4	Should have integrated bonding bar for grounding individual jacks
1.5	Shall be RoHS Compliant
1.6	Shall have minimum 25-Year Extended Product Warranty and System Warranty
1.7	Shall be having a 6 port module construction for better cable dressing at the rear
1.8	Shall have Comprehensive port numbering on front
1.9	Shall be suitable for loading unshielded & shielded jacks for different category systems (CAT 6 & CAT 6A)
1.10	Shall be certified by independent labs like ETL/UL etc.

1.3.2. FACE PLATE FOR INFORMATION OUTLET (SINGLE / DUAL)

SR.No	Minimum Specifications / Functionalities / Capabilities
V	**Faceplate Single/ Dual/ Quad Port (Work Area End)**
1	**Minimum Specifications**
1.1	Shall be Single/ Dual/ Quad Port (RJ45) square plate, dimension as per commercially available modular office furniture.
1.2	Shall have spring shuttered front access for preventing ingress of dust
1.3	Shall be supplied with Gang Box of the same size by System Integrator or OEM
1.4	Shall have Write on labels in transparent plastic window along with the plate
1.5	Shall have Screw hole covers along with the plate
1.6	Shall be able to support variety of jacks – UTP and STP Information outlets

1.3.3. <u>CATEGORY 6A F/UTP CABLE</u>

Sr. No	Minimum Specifications / Functionalities / Capabilities
I	Cat 6A F/UTP LSZH Cable, TIA-568C.2, (305 Mtrs./1000 feet per Box)
1	Minimum Specifications

1.1	Shall be of 4 twisted pairs of 23 AWG solid conductors
1.2	Shall support network line speeds up to 10 gigabits per second.
1.3	Shall be 4-pair overall FTP to restrict alien crosstalk & should have a cross filler/ divider/ isolator pair separator, meeting Category 6A tested to 500 MHz or more as per TIA-568C.2.
1.4	Shall support IEEE 802.3 10GBase -T, 1000Base -T and Video, Voice
1.5	The Alien Crosstalk performance of the Solution shall be guaranteed for 10 Gbps transmission for the complete channel (not just cable) across the entire swept frequency (1-500 MHz) and tested in a stringent 6-around-1 configuration that is representative of worst-case installation conditions. Test Certificate/report from independent labs like ETL for 4 connections shall be required for the same.
1.6	Shall provide the above performance up to 4 connections, up to 100 meters.
1.7	The Category 6A Solution shall fully comply with the IEEE 802.3an link segment specifications for 10G Base-T, in addition to the ANSI/TIA and ISO/IEC Category 6A requirements
1.8	Shall support up to 100 meter channel configuration with at least 4 connections and meet PSANEXT, PSACR-F and Insertion Loss specifications extrapolated to 500 MHz or better per IEEE 10GBase-T standard.
1.9	Shall have the length printed on the outer jacket of the cable after every meter.
1.10	Shall be RoHS Compliant
1.11	Shall be FTP Shielded cable with Low-Smoke & Zero-Halogen as per IEC 60332-1/CMR, IEC 61034-2 & IEC 60754-2 respectively
1.12	Shall be certified by independent labs like ETL for compliance to EIA/TIA-568C.2 (Report required)
1.13	Shall be supplied in Reel of 305 Meters/ 1000 feet packed in Boxes

1.3.4. <u>CATEGORY 6A INFORMATION OUTLET (IO)</u>

SR.No	Minimum Specifications / Functionalities / Capabilities
	PCB based shielded Information Outlet (I/O) RJ45, TIA-568C Category-6A, Termination of Catergory-6A FTP Cable
1	Minimum Specifications
1.1	Shall conform to Category-6A as per the EIA/TIA-568C.2
1.2	Shall support network line speeds up to 10 Gbps
1.3	Shall have RJ-45 type connector
1.4	Shall be of high performance type
1.5	Shall Snap into standard faceplates, surface-mount boxes, consolidation point boxes, and Modular Panels
1.6	Shall be mountable either at 90 degrees (straight) or 180 degrees in any faceplate.

1.7	Shall be certified by independent labs like ETL/GHMT (Report required)
1.8	Shall be RoHS Compliant
1.9	The jack should be metallic and made of zinc alloy or equivalent
2.0	Shall have minimum 25-Year Extended Product Warranty and system warranty

1.3.5. CATEGORY 6A PATCH CORD (3 FEET / 7 FEET)

S.No	Minimum Specifications / Functionalities / Capabilities
	Cat 6A STP LSZH Patch Cable, TIA-568C Category-6A
1	Minimum Specifications
1.1	Length shall be 1 or2 meters
1.2	All patch cords shall conform to Category 6A
1.3	Shall support network line speeds up to 10 Gbps
1.4	Shall have RJ-45 plugs with matching color molded boot at both the ends
1.5	All patch cords shall be factory crimped and packed.
1.6	Shall be RoHS Compliant
1.7	Shall be LSZH for safety measures
1.8	Shall support applications such as ISDN, POE, token ring & VOIP.
1.9	Shall be certified by independent labs like ETL/GHMT/UL.
1.10	Shall have minimum 25-Year Extended Product Warranty and system warranty
1.11	Colors- White, Blue, Grey, Yellow, Red & Green

1.3.6. Speaker Cable

Speaker Cable	Should be compliance with European directive 2002/95/IEC. Should be CSA CM and FT4 certified. Should be 16AWG with 26/30 bare copper conductors.

E – 15 **EXTERNAL LIGHTING**
(Not Applicable)

E – 16 **LIGHTNING ARRESTOR**
(Not Applicable)

E – 17 **DG SET**
(Not Applicable)

B SPECIAL CONDITION FOR TESTING

(CONTRACTOR TO READ THIS CAREFULLY)

1.0 SCOPE :

Contractor should have to take all necessary testing/ random testing of equipments and component prior to supply as per the guidelines / rules / sampling method etc. of IS at manufacturing works or other standard lab in presence of Client's representative & consultant as witness testing. Any deviation in parameters which is not as per IS is not accepted and clent reserve the rights to reject the same at any stage of the project.

C. MODE OF PAYMENT

The following payment will be made after deducting retention money.
Payment for various items shall be made as follows:

1.	Light, Fan, Plug, Bell, Telephone, TV, Computer point Etc.(Part payment of plug on Board will not be considered)	20 % when conduits are laid in slab & Boxes are fixed
		50 % when wires are drawn in above conduits.
		15 % when switches are fitted and testing is done.
		15 % after completion of the job.
2.	HT Equipment, Transformer, MV switchgear, Distribution Boards Cable Trench,Cables,Bus Duct, Server, EPABX	70 % for erection. . 30 % after testing and commissioning
3.	Earthing	70 % after earthing is complete. 30 % after testing and commissioning.
4.	Light fixture and Fans	70 % for erection. 30 % after testing and commissioning.

Special Notes:

- **NO PAYMENT SHALL BE MADE AGAINST THE MATERIAL, WHICH IS NOT GOING TO CONSUME IN NEXT 2 MONTHS.**
- **THE FINAL CERTIFICATE SHALL BE GIVEN ONLY AFTER THE CONTRACTOR SUBMITES FOUR SETS OF AS BUILT DRAWING BOTH HARD COPY AS WELL AS SOFT COPY DULY APPROVED BY CLIENTS ENGINEER AND CONSULTANT.**
- **FOR THE VERTUAL COMPLITION AND FINAL CERTIFICATES CONTRACTOR WILL HAVE TO PRODUCE NO OBJECTION CERTIFICATE FROM CLIENTS.**

Sign & Seal Of

CONTRACTOR

D. APPLICABLE STANDARDS - IS CODES

Sr. No.	IS No.		Description
1)	IS: 2026-1977 1981 -1994	:	Power transformers & fittings.
2)	IS 3639-1966	:	Fittings and acc. For P.T.
3)	IS10028-Part III 1981	:	Installation of Transformer.
4)	IS: 13118-1991	:	Specification for High voltage AC circuit breakers.
5)	IS: 335-1993	:	Insulating oil for Transformers & switch gear.
6)	IS: 2705-1992	:	CT for measuring and protection.
7)	IS: 3156-1992	:	Voltage (Potential) Transformers.
8)	IS: 3156-1992	:	Voltage Transformer.
9)	IS: 8623-Part II 1993	:	Bus-bar arrangement and marking.
10)	IS: 2099-1986	:	Bushing
11)	IS: 5621-1980	:	Large Hollow Porcelains Insulator
12)	IS: 2544-1973	:	Insulators greater than 1000V
13)	IS: 2629-1985 IS: 2633-1986	:	Hot Dip Galvanizing
14)	IS: 3842-1967	:	Relays for AC system
15)	IS: 1248-2003	:	Meters (measuring).
16)	IS: 10118-1982	:	Installation of Switch gears.
17)	IS: 692-1994	:	HV Cable Paper Insulated Lead Sheathed Cables for Rated Voltage up to and Including 33 kV – Specification
18)	IS: 1255 -1983	:	Installation of HV cables and jointing.

19)	IS: 3043-1987	:	Code of practice for earthing.
20)	IS: 13947-Part III -1993	:	HD Air breaker, Switch gears and fuses for Voltage not exceeding 1000 Volts.
21)	IS: 13703-Part IV -1993	:	Selection, installation and maintenance of fuses up to 650 Volts.
22)	IS: 13947-Part I -1993	:	General requirements for switch gear and control gear for voltage not exceeding 1000 Volts.
23)	IS: 13947-Part III -1993	:	Air-break isolators for Voltage not exceeding 1000 Volts.
24)	IS:8623-1993	:	Factory built assemblies of switch gears and control gears for voltage up to and including 1000 Volts A.C. and 1200 Volts D.C.
25)	IS: 11353-1985	:	Marking and arrangement of switch gear bus bars main connectors and auxiliary wiring.
26)	IS: 13947 PART-1	:	Cubical Boards.
27)	IS: 8084-1976	:	Insulated Busbar rating.
28)	IS: 2675-1983	:	Enclosed distribution fuse boards and cutouts for Voltage not exceeding 1000 Volts.
29)	IS: 8828-1995	:	Miniature Circuit Breaker.
30)	IS: 9926-1981	:	Fuse wire used in rewirable type electric fuses up to 650 Volts.
31)	IS: 1554-Part I -1988	:	PVC insulated electric cables Heavy duty.
32)	IS: 3961-Part II & IV -1967	:	Recommended current rating for cables.
33)	IS: 8130-1984	:	Copper conductor in insulated cables and cores.
34)	IS: 8130-1984	:	Conductor for insulated electric cables and flexible cords.
35)	IS: 3975-1999	:	Low Carbon Galvanized Steel Wires, FormedWires and Tapes for Armouring of Cables - Specification
36)	IS: 5831-1984	:	PVC insulation and sheath of electric cables.
37)	IS: 8130-1984	:	Aluminum conductor for insulated cables.
38)	IS: 11955-1987	:	Recommended current rating for Cable.
39)	IS: 732-1989	:	Code of practice for electrical wiring installation system Voltage not exceeding 650 Volts.

40)	IS: 1646-1997	:	Code of practice for fire safety of Buildings (general) electrical installation.
41)	IS: 9537-1981	:	Rigid steel conduits for electrical wiring.
42)	IS: 2667-1988	:	Fittings for rigid steel conduits for electrical wiring.
43)	IS: 3480-1966	:	Flexible steel conduit for electrical wiring.
44)	IS: 3837-1976	:	Accessories for rigid steel conduits for electrical wiring.
45)	IS: 694-1990	:	PVC insulated cables (wires).
46)	IS: 9537-Part III -1983	:	Installation of Rigid non-metallic conduits for electrical wiring.
47)	IS: 6946-1973	:	Flexible (playable) nonmetallic conduits for electrical installation.
48)	IS: 1293-2005	:	Plugs and sockets upto 250V.
49)	IS: 8130-1984	:	Conductors for insulated electrical cables and flexible codes.
50)	IS: 9537-1980	:	Specification for conduit for electrical installation.
51)	IS: 3419-1988	:	Accessories for non-metallic conduits for electrical wiring.
52)	IS: 3854-1997	:	Switches.
53)	IS: 6538-1971	:	Plugs.
54)	IS: 13585-Part I -1998	:	Shunt Capacitors for power systems upto 650V.
55)	IS: 13703	:	Low voltage fuse and links up to 1000 volts.
56)	IS: 1913-1978	:	General and safety requirement for lighting fittings.
57)	IS: 1944-1981	:	Code of practice for lighting public thorough fares.
58)	IS: 3528-1966	:	Waterproof electric lighting fittings.
59)	IS: 3553-1966	:	Water tight electric lighting fitting.
60)	IS: 1239-Part I -2004	:	Mild Steel tubular and other wrought steel pipe fitting.
61)	IS: 10322-Part V -1987	:	Luminaries for street light.
62)	IS: 13703-Part III -1993	:	HRC fuses having rupturing capacity voltage upto 1000V.
63)	IS: 2312-1967	:	Exhaust Fan.
64)	IS: 374-1979	:	Class I Ceiling Fan.
65)	IS: 7098 (Part I, II, III)	:	XLPE armoured Cables upto

-1988 1000V.

NOTE: All codes and standards means the latest where not specified otherwise the installation shall generally follow the Indian Standard codes of practice or relevant British Standard Codes of Practice in the absence of corresponding
Indian Standards.

PLEASE FOLLOW:

a. Indian Electricity Act of 1910 and rules issued there under revised up to date.
b. Regulations for electrical equipment in building issued by The Bombay Regional Council of insurance Association of India.

E. LIST OF APPROVED MAKE / MANUFACTURER FOR ELECTRICAL WORK MATERIALS

1)	Rigid PVC Conduit	:	ISI approved & manufactured from virgin material. **Precision(PPI), NIHIR, Vraj**
2)	Accessories for conduit	:	Same make as of pipe.
3)	Flexible Copper Wires	:	**FRLS type : Havell's, Finolex, Polycab, KEI, LAPP.**
4)	Switches	:	**MK(Blenze), Legrand(Arteor), Crabtree Schneider (Opale) or as per Interior approval**
5)	Light Fixture	:	**Phillips, Wipro, Surya, OSRAM, Artlite, Crompton, Keselec Schreder, Havell's, XAL, Zumtobel, Regent, Riggiani, Lance, Ligman, PUK, Disano, Or Equivalent** (As suggested by architect - Sample to be approved)
6)	FTL/CFL/Lamps or any kind of light source	:	**Osram, Philips,Crompton, GE.**
7)	LED lamp souce	:	**CREE, NICHIA, OSRAM**
8)	Ceiling Fans	:	**Crompton, Usha, Orient, Havell's**
9)	Fan box	:	**Cast Iron Type Only**
10)	Exhaust Fan	:	**Crompton, Almonard,**
11)	Call bell	:	**Anchor Ding Dong type.**
12)	PVC tape	:	**Steel grip, Anchor**
13)	Distribution boards	:	**Legrand (Ekinoxe),Schneider MG, L&T, Hager.** Factory fabricated. Double door type
14)	ACB / MCCB / MCB / ELMCB & Acc	:	**Legrand (DX3),Schneider MG,L&T, Hager.**
15)	DB Surge protector	:	**Legrand, Schneider, L&T, Hager, OBO**
16)	Timer	:	**Legrand, Schneider, L&T, Hager, Theben**
17)	RTPFC Panel manufacturer	:	**Datar, EPCOS, L & T or Readymade As per Switchgear make**
18)	Metal Clad and Wheather proof		

Plug-socket	:	**Legrand, Schnieder, L&T, Hager**
19) LT Cables	:	**Finolex, Havells, Polycab, KEI, Primecab**
20) HT Cable	:	**Havell's, Torrent, Primecab, Finolex, KEI**
21) HT Joint Kit	:	**Raychem, 3M**
22) Panel Fabricators	:	**CPRI Approved panel builders only**
23) Load Manager / Energy Meter: (Suitable for PC Connected and LAN with open protocol, Sample to be approved)		**Conzerve, Secure, Elmeasure, Rushabh.**
24) Meters(Digital : V,A,PF etc)	:	**Conzerve, Secure, Elmeasure.**
25) Relay	:	**Siemens, L&T, ABB, Schnieder**
26) Connectors	:	**ELMEX, Wago**, **Connectwell**.
27) Glands	:	Compression type, Heavy duty and deep threding with rubber-ring and double washers. (Sample tobe approved) **HMI, Comet, Dowell's**
28) Cable Lugs	:	**Dowell's, 3-D (long neck)**
29) Button holder, Angle holder, ceiling rose	:	**Anchor, CPL**
30) M.S. Boxes	:	Fabricated out of CRCA sheets / Angle / Strip continuously welded (sample to be approved) with Powder coating / Colour coating.
31) Whether protected junction boxes	:	**Spelsberg, Hensel, SCAME**
32) Ladder type Cable Tray	:	**Rushabh, MEK, Indiana**
33) Raceway	:	**OBO, MK (Ega), Legrand**
34) Anchor Fastener	:	**Hilti, 3M**
35) Current Transformer	:	**AE, Virat, Narmada**
36) Indication Lamp	:	**LED Type : Schneider, L&T, RASS, Salzer**
37) Voltage Selecter Switch	:	**L&T, Salzer**
38) Ameter Selecter Switch	:	**L&T, Salzer**
39) Fire Stoppers	:	**Hilti, 3M, OBO**
40) Chemical Earthing	:	**OBO, MAP**
41) Unitized Sub Station	:	**Schneider, ABB, C & S, Voltamp**
42) D G Set	:	**Sudhir, Gmmco, Supernova, Sterling & Wilson.**
43) Stabilizer	:	**Suvik, Belltronics, Protek-G, Consul**
44) Cat6 Cable & Components	:	**Tyco Commscope, Legrand, R&M**

44) Speaker Cable : **Kramer, Belden, Delton**

Special Notes :

- The successful tenderer will have to supply the makes from above in consultation with the Client/Architect/Consultant without any extra cost.
- tender, in covering letter of separate letter enclosure. However, the final decision for accepting make specified by tenderer would be of client/Architect/Consultants.
- As far as possible, the successful tenderer will have to place order directly to the manufacturer OR it's authorized dealer.
- The Client/Architect/Consultants have right to check the challans of supplier.
- The MCB and MCB DBs must be of same make.
- Make of components reuired to be used by contractor to complet the installation, if not mentioned any where, shall be required to GOT IT APPROVED by Client/Architect/Consultant before installation in writing manner.
- Within a week of work order, the contractor shall submit the sample of each item / component of above mentioned approved make for the approval of the Client/Architect/Consultant.