Tender for External Fire Fighting Works at PDEU Campus, Gandhinagar

Part – A

General & Technical Specifications

HCP DESIGN, PLANNING AND MANAGEMENT PVT. LTD.
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Tender for External Fire Fighting Works at PDEU Campus, Gandhinagar

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Site	**:**	**Pandit Deendayal Energy University, Village - Raysan District - Gandhinagar – 382 426.**
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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	IS:2502

	reinforcement	
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.

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/m^2.

D. PLASTERING

12 mm. thick plaster in Cement mortar, on Brick masonry			
	1:2	0.24	Bags/m^2.
	1:3	0.17	Bags/m^2.
	1:4	0.14	Bags/m^2.
	1:5	0.10	Bags/m^2.
	1:6	0.09	Bags/m^2.
12 mm. thick plaster in Gauged mortar, on Brick masonry			
	1:1:8	0.07	Bags/m^2.
	1:2:09	0.60	Bags/m^2.
12 mm. thick plaster in Cement mortar, on Stone masonry			
	1:2	0.31	Bags/m^2.
	1:3	0.22	Bags/m^2.
	1:4	0.17	Bags/m^2.
	1:6	0.11	Bags/m^2.
12 mm. thick plaster in Gauged mortar, on Stone masonry			
	1:1:8	0.80	Bags/m^2.
	1:2:09	0.07	Bags/m^2.
20 mm. thick plaster in Cement mortar, on Brick masonry			
	1:2	0.34	Bags/m^2.
	1:3	0.24	Bags/m^2.
	1:4	0.19	Bags/m^2.
	1:5	0.13	Bags/m^2.
	1:6	0.12	Bags/m^2.
20 mm. thick plaster in Gauged mortar, on Brick masonry			
	1:1:8	0.10	Bags/m^2.
	1:2:09	0.80	Bags/m^2.
20 mm. thick plaster in Cement mortar, on Stone masonry			
	1:2	0.41	Bags/m^2.
	1:3	0.29	Bags/m^2.

	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	75 mm. dia.	8.6	Bags/100 m.
Cement mortar 1:4 and joints in Cement mortar 1:1	100 mm. dia.	10.88	Bags/100 m.
C.I Soil pipe/Rain water pipe, concealed, including filling the	100 mm. dia.	10.88	Bags/100 m.
zari with C.M. 1:4 and joints in Cement mortar 1:1	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.

Item Specifications
For
Civil Works

Item No-1.01, 1.02, 1.03

Earthwork in excavation by mechanical means / manual means including necessary shoring & strutting, dewatering, getting out the excavated soil, sorting and stacking of useful material, dressing of the sides, ramming of bottom and disposal of surplus excavated earth for all lead and lift within plot boundary including back filling foundations, the trenches, plot filling with excavted material (excluding hard rock and black cotton soil) anywhere from the site/ campus etc complete as directed by engineer-in-charge. For all civil, electrical and plumbing works. For all kind of soil. Mode of measurement will be PCC area only. Rate includes disposal of soil with in plot boundary with spreading and leveling of the same.

a) Depth upto 1.5m
b) b) Depth upto 1.5 to 3.0m
c) c) Depth upto 3.0 to 4.5m

1.0 General

1.1 CPWD specifications clause no. 2.0, 2.1, 2.2, 2.3 shall be followed.

2.0 Site Clearance

2.1 CPWD specifications clause no. 2.4 shall be followed except nothing extra will be paid for removing, diverting existing structures and services and providing fencing for the any archeological monuments within or adjacent to the area.

3.0 Setting out and making profiles

3.1 CPWD specifications clause no. 2.5 shall be followed.

4.0 Excavation

4.1 CPWD specifications clause no. 2.7, 2.9 shall be followed up to any width (not restricted to 1.5m) and any area (not restricted to 10 sqm) on plan.

4.2 The Contractor shall do the necessary shoring and strutting or shall provide necessary slopes to a safe angle or steps as required or directed at his own cost. No extra payment shall be made for such precautionary measures taken by contractor.

4.3 The Contractor shall at his own expense and without extra charge make provision of supporting all utility services, lighting the trenches, separating and stacking serviceable materials neatly, shoring, timbering, strutting, bailing out water either sub-soil or rainwater, including pumping at any stage of the work. Trenches shall be kept free of water while masonry or concrete works are in progress and till the Architect and Engineer-in-charge considers it necessary, i.e. till the concrete is sufficiently set.

5.0 Disposal of the excavated stuff

5.1 The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers, including ramming and watering etc. complete as directed by the engineer-in-charge.

5.2 The Contractor has to dispose the surplus excavated earth within the plot / outside at non objectionable place as directed by engineer in charge.

5.3 The lead is the shortest practical route and not necessarily the route actually taken. The decision of Engineer-In charge shall be final.

6.0 Mode of Measurement and Payment

6.1 CPWD specifications clause no. 2.11, 2.12 shall be followed.

6.2 The rate shall also include necessary shoring & strutting, dewatering, getting out the excavated soil, sorting and stacking of useful material, dressing of the sides, ramming of bottom, backfilling into trenches and disposal of surplus excavated earth at non objectionable place for all lead and lift as directed by engineer in charge.

6.3 The measurement shall be per Cum basis.

Item No-1.04

Supplying and Filling in foundation, plinth with murrum or selected soil brought from outside in plinth and sides of foundations, in layers not exceeding 30 cm. in depth with optimum moisture conditions to give at least 95% of the maximum dry density (proctor density) including watering, ramming and compacting using mechanical vibrator (static / pneumatic) of required capacity, including freight, transportation, loading, unloading, screening, passes etc. all complete as directed by the Engineer-in-charge (Consolidated measurements of fill shall be paid for under this item). The rates shall include for all leads and lifts including transporting using mechanical / manual means within the campus area. Contractor has to take prior approval from EIC. before execution of this item.

CPWD specifications clause no. 2.10 and 2.23 shall be followed along with relevant specifications of item no. 1.01.
The measurement shall be per Cum basis.

Item No-1.05

Supplying and filling with good quality course river sand, in foundation and plinth (under floors), obtained from outside, including watering, ramming well, consolidating and dressing etc. complete for all lead and lift/ depth as directed by engineer in charge.

1.0 Materials

1.1 **Sand**

CPWD specifications clause no. 2.24.1 shall be followed except the sand shall be crushed sand.
CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

2.0 Workmanship

2.1 CPWD Specification clause no. 2.24.2 shall be followed along with following specifications.

3.0 Mode of Measurement and Payment

3.1 CPWD specification clause no. 2.24.3 and 2.24.4 shall be followed along with following specifications.
CPWD specification clause no. 2.23.3, 2.23.4 shall be followed.

3.2 The payment shall be made for filling in plinth and sides of foundations. No deductions shall be made for shrinkage or voids, if considered as instructed above.

3.3 The rate includes cost of collecting and carting sand of approved quality with all lead, lift and labor required for filling in foundations and plinth and all the operations as described above.

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

3.5 Only consolidated measurements of the fill shall be measured and paid for under this item.

Item No-1.06

Providing and injecting Chemical emulsion for PRE - CONSTRUCTIONAL anti-termite treatment and creating a chemical barrier on the top surface of plinth filling, inside junction of wall and floor, on top of damp proof course or on masonry at level of plinth filling as per IS 6313 (Part-2)-1981 using chemical like Imidacloprid 30.5% SC (CIB approved) and proportion of dilution with water shall be as per manufacturer's specification. The emulsion shall be applied as mentioned below, all as per specification and directions of Engineer-in-charge. Plinth area in plan at GF shall only be measured and paid. A guarantee bond of 10 years shall be furnished in prescribed proforma. Rate shall be inclusive of material required for Anti Termite Treatment and labor and equipments required for applying all etc. complete as directed by engineer in charge. (Stage of treatment may be vary as per site condition. Contractor shall be approved by Engineer in charge before execution.)

a) Treatment to soil below raft - Before laying the rubble soling and/or PCC, the compact and leveled soil shall be treated at 5 liters per sq m. OR In case of soils/sand filled above the raft, the treatment at 5 liters per sq m shall be carried out on the top surface of filled soil/sand.

b) Treatment to soil along the retaining wall - The soil retained by the walls (soil coming in contact with retaining wall) shall be treated at the rate of 7.5 liter per sq m of the vertical surface in full depth.

c) Treatment of soil along external perimeter of building - After the building is complete, the earth along the external perimeter of the building shall be rodded at intervals of 150 mm and to a depth of 300 mm. The rods should be moved backward and forward, parallel

to the wall to break up the earth and emulsion poured along the wall at the rate of 7.5 liter per square meter of vertical surfaces.
d) Top surface of the plinth filling including damp proof courses at the rate of 5 liter/sqm of internal plinth area (if required)
e) Treatment of soil surrounding pipes, wastes and conduits - When pipes, wastes and conduits enter the soil inside the area of the foundation, soil surrounding the point of entry shall be loosened around each of such pipe, waste or conduits for a distance of 150mm and up to a depth of 75 mm before the treatment is commenced. When they enter the soil external to the foundation, they shall be similarly treatment for a distance of 300 mm, unless they stand clear of the walls of the building are about 75 mm.
Foot print area of Ground Floor of the building shall be considered for payment in sqm.

CPWD specifications – clause no. 2.28.0, 2.28.1, 2.28.2, and 2.28.3 shall be followed except using chemical like Imidacloprid 30.5% SC (CIB approved) and proportion of dilution with water shall be as per manufacturer's specification.

Anti-termite treatment shall be carried out as per following:

A1) Bottom surface and the sides of the excavation made for masonry foundations at the rate of 5 liters/ sqm (wherever applicable)

A2) at the rate of 7.5 liter/ sqm to the backfill at the depth of 500mm below the original ground level. The soil in the immediate contact with the vertical surface of RCC column/ Masonry shall be treated.

B) Top surface of the plinth filling including damp proof courses at the rate of 5 liter/sqm of internal plinth area etc. complete.

C) At the rate of 7.5 liter/ sqm to the internal vertical surface from original Ground level to top of the earth filled in the plinth.

D) At the rate of 7.5 liter/ sqm to the external vertical surface below finished Ground level to the full depth of the filling complete.

E) 1 liter / linear meter along the junction of wall and floor at all stages.

1.0 The treatment against termite infection shall remain effective for a period not less than 10 years, from date of issue of the final certificate of completion of work. If at any time during this period, any defects in treatment are revealed or any evidence of infection in any part of the building or structure is noticed, the Contractor shall rectify the concerned defects within 15 days on receipt of notice from Engineer-in-charge. On Contractor's failure to do so the Engineer-in-charge may get the same rectified through any other agency at the Contractor's risk and cost, and the decision of Engineer-in-charge as to the cost payable by the Contractor for the same shall be final and binding to the Contractor.

2.0 Unless otherwise specified anti-termite treatment shall be executed through approved specialized anti termite agency.

3.0 Copy of work order mentioning the rate issued to the specialized agency shall be attached with guarantee bond.

4.0 Mode of measurement –
Foot print area of Ground Floor of the building shall be considered for payment in sqm. Rate shall be for all above mentioned steps of termite treatment and relevant detailed specifications.
The rate shall be for a unit of one Sqm.

PCC and RCC Work

General Note: All Concrete shall be machine batched, machine mixed and machine vibrated design mix fair finish/ smooth finish reinforced cement concrete. Mix design shall be carried out for environmental exposure condition as given in IS 456:2000 page 18 -table 3 according to grade for all PCC & RCC elements of all shape, all size, at all places and heights/ depths including transporting, laying of concrete to site by any means like pumping or tower crane etc., finishing and curing etc. and including Admixtures in recommended proportions as per IS 9103 to accelerate, retard setting of concrete 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 as per drawing and as per the instruction of the architect in charge. Rate also to include lift charges and scaffolding for all heights / depths from FFL / GL. Filtered sand must be used in all type of concrete work.
The design mix of concrete by Contractor/ supplier has to be obtained well in time and approval of Engineer in Charge to be obtained prior to use. This approval has to be obtained whenever the design mix is changed. Minimum cement content shall be as per IS 456 for all items.
The rate shall be for at all floor/ all heights / all level / all shapes / all elements.

Item No-2.01
Providing and laying in position machine mixed, machine mixed plain cement concrete (PCC) of grade - M15 including compaction, vibration, curing, transporting and pumping wherever necessary, dewatering etc. complete for all level, all height/ depth and for any lead and lift as directed by the Engineer.

1.0 Material

1.1 Water
CPWD specifications clause no. 3.1.1 shall be followed.
CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

1.2 Cement

CPWD specifications clause no. 3.1.2 shall be followed.
CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

Reduction of strength of cement with passage of time
Reduction of strength at 28 days of concrete made from fresh and stored cement.

Sr.no.	Storage Period of Cement	Strength Reduction
1.	Fresh	NIL
2.	3 months old	20%
3.	6 months old	30%
4.	12 months old	40%
5.	24 months old	50%

Stored cement can be used only upto the 3 months from the date of manufacture. After 3 months cement is to be used after prior permission of the consultant.

1.3 Coarse Sand

CPWD specifications clause no. 3.1.4 shall be followed.
CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

1.4 Coarse Aggregate

CPWD specifications clause no. 4.1.1 shall be followed.

2.0 Workmanship

2.1 CPWD specifications clause no. 4.2.1 to 4.2.14 shall be followed.

2.2 General

2.2.1 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, leveled, watered and rammed, as directed by engineer-in-charge.

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

2.3 Inspection

2.3.1 Contractor shall give the Architect and Engineer-in-charge due notice before reinforcement

bars are placed in position, 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.

2.1.1 Centering design and its erection shall be got approved from the Engineer-in-charge. Sufficient 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.

2.1.2 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.

2.4 Ordinary fair finished formwork for walls, columns, beams of Super structure

For walls, columns and beams, the shuttering plates on either side shall be bolted with through tie rods made from round bars minimum 12 mm with heavy quality PVC sleeves and minimum 25 mm thick PVC cones on either side of the sleeve. The whole tie rod assembly along-with PVC cone shall be placed /fixed with through bolts on either side of the shuttering plates. Holes of cones shall be filled with rich cement mortar (1:1) and bonding agent in recommended proportion.

2.5 Sampling and testing of concrete

2.5.1 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.

2.5.1.a 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.

2.5.2 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.

2.6 stripping

2.6.1 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 $20^{O}C$) 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.

2.6.2 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.

2.6.3 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.

2.6.4 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.

2.6.5 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.

3.0 Mode of Measurement and Payment

3.1 CPWD specifications clause no. 4.2.15.1 to 4.2.15.5 and 4.2.15.7 shall be followed.

3.2 All structural elements like footing, slab, beam, columns, walls, lintels, chajjas, etc. shall not be classified, measured and paid separately.

3.3 The rate includes the cost of material, labour, tools and plant required for mixing, placing in position vibrating and compacting, finishing as directed by engineer-in-charge 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.

3.4 The rate shall be for a unit of one cum. The cost of formwork and reinforcement shall be excluded as per the item description.

Item No-2.02

Providing and laying in position machine mixed, machine batch, machine vibrated design mix cement concrete of M 20 grade with minimum cement content as per IS 456 with nominal steel reinforcement as per drawing including curing, shuttering (if required) & finishing but excluding the cost of steel reinforcement etc. complete for grade slab with any lead, as directed by engineer-in-charge.

Relevant specifications of item no. 2.01 shall be followed except the grade of concrete shall be as specified in Item description.

The rate shall be for a unit of one cum. The cost of formwork is included but reinforcement shall be excluded as per the item description and shall be paid in relevant tender item.

Item No-2.03, 2.04

Providing material and labour for laying in position Ready mix concrete/ batch mix concrete for reinforced cement conctere work, using cement content as per approved Design Mix with/without Fly Ash (Min cementitious level as per latest IS 456 shall be maintained) manufactured in fully automatic batching plant and transported to site of work in transit mixer for all lead having continuous agitated mixer, as per mix design for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying; cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability; finishing, compacting, vibrating, curing etc excluding cost of Form work and reinforcement etc complete for all elements, all floors, any heights/depths, any lead and lift as directed by Engineer Incharge.

M-30 Grade

M-35 Grade

Relevant specifications of item no. 2.01 shall be followed except the grade of concrete shall be as specified in Item description.

The rate shall be for a unit of one cum. The cost of formwork is included but reinforcement shall be excluded as per the item description and shall be paid in relevant tender item.

Item No-2.05

Supplying, fabricating, placing and fixing in position TMT reinforcement bars FE-500D as per approved make confirming to IS-1786 reinforcement for RCC structures/ items as per design including transporting steel to the work site, handling, decoiling, cutting, bending, cranking, fabricating to required shape, placing in position and binding the system with GI 18 gauge wires, welding if necessary, keeping it in position during concreting by means of stays, blocks, ties, spacers, chairs, hangars, etc. for all floors/ any levels/ any

heights/depth complete as per drawings, specifications and direction of Engineer in Charge. Measurement will be paid on the length basis and converted into weight by using standard co-efficient (rolling margin's and wastage shall not be paid). The quoted rate should be inclusive of the cost of Binding wire, and the same will not be measured and paid separately.

1.0 Material

All CPWD clauses shall be followed as specified below.

1.1 Reinforcement

CPWD specifications clause no. 5.1.3 shall be followed except chairs, separators etc. will be measured and paid under this item.

1.2 Binding Wire

1.2 The GI wire shall be of 16 gauge (1.63 mm), 18 gauge (1.22mm) or 20 gauge (1 mm) or as specified in the item conforming to relevant latest IS.

18.2 It shall be free from rust, oil paint, grease, loose mill scale or any other desirable coating which may prevent adhesion of cement mortar.

2.0 Workmanship

2.1 CPWD Technical specifications clause no. 5.3.1 and 5.3.2 is to be followed.

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 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.

2.4 All the reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position with 18 guage binding wire as approved by Engineer-in charge. 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 at 1m c/c , Precast cover blocks in cement mortar 1:2 (1cement : 2 coarse sand) about 4 X 4 cm square section or 4 cm dia round section or PVC cover blocks shall be used to maintain the cover of the concrete members as directed by Engineer In charge 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.

2.5 Bars crossing each other where required shall be secured by 18-gauge 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.

1.1 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 and 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.

1.2 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.

1.3 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. Welding shall be done by electric arc process as per IS : 816 and IS : 823.

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

1.5 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 -in charge.

3.0 Mode of Measurement 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 paid extra. The rolling margin of steel shall not be paid extra.

3.2 The rate for reinforcement shall include the cost of labour and material required for all operations described above like cleaning of reinforcement bars, straightening, cutting, hooking, bending, binding, welding placing in position etc. as per the drawing or directed by the Architect or engineer-in-charge Rate shall also include the cost of binding wires of 16 to 18 gauge, devices like chairs, pins, spacer bars, cover blocks of PVC or cement mortar etc. for keeping reinforcement in position. The rate shall for a unit of Kg.

Item No-2.06 to 2.10

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 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) Up to 52 mm dia

b) Beyond 52mm dia up to 77 mm dia

c) Beyond 77mm dia up to 102 mm dia

d) Beyond 102mm dia up to 152 mm dia
e) Beyond 152mm dia up to 202 mm dia

1.0 Materials and Workmanship

Marking and location of holes is to be approved by Architect and Engineer in charge. Holes in RCC walls, slabs, beams or any other RCC member shall be drilled by Core cutting machine.

Core cutting shall be executed by approved agency of approved make of core cutting machine. Scanning of reinforcement shall be carried out before core cutting if required and as suggested by Engineer in charge. RCC surface is cleaned after drilling including disposing of debris as specified in the disposal item. Necessary platform for the machine location and electrical wire management shall be adhering to safety standards.

Rate shall be inclusive of providing and filling epoxy based water proofing compound/ micro concrete/ patch repair mortar for gaps around the pipes, after placing of service pipe.
Only fire seal shall be paid separately as per fire requirement.

2.0 Mode of Measurement

The rate shall be for a unit of running meter length.
Rate shall be inclusive of scaffolding, cleaning, disposing of debris etc. complete for all height as directed by engineer-in-charge. Actual length shall be measured irrespective of wastage inclusive of all material labour tools tackles etc complete

Item No-2.11 to 2.14
Providing in position 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.

1.0 Materials and Workmanship

The PVC pipe of approved make shall confirm to CPWD material specification. Before pouring the concrete PVC sleeves are placed in between the reinforcement as per drawing. Pipe sleeves shall be 50mm larger diameter than pipes; which are passing through. All pipes shall

be accurately cut the required sizes and reinforcement bars shall be kept in position before placing of sleeves. 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. Wherever pipes pass through walls, slab and circular space filled with fire proof materials like putty, fire seals etc shall be paid separately.

2.0 Mode of Measurement:

The rate shall be for unit of one running meter. No wastage shall be paid.
Measurement shall be taken up to two decimal. (Minimum 0.01 m)

FORM WORK

Item No-3.01
Form Work (Centering and shuttering) including strutting, propping, bracing etc. complete to give fair / expose finish using best quality ordinary timber planking, shuttering plywood (plain or laminated) or steel plates with MS adjustable steel props, H frames with bracing, adjustable spans, etc. including removal of forms for foundations, footings, bases of columns, walls, slabs beams, sills, lintels, coping, staircases, arches, chajjas etc. in all shapes at all levels all height etc. complete as directed by engineer-in-charge. The Height of propping and centering from supporting floor to ceiling should not exceed 4.5 meter.

Relevant specifications shall be followed as per CPWD specification Vol – I, clause No-5.2 for shuttering including provision of tie rod/ water barrier assembly. Selection of tie rod assembly/ water barrier and fixing pattern/ method shall be as approved by engineer in charge. After removal of form work, tie rod hole shall be removed, cleaning of the holes with Blower and removal of slurry, grouting the hole with non-shrink grout/ polymer concrete/ ready mix patch repair mortar as approved by engineer in charge.

The rate shall be for unit of Sqm.

Item No-3.02
Extra over item no. 3.01 (Form Work) for providing and erecting false staging with MS props or MS H frames for each additional height of propping and centering where the height of propping and centering exceeds 4.5 m between supporting floor to ceiling, including temporary masonry work, stone pillars for supporting as required for steel props, H Frames etc. including cost of deshuttering and centering at all levels. (Height more than 4.5 m. and upto 9.0 m) No staging shall be measured for vertical walls & beam sides and only plan area is to be measured and paid.

1.0 Material and Workmanship

1.1 The relevant specifications of item no. 3.01 shall be followed except the height of the propping and centering between supporting floor to ceiling exceed 4.5 m to 9m.

1.2 The material shall be steel H-frames, steel plates, steel props, base plate, bracing, spans, channels, couplers etc.

1.3 The false staging work for double height shall be designed by contractor so that it shall be able to resist forces like live load, dead load, impact load, lateral loads or any other incidental loads and get it approved by Engineer-in charge before starting the centering work.

1.4 Vertical members shall be placed directly over those or below shall be so designed and placed that the load shall be transmitted directly to them. Proper horizontal and diagonal bracing in both the directions and at both the stages shall be provided. The completed false staging work for double height formwork shall be got inspected by and got approved by Engineer-in-charge before placing the reinforcement.

1.5 If there is a failure of formwork or centering/staging, contractor shall be solely responsible for the damage of the work, injury of life and damage to property.

2.0 Mode of Measurement and Payment

2.1 The payment shall be made for the false staging work. This will be paid only if there is no slab/platform in between and extra staging is necessary. The rate is extra over and above on the payment made for formwork of slab. The work of false staging shall be measured in sqm on plan.

2.2 The rate includes the cost of providing stone or masonry temporary pillars for supporting as required, and a provision for a platform at working level with sufficient access for monitoring the underside of the slab during the concrete pouring without any extra cost.

2.3 The relevant specifications of item no. 3.01 shall be followed.

2.4 The rate shall be for a unit of sqm.

Item No-3.03

Extra for providing and fixing formwork for Architectural exposed fair finish concrete surfaces (vertical or horizontal surface of any shape) in desired pattern and size as per drawing and specifications using laminated shuttering plywood or suitable proprietary system formwork for all types of RCC elements like slabs, walls, columns, beams, folded staircase (all sides), sill, coping, lintels, jambs, beam hunching, vertical fins, etc. including

de-shuttering and neat cleaning the exposed concrete surface, as directed by the engineer-in-charge. Rate shall be applicable for all levels, all height, all shapes and all elements.

1.0 Material and Workmanship:

CPWD specifications clause no. 5.2.1, 5.2.2, 5.2.3, 5.2.5 shall be followed except that the laminated shuttering plywood not less than 12 mm with supporting frame work comprising of MS angle / Tee / Flat / Channel / I beam and steel sheathing and steel plates made out of CR MS sheet not less than 2 mm thickness (14 gauge) shall be used instead of ordinary shuttering plywood / steel sheathing, to obtain a desired smooth exposed surface finish. The surface shall be rendered and touched up to the satisfaction of the Engineer in charge. The exposed surface shall be in desired pattern and size as per the drawing. The shuttering shall have restricted reuse to obtain good surface finish. 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 replaced. Only similar type of material shall be used for the entire work. The surface shall be presentable without further treatment.

1.2 All vertical members for formwork scaffolding shall be of steel like props, 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. Crimps, 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 in charge 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 in charge.

2.5 Exposed / Ordinary fair finished formwork For walls, columns, beams of basement and water retaining structures

For water retaining structure 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. Holes of tie rod in total thickness of wall shall be filled with

polymer added cement mortar (1:1) or non shrink grout in recommended proportion by manufacturer.

1.4 Exposed / Ordinary fair finished formwork For walls, columns, beams of Super structure

For walls, columns and beams, the shuttering plates on either side shall be bolted with through tie rods made from round bars minimum 12 mm with heavy quality PVC sleeves and minimum 25 mm thick PVC cones on either side of the sleeve. The whole tie rod assembly along-with PVC cone shall be placed /fixed with through bolts on either side of the shuttering plates. Holes of tie rod in total thickness of wall shall be filled with polymer added cement mortar (1:1) or non shrink grout in recommended proportion by manufacturer.

1.5 Mode of measurement and payment

Payment shall be made for exposed surface concrete work as per drawing and as directed by engineer in charge. Exposed RCC area shall be measured and paid.
In case of round/ half round window opening in exposed RCC wall, for payment of expose shuttering opening cutout shall not be deducted (both side).

The rate shall be for a unit of sqm

Brick Work

Note -
1) Rate shall be for all floor, all height, all level.

Item No-4.01
Providing and laying brick work using common burnt clay conventional building bricks in foundation and plinth in CM 1:5 (1 Cement : 5 coarse Sand) conforming to IS 1077-1992 having compressive strength not less than 35 Kg/ cm2 in any width, any shape and all depth including curing, scaffolding, racking / flush jointing etc. as per drawing, specification etc complete for all floor all height all level and as directed by engineer-in-charge.

1 Material
1.1 Water
1.1 CPWD specifications clause no. 3.1.1 shall be followed.
1.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

1.6 Cement Mortar
11.1 CPWD specifications clause no. 3.2.1 shall be followed.

1.3 Brick
23.1 CPWD Technical specifications clause no. 6.1 shall be followed

2 Workmanship
2.1 Proportion
2.1.1 The proportion of the cement mortar shall be as specified in item and conform to relevant IS standards.

2.5 Soaking of Brick
2.5.5 CPWD specifications clause no. 6.2.3 shall be followed.

2.6 Laying
2.6.5 CPWD specifications clause no. 6.2.4 shall be followed.

2.6.6 **In a day brick work shall not be laid more than 1m or 10 courses in height**.

2.6.7 The frames of doors, windows, cupboards, etc. shall be housed into the brick work at the correct location and level, as directed while executing the masonry work. 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.

2.7 Joints

2.7.5 CPWD specifications clause no. 6.2.5 shall be followed except in case of non-modular bricks thickness of four course and four joints shall be 35 cm and thickness of mortar at the joint shall be 12 mm.

2.7.6 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.

2.8 Curing

2.8.5 CPWD specifications clause no. 6.2.6 shall be followed.

2.9 Scaffolding

2.9.5 CPWD specifications clause no. 6.2.7 shall be followed.

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

2.10 Preparation of foundation bed

If the foundation is to be laid directly on the excavated bed, the bed shall be leveled, 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 Mode of Measurement and Payment

3.1 Brickwork shall be measured in cubic meter unless otherwise specified. Dimensions shall be measured correct to the nearest to 0.01m. Areas shall be calculated to the nearest 0.01 sqm and cubic contents shall be worked out to the nearest 0.01 cum. half brick wall thick shall be measured separately in sqm stating the thickness.

3.2 The measurement 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. Battered, tapered and curved portions shall be measured net as walls.

3.3 No deduction shall be made from the quantity of brick work, nor shall any extra payment 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 0.1 m^2.

(2) Architectural openings in walls, parapet and compound walls, not exceeding 0.1 sqm 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 cross section or 50 cm in girth.

3.4 Apertures for fire places shall not be deducted nor shall extra labor 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 moldings like corbelling, pattas, etc.

The rate shall be for a unit of one cum.

Item No-4.02

Providing and laying Half brick, 115mm thick masonry using common burnt clay conventional building bricks confirming to IS 1077-1992, having crushing strength not less than 35 Kg/cm2, in any shape, in CM 1:4 (1 cement : 4 coarse sand) including curing, racking out joints, scaffolding, etc. complete, for all floors / all heights / all levels as directed.

3.0 Material

1.1 Water

1.1 CPWD specifications clause no. 3.1.1 shall be followed.

1.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

1.2 Cement Mortar

1.2.1 CPWD specifications clause no. 3.2.1 shall be followed.

1.3 Brick

1.3.1 CPWD Technical specifications clause no. 6.1 shall be followed

2.0 Workmanship

2.1 Proportion

2.1.1 The proportion of the cement mortar shall be as specified in item and conform to accepted standards.

2.2 Soaking of Brick

2.2.1 CPWD specifications clause no. 6.2.3 shall be followed.

2.3 Laying

2.3.1 CPWD specifications clause no. 6.4 and 6.2.4 shall be followed.

2.3.2 In a day brick work shall not be laid more than 1m or 10 courses in height.

2.3.3 Relevant specifications of item no. 4.01 shall be followed except the bricks shall be laid in stretcher bond. When half bricks are to be reinforced 2 nos. MS bars of 6 mm dia shall be embedded at every third courses as given in the item. (the dia of bars shall not exceed 6 mm dia) These shall be securely anchored at their end where the partitions end. The free ends of the reinforcement shall be keyed into the mortar of the main brickwork to which the brickwork is joined. The mortar used for the reinforcement of the brickwork shall be rich dense cement mortar 1:4. Overlap of the reinforcement shall not be less than 30 cm. The mortars interpose between the reinforcement bars and the brick shall not be less than 5 mm.

2.4 Joints

2.4.1 CPWD specifications clause no. 6.2.5 shall be followed.

2.4.2 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

2.5.1 CPWD specifications clause no. 6.2.6 shall be followed.

2.6 Scaffolding

2.6.1 CPWD specifications clause no. 6.2.7 shall be followed.

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

3.0 Mode of Measurement and Payment

3.1 CPWD specifications clause no. 6.4.1, 6.4.2 and relevant specifications of item no. 4.01 shall be followed.

3.2 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 exclude the reinforcement if it is given in the item description and shall be paid in relevant item.

1.9 The rate shall be measured in sqm.

Item No-4.03

Providing and Fixing Autoclave Aerated Concrete Blocks (AAC Block) as per drawing and specification (IS No :2185 (Part III) - 1984) for required thickness in single or multiple layers as per drawing, fixed with polymer modified adhesive mortar as per manufacturer's specifications in true line level and plumb including curing, racking / flush jointing, finishing, scaffolding, cleaning etc complete, for all floor, all height, alllevel and as directed by Engineer In charge.

Crushing strength of aerated concrete block shall not be less than 35 KG/sqcm, density in oven dry condition minimum 600 Kg/cum, thermal conductivity 0.16 w/mk, fire resistant 2 hours.

1.0 TERMINOLOGY: For the purpose of this item, the following definitions shall apply.

1.1 Autoclaved : Steam curing of concrete products, sand lime bricks, asbestos cement products, hydrous calcium silicate insulation products or cement in an autoclave at maximum ambient temperatures generally between 170 and 2150 C. Signature of Contractor 344

1.2 Block: A concrete masonry unit, anyone of the external dimensions of which is greater than the corresponding dimension of a brick as specified in IS : 3952-1978 and of such size and mass as to permit it to be handled by one man. Furthermore, to avoid confusion with slabs and panels, the height of the block shall not exceed either its length or six times its width.

1.3 Block Density: The density calculated by dividing the mass of a block by the overall volume, including holes or cavities and end recesses.

1.4 **Drying Shrinkage:** The difference between the length of specimen which has been immersed in water and then subsequently dried to constant length, all under specified conditions: expressed as a percentage of the dry length the specimen.

1.5 **Gross Area:** The total area occupied by a block on its bedding face, including areas of the cavities and end recesses.

1.6 **Height:** The vertical dimension of the exposed face of a block, excluding any tongue or other device designed to provide mechanical keying.

1.7 **Length:** The horizontal dimension of the exposed face of a block, excluding any tongue or other device designed to provide mechanical keying.

1.8 **Width:** the external dimension of a block at the bedding plane, measured at right angles to the length and height of the block.

2.0 **DIMENSIONS AND TOLLERANCES :**

2.1 Concrete masonry building units shall be made in sizes and shapes to fit different construction needs. They include stretcher, corner, double corner or pier, jamb, header, bull nose and partition block and concrete floor units.

2.2 **Concrete Block:** Concrete block shall be referred to by its nominal dimensions. The term nominal means that the dimension includes the thickness of the mortar joint. Actual dimensions shall be 10 mm short of the nominal dimensions (or 6 mm short in special cases where finer jointing is specified).
The nominal dimensions of the concrete block shall be as follows:

Length	400,	500		or	600 mm
Height	200,		250	or	300 mm
Width	100,	150,	200	or	250 mm

In addition, block shall be manufactured in half lengths of 200, 250 or 300 mm to correspond to the full lengths. The nominal dimensions of the units are so designed that taking account of the thickness of mortar joints, they will produce wall lengths and heights which will conform to the principles of modular co-ordination.

Blocks of sizes other than those specified in 2.2.1 may also be used if so specified. In the case of special concrete masonry units such as jali or screen wall block and ornamental block, the specified sizes may not necessarily apply.

2.3 The maximum variation in the length of the units shall not be more than + 5 mm and the maximum variation in the height and width of unit, not more than + 3 mm.

2.4 Subject to the tolerance specified in 2.2.3 and the provisions of 3.4 the faces of masonry units shall be flat and rectangular, opposite faces shall be parallel, and all arises shall be square. The bedding surfaces shall be at right angles to the faces of the blocks.

2.4 **Blocks with Special Faces :** Blocks with special faces shall be manufactured and supplied if so specified.

3.0 CLASIFFICATION:

3.1 The autoclaved AERATED concrete blocks shall be classified in two grades according to their compressive strengths as indicated in Table 1.

TABLE 1 : PHYSICAL PROPERTIES OF AUTOCLAVED AERATED CONCRETE BLOCKS

Sr. No.	Density in Oven Dry Condition	Compressive Strength, Min		Thermal Conductivity in Air Dry Condition
		Grade 1	Grade 2	
	Kg/m2	N/mm2	N/mm2	W/m.k
i)	451 to 550	2.0	1.5	0.21
ii)	551 to 650	4.0	3.0	0.24
iii)	651 to 750	5.0	4.0	0.30
iv)	751 to 850	6.0	5.0	0.37
v)	851 to 1000	7.0	6.0	0.42

4.0 MATERIALS:

4.1 **Cement :** Cement complying with any of the Indian Standards may be used at the discretion of the manufacturer.

Use of fly ash conforming to IS : 3812-1981 may be permitted to a limit of 20 percent in cement conforming to IS : 269-1976. However, it shall be ensured that blending of fly ash with cement is as intimate as possible, to achieve maximum uniformity.

4.2 **Lime :** The lime shall satisfy the requirements for Class C lime specified in IS : 712-1973.

4.3 **Aggregate :** The aggregate used for the manufacture of AERATED concrete blocks shall conform to the following requirement:

a) **Sand :** Conforming to IS : 383-1970 except for the grading which may be made to suit the product and the silica content shall not be less than 80 percent.

b) **Fly Ash :** Conforming to IS : 3812-1981 with loss on ignition not more than 6 percent.

c) **Granulated Blast Furnace Slag :** Generally conforming to Notes 1 and 2 of 4.2 of IS : 455-1976 may be used.

4.4 **Water :** The water used in the manufacture of concrete masonry units shall be free from matter harmful to concrete of reinforcement or matter likely to cause efflorescence in the units and shall meet the requirement of IS : 456-1978.

4.5 **Ready mixed jointing mortar** : Ready mixed jointing mortar shall be used (surface preparation, mixing of mortar and method of application, thickness of jointing layer), as per manufacturer's specifications.

4.6 **Additive or Admixtures:** Additives or Admixture may beadded either as additives to the cement during manufacture or as admixtures to the concrete mix. Additives or admixtures used in the manufacture of concrete masonry units may be:
a) Accelerating, water-reducing and air-entraining admixtures conforming to IS: 9103-1979.
b) Waterproofing agents conforming to IS: 2645-1975 and
c) Colouring pigments

Where no Indian standards apply the additives or admixtures shall be shown by test or experience, to be not detrimental to the durability of the concrete.

5.0 MANUFACTURE:

5.1 The aerated structure or the cells of the AAC blocks shall be formed by generation of a gas by chemical action, with the mix, prior to hardening with the aid of suitable chemical foaming agents and mixing devices. The cells in the block shall be distributed evenly throughout its volume. Broad principles for the manufacture of the autoclaved AERATED concrete blocks shall be as IS : 2185 Part-III.

6.0 SURFACE TECTURE AND FINISH:

6.1 Concrete masonry units can be given a variety of surface textures ranging from a very fine close texture to a coarse open texture by the proper selection, grading, and proportioning of aggregates at the time of manufacture. Textures may also be developed by treating the face of the units while still green by wire brushing or combing by slightly eroding the surface by playing a fine spray of water upon it, and by splitting (split block). Colour may be introduced by incorporating non-fading mineral pigments in the facing concrete, or by applying a coloured cement grout or paint to the face of the units soon after they are removed from the moulds. Selected coloured aggregates may also be used in the facing and exposed by washing with water or dilute hydrochloric acid.

6.2 Well made concrete masonry may not require plaster in case of unimportant buildings in low rainfall areas; two or three coats of a cement paint being sufficient to render it resistant to rain water. If, however, it is intended to plaster concrete masonry the block shall have a sufficiently rough surface to afford a good key to the plaster. Waterproofing admixtures may be used for preparing the plaster.

7.0 PHYSICAL REQUIREMENTS:

7.1 **General:**

All units shall be sound and free of cracks or other defects which interface with the proper placing of 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.

7.1.1 Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall be free of chips, cracks, or other imperfections, except that if not more than 5 percent of a consignment contains slight cracks or small chippings not larger than 25 mm, this shall not be deemed grounds for rejection.

7.2 **Dimensions :** The overall dimensions of the units when measured as given in 2.2.3 shall be in accordance with 3.2.1 subject to the tolerances mentioned in 2.2.3.

7.3 **Block Density :** The block density shall conform to the requirements specified in Table 1 when tested in accordance with 8.1.

7.4 **Compressive Strength:** The minimum compressive strength, being the average of twelve units shall be as prescribed in Table 1 when tested in accordance with 8.2.

7.5 **Thermal Conductivity:** The thermal conductivity shall not exceed the values specified in Table 1 when tested in accordance with 8.3.

7.6 **Drying Shrinkage:** The drying shrinkage shall be not more than 0.05 percent for Grade 1 blocks and 0.10 percent for Grade 2 blocks when tested in accordance with 9.4.

7.7 **Sound Reduction Index:** The Sound Reduction Index shall be 60 Db for 200 mm thick wall.

7.8 **Fire Resistance:** The fire resistance shall be 4-6 hours depends on thickness of wall.

8.0 TESTS:

8.1 **Block Density:** The block density shall be determined in the manner described in IS : 6441(Part 1)-1972.

8.2 **Compressive Strength:** The compressive strength shall be determined in accordance with IS:6441 (Part 5)-1972.

8.3 **Thermal Conductivity:** The thermal conductivity shall be determined in accordance with IS : 3346-1980.

8.4 **Drying Shrinkage:** The drying shrinkage shall be determined in the manner described in IS : 6441 (Part 2)-1972.

9.0 **Sampling** No. of Tests, and criteria of conformity shall be as per IS : 2185-1984.

WORKSMANSHIP:

10.0 STORAGE AND HANDLING OF MATERIALS:

10.1 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.

10.2 Cement, lime, aggregates and other masonry materials shall be stored and hauled as laid down in the relevant Indian Standard specifications for these materials.

11.0 PREPARATORY WORK:

11.1 **Wetting of Blocks :** These blocks need not be wetted before or during the laying in the walls; in case the climatic condition so required, the top and the sides of the blocks may be slightly moistened so as to prevent absorption of water from the mortar and ensure the development of the required bond with the mortar.

12.0 LAYING OF AUTOCLAVED AERATED CONCRETE BLOCK MASONRY IN SUPERSTRUCTURE:

12.1 **Use of Mortar in Masonry:** 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 the joints, both horizontal and vertical shall be upto 20 mm thick. Except in the case of extruded 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 a rounded or U-shaped 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 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 water-tight joint.

In case of ready mixed jointing mortar, it shall be used as per manufacturer's specifications.

12.2 **Operations for Laying Block Masonry:**

12.2.1 **First Course:** The first course of AAC block masonry shall be laid with greater care, making sure that it is properly aligned, leveled and plumbed, as this may assist the mason in laying succeeding courses to obtain a straight and truly vertical wall. The first layer of AAC block masonry on plinth should preferably have groove / offset outside so that rain water coming down the wall falls out.

12.2.1.1 Before laying the first course, the alignment of the wall shall be marked on the damp-proof course. The block for this course shall first be laid dry, that is without mortar along a string 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 mortar bed spread and these blocks laid back in place truly level and plumb. The string shall then be stretched tightly along the faces of two corner blocks and the faces of the intermediate ones adjusted to coincide with the line. Thereafter, each block shall be removed and relaid over a bed of mortar. After every three or four blocks have been laid, their correct alignment, level and verticality shall be carefully checked.

12.2.2 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 blocks are all in the same plane. This precaution is necessary to ensure truly straight and vertical walls.

12.2.2.1 The use of a storey rod or course pole which is simply a board with marking 200 mm apart, provides an accurate method of finding the top of the masonry for each course. Each course, in building the corner, shall be stepped back by a half-clock and the horizontal spacing of the block shall be checked by placing a mason level diagonally across the corners of the blocks.

12.2.3 When filling in the wall between the corners, a mason’s line shall be stretched from corner to corner for each course and the tope 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.

12.2.3.1 To assure satisfactory bond, mortar shall not be spread too far ahead of actual laying of the block or it will stiffen and loose its plasticity. 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 blocks just laid. If there be any delay long enough for the mortar to stiffen on the block, the mortar shall be removed to the mortar board and reworked. Dead mortar that has been picked up from the scaffold or from the floor shall not be used.

12.2.4 **Closure Block:** When installing the closure block, all edges of the opening and all four edges of the closure block shall be buttered with mortar. The closure block shall be carefully lowered into place. If any mortar falls leaving an open joint, the closure block shall be removed, fresh mortar applied and the operation repeated.

13.0 PROVISION FOR DOOR AND WINDOW FRAMES:

13.1 Door and window frames shall be attached to the surrounding masonry either by conventional method or with 200 mm flooring nails with screwed ends fixed directly into the block after the frame has been wedged into the opening at every nailing position. The number of nails to give adequate stability will be dependent on the dimensions of the frames. The nails should be spaced at maximum 400 mm and the first nail should not be farther than 200 mm from a corner.

13.1.1 Frames may be attached to the masonry by holdfasts anchored in the vertical reinforced concrete studs provided to the frames as specified earlier.

13.2 **Provision for Lintels :** Lintels for doors, windows and other opening shall be made of either RCC cast in situ or precast units or shall conform to IS : 9893-1981; where openings occur close to one another, continuous lintels may be provided.

14.0 PROVISION FOR ROOF:

14.1 The top of the roof course shall be finished smooth with a thin layer of 1:3 cement mortar and covered with a coat of crude oil or craft or oil paper to ensure free movement of the roof.

14.2 Where the roof slab projects beyond the external wall face, it shall be provided with a drip.

15.0 INTERSECTING WALL:

15.1 All walls wherever they meet or intersect shall be bonded or tied securely in accordance with 15.1.1 and 15.1.2.

15.1.1 **Load Bearing Walls:** When two load bearing walls meet or intersect and the courses are to be laid up at the same time, a true masonry bond between at least 50 percent of the units at the intersection is necessary. When such intersecting bearing walls are laid up separately,

pockets with 200 mm maximum vertical spacing shall be left in the first wall laid. The corresponding course of the second wall shall be built into these pockets.

15.1.2 **Non-load Bearing Walls:** Meeting or intersecting non-load bearing wall shall be bonded by either of the two methods recommended for load bearing walls.

16.0 MODE OF MEASUREMENT:

16.1 The measurement of this item shall be taken for the block 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.

16.2 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 too things, 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.

16.3 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.

16.4 The rate shall be for a unit of one cum.

PLASTER WORK

Note -
1) Rate shall be inclusive of any type of groove and drip mould in all type of plaster work for all floor, all height, all level.

Item No-5.01
Providing and applying average 10 mm. thick single coat Mala plaster using steel trowel in CM 1:3 (1 cement : 3 coarse river sand), on ceilings, stair soffits etc.as per instructions including hacking of concrete/ application of bonding agent, finishing, curing, scaffolding for all floor, all level, all height etc complete as directed by engineer in charge. Rate shall be inclusive of bonding agent, provision of groove/ drip mould as per drawing etc complete as directed by Engineer in charge. Chicken mesh shall be paid in relevent tender item.

Material

1.1 Water

1.1 CPWD specifications clause no. 3.1.1 shall be followed.
1.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.
1.3 Chicken wire mesh having openings 20 mm. x 20 mm. of 22 gauge shall be provided as directed.

1.2 Cement Mortar

11.1 CPWD specifications clause no. 3.2.1 shall be followed.

2.0 Workmanship

2.1 Scaffolding

2.1.1 CPWD specifications clause no. 13.1.1 is to be followed.
2.1.2 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 engineer-in-charge before starting the work.

2.2 Preparation of Surface

2.2.1 CPWD specifications clause no. 13.1.2 is to be followed.

2.2.2 All putlog holes in brickwork and junction between concrete and brickwork shall be properly filled in advance with concrete. Joints in brick work shall be raked about 10 mm if not raked during the masonry work and concrete surface shall be hacked to provide grip to the plaster. **Hacking of concrete should be done after immediate the deshuttering the concrete.** 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.

2.2.3 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.

2.3 Application of plaster and finish of plaster

2.3.1 CPWD specifications clause no. 13.1.4, 13.1.7 shall be followed.

1.1.1 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.

1.1.2 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.

2.3.4 CPWD specifications clause no. 13.2 is to be followed for floating coat of neat cement.

2.4 Thickness

2.4.1 CPWD specifications clause no. 13.1.5 shall be followed except the thickness of the plaster shall be as per the item description. **Thickness of plaster shall be average thickness with minimum 10 mm, at any point on the surface.**

2.5 Curing

2.5.1 CPWD specifications clause no. 13.1.6 shall be followed.

1) Precautions

2.6.1 CPWD specifications clause no. 13.1.8 shall be followed.

2.0 Workmanship for chicken mesh

2.1 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.

2.2 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.

2.3 The mesh shall be over lapped by 15 cms in the length while joining the two pieces of mesh and also at corners.

3.0 Mode of Measurement and Payment

3.1 CPWD specifications clause no. 13.1.9.1, 13.1.9.3, 13.9.5, 13.9.6, 13.1.9.7, 13.1.9.9 shall be followed except the plaster on moulded cornices and coves in curved shape not paid separately measured and paid as per actual area in sqmt.

3.2 Soffits of the stairs even folded stair also shall be measured as plastering on the ceilings.

3.3 The rates shall include for work at any height, position, shape 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 directed by engineer in charge.

The rates shall also include for all work in narrow width, 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 10 mm. x 10 mm to be formed in plaster at junction two different materials (skirting and plaster, dado and plaster, RCC and brickwork, around door window etc.) without any extra charge.

3.4 The rate shall be for a unit of one sqm.

Item No-5.02

Providing & laying average 18 mm thick mala finish cement plaster in two coats (internal plaster) on sides of masonry work / block wall / RCC wall at all heights, all shapes and all levels with 12 mm thick under coat in CM 1:4 (1 cement : 4 coarse sand) rough wired finish and 6 mm thick finishing coat in CM 1:3 (1 cement : 3 fine sand) mala finish (finished with steel trowel) scaffolding, finishing, curing, making grooves, forming pattas and drip mould, hacking RCC surface etc. complete, as directed by Engineer-In-charge. Chicken mesh shall be paid in relevent tender item.
(a) Internal Plaster
(b) External plaster

1. Material

1.1 Water

1.1 CPWD specifications clause no. 3.1.1 shall be followed.

1.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

1.2 Cement Mortar

1.2.1 CPWD specifications clause no. 3.2.1 shall be followed. The mortar of the specified mix using the type of sand described in the item shall be used.

2. Workmanship

2.1 Relevant specifications of item no. 5.01 shall be followed except internal cement plaster 15mm thick in two coats in cement mortar 1:4 without neeru finish.

2.2 10m under coat

Plaster has been brought to a true surface a wooden straight edge and the surface shall be left rough and furrowed 2 mm deep with a scratching tool diagonally both ways, to form key for the finishing coat. The surface shall be kept wet till the finishing coat is applied. Before the first coat of surface hardens roughing shall be done to receive the second coat. Second coat shall be applied only after minimum curing of 72 hours.

2.7 5 mm Finishing Coat

The finishing coat shall be applied after the under coat has sufficiently set but not dried and in any case within 48 hours.

3. Mode of Measurement and Payment

The rate shall be for a unit of one sqm.

Item No-5.03

Providing material and labour for laying average 18mm thick double coat (water proof) smooth/ wired finish cement plaster on sides of masonry work/ block wall/ RCC wall, 12 mm thk first coat in CM 1:3 (1 cement : 3 coarse sand) by spraying , second coat of 6 mm of CM 1:3 (1 cement : 3 fine sand) and mixing Integral waterproofing liquid admixture for mortar in recommended proportions in both coats, finishing the surface wired finish/ smooth finish with a floating coat of neat cement slurry at 2.75 Kg/ sqm to receive the tiles for all floors, all shapes and all height including hacking to RCC surface, scaffolding, curing etc. complete for all floor, all height as directed by engineer-in-charge. Cement slurry admixed with Integral waterproofing liquid admixture for mortar in recommended proportions is to be applied before each coat and final finishing coat.

Material

1.1 Relevant Technical specifications of item no. 5.01 shall be followed.

1.2 The water proofing compound shall conform to IS 2645-latest version. It should be chloride free, corrosion nhibitor, Hydrophoper and water reducer. It shall be compatible with all types of cement. It should be able to reduce water absorption and dampness. It shall be highly water-tight against water head pressure. It shall be able to reduce efflorence, salt petering, and fungus growth. It shall be of approved make as approved by Architect.

31.2 It should be non-flammable, non-toxic and eco-friendly. It should be able to reduce shrinkage. It should be able to increase plastic workability.

1.0 Workmanship

1.1 Relevant technical specifications of item no. 7.01 shall be followed except thickness of the plaster will be 15 mm and water proofing material such as Hydroshield liquid of ConTech Chemicals or CICO no.1 or equivalent shall be added to the cement at the rate specified by the manufacture specification or as approved by the engineer-in-charge.

2.0 Mode of Measurement and Payment

2.1 The payment shall be made for 18-20 mm. thick waterproof plaster work as per the relevant specifications of item no. 5.01. The rate shall include the waterproofing material as per manufacture's specification.

2.2 The rate shall be for a unit of one sqm for plaster work using water proofing materials such as Hydroshield liquid of ConTech Chemicals or CICO no.1 or equivalent in recommended proportions by manufacture.

Item No-5.03

Providing material and labour for fixing G.I. hexagonal chickenmesh 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 surfaces including necessary "U" nails/ screws/ washers with cleats for fixing, overlaps, curing, scaffolding etc complete for all floors/ all levels/ all heights/ all shapes as per direction of Engineer-in-charge.

1.0 Material:

GI Hexagonal Chicken wire mesh confirming to latest revision of IS 16014 having openings 20 mm. x 20mm of 22 gauges shall be used with 200mm minimum width as directed.

2.0 Workmanship:

2.1 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.

2.2 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 minimum 100mm mesh is provided on either side of the joint. The mesh shall be fixed with both the elements with the help of “U” nail/ screws/ washer with cleats. Drilling shall be carried out if required in RCC member.

2.3 The mesh shall be over lapped by 15 cm in the length while joining the two pieces of mesh and also at corners.

3.0 Mode of measurement:

The item shall be measured and paid in Sqm. Only clear visible area shall be measured and paid. No extra payment shall be done for over lapping of mesh and wastage.

WATER PROOFING WORKS

Item No-6.01
TERRACE WATER PROOFING
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 upto 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 upto 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 fibre cloth of approved quality in top layer of plaster and finally Finishing the surface to make wired finish with average 12-20 mm thick jointless 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 Material

1.1 Water
1.1.1 CPWD specifications clause no. 3.1.1 shall be followed.
1.1.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

1.2 Cement Mortar
1.2.1 CPWD specifications clause no. 3.2.1 shall be followed. The mortar of the specified mix using the type of sand described in the item shall be used.

1.3 Cement
1.3.1 CPWD specifications clause no. 3.1.2 shall be followed.

1.3.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

1.3.3 Reduction of strength of cement with passage of time

Reduction of strength at 28 days of concrete made from fresh and stored cement

Sr.no.	Storage Period of Cement	Strength Reduction
1.	Fresh	NIL
2.	3 months old	20%
3.	6 months old	30%
4.	12 months old	40%
5.	24 months old	50%

1.3.4 Stored cement can be used only upto the 3 months from the date of manufacture. After 3 months cement is to be used after prior permission of the consultant.

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1.4 Brickbats

Brick Aggregate shall be obtained by breaking well burnt or over burnt dense bricks/ brickbats. They shall be homogeneous in texture, roughly cubical in shape and clean. They shall be free from unburnt clay particles. Soluble salt, silt, adherent coating of soil, vegetable matter and other deleterious substances such aggregate should not contain more than one percent of sulphates and should not absorb more than 10% of their own mass of water, when used in cement concrete and 20% when used in lime concrete. It shall conform to IS : 306 – 1983 unless otherwise specified.

1.5 Water Proofing Compound

1.5.1 The water proofing compound shall conform to IS 2645-latest version. It should be chloride free, corrosion inhibitor, Hydrophoper and water reducer. It shall be compatible with all types of cement. It should be able to reduce water absorption and dampness. It shall be highly water-tight against water head pressure. It shall be able to reduce efflorence, salt petering, and fungus growth. It shall be of approved make as approved by Architect.

1.5.2 It should be non-flammable, non-toxic and eco-friendly. It should be able to reduce shrinkage. It should be able to increase plastic workability.

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 which is also to be signed by the specialized agency. However, soul responsibility shall be of main contractor for any leakages.

2.2 Copy of work order mentioning the rate issued to the specialized agency shall be attached with guarantee bond.

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."

2.3 **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**.

2.4 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.

2.5 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.

2.6 The slab surface shall be washed with water and cement slurry mixed with water proofing compound as manufacture's specification as directed by engineer-in-charge shall be applied over the slab including adjoining walls upto 300 mm height including cleaning the surface before the treatment.

2.7 20 mm thick cement mortar 1:5 admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge to required slope and treating similarly the adjoining walls upto 300 mm height including rounding of junctions of walls and slabs.

2.8 The surface treated shall have a minimum slope of 1 in 120 or as specified in the drawing.

Brickbats of varying size (25 mm to 115mm) as per requirement shall be arranged in proper gradient with cement mortar 1:5 according to desired slope.

2.9 After three days of proper curing applying a second coat of cement slurry admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge.

2.10 Finally the surface is finished with to make wired finish with 12 mm thick joint less cement mortar of mix 1:4 (1cement :4 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by engineer-in-charge.

2.11 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.

2.12 At places of construction joints and 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.

2.13 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.

2.14 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.

2.15 For cast iron drain outlets, a groove shall be cut all around to touch the treatment.

2.16 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.

2.17 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.

2.18 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.

2.19 In case of existing R.C.C. and stone wall cutting the chase for tucking in the water proofing treatment is not recommended.

2.20 At the junction between the terrace slab and vertical face of the parapet wall, a fillet 75-100 mm. in radius shall be constructed.

2.21 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.

2.22 Outlet at every low dividing wall about less than 300 mm. in height shall be rounded smooth and corners rounded off or easy application of water proofing treatment.

2.23 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 Measurement 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 / rounding off treatment including flashing / rounding 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 The item shall be measured and paid in sqm.

3.6 The work is to be got done through approved specialized agency.

Item No-6.02
Toilet & Wet area
Providing and applying Two-part acrylic polymer modified cementitious elastomeric waterproof coating having minimum 1 N/mm2 tensile strength, at minimum 1.5mm thickness DFT, and shall cover 2.2 kg / sq.m. The coating shall have an elongation of a minimum of 80% when tested as per ASTM D 412, resisting 5 bars hydrostatic pressure as per DIN 1048 and having crack bridging ability of up to 2mm. Thorough surface preparation by mechanical means to level and plain the surface of walls and floors of the toilet areas. All cracks and crevices to filled and made good to receive waterproofing coating treatment The coating shall cover all the floor area of the wet area (toilet) and be applied over on to the vertical walls for a height of 4 feet above the floor. The periphery of the toilet floor shall be additionally reinforced with an extra third coat of the coating with a fiber band sandwiched between the first and the second coat, which shall also done around protrusions (pipes) meant for plumbing purpose. The last coat when wet, shall be sprinkled with clean and washed sand, to facilitate the floor screed or plaster.
Pipes being fixed for plumbing shall be fixed in holes which are mechanically core cut, more than the dia of the pipes. Pipes shall be fixed by grouting the annular space with non-shrink cementitious grout of proprietary make. Before grouting the pipes shall be wrapped with a two-way self adhesive tape at least 2 inches wide and then grouted to fill in the grout, ensuring total watertight plumbing fittings. Contractor shall submit methodology statement with all detail in illustrative sketch form and get approved from Engineer in charge. Application shall be carried out by approved applicator of manufacture and as per recommended by manufacturer. Applied area of cementitious elastomeric coating (horizontal and vertical) shall be measured for payment.

Material:

Elastomeric Polymer modified cementitious waterproofing compound shall be with following technical specifications and applied as per manufacturer’s specification.

The coating shall have an elongation of a minimum of 80% when tested as per ASTM D 412, resisting 5 bars hydrostatic pressure as per DIN 1048 and having crack bridging ability of up to 2mm.

1.0 Method of Application:

1) Cleaning the slab to remove loose dust, dirt, oil, debris (sunken slab for toilet or balcony) with water jetting, saturating the slab with water.

2) Repairing of cracks (if any) with using polymer modified mortar, carry out cementitious injection grouting at leakage points modified with Plasticized Expansive Grout Admixture as per manufacturer's specification.

3) Carry out / making 50 mm thick cement mortar (1:3) vata/ fillet and modified with Polymer bonding agent at dosage of 2.5 Ltr per 50kg cement.

4) Pipes being fixed for plumbing shall be fixed in holes which are mechanically core cut, more than the dia. of the pipes. Pipes shall be fixed by grouting the annular space with non-shrink cementitious grout of proprietary make. Before grouting the pipes shall be wrapped with a two-way self-adhesive tape at least 2 inches wide and then grouted to fill in the grout, ensuring total watertight plumbing fittings.

5) Applying first coat of Elastomeric Polymer modified cementitious waterproofing compound as primer coat as per manufacturer's specification.

6) Laid 45 gsm fiber mesh (alkali resistant) on first layer of coating become sandwich between two layers.

7) Apply second coat of Elastomeric Polymer modified cementitious waterproofing compound by brush or roller so as fiber mesh is completely covered.

8) Coating shall be applied over on to the vertical walls for a height of 4 feet above the floor.

9) The last coat when wet, shall be sprinkled with quartz sand, to facilitate proper bonding the floor screed or plaster.

   Total water proofing system with hole/bore packing shall be applied by approved applicator of approved manufacturer's only with 10 years composite guarantee against leakages of total water proofing system to be provided by the contractor/ applicator and manufacturer.

2.0 Mode of Measurement and Payment :

The rate includes cost of all materials and labour required to carry the works as per the above specifications. The rate also includes cleaning surface and treating the cracks, joints, providing vata/ fillet and modified with bonding agent, bore/ hole packing treatment etc shall not be paid separately.

Applied area (horizontal & vertical) of coating shall be measured for payment.

The rate shall be unit of Sqm.

Item No-6.03
Providing and laying average 65 mm thick IPS, water proof cement concrete flooring in 1:1:2 (1 Cement : 1 Sand : 2 Graded Aggregate 10mm Nominal size) to RCC water tanks floor, sump floor etc at all heights in line, level and gradient including mixing water proofing compound of approved make in recommended proportions and leaving the surface rough wired finish to receive any type of flooring / smooth finish, curing etc complete as directed by Engineer in charge.

1.0 Material :

1.1 Cement Concrete

1.1.1 CPWD specifications clause no. 11.2.1 shall be followed.

2.0 Workmanship

2.1 CPWD specifications clause no. 11.2.2, 11.2.3, 11.2.4, 11.2.5, 11.2.6, 11.2.7 shall be followed except rate is inclusive of providing and fixing glass strip or any type strip.

2.2 The cement concrete flooring of 40mm thickness 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 be carried out on a watertight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in color 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 of 300x300 mm 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.

2.3 The form work shall be provided if necessary as directed by Architect. Concreting shall be done as per alternate bay method with necessary centering.

2.4 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 a 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 depends 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. 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.

3.0 Mode of measurement and Payment

CPWD specifications clause no. 11.2.8, 11.2.9 shall be followed. Rate shall be inclusive of glass strips or any type of strips. The rate shall be unit of Sqm.

Item No-6.04
Water proofing & Insulation for terrace/balcony
Providing and applying single component, elastomeric, PU coating to be applied at required consumption to achieve a minimum 1.5mm DFT with required coat (minimum 2 coat) uniformly spread in entire area. System shall be executed as follows:
1) Surface preparation shall be done as per manufacturer specifications followed by single component PU water proofing coating
2) Repairing cracks on mother roof slab, repairing cracks by cutting & making V grooves in 25x25 mm, and filling with a polymer modified sand-cementitious mortar, of 1:3 proportion and filling the groove with CM (1:3) mixed with an active polymer content @10% by weight of cement content, excluding the water in the latex polymer

3) making fillet with polymer modified mortar or as per manufacturer of size 50mm x 50mm

4) Supplying and applying a base coat of one component polyurethane based waterproofing coating, having elongation > 400%, crack bridging ≤ 2 mm, tensile strength of > 2.0 Mpa, minimum DFT 1.5mm (as per ASTM D 412), at the corners above the mother slab of roof and over the concrete haunches provided in the periphery of the slab at the junctions of the parapet wall.

5) Supplying & laying 300 gsm Geotextile (non woven polyester) over the entire membrane maintaining proper overlaps of 100 mm.

Screed /filling shall be laid as required by site condition and shall be paid in relevent tender item.

Contractor shall submit methodology statement with all detail in illustrative sketch form and get approved from Engineer in charge. All material from single manufacturer. Application shall be carried out by approved applicator of manufacture and as per recommended by manufacturer. Actual applied area of PU coating with PU foam insulation shall be measured for payment.

1.0 Material:

1) PU coating on mother slab – a base coat of one component polyurethane based waterproofing coating, having elongation > 400%, crack bridging ≤ 2 mm, tensile strength of > 2.0 Mpa, minimum DFT 1.5mm (as per ASTM D 412)

2.0 Method of Application:

1) The cleaning and preparation of the substrate on which the waterproofing coating is applied as follow.

- Cleaning the surface, removing laitance ensuring substrate shall be free from dust by mechanical means
- Grinding of the substrate, ensuring substrate shall be free from any coating, oil or other contaminants that interferes to the bond or membrane with concrete.

2) Repairing cracks on mother roof slab, repairing cracks by cutting & making V grooves in 25x25 mm, and filling with a polymer modified mortar, of 1:3 proportion and mixed with an active polymer content @10% by weight of cement content, excluding the water in the latex polymer

3) Making fillet with polymer modified mortar or as per manufacturer of size 50mm x 50mm

4) Supplying and applying a base coat with primer application of one component polyurethane based waterproofing coating, having elongation > 450% and tensile strength of > 2 Mpa, applied at 1.5 kg/ sq.m. (as per ASTM D 412), at the corners above the mother slab of roof

and over the concrete haunches provided in the periphery of the slab at the junctions of the parapet wall

7) Supplying & laying 300 gsm Geotextile (non-woven polyester) over the entire membrane maintaining proper overlaps of 100 mm.

8) Screed shall be minimum M25 grade shall be laid with reinforcement as per design. Screed shall be minimum 65mm thick at khurra/drain point complying with BS 8204. Pipe penetrations and RCC top level shall match.

Total water proofing system shall be applied by approved applicator of approved manufacturer's only with 10 years composite guarantee against leakages of total water proofing system to be provided by the contractor/ applicator and manufacturer.

3.0 Mode of Measurement and Payment:

The rate includes cost of all materials and labour required to carry the works as per the above specifications. The rate also includes cleaning surface and treating the cracks, joints, providing vata/ fillet, vertical and horizontal protection.

Rate quoted shall be for all places all heights and at all levels.
Actual area covered (horizontal & vertical) shall be measured once in sq meter as a system i.e. both layer of polyurethane coatings polyurethane form and geotextile shall not be measured separately.

Trowel finished protection screed concrete laid to required gradient and reinforcement shall be paid separately in relevant tender. SRI coating shall be paid in relevant tender item**.**

The rate shall be unit of Sqm.

Item No-6.05
Providing and filling light weight AAC bats (of size 40-60 mm) with cement mortar mixed in the ratio 1:3:6 (1 cement : 3 coarse sand : 6 block bats) including mixing of approved water proofing compound in recommended proportion. The laid AAC bat mix shall be well rammed and compacted as required. Further surfaces shall be screeded with cement concrete mix 1:1.5:3 (1 cement : 1.5 coarse sand : 3 stone grit of size 6 mm and below by volume) admixed with approved integral water proofing compound in recommended proportion, laid to an average thickness of 25mm and finished smooth or ready to receive finish material as specified. Care shall be taken prior to filling all pipes passing through sunk portion such that the pipes are pressure tested by maintaining pressure for 24 hours and junctions of pipes passing through walls, slabs are well grouted and sealed.

This shall be tested by ponding water for required depth and maintaining for 72 hours. (Rate includes cost of AAC bats, cement mortar, top screed, labour charges for working at all levels, leads and heights). For payment the area of sunken slab and the depth of filling including the thickness of screed shall be measured.

1. **Materials:**
   Relevant specifications shall be followed as per CPWD specification Vol – I clause – 4.1 & 4.2 except that the Autoclave Aerated Concrete Block chips/bats shall be used as coarse aggregates instead of stone aggregates.

2. **Workmanship**
   Relevant specifications shall be followed as per CPWD specification Vol – I clause – 4.1 & 4.2 except that the Autoclave Aerated Concrete Block chips/bats shall be used as coarse aggregate instead of graded stone aggregate. The concrete shall be compacted with iron rammer.

3. **Mode of Measurement:**
   In total thickness of sunk, 25mm thick top layer shall be consist of cement concrete mix 1:1.5:3 (1 cement: 1.5 coarse sand: 3 stone grit of size 6 mm and below by volume) admixed with approved integral water proofing compound in recommended proportion.
   And remaining bottom thickness shall be AAC block filling.
   Total quantity (of both layers) shall be measured and paid in cum.

   The rate shall be for a unit of one cum.

FLOORING WORK

Note -
1) Stones shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for all kind of stone work.
2) All natural stones shall be selected and sorted for uniform colour, figure and thickness and approved by Architect and Engineer in charge prior to procurement.
3) Stone shall be from same lot and/ or source (stone quarry) for same kind of work and as approved by Architect and Engineer in charge.
3) All type of loose and laid sample of flooring shall be approved by Architect and Engineer in charge.
4) Stone work shall be carried out for all level, all height/ depth, all places including loading, unloading, stacking, transporting, hoisting, by any means (mechanical or manual).

Item No-7.01
Providing and laying 9 to 10 mm thick, full body Vitrified tiles of 600x600mm size of required finish (satin/ matt/polished/ anti skid) of approved make and shade in flooring as per drawings laid over 40 mm (average) base of cement mortar 1:4 (1 cement : 4 coarse

sand) and fixed with cement slurry with matching pigment or cement based high polymer modified quick-set tile adhesive (Water based) conforming to IS: 15477, in minimum 6 mm thickness including provision groove upto 5 mm wide and grouting with Epoxy grout of approved make and shade including curing, cleaning with mild oxalic acid, maintaining till handling over the project, etc complete as directed by Engineer-in-charge for all floors/ any height/ any levels. Grouting the groove shall be paid in relevant tender item. Sample shall be approved before procurement of material.

Relevant specification shall be as per CPWD specification clause no – 11.16, 11.17 except the tile shall be fixed with cement based high polymer modified quick-set tile adhesive (Water based) conforming to IS: 15477 and type, color, size, thickness, pattern and finishing of vitrified tile shall be as per item description.

The tiles shall be laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand), fixed with cement based high polymer modified quick-set tile adhesive (Water based) conforming to IS: 15477, in minimum 3 mm thickness including provision groove up to 5 mm wide and grouting with epoxy grout of approved make and shade. Grouting the groove shall be paid in relevant tender item.

Rate shall be for unit of One Sqm.

Item No-7.02

Providing material and labour for laying 9 to 10mm thick, Vitrified tiles of 600x600mm size of required finish (satin/ matt/polished/ anti skid) of approved make and shade in wall tile, dado, skirting, risers of steps, as per drawings. Wall tile is to be fixed over 10 to 12 mm thick smooth finish plaster in cement mortar 1:3 (1 cement: 3 coarse sand) and fixed with cement based high polymer modified quick set tile adhesive (water based) conforming to IS : 15477, in average 6 mm thickness, including provision of groove, grouting of joints, finishing of joints, curing etc complete for all floors any heights, any lead and lift as directed by Engineer In charge. Plaster shall be inclusive but Grouting shall be paid in relevant tender item. Sample shall be approved before procurement of material.

Relevant specification shall be followed as per CPWD specification 2019 Vol – I, clause – 11.16 full body vitrified tile in required finish of size 600 x 600 mm (minimum 8mm thickness) and full body vitrified tile in required finish of size up to 1200mm x 800 mm x min 12mm thick Vitrified tile shall be of approved make, shade and texture except the tile shall be fixed with cement based high polymer modified quick-set tile adhesive (Water based) conforming to IS: 15477 and type, color, size, thickness, pattern and finishing of vitrified tile shall be as per item description.The rate shall be for unit of One Sqm.

Item No-7.03

Extra for Providing and Grouting the joints of flooring/ dado tiles having joints of 3 mm width in total thickness, using epoxy grout mix of 0.70 kg of organic coated filler of desired shade (0.10 kg of hardener and 0.20 kg of resin per kg), including filling/ grouting and finishing complete as per direction of Engineer-in-charge.

Relevant specification shall be followed as per CPWD specification clause no – 11.29 for epoxy grout except type, color, size, thickness, pattern and finishing of stone shall be as per item description.

Rate shall be for unit of One Sqm.

Item No-7.04

Providing & laying broken china mosaic flooring for plain and curved surfaces, comprising of 12 to 20 mm size broken pieces of glazed tiles (one or more colours, as directed) of Somany, Asian, Johnson or equivalent, laid over cement mortar 1:3 bedding including applying cement slurry at the rate of 2.75 kg per sqm on plain or sloped surfaces. The flooring/ dado shall be tampered with wooden rammer not exceeding 2 Kg in weight to bring the mortar up to the surface, including rounding of the junctions and extending them upto 30 cm. along the parapet wall. The rate shall include any type of bands, vata, any colour, any pattern or design as per drawing, curing, cleaning with water and oxalic acid etc. complete as sample approved by Architect/ EIC. (Only plan area shall be measured and paid). Rates should be inclusive of acid washing and vata.

1.0 Material

1.1 Cement Mortar

1.1.1 CPWD specifications clause no. 3.2.1 shall be followed.

1.2 China Mosaic

1.2.1 China mosaic shall be from broken pieces of white glazed tile. 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 for the execution.

1.3 White Cement

1.3.1 White cement shall conform to IS: 8042.

2.0 Workmanship

2.1 The sub-grade shall be cleaned, wetted and mopped. The cement slurry @2.75kg/sqm (with polymer based waterproofing & bonding 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.

2.2 Broken pieces of white china mosaic shall be soaked for 24 hours before laying. 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.

2.3 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.

2.4 Vatta shall be done along with the floor keeping machine cut edges at the top end of the vatta.

2.5 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.

2.6 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

3.1 The rate shall be for a unit of one sqm and shall be measured wall to wall in plan. Length and breadth shall be measured correct to a cm and area shall be measured in sqm correct to two places of decimal. No extra measurement shall be given for rounding off up to 15cm. The rate of white cement is included in the item even if grey cement is supplied by the client.

Item No-7.05

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 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 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 reuired size. Sample and mockup shall be approved before procurement of material.

1.0 Material

1.1 Kota Stone

1.1.1 The kota stones shall be of selected quality, hard, even, sound, dense and homogeneous in texture free from cracks, decay and weathering and flaws. They shall be hand or machine cut to the requisite thickness. They shall be of color as indicated in the drawings or as instructed by engineer-in-charge.

1.1.2 The slabs shall conform to the size required. Before starting of the work the contractor shall get the samples of the slabs approved by engineer-in-charge.

1.1.3 Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth and so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane.

1.1.4 The thickness of the slab after it is dressed shall be 25 mm as specified in the description of the item. Tolerance of ± 2 mm shall be allowed for the thickness. In respect of length and breadth of slabs tolerance of ± 5 mm for hand cut slabs and ± 2 mm for machine cut slabs shall be allowed.

1.2 Cement Mortar

CPWD specifications clause no. 3.2.1 shall be followed.

2.0 Workmanship

2.1 For dressing CPWD specifications clause no. 11.21.2 shall be followed.

2.2 For laying and preparation of surface CPWD specifications clause no. 11.21.3 shall be followed except average thickness of CM shall be 40 mm, cement mortar shall be 1:6 (1 cement : 6 sand) used.

2.3 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.

2.4 All necessary slopes, gradients and levels shall be truly maintained as required and directed by the Architect and Engineer-in-charge.

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

2.6 **Polishing** shall be normally commenced after 14 days of laying the slab. For special polish polishing to be done with 2 coats of 60, 120 grades of emery, balckchapadi and gutka. For semi

mirror polish polishing to be done with 220, 320, 400, 600 grades of emery. 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.

2.7 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.

3.0 Mode of Measurement and Payment

3.1 Kota slab flooring shall be measured in $m^{2.}$ for visible area of work done. Length and breadth shall be measured correct to a cm before laying skirting, dado or plaster.

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. Kota 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 rate shall be for a unit of one sqm.

Item No-7.06

Providing & laying average 25 mm thick machined cut green river wash finish green kota stone of required size, approved quality, selected and sorted for uniform color & texture, in floor, otta etc., in required sizes and pattern (straight or staggered joint with square or rectangular shaped stone) and drawings (with grooves of 10mm wide or without grooves). Kota stone is to be laid over cement mortar 1:5 bedding of average 40 mm thickness with joints, pointing and finishing and filling the grooves with CM 1:2 as sample approved, including curing and cleaning with wire brush to remove excess cement on the sides of stone upto the satisfaction of the Architect & Engineer-in-charges etc. complete.

Relevant Technical specifications of item no. 7.05 shall be followed except the kota shall be of riverwash finish in floor, otta etc. as per item description. The rate shall be for a unit of one sqm.

Item No-7.07

Providing & laying 8 to 10 mm thick Kota stone slabs in upto 100mm high skirting, (flush with plaster) laid on average 10 mm thick cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs/ stone fixing adhesive, including providing 10mm wide grove between skirting and plaster, rubbing and polishing complete as directed by Engineer In charge. Sample shall be approved before execution. Kota stone shall be in uniform shade of reuired size. Sample and mockup shall be approvd procurement of material. Shade and joint of skirting must be match with flooring stone.

Relevant Technical specifications of item no. 7.06 shall be followed except application and thickness shall be as per item description. The rate shall be for a unit of one sqm.

Item No-7.08

Providing material and labour for laying average 25 mm thick machine cut polished Green kota stone slab of size upto 2.1mt length with uniform thickness for tread, riser, window jambs & sills, coping over 20 mm (average) thick base of cement mortar 1:6 (1 cement : 6 coarse sand) laid over and jointed with gray cement slurry including pencil sharped exposed edges, polishing, rubbing, curing, finishing, buffing after final polishing, maintaining upto handling ovre 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 Incharge. Sample and mockup shall be approvd before procurement of material.

Relevant Technical specifications of item no. 7.07 shall be followed except application and thickness shall be as per item description. The rate shall be for a unit of one sqm.

Item No-7.09

Providing roughened strip 2.5 cm. wide to form antiskid surface on floors & treads as per design, including forming straight deep curved gishi (groove), 6 mm. Wide & 4 mm deep on two sides of the roughened area, chiseling, polishing the edges, sides and bottom of gishis etc. complete as per sample approved. One time length od steps/ treads shall be considered foe payment.

1.0 Workmanship

The roughened strip 2.5 cm wide shall be provided as and where directed. The roughing strip shall be carried out by providing two curved grooves on either side of roughed strip provided with machine and polishing the same and as per sample approved.

2.0 Mode of measurement and Payment

The length of the groove and roughened strip clearly visible shall be measured. The rate shall be for a unit of one meter. Two gishis and roughened strip including polishing the ghisis shall be considered as one single unit.

Item No-7.10

Providing material and labour for fixing machine cut average 18mm thick mirror polished Granite stone slab of approved shade as per approved sample for dado, cladding, skirting etc., in required design and pattern as per drawing, laid on 12mm thick cement mortar 1:3 (1 cement : 3 coarse sand) and jointed with white cement slurry @ 3.3 kg/sqm including pointing with white cement slurry admixed with pigment of matching shade, or fixed with stone fixing adhesive as per manufacturer's specifications including mirror polishing, pencil sharped edges, edge polishing, rubbing, curing, finishing, necessary scaffolding, maintaining upto handling over the project etc complete for all floors any heights, any lead and lift etc complete as directed by Engineer Incharge. Item shall be inclusive of providing and laying of backing coat plaster. Shade of skirting must be match with flooring stone.

1.0 Material

1.1 Granite Stone

1.1.1 Granite shall be of approved color 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 color. It shall be without any soft veins, cracks or flaws.

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

1.1.3 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.

2.0 Workmanship

2.1 CPWD specifications clause no. 11.19.3 is to be followed.

2.2 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.

2.3 The holes required for Nahni traps, pipes any other fittings shall be made without any extra cost.

3.0 Mode of Measurement and Payment

3.1 Item shall be measured in $m^{2.}$ for visible area of work done. Length and breadth shall be measured correct to a cm before laying skirting, dado or plaster.

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. Kota 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.

3.9 The treads of stairs and steps paved with tiles without nosing shall also be measured under this item.

3.10 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.

3.11 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.

3.12 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.

3.13 The basic rate, if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

3.14 The cladding, skirting or dado shall be measured in m^2. Length shall be measured along the finished cladding, 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.

3.15 The rate shall be for a unit of one sqm.

Item No-7.11

Providing and fixing both side mirror polished average 18mm thick best quality Granite stone slab as per sample approved by Engineer in charge with edges rounded and mirror polished, of required size fixed as urinal partitions/ wash basin counter by cutting a chase of appropriate width with chase cutter and embedding the stone in the chase with epoxy grout or with cement mortar 1:2 (1 cement : 2 coarse sand) as per drawing and as per direction of Engineer-in-charge. All expose edges shall be champhered and mirror polished. Rate shall be inclusive of chasing, cutting, edge champhering, edge polishing, making holes (if required), curing, finishing, maintaining upto handling ovre the project etc complete for all height. The work shall be carried out as per the approval of Engineer-in-charge. Only finished granite work shall be measured.

1.0 Material

1.1 Granite Stone

1.1.1 Granite shall be of approved color 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 color. It shall be without any soft veins, cracks or flaws.

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

1.1.3 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.

2.0 Workmanship

2.1 CPWD specifications clause no. 11.19.3 is to be followed except grade of cement mortar shall be as per item description.

2.2 Polishing shall be normally commenced after 14 days of laying the slab. For special polish polishing to be done with 2 coats of 60, 120 grades of emery, balckchapadi and gutka. For semi mirror polish polishing to be done with 220, 320, 400, 600 grades of emery. 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.

2.3 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.

2.4 The holes required for Nahni traps, pipes any other fittings shall be made without any extra cost.

3.0 Mode of Measurement and Payment

3.1 Item shall be measured in $m^{2.}$ for visible area of work done. Length and breadth shall be measured correct to a cm before laying skirting, dado or plaster.

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 the granite in composite pattern as per the drawings.

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 a unit of one sqm.

Item No-7.12

Providing material and labour for laying sandwich platform comprising of a) Sandwich of 18 mm thick single side polish Granite of approved size, shade and sample on top and 30 mm thick polished kota in bottom with 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 curing, making holes & cutouts for sink, wash basin, Piller tap/ Bib tap but excluding the cost of MS work, plumbing fixtures ans sink. at all floors all height etc complete as directed by Engineer Incharge. (Only plan area shall be measured & paid for). Rate shall be included all kota & granite mentioned in above.

Relevant Technical specifications of item no. 7.05 and 7.10 shall be followed except application and thickness shall be as per item description. The rate shall be for a unit of one sqm.

STRUCTURAL STEEL WORK

Item No-8.01

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 as per latest IS 4923, IS 1161, IS 806 for the work of Railing, Handrail, duct platform, ladder, grill, gate, framework of GRC Jali and similar works etc. including cutting and welding the members as per detailed drawing and design. The rate shall include sand blasting, degreasing (wet cleaning) & preparation of rust free surface manually or mechanically, metal putty to make the surface even and smooth, 1 coat of epoxy primer and 2 top coats of Metal PU Paint of having DFT 40 to 50 micron of approved make and shade as per manufacture's specification 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 by the contractor for the approval of the architect.

Rate shall be inclusive of cutting, wastage, welding, bending (shop at site), and bolting wherever necessary, in position welding of required length, grinding, finishing edges, and filling the welded spots with metal putty. Rate shall be inclusive of 5 years guarantee against corrosion.

The fabrication work shall start after approval of finished sample as per drawing by Architect.

Rolled steel sections, bars, RHS, SHS, tubular hollow sections, plate, bolt etc. as approved by engineer in charge & as per drawing.

1 Material

1.1 Structural steel

CPWD specification clause no. 10.1.1 shall be followed.

2 Workmanship

2.1 Laying Out

CPWD specifications clause no. 10.3.1 shall be followed.

2.2 Preparation of Surface

Surfaces which are to be welded together shall be free from loose mill scale, rust paint, grease or foreign matters. A coating of linseed oil shall be permitted.

2.3 Fabrication

CPWD specifications clause no. 10.3.2, 10.4.2.1, 10.4.2.2, 10.4.2.3 10.4.2.4, 10.4.2.5, 10.4.2.6 shall be followed.

2.4 Erection

CPWD specifications clause no. 10.3.3, 10.4.2.7 shall be followed. Grouting shall be done with cement mortar 1:3 (1 cement: 3 coarse sand) or non shrink free flow cement grout of approved make as per manufacture's specification as directed by engineer-in-charge.

2.5 Precautions

2.5.1 CPWD specifications clause no. 10.4.2.3 shall be followed.

2.5.2 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 or as per approved make.
(g) The drilling is to be done with drill or magnetic drill.

2.5.3 The defective welds which shall be considered harmful to the strength shall cut out and rewelded.

2.5.4 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.

2.5.5 All the members shall be thoroughly cleaned of rust, cakes, dust etc. and given a priming coat of PU before fixing them in position. All fabricated members shall be suitably packed to be protected from any damage while transportation, if any.

2.5.6 grinding to the finished level is to be done, if directed by 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.

2.5.7 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

2.6 Painting

2.6.1 CPWD specification clause no. 10.4.2.8 shall be followed except paint shall be as per Item description.

2.6.2 First priming coat of zinc chromate yellow oxide is to be applied on the fresh steel arrived at site.

2.6.3 Once the cutting, fabrication, grinding work gets completed second coat of epoxy primer and first coat of PU paint is to be applied on the priming coat.

2.6.4 After paint has been already dried erection is done as specified in the item or as directed by engineer-in-charge.

2.6.5 After the erection final coat or second coat of paint is to be applied on the structural steel.

3.0 Mode of Measurement and Payment

3.1 For welded and bolted sections, CPWD specification clause no. 10.3.5, 10.4.3 shall be followed except in case of skew cut if the balance material is used at other place, same shall be deducted from quantity of skew cut i.e. Used wastage from skew cuts shall be deducted from it's quantity and shall not be paid in skew cut**.**

3.2 The weight of steel plates, sections 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 actual weight basis on which steel is supplied to the Contractor by the Client. If the steel is supplied by the client, testing & checking as per relevant IS code, recording and intimation of quality of steel (to client and consultant) shall be sole responsibility of the contractor.

3.3 For forged steel and steel castings, weight shall be calculated on the basis of 7850 kg/m3.

3.4 Rolling Margin and wastage shall not be considered when weight is determined by standard weight on the basis of IS codes.

3.5 The rate includes cost of all material, labor involved in all operations as described above like erection, hoisting, scaffolding, painting as specified in item description, safety measures and sundry required for proper completion of the item of work, at all heights, all shapes and all

places. This shall also include conveyance and delivery, handling, loading, unloading and storing etc. required for completion the item described above including necessary wastage involved.

3.6 The rate shall be for a unit of one Kg.

Item No-8.02

Providing and fixing stainless steel (Grade 316) Railing and baluster modular system of approved make stair railing, hand rail, or similar with knock down system in liner or curveliner shape made of Hollow or solid section i.e. tubes, square, flat, plates, bar etc with base plate, cover cap, finishing accessories, in-filled holding brackets, fixing accessories etc. for any type of design, shape (plain/ curvature), size as per drawing. Railing shall be top mounted or side/ wall mounted. Railing shall be fixed with SS 304 grade anchor fastener of required size and as per fixing position of approved make. Any kind of welding or fabrication shall not be allowed on site. Sample shall be approved before execution. Contractor shall submit the shop drawing base on concept drawing. As per approved shop drawing, contractor shall arrange mock up of railing system (2 or 3 no) in required length as directed by Architect and Engineer in charge. Contractor shall protect railing system up till handling over the project.

Rate shall be inclusive of fixing accessories and all type fastners but for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.

Relevant specification shall be followed as per CPWD specification Vol – I clause No – 10.20 except SS 316 shall be used instead of SS 304 grade steel.

Cost of fixing accessories i.e. anchor fastener, bolts, nuts shall not be paid separately.

Contractor shall submit shop drawing as per intent drawing as per tender document for all structural elements. Contractor shall also submit deign calculations for peer review approval for stability of element. Contractor shall getting approval of shop drawing before execution of work.

The rate shall be for unit of Kg. For payment purpose weight of installed SS member shall be considered excluding fixing accessories.

PAINT

Item No-9.01

Providing and applying Easy clean, Washable INTERNAL Plastic emulsion Paint of approved make, color & shade in three coats (first one coat with brush and final two coats with roller), on newly dry interior plastered surface at all heights, all floors, all levels complete to give an even shade, including required coats (minimum two coats) white cement based putty of Birla white/ Acrylic putty of approved make after thoroughly brushing the surfaces 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. Priming coat of alkali resistant cement primer (water or solvent based) is to be applied before commencement of painting etc. complete as directed by engineer-in-charge. Sample to be approved by Architect and Engineer in charge before starting of the work. The rates shall include the cost of filler for filling the cracks on surface for all floors/ any height/ any levels.

1.0 Materials :

1.1 Plastic emulsion paint shall conform to IS : 5411 of approved brand and manufacture and of the required shade shall be used.

1.2 The plastic emulsion paint is not suitable for application on external, wood and iron surface and surfaces which are liable to heavy condensation. These paints are to be used on internal surfaces except wooden and steel.

2.0 Workmanship

2.1 Scaffolding

2.1.1 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 painted. A properly secured strong and well tied suspended platform (Zoola) may be used for painting. 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 painting 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

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, algae or other foreign materials shall be removed by suitable chemical and vigorous brush. If the surface is cleaned with water than it should be allowed to dry before application of paint. In no case the finishing shall be allowed on damp course.

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 crevice, 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.

2.2.6 The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with IS: 2395 (Part-1)-1966.

2.28 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 paint 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 Preparation of Mix

2.3.1 This shall be done as per manufacture’s specifications.

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.

2.3.1 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.

2.3.2 The paint shall be applied with brush for 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.

2.3.3 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. complete.

2.3.4 The number of coats shall be as specified in the item. The paint will be applied in the usual manner with brush, spray or roller. The paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces and 2 to 3 hours on nonabsorbent surfaces.

2.3.5 The surface on finishing shall represent a flat velvety smooth finish. If necessary more coats will be applied till the surface presents a uniform appearance.

2.5 Precautions

2.5.1 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.

2.5.2 In the preparation of walls for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.

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

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

2.6 Protective measures

2.6.1 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 Measurement and Payment

Length and breadth shall be measured correct to a cm and area shall be calculated in sqm correct to two places of a decimal.

3.2 All the work shall be measured net in this item as in place subject to the following limits unless

otherwise stated herein after
(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.

3.4 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 opening

(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

3.5 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.

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

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 Rate

3.9.1 The rate includes cost of all materials, labors, 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. as directed by engineer in charge.

3.9.2 The rate shall be for a unit of one sqm.

Item No-9.02

Providing & applying External 100% Acrylic Paint of approved make, colour & shade in minimum three coats (first coat with external primer & balance two coat of paint as per manufacturer's specification) with brush on exterior sand faced plastered surfaces/ mala plastered surfaces at all heights/ all floors/ 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. The rate shall also include the cost of filler for cracks on the surfaces. Actual surface area shall be measured and considered without multiplying any coefficient for payment.

Materials: Water shall conform to

CPWD specifications clause no. 3.1.1 shall be followed.
CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.
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: 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 painted. A properly secured strong and

well tied suspended platform (Zoola) may be used for painting. 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 painting 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.

2.2.1 **Preparation of surface:**

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 manufacturer'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. 11.02 shall be followed.

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

Item No-9.03
Providing and applying external finish of average 2 to 2.5mm thick acrylic polymer based texture of approved make 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 seperate tender item. (Item should be executed by approved applicator only.)

1.0 Textured Wall Finish
1.1 Material shall be as per manufacturer's specifications.

2.0 Workmanship
2.1 Relevant specifications shall be followed as per item No. 11.02 except that the item shall be for average 2 to 2.5mm thick acrylic polymer based texture and it shall be applied with standards tools and applicators as specified by the company and under close supervision of representatives of companies. Sample shall be got approved prior to application.
2.2 Rate will be inclusive of including thoroughly brushing the surfaces free from mortar droping and other foreign matter and sand papared smooth with two coats 100% Acrylic Paint.

3.0 Mode of Measurement and Payment
3.1 The item shall be measured and paid in sqm. No extra will be paid for the protective coat on textured wall finish.

Item No-9.04

Providing and applying Hydrophobic Silane - Siloxane base silicone coating of approved make, to exposed concrete surfaces at all heights & leads and wherever instructed by Engineer-In-Charge. The treatment shall be in two coats wet-on-wet or as recommended by approved manufacturer including preparation of surfaces by cleaning, curing, protecting, independent double legged scaffolding etc complete. The rate includes the cost of all materials, its application by specialized applicators by spray coating with airless sprayer, cleaning the substrate of all laitance, construction dust, contaminants, double scaffolding, labour etc., all complete and at all levels, leads and heights as per particular specification & directions of engineer in charge. Guarantee Bond in the prescribed proforma shall be executed by the contractor for the satisfactory performance of the application for 5 years.

1.0 Materials

1.1 Silicone paint

1.1.1 Silicone Paint shall be of approved make.

2.0 Workmanship

2.1 The silicone paint shall be diluted with water or solvent (benzene or toluene) based 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 or engineer-in-charge. Normally 5% concentration is sufficient for not to have change In parent color.

2.3.a Before applying the 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, rubbing with gunny bags and soft brush, washing with biowash chemical 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.

2.3.b 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) + mixer of teapol (mild detergent) and water (1:6) on brick surface using brush.
2) After required / specified time interval the surface treated as mentioned in 1 above should be washed with soft water using brush or spray.

2.4 The concrete surfaces shall also be thoroughly cleaned of dust, dirt, rust, concrete slurry or any other foreign material using appropriate method so as not to damage the RCC work, as approved by the EIC

2.5 Rate shall be inclusive of moping, cleaning, masking the door windows/floor/plants etc during and after the execution for protection.

2.6 Unless otherwise specified silicone paint shall be executed through approved specialized agency. Contractor shall furnish a guarantee of 5 years on stamp paper to the employer directly and the tender rate shall be inclusive of the same which is also to be signed by the specialized agency. However, soul responsibility shall be of main contractor for any leakages.

2.7 Copy of work order mentioning the rate issued to the specialized agency shall be attached with guarantee bond.
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 Client 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 Client and further guarantee to redo the affected work without claiming any extra cost."
This guarantee shall remain in force for a period of 3 years from the completion of the work under the contract and it shall remain binding to the Contractor for period of 3 years.

2.8 The deposit at the rate of 50% of the cost of this item from the running and final bills shall be recovered and retained for the first one 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.

Mode of Measurements and Payment.

3.1 The rate shall be for a unit of one sqm.

FALSE CEILING WORK

Item No-10.01
WPC board false Ceiling (partly openable)
Providing and fixing 12mm thick WPC board false ceiling with aluminium framing system along the perimeter of existing wall/ partition with the help of screws at 600mm centers. False ceiling shall be partly openable and parlty fixed. Item is inclusive of WPC shutter, Pivot, L N key and safety hinge for openable part. For fixed part, WPC board shall be fixed on framing system with suitable screw and joint filling material. Item shall be inclusive of acrylic putty and paint (minimum 2 coat) of approved make and shade and for all floors/ any height/ any levels as directed by Engineer in Charge. Work shall be carried out as per approved sample, Mock-up and shop drawing including all material and labour. Actual area of ceiling shall be measured for payment.

Material:
WPC board false Ceiling

Workmanship:
12mm thick WPC board false ceiling with aluminium framing system along the perimeter of existing wall/ partition with the help of screws at 600mm centers. False ceiling shall be partly openable and parlty fixed. Item is inclusive of WPC shutter, Pivot, L N key and safety hinge for openable part. For fixed part, WPC board shall be fixed on framing system with suitable screw and joint filling material. Item shall be inclusive of acrylic putty and paint (minimum 2 coat) of approved make and shade and for all floors/ any height/ any levels as directed by Engineer in Charge. Work shall be carried out as per approved sample, Mock-up and shop drawing including all material and labour.

Mode of measurement and payment:
Item shall be measured and paid in sqm.
Actual area of ceiling shall be measured for payment.

MISCELLENEOUS WORK

Item No-11.01

Providing & fixing Precast GRC (Glass Fiber reinforced Cement) Jali/ screen made out of White cement having 40 mm thickness in required shape and size shall be made by using high power spray machine, using Cem-fill manufactured AR Glass fiber with minimum ZrO2 17%. Jali shall be fixed individual or composite elements and their proper jointing/sealing with approved adhesives & sealants and drilling holes in RCC/ Steel/ Brick work and fixing on to external façade with Stainless steel 316 grade clamps/ fastner of suitable dia & lengths, grouting with sealants as per manufacturer's specifications etc. complete for all height all level and as per drawing and as directed by Engineer-in-Charge. Contractor shall arrange sample as per intent design for approval. Mock-up shall be carried out for minimum one panel of approved sample with suggested fixing arrangement. Work shall be carried out as per approved sample, Mock-up and shop drawing. Actual area of Jali shall be measured fort payment. Only supporting MS structure shall be paid in relevant items.

Item shall be executed as manufacture's specification. Rate shall be inclusive of material as per manufacturer's specification.

MS structural work, foundation and related civil works for the supporting frame structure will be paid in relevant tender item. Item shall be measured and paid in sqm.

Item No-11.02

Providing and fixing 190 ± 5 mm x 190 ± 5 mm x 80 ± 5 mm glass bricks of approved make and design (any pattern) with polymer based white cement mortar 1:2 (1 white cement: 2 sand + white marble dust). 2 numbers of 5 mm thick GI wires shall be embedded in all the sides of glass brick by drilling holes to be passed through PVC spacers in each joint horizontal as well as vertical by drilling holes and filling the same with chemical (re-barring) of approved make. The PVC concealed spacer (with provision for passing the 2no. GI wires in horizontal and vertical direction) shall be provided to maintain grooves/ spaces for GI wire and polymer white cement mortar at the junction/ groove of two glass bricks including curing. The sample of the glass brick shall be got approved by Architect and Engineer-in-Charge.

The glass bricks shall be fixed with placing GI wires vertically as well as horizontally after passing through the spacer and having minimum lap length of +200mm as per the site conditions at all the places, all heights, all level and in all shapes, etc. complete, as per approved shop drawing and as directed by Engineer-in-charge. Joints along the periphery of glass bricks shall be filled with approved make and color weather silicone sealant of approved make. All the grooves between the glass brick shall be smoothly finished with paste /putty of white cement and polymer for water tightness. The shade and size of the

glass bricks shall be as approved by architect and engineer in charge. Contractor shall prepare shop drawing as per site condition and get approved by Architect and Engineer in charge for all floors/ any height/ any levels.. Required MS framing work shall be paid in relevant tender item.

1.0 Material:

1.1 Glass Brick shall of approved make and confirm to following material specification:
It shall be of approved make or as approved by the Architect and Engineer-in-Charge.
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 ± 5 mm shall only be allowed in dimensions of glass brick. Spots of color other than that of bricks or in bricks shall not be allowed. The weight of each brick shall be approximate 2.25 kg.

The transmission of direct light through brick shall not be less than 40%. The glass brick shall have good thermal insulation. It shall also have fire performance as per EN-13501 or equivalent. It shall be sound proof and vibration absorber having adequate compressive strength. If bricks with groove shall be used, the groove shall be uniform and regular in size & shape.

1.2 PVC spacer (suitable for 5mm GI wire) and GI wire (5mm thick) shall be used of approved quality.

2.0 Workmanship

Contractor shall prepare shop drawing based on concept and as per site condition and get approved by Architect and Engineer in charge.

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 polymer white CM 1:2 (1 white cement: 2 white sand) as directed.

2.2 Before starting of the work, markings of the glass bricks on ceiling sill, ceiling and sides shall be done with the template made after placing the one row of glass brick with spacers on leveled floor @ 200 mm c/c or as per glass brick size and drawing shall be done on surfaces where glass bricks are to be laid.

2.3 Two numbers of 5mm thick GI wires dowels to be anchored in each joint horizontal as well as vertical by drilling holes in adjoining surface and filling the same with chemical. Length and type of anchor shall be as per adjoining surface material.

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 white cement mortar 1:2 at the junction of two glass bricks.

2.5 The sample of the glass brick partition made of suggested size shall be got approved by the engineer in charge and Architect.

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 minimum 200mm as per the site condition at all places, heights and shapes. After completion of the placing of the bricks, joints between the bricks and around it shall be finished with white cement and cleaned properly.

2.7 Additionally as the glass bricks cannot be broken, the opening etc. shall be so designed that only full size bricks can be used at all places.

2.8 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.

2.9 After completion of laying of glass bricks all the groove between and around glass bricks shall be finished smoothly and uniformly with the paste of white cement, marble powder and polymer to avoid water leakage.

3.0 Mode of Measurement and Payment

3.1 Dimensions shall be measured correct to the nearest to 0.01m. Areas shall be calculated to the nearest 0.01 sqm. The rate shall be for a unit of one sqm inclusive of grooves of 10 mm on all sides for a visible area of work done, spacers, GI wires etc. No wastage shall be permitted, measured and paid for. Work shall be carried out for all lead and all lift including scaffolding.

3.2 The measurement shall be taken for the glass brick masonry fully completed for all levels, heights, shapes and locations. Battered, tapered and curved portions shall be measured net as walls.

3.3 Rate shall be inclusive of all material, labour, tools, tackles, scaffolding etc. Only required MS framing work shall be paid in relevant tender item.

The rate shall be for unit of Sqm.

List of Approved Makes For Civil Work

Section B - List of Approved Make for Civil Works

Sr. No.	Material / Item	Approved Make
1	Anti-Termite Pestisides	Bayer, FMC India, Hindustan Insecticides, DE-NOCIL
2	Sand	Only River sand of approved area (Sea sand not acceptable) or manufactured sand
3	Aggregates	From Approved quarry nearby site.
4	Cement OPC/ PPC	Ultratech, ACC, Nuvoco, Ambuja, JK Laxmi, Sanghi, Wonder
5	Admixture for Concrete	BAFS, SIKA, Fosroc, Ardrex Endura, Cico, Pidilite
6	Cement - White	Birla, JK Laxmi, Shree
7	Reinforcement Steel: Main Producers only	SAIL, TATA (TISCO), RINL, JSW steel
8	Bricks	Locallly available as per approved sample having strength not less than 35 Kg/cm2
9	AAC Block	Xtralite from Ultratech, Magicrete, Aerocon from HIL, Biltech, Ethios Enviro Soluiton Pvt Ltd.. JK Laxmi
10	AAC Block joining mortar	Fixoblock xtralite from Ultratech, Smartfix from Aerocon, MYK Laticrete, Ardex Endura
11	Polymer modified cementitious elastomeric waterproof coating and PU coating	Pidilite, Fosroc, Sika, BASF
12	Vitrified Tiles	Kajaria, RAK, Restile, Somany, Jhonson, Asian, Nitco, Simpolo
13	Tiles/ Stone fixing Adhesive	Pidilite, MYK- Latricrete, Ardex Endura, KeraKoll, Ultratech
14	Epoxy Grout	Ardexl Endura, MYK Latricrete, Kerakoll, Pidilite
15	Structure Steel & Hallow Section Producers only	SAIL, TATA (TISCO), RINL, Jindal steel & Power (JSPL)
16	SS railing	Kich, Dorma, Jindal
17	Paint, Texture	Asian Paints, Akzo Nobel (Dulux), Berger, Nerolac, Jotun
18	Paint - PU paint, epoxy paint and primer	Asian, Nippon, ICI, Berger, Jotun
19	Precast GRC (Glass Fiber reinforced Cement) Jali/ screen	Swastik, Everest, Ultratech

20	Hydrophobic Silane - Siloxane base silicone coating	Wacker, Dow Corning, GE momentive
21	WPC board	Akruti, Alstone, Hardy smith
22	Glass brick	SEVES, KIG, Mulia
23	PVC Pipe	Astral, Ashirvad, Supreme

Note:

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

FFTG Works

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A. SPECIAL CONDITIONS OF CONTRACT

1.0 GENERAL:

These special conditions are meant to amplify the specifications and General Conditions of Contract. If any discrepancy is noticed between General Conditions of contract, specification, Bill of Quantity and Drawings, the most stringent of the above shall apply.

The scope of this section is to describe materials and systems for firefighting installations within the building which form together with the project documents, a complete volume of work and quality description.

All firefighting installations shall be of high quality, safe, complete and fully operational including all necessary items and accessories whether or not specified in details. All firefighting works shall be completed in accordance with the regulations and standard to the specification OWNER, the general provisions, special provisions and general requirements apply to all items of this specification.

The work shall be carried out simultaneously with building work, civil work, etc. and shall be continued till it is completed satisfactorily along with the completion of essential portions of the building works.

During the progress of work, completed portion of the building may be occupied and be put to use by OWNER but the contractor will remain fully responsible for the maintenance of Fire Protection System installations till the entire work covered by this contract is satisfactorily completed by him and handed over to OWNER.

2.0 ACCOMPANIMENT TO TENDER:

The tendered will attach to the Tender, at the time of submission, a statement containing information on the following points on separate pro forma.

List of all the confirmation of materials to be used as per specification along with manufacturer's name, catalogue and other technical details. Any deviation from the specifications shall be separately pointed out.

3.0 INTENT:

It is the intention of the specification and drawings to call for finished work, tested and ready for operation, whenever the words “Supply” or “Provide” are used. It shall mean delivery of material as specified in an assembled manner, ready for installation. Any apparatus, material or work not shown on drawings but mentioned in the specification or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the contractor without additional expenses to OWNER. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work and in the contract.

4.0 INTERPRETATION OF PROJECT DOCUMENTS:

The Specification, Drawings, and Bill of quantity shall be interpreted in accordance with good installation practice defined in the appropriate regulations and standards whether specifically referred to or not. If there is any discrepancy or shortfall in the application of the regulations to any aspect of this contract or the contractor considers there is anything detrimental to the standards or inconsistent with his obligations and guarantees, OWNER shall be informed prior to signing the contract and shall thereafter inform the contractor in writing the course to be followed. Where the drawings are to a small scale or are expressed in symbolic terms or are in the form of a diagram, then exact location of items shall not be inferred and in all cases, the work shall be fully integrated with the work of other trades and with the fabric of the building. The contractor shall appraise the duties of all plants and equipment taking account of any additions or variations and shall inform the OWNER of

any matters which may affect the design. In all cases the equipment installed shall be of appropriate rating for the duty it performs.

The Specifications and Bill of quantity shall be considered as part of this contract and any work or material shown on BOQ and not called for in the specification or vice versa, shall be executed as if specifically called for in both. The Drawings indicate the extent and general arrangement of the Fire Pumps, Fire Hydrants layout etc. and are essentially diagrammatic.

The work shall be installed as indicated on the drawings, however, any minor changes found essential to coordinate the installations of this work with other services shall be made without any additional cost to the owner. The drawings are for the guidance of the contractor, exact locations, distances and levels will be governed by the building. The contractor shall examine all structural and Fire Protection system drawings before starting the work, and report to OWNER or its representative, any discrepancies which in his opinion appear on them, and get them clarified.

5.0 SCOPE OF WORK:

The work to be carried out under this contract comprises of the Fire Fighting work for the proposed project called for in the documents. The work covered under this contract comprises of supply (wherever called for), installation, connection, testing and commissioning the Fire Fighting work commencing from point of fire brigade inlet or fire water storage within the project/site as per specifications, relevant to NBC, Indian standards, Local Fire Rules and Code of practice.

The contractor shall carry out and complete the said work under this contract in every respect and in conformity with the current rules and regulations of the local Fire Authority, the Indian Standards and with the directions of and to the satisfaction of the Consultant and Owner. The Contractor shall furnish all labour and install all materials, appliances, equipment (except those items which will be supplied by the Owner to the contractor at site), necessary for complete provision and testing of the whole firefighting installation as specified herein and shown on the drawings. This also includes any material, appliances, equipment not specifically mentioned herein or noted on the drawing as being furnished or installed but which are necessary and customary to make complete installation and to make the firefighting system shown in the schedule or described herein, properly connected and in working order.

The work shall include all incidental jobs connected with Fire Fighting installation such as foundation block for pump-motor sets, excavation for pipe trenches and back filling, cutting/drilling holes through walls/floors and grouting, necessary civil work , supports & hangers for hydrant / pipes, etc.

In general, the work to be performed under this contract shall comprise of supply, installation, testing &

commissioning of the following work: -

External Hydrant & Accessories
Isolation valves & Fire Extinguisher
Fire Pumps & U.G Tank
System Pipes with all fittings, Flanges, valves, Hangers, Supports.
Excavation / Back filling / Hume pipe / Valve chamber
Fire Safety Certificate after completion of work

All qualities mentioned in the Bill of quantity are approximate and the contractor shall not be eligible for any claim due to any variation in / or omission of any item.

Any extra item shall be calculated on the rate analysis basis approved by OWNER.

It is the responsibility of the contractor to co-ordinate with Local Fire Authority, Fire Officer and fulfils all the documents, drawings & any other requirement of them at no extra cost.

6.0 MODE OF MEASUREMENTS:

M.S. pipes (H) shall be measured per linear meter of the finished length and shall include all fittings, welding, jointing, clamps for fixing to walls or hangers, anchor fasteners and testing.

Sluice valves, check valves, butterfly valves shall be measured by numbers and shall include all items necessary and required for mixing and as given in the Specifications/Bill of Quantities.

Hydrant valves, hose cabinets, rubberized fabric linen fire hose pipes, First-aid fire Hose reels, S.S. branch pipes shall be measured by numbers and shall include all items necessary and required for fixing as given in the Specifications/Bill of Quantities.

Suction and delivery headers shall be measured per linear meter of finished length and shall include all items as given in the Bill of Quantities. Painting shall be included in the rate of headers. Painting of pipes shall be included in the rate for pipes and no separate payment shall be made.

No additional payment shall be admissible for cutting holes or chases in walls or floors, making connections to pumps, equipment and appliances.

7.0 MODE OF PAYMENT:

The following payment will be made after deducting retention money.

Payment for various items shall be made as follows:

Fire Fighting system	60 % against the material supply at site
	20% against executed work at site
	20% against completion of work / Fire Safety Certificate

<u>Special Notes:</u>

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 submits four sets of as built drawing both hard copy as well as soft copy duly approved by PDEUs engineer and consultant.

For the virtual completion and final certificates contractor will have to produce no objection certificate from PDEUs.

Final payment will be done after getting the final Fire Safety Certificate from the fire department.

8.0 FEES, PERMITS AND TESTS:

The Contractor shall pay for any and all fees and obtain permits required for the firefighting work. On completion of the work the contractor shall obtain and deliver to the OWNER, certificates of **final inspection** and **approval/ fire safety certificate** by the local fire authority and the Fire inspector.

9.0 UTILITY SUPPLY:

It is the responsibility of the contractor to co-ordinate with various utility agencies, the exact location of such Hook-Up Point and mode of connection. Further the contractor shall co-ordinate with such utility agencies to provide necessary drawings, documents, get their approval, make the necessary arrangement for the payments and arrange the utilities supply at no extra cost.

10.0 ACTUAL ROUTE OF PIPE:

The locations of the Hydrant pipes are only indicative; therefore, the actual route may differ from the plans according to the details of the building construction and the conditions of executions of the installations.

The contractor shall supply and install at his expense all secondary materials and special fittings found necessary to overcome the interference and to supply the modifications on the route of pipe and fittings that are found necessary during the work, to the complete satisfaction of the owner's representative.

11.0 MATERIAL AND EQUIPMENT:

All material and equipment shall conform to the relevant standards and shall be of the approved make and design. The materials and equipment shall conform to relevant Indian Standards. The Contractor shall be responsible for the safe custody of all the materials and shall insure them against theft, damage by fire, earthquake etc. A list of items of materials and equipment, together with sample of each shall be submitted to the OWNER within 10 days of the award of the contract. Any item which is proposed as a substitute, shall be accompanied by all technical detail giving sizes, particulars of materials and the manufacturer's name and shall be submitted along with the tender or bid offer. At the time of the submission of proposed substitute the Contractor shall state the credit, if any due to the owner. In the event the substitution is approved, all changes and substitutions shall be requested in writing and approvals obtained in writing from OWNER. Owner's decision in the matter shall be final.

All materials of the same kind of service shall be identical and made by the same manufacturers. Any deviation to this rule shall be approved by the Consultant. Top priority shall be given to the products that have a permanent agent providing spare parts and maintenance facilities in the same city where the project is situated.

The make of fire equipment, components, accessories, etc. has been mentioned in the tender. In case if the make is not given for the equipment / component / accessories, the contractor shall get approval for sample of that particular equipment / component / accessories from the PDEU / Consultants before any procurement.

12.0 MANUFACTURERS:

Where manufacturers have furnished specific instructions relating to the materials used in this job, covering points not specifically mentioned in these documents, these instructions shall be followed in all cases.

Where manufacturer's names and/or catalogue numbers are given, this is an indication of the quality, standards and performance required.

When interfacing occurs, equipment shall be mutually compatible in all respects.

13.0 RATING:

Rating of all items shall be appropriate for the conditions on the particular site on which the items will be used. All the equipment shall be fit for continuous work under the worst conditions of site and shall be rated for the following ambient condition.

- Outdoor temperature 50° C.
- Corrosive and humid

14.0 INSPECTION AND TESTING:

OWNER'S representative reserves the right to request inspection and testing at manufacturer's works at all reasonable times during manufacture of items for this contract. Tests on site of completed works shall demonstrate, among other things:

That the equipment installed complies with specification in all particulars and is of the correct rating for the duty and site conditions.

That all items operate efficiently and quietly to meet the specified requirements.

That all circuits are correctly fused and protected and that protective devices are properly coordinated.

That all non-current carrying metal work is properly and safely grounded in accordance with the specifications.

The contractor shall provide all necessary instruments and labour for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the OWNER and shall provide **test certificates/ Fire Safety Certificate** signed by a properly authorized person. Such test certificates shall cover all works.

If tests fail to demonstrate the satisfactory nature of the installation or any part thereof then no claims for the extra cost of modifications, replacements or retesting will be considered. Owner's decision as to what constitutes a satisfactory test shall be final.

The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

15.0 PRICE DETAILS:

At any time and at the request of OWNER, the contract shall provide details or breakdown of costs and prices of any part or parts of the works.

16.0 TEST CERTIFICATES:

The contractor shall submit test certificates for all the material/system installed. These shall be issued by a **government recognized inspection office** certifying that all equipment, materials, construction and functions are in agreement with the requirements of these specifications, ISI and when ISI is not applicable other approved certifying agencies.

17.0 INSTRUCTION MANUAL:

The contractor shall prepare and produce instruction, operation and maintenance manuals in English for the use, operation and maintenance of the supplied equipment and installations, and submit 3 sets to OWNER, at the time of handing over.

18.0 SAMPLES AND CATALOGUES:

Before ordering the material necessary for this work, the contractor shall submit to OWNER for approval, a sample along with the catalogues.

For big items such as Pump, Prime Mover, Valves, Hydrants, Pipe the submission of catalogues shall be enough. Prior to ordering any firefighting equipment/material/system, the contractor shall submit to OWNER, the catalogues, along with the samples, at least from three different manufacturers. After the selection of manufacturer by OWNER, the contractor shall arrange inspection and testing at the manufacturer's factory or assembly shop for final approval. No material shall be procured prior to the approval of the OWNER.

19.0 SHOP DRAWINGS & AS BUILT DRAIWNGS:

The contractor shall prepare and submit two sets of detailed drawings before starting the execution work for approval.AS BUILT DRAWINGS:

At the completion of work and before issuance of certificate of virtual completion the contractor shall submit to OWNER, three sets of layout drawing drawn at appropriate scale indicating the complete Fire Protection system "as installed". These drawings must provide (in plan, elevation and section)

Location and details of Fire Pumps, Prime Movers and Panels,

Location of hydrant & Accessories, Fire Extinguisher

Location of Fire Brigade inlets & Fire Storage Tank.

20.0 CIVIL WORK INCLUSION:

- Pedestal support for piping
- Foundation of pumps
- Excavation / backfilling for pipes
- Hume Pipe

21.0 GUARANTEE:

At the close of the work and before issuance of final certificate of virtual completion by OWNER, the contractor shall furnish written guarantee indemnifying OWNER against defective materials and workmanship for a period of one year after completion. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to OWNER, the following:

Any defective work or material supplied by the contractor.

Any material or equipment supplied by OWNER which is damaged or destroyed as a result of defective workmanship by the contractor.

Any material or equipment damaged or destroyed as a result of defective workmanship by the contractor.

22.0 SAFETY OF MATERIALS:

The contractor shall provide proper and adequate, storage facilities to protect all the materials and equipment including those issued by OWNER against damage from any cause whatsoever.

23.0 COMPLETION CERTIFICATE:

On completion of the Fire Protection System installation (or an extension to an installation) a certificate shall be furnished by the contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local supply authority. The contractor shall be responsible for getting the approval by the local concerned authorities.

24.0 DEFECTS LIABILITY:

Defects liability period shall mean 12 calendar months after OWNER have issued certificate of completion of the whole work. The certificate of completion shall be issued after the necessary tests have been carried out to the satisfaction of OWNER and the required drawings are submitted.

The contractor shall make good at his own cost and to the satisfaction of OWNER, all defects or other faults arising in the opinion of OWNER out of bad workmanship or faulty materials not in accordance with the drawings, NBC and the Rules and Regulations under which it may appear within twelve months after completion of the work.

25.0 STAFF:

The contractor shall employ a competent fully licensed qualified, full time erection engineer to direct the work of erection in accordance with the drawings and specifications. The engineer shall be available all times at site to receive instructions from OWNER, in the day to day activities throughout the duration of contract. The engineer shall correlate the progress of the work in conjunction with all the relevant requirements of the supply authority.

26.0 REINSTATING AND FINISHING OF CIVIL DAMAGES:

For erection of equipment / cables etc., if any civil structure is required to be broken, the same shall be done, restated and finished as original by the tendered without any extra cost.

B. TECHNICAL SPECIFICATIONS

1.0 SCOPE OF WORK:

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install Wet riser, First Aid Fire Protection system as required for all floor as per the drawings and specified here in after or given in the Bill of Quantities.

Without restricting to the generality of the foregoing, the fire safety system shall include the following: -

a) M.S. (H) piping, hydrant, Hose box, hose reel & accessories

b) Fire Extinguishers

c) Pump House & Accessories

d) Suction, Delivery & header pipe, fittings, flanges & valves.

e) Excavation / Back filling / Hume pipe / Valve chamber

f) Fire Safety Certificate after completion of work

2.0 PIPE WORK:

2.1 GENERAL REQUIREMENT:

All the materials shall be of ISI mark, best quality conforming to the specifications and subject to the approval of the PDEU or his representative. If so directed, materials shall be tested in an approved testing laboratory & the contractor shall produce the test certificate in original to the Engineer-in-charge & the entire charges for original as well as repeated tests shall be borne by the Contractor.

Before welding, the pipe faces shall be cleared & then shall be welded conforming to IS: 9595 – 1980. The electrodes used for welding shall comply with IS: 814. The laying of welded pipe shall also comply to IS 5822 – 1986. The welding joints shall be tested in accordance to IS: 3600, Part 1973.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by **suitable clamps or supports as mentioned in IS code.** Only approved type of anchor fasteners shall be used for RCC ceiling and walls.

Valve and other apparatus shall be so located that they are easily accessible for operations, repairs and maintenance.

2.2 PIPE AND FITTINGS:

All pipes shall be conforming to IS:1239-1990 (M.S. Heavy class) welded joints as specified by the PDEU's Representative.

Pipes (exposed) shall be given one primary coat of Zinc chromate with two coat of compatible epoxy paint give an even look (Fire red, shade No. 536 as per IS: 5).

All black steel pipes under floors or below ground shall be provided with protection against corrosion by

application of 100/ 150 mm wide and 4mm thick layer of PYPKOTE/ MAKPOLYKOTE (IS:10221) over the pipe, as per manufacturer's specifications Checking with holiday testing machine. Excavation of soft soil including backfilling, compacting, watering up to 1.3M depth.

All fittings 50mm & below 50 shall be forged fitting.

All fittings above 50mm shall be butt welded.

All piping laid shall be as follows:

Pipe Size	Material	Joints & Fittings	Sealing Material
Up to 50mm	E.R.W., M.S. pipe Heavy Class IS:1239	Forged Fittings Raised face Slip-on Flanges	3mm, 3-ply Rubber insertion
65mm to 150mm	E.R.W., M.S. Pipe Heavy Class IS:1239	Butt welded Fittings Raised face Slip-on Flanges	3mm, 3-ply Rubber insertion
200mm to 300mm	E.R.W., M.S. pipe Heavy Class IS:3589 (Minimum 6.3mm thk.)	Welded Raised face Slip-on Flanges	3mm, 3-ply Rubber insertion

Pipes shall be provided with electrical resistance welding. Jointing shall be butt welded between pipe and pipe and fittings.

Joints between C.I. and M.S. / G.I. pipes shall be made by provided a suitable flanged tail or sockets piece and M.S. flanges on the M.S./G.I pipe shall have appropriate number of holes and shall be fastened with nuts, bolts and 1.5mm thick compressed asbestos gaskets.

Tee off connections shall be through reducing tees. Drilling and tapping of the main walls of the main pipe shall not be allowed.

All equipment and valve connections shall be through welded flanges.

All welded piping is subjected to the approval of the PDEU's Representative and sufficient number of flanges

and unions shall be provided.

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. He must keep in view the specific openings in buildings and other structures through which pipes are designed to pass. Drawings to be got approved from Local Fire Authorities.

Contractor shall submit the Hydraulic calculation for the system in accordance with Fire Authority By Laws.

Piping shall be properly supported on or suspended from stand 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.

Pipe supports shall be of steel, adjustable for height and primer coated with rust preventive paint and finish coated back. Where pipe and clamps are of dissimilar materials a gasket shall be provided in between. Spacing of pipe supports shall not exceed as per relevant IS Code.

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 roof 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. The Contractor shall coordinate with structural.

Pipe sleeves, 50 mm larger diameter than pipes, shall be provided wherever pipes pass through walls and slabs, and annular space filled with fireproof materials like putty, fire seal etc.

Piping work shall be carried out in a workmen like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation and coordination with other agencies work so that particular area work shall be carried out in one stretch.

Piping layout shall take due care for expansion and contraction in pipes.

Using screwed fittings shall be accurately cut to the required sizes and thread in accordance with IS:554 and burrs removed before lying. Wherever reducers are to be made, eccentric reducers shall be used.

2.3 PROCEDURE FOR PYPKOTE / COATEK APPLICATION FOR UNDER GROUND PIPES

Surface Preparation - The pipe surface shall be cleaned by a wire brush.

Application of Primer - Pypkote / Coatek primer is to be applied on pipes immediately after cleaning. This is to prevent any further accumulation of rust on the pipe. This is a cold applied primer and is applied by brush.

Application of Pypkote / Coatek 4 mm Tape - After the primer is applied on the pipe, it is allowed to dry for about 30 min. till it becomes touch dry. Before adhering the tape to the pipe, it is advisable to gently heat the primer coated pipe by a run of LPG torch. Remove the bottom polyethylene from the tape & then heat bottom surface of the tape by LPG torch or any heat source & start wrapping the tape to the pipe by heating the primer coated pipe & by removing the bottom polyethylene from the tape before wrapping better adhesion between the tape & pipe is obtained. Overlaps are maintained with a minimum of 12.5 mm.

Tape coating of weld joints - The tape is applied over the weld joints after the necessary welding & testing methods of the joints is completed. The procedure for application of tape shall be the same as bare pipe procedure. Overlaps on each side of the weld joints shall be 50 mm.

A final coat of White wash with water based cement paint is done immediately over the entire coated pipe. Holiday Testing Before lowering the pipes in the trenches and before back filling the trenches the holiday test is to done at min. 20 KV. Defective area shall cleaned and re wrapped as per above.

Painting

Two coat of Zinc chromate Primer with two coats of First quality Synthetic Enamel paint of approved brand and shade.

Contractor shall do Zinc Phosphate primer, epoxy based, followed by 2 coats of Enamel paint. Please note enamel paint application to be done after min 1 hour & max 24 hrs, after application of Zinc phosphate primer. Time interval after application of Zinc phosphate & application of 1st coat of enamel should be min 1hour & max 24 hrs; so that the Zinc phosphate does not loose it's etching characteristics. The interval will be 5 to 6 hrs between application of 1st coat enamel paint & 2nd coat enamel paint.

Paint shall be of approved quality and shade. Where directed by the Owner's site representative pipes shall be painted in accordance with approved pipe colour code.

Painting shall be expertly applied; the paint shall not over run on surfaces not requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue.

3.0 VALVES

3.1 C.I. SLUICE VALVES:

Contractor shall provide cast iron gate valves as per below mentioned details. Valves should be provided with companion flange & require accessories.

- Type: Sluice valve
- Rating: PN 16
- Body material: IS-210 Gr. FG-200 Cast Iron, Bolted Bonnet Inside screw non rising stem
- Seat: Renewable
- Wedge: Solid wedge
- Stem: Cu-Alloy, Stem SS (12 Cr. 12)
- Standard: IS:14846
- End Details: Flanges as per IS 1538 F/F Drilled
- Test Pressure: Body 24 Bar, Seat 16 Bar

3.2 NON-RETURN VALVE:

Check valves / non-Return valve shall normally be used in all water services. Check Valve / Non return valves shall be provided as required or as shown in the drawings and conform to the following specifications:

- Type: Dual Plate wafer check valve
- Body material: CI IS 210 Gr. Fg. 200

- Rating: PN 16
- Seat: EPDM Rubber lining
- Disc: Ductile iron
- Trim: Spring & Trim SS 304
- End connection: Wafer type suitable for clamping between flanges as per ASME B 16.5 Class-150
- Test Pressure: Body 21 Bar, Seat 14 Bar

3.3 BUTTERFLY VALVES:

The valve shall be wafer type. They shall be designed to fit with/without gaskets, the watertight seal being obtained by EPDM seat projection at the faces compressed between the flanges. The valves shall be supplied inclusive of flanges and high tensile steel bolts of dimensions recommended by suppliers of valves. The valves shall comply with following specification.

- Type: Wafer type
- Pressure rating: PN 16
- Body Material: IS-210 Gr. FG-200 Cast Iron
- Type of disc: CF8 Stainless Steel
- Seat material: EPDM
- Operation: hand Lever
- Stem: Stainless Steel 12 Cr. 12
- Standard: IS:13095
- End Details: Flanges as per BS-10 Table D/E ANSI B 16.1 CI-125
- Test Pressure: Body 24 Bar, Seat 18 Bar

3.4 AIR RELEASE VALVE:

- Material: Gun Metal
- Inlet: 25mm male BSP threads

- Body: Gunmetal, IS: 318 LTB- 2
- Air Vent: Gunmetal, IS: 318 LTB- 2
- Top Cap: Gunmetal, IS: 318 LTB- 2
- Ball: Rubber coated Cork
- Hydro-static Pressure: Test 21 Kg/cm²

3.5 BALL VALVES

Ball valves shall be provided with each Hose reel, air release valve & wherever required for drain purpose as mentioned in BOQ/ Drawing.

- Pressure /Class / Rating: PN-25
- Body Material: Forged Brass
- Seat: Renewable P.T.F.E. Seat
- Ball: Brass (Nickle Plated)
- Stem: Machined Brass Nickle Plated
- Body Test Pressure: 40kg/cm²
- Working Pressure: 25kg/cm²

3.6 INSTALLATION:

- Valve shall be installing in a manner that allows future removal and service of the valve.
- Packing and gasket shall not contain asbestos.
- The valve shall be of the same size as the pipe to which they are installing.
- Valve above 150mm diameter shall be self-locking warm gear type waterproof and protory lubricated.
- Provide chain operator’s w/chain cleats on all valves more than 2.4 meter above floor.

4.0 HYDRANT VALVES

4.1 EXTERNAL HYDRANTS:

The Contractor shall provide S.S. Fire Hydrant valve, as specified in Schedule of Quantities, and as shown in drawings. All required accessories shall be inclusive to complete the installation.

- Hand wheel – C.I. – IS:210
- Spindle – S.S. 304
- Bonnet – S.S. 304 - IS:3444, GR-I
- Body – S.S. 304 - IS:3444, GR-I
- 63mm female inst. - S.S. 304 - IS:3444, GR-I
- Pull out type lug - S.S. 304 - IS:3444, GR-I
- Blank cap – ABS plastic
- Chain – S.S. 304
- Nut, bolt & washer – Galvanized
- Seat test pressure – 14 bar
- Body test pressure – 21 bar

5.0 HOSE PIPE, BRANCH PIPE & NOZZLE

5.1 HOSE PIPES

Hose Pipes (2nos. x 15mtr.) shall be provided with each hydrant valve. The hose shall be sufficiently flexible and capable of being rolled.

Hose pipe shall be as per below mentioned specification.

- Type - Reinforced Rubber-lined (RRL)
- Standard – IS: 636
- Type of Hose – Type-1 (Uncoated)
- Internal dia – 63mm

- Length – 15mtrs.
- Hydro-static Proof Pressure – 23 kg/cm²
- Hydro-static Burst Pressure – min. 38 kg/cm²
- Type of Coupling - Instantaneous Pair of Male & Female Parts
- Material of Construction - SS 304 (IS 3444 Gr. 1)
- Binding Wire – SS wire
- Standard – IS:903

5.2 BRANCH PIPE & NOZZLE

Branch pipe shall be of S.S. as given in BOQ 63 mm dia and be complete with male instantaneous spring lock type coupling for connection to the hose pipe. The branch pipe shall be externally threaded to receive the nozzle.

- Type - Short Branch Pipe with Nozzle
- Inlet - 63mm Instantaneous Male Inlet
- Outlet – 20mm bore Solid Jet Nozzle
- Material of Construction - Stainless Steel (SS304)
- Standard - IS: 903
- Washer - Rubber
- Hydrostatic Pressure Test - 21 kg/cm²
- Working pressure – Up to 12 Kg/cm²

6.0 HOSE REEL:

Contractor shall provide First Aid Hose Reel as mentioned in BOQ & drawing with painting, anchor fastener, bolts & nuts etc. complete as required by Local Fire Authority as per below mentioned technical details.

- Hose reel drum – IS:884
- Type – Fixed wall mounting
- Material – M.S.

- Hose – Rubber, as per IS:444, Type-3
- Working pressure – 25kg/cm²
- Length – 25mm bore x 30mtr long.
- Shut of nozzle – 8mm, S.S.

7.0 FIRE HOSE CABINETS:

Provide Hose cabinets for each hydrant with double glass front door and locking arrangement with breakable glass key access arrangement, duly painted red with stove enamelled paint fixed to wall or self-supported on floor as per site conditions.

The cabinet shall also have a separate chamber to keep the key with breakable glass as per approved design.

Hose cabinets shall be stove enamelled fire red paint with “FIRE HOSE” written on it prominently.

Samples of hose cabinet for internal and external works be got approved from PDEU’s Representative/ Consultant before installation at site.

Fire hose cabinet suitable to accommodate 2 Nos. 15 metres long hoses, 1 No. branch pipe and nozzle.

- Type - Hose Box (Double)
- Body - Mild Steel SWG 18 Gauge
- Handle - Nickel Chrome
- Key Box - Mild Steel SWG 18 Gauge
- Lock - Standard Panel Lock
- Dimensions (Approx.) - 750mm (W) x 600mm (H) x 250mm (D)
- Finish - 2 Coats Anticorrosive Fire Red Paint Outside, and White Inside

8.0 FIRE BRIGADE INLET CONNECTIONS:

Fire Brigade inlet connection shall be provided for Fire Tender. It should be installed at a point near the entry to the premises where a fire service vehicle can approach easily & feed water in system line as well as in underground water tank.

C.I. 4-way fire brigade inlet (IS:904) with isolation / check valve shall be installed and connected with system Line & water tank.

C.I. Draw out connection with foot valve with strainer shall be provided for underground fire water tank.

9.0 FIRE EXTINGUISHERS

Contractor shall provide Fire extinguishers as per BOQ, specifications and drawings.

Fire extinguishers shall conform to the following Indian Standard specifications and shall be with BIS approved stamp as revised and amended up to date.

a) Co_2 Type: IS:15683 – 4.5kg – squeeze type

b) ABC Powder Type: IS:15683 – 6kg – squeeze type, stored pressure

Fire extinguishers shall be installed as per Indian Standard Code of practice for selection, installation and maintenance of portable first aid appliances IS:2190-1979.

Hand appliances shall be installed in readily accessible locations with the Appliance brackets fixed to wall by suitable anchor fasteners.

Each appliance shall be provided with an inspection, testing, change of charge and other relevant data.

All appliances shall be fixed in a true workman like manner truly vertical and at current locations.

10.0 FIRE PUMPS:

10.1 SCOPE:

Contractor shall furnish all labour, for installation testing and commissioning of complete fire pumping system. In general, the item of works shall include but not limited to the following:

a) 1 no. of Main Pump - Electrically operated pump

b) 1 no. of Standby Pump – Diesel Engine operated pump

c) 1 no. of Jockey Pump - Electrically operated pump

d) Complete electrical system, Panel for pumps.

10.2 MAIN PUMP (ELECTRIC DRIVEN):

Contractor shall provide and install electrically operated fire pumps of capacity and head indicated in the Drawings/Bill of Quantities.

Pumping sets shall be horizontal end suction back pull-out centrifugal pump.

Pumps shall be capable of giving a discharge of not less than 150 % of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of rated head.

2850 lpm – 100m head

MOC: Casing CI – Impeller Bronze – Shaft SS410, Mechanical seal

Bearing of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

The pump shall be provided with a plate indicating the suction lift, delivery head, discharge, speed and number of stages.

The pump casing shall be designed to withstand 1.5 times the working pressure.

10.3 MOTORS FOR ELECTRIC DRIVEN PUMPS:

10.3.1 MOTOR:

The motor (IE2) shall be TEFC squirrel cage A.C. induction type suitable for operation on 415 volts 3 phase 50 Hz. System.

Degree of protection shall be IP 55. The class of insulation shall be F. Temperature rise limit up to class 'B', duty 'S1' The synchronous speed shall be 2970 RPM as specified.

The motor shall be rated for continuous duty and shall have a horsepower rating necessary to drive the pump at 150% of its rated discharge with at least 65% rated head. The motor shall conform to I.S. 325 - 1978.

10.3.2 MOTOR STARTER:

The motor starter shall be soft type conforming to IS: 1822 - 1967. The unit shall include suitable current transformer and ammeter of suitable range on one line to indicate the current. The starter shall not incorporate under voltage no voltage trip overload or SPP.

The starter assembly shall be suitably integrated in the power and control panel for the wet riser system.

10.4 JOCKEY PUMP (ELECTRIC DRIVEN):

Contractor shall provide and install electrically operated fire pumps of capacity and head indicated in the Drawings/Bill of Quantities.

Pumping sets shall be vertical inline pump.

180 lpm – 100m head

MOC: Casing SS 304 – Impeller SS 304 – Shaft SS 304, Mechanical seal

Bearing of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

The pump shall be provided with a plate indicating the suction lift, delivery head, discharge, speed and number of stages.

The pump casing shall be designed to withstand 1.5 times the working pressure.

10.5 MOTOR FOR ELECTRIC DRIVEN PUMP:

10.5.1 MOTOR:

The motor (IE2) shall be TEFC squirrel cage A.C. induction type suitable for operation on 415 volts 3 phase 50 Hz. System.

Degree of protection shall be IP 55. The class of insulation shall be F. Temperature rise limit up to class 'B', duty 'S1' The synchronous speed shall be 2900 RPM as specified.

The motor shall be rated for continuous duty and shall have a horsepower rating necessary to drive the pump at 150% of its rated discharge with at least 65% rated head. The motor shall conform to I.S. 325 - 1978.

10.5.2 MOTOR STARTER:

The motor starter shall be soft type conforming to IS: 1822 - 1967. The unit shall include suitable current transformer and ammeter of suitable range on one line to indicate the current. The starter shall not incorporate under voltage no voltage trip overload or SPP.

The starter assembly shall be suitably integrated in the power and control panel for the wet riser system.

10.6 DIESEL ENGINE:

10.6.1 ENVIRONMENTAL CONDITIONS:

The engine shall be required to operate under the conditions of environment as specified the place of installation.

10.6.2 ENGINE RATING:

The engine shall be cold starting type without the necessity of preliminary heating of the engine cylinders or combustion chamber (for example, by wicks, cartridge, heater plugs etc.). The engine shall be multi cylinder / vertical 4 stroke cycle, water cooled, diesel engine, developing suitable HP at the operating speed specified to drive the fire pump. Continuous capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and after correction for altitude, ambient temperature and humidity for the specified environmental conditions. This shall be at least 20% greater than the maximum HP required to drive the pump at its duty point. It shall also be capable of driving the pump at 150% of the rated discharge at 65% of rated head. The engine shall be capable of continuous non-stop operation for 8 hours and at least 3000 hours of operation before major overhaul. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run. Engine rpm shall be 2300.

The engine shall accept full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to BS 649/IS 1601/IS 10002, all amended up to date.

10.6.3 ENGINE ACCESSORIES:

The engine shall be complete with the following accessories: -

a) Fly wheel dynamically balanced.

b) Direct coupling for pump and coupling guard.

c) Radiator with hoses, fan, water pump, drive arrangement and guard.

d) Corrosion Resister.

e) Air cleaner, oil bath type / dry type.

f) Fuel service tank support, semi-rotary pump and fuel oil filter with necessary pipe work.

g) Pump for lubricating oil and Lub. oil filter.

h) Elect. starting battery (2 x 12 v).

i) Exhaust silencer with necessary pipe work & mineral wool insulation with aluminium sheet

j) Governor.

k) Instrument panel housing all the gauges, including Tachometer, hour meter and starting switch with key (for manual starting).

l) Necessary safety controls.

m) Winterization arrangement, where specified.

10.6.4 COOLING SYSTEM:

The engine cooling system shall be radiator water cooled system. The radiator assembly shall be mounted on the common bed plate. The radiator fan shall be driven off the engine as its auxiliary with a multiple fan belt. When half the belts are broken, the remaining belts shall be capable of driving the fan. Cooling water shall be circulated by means of an auxiliary pump of suitable capacity driven by the engine in a closed circuit.

10.6.5 FUEL SYSTEM:

The fuel shall be gravity fed from the engine fuel tank to the engine driven fuel pump. The engine fuel tank shall be mounted either over or adjacent to the engine itself or suitably wall mounted on brackets at a height not less than 60 cm above the fuel injection pump. The fuel filter shall be suitably located to permit easy servicing.

All fuel tubing to the engine shall be with copper, with flexible hose connections where required. Plastic tubing shall not be permitted.

The fuel tank shall be of welded steel construction relevant to Indian or foreign standard for mild steel drums (IS 2552) and of capacity sufficient to allow the engine to run on full load for at least **2 hours**. The tank shall be complete with necessary floor mounted supports, level indicator (protected against mechanical injury) inlet, outlet, overflow connections and drain plug and piping to the engine fuel tank. The outlet should be so located as to avoid entry of any sediment into the fuel line to the engine.

A semi rotary hand pump for filling the daily service tank together with hose pipe 5 mtr. long with a foot valve etc. shall also form part of the scope of work or as specified in Bill of Quantities.

10.6.6 LUBRICATING OIL SYSTEM:

Forced feed Lub. oil system shall be employed for positive lubrication. Necessary Lub. oil filters shall be provided, located suitably for convenient servicing.

10.6.7 STARTING SYSTEM:

The starting system shall comprise necessary batteries (2x12v), 24 volts starter motor of adequate capacity and axle type gear to match with the toothed ring on the fly wheel. By metallic relay protection to protect starting motor from excessively long cranking runs suitably integrated with engine protection system shall be included within the scope of the work.

The capacity of the battery shall be suitable for meeting the needs of the starting system.

The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression.

The scope shall cover all cabling, terminals, initial charging etc.

10.6.8 EXHAUST SYSTEM:

The exhaust system shall be complete with silencer suitable for outdoor installation, and silencer piping including bends and accessories needed for a run of 5 meter from the engine manifold. (Adjustment rates for extra lengths shall also be given). The total back pressure shall not exceed the engine manufacturer's recommendation. The exhaust piping shall be suitably lagged.

10.6.9 ENGINE SHUT DOWN MECHANISM:

This shall be manually operated and shall return automatically to the starting position after use.

10.6.10 GOVERNING SYSTEM:

The engine shall be provided with an adjustable governor to control the engine speed within 5% of its rated speed under all conditions of load up to full load. The governor shall be set to maintain rated pump speed at maximum pump load.

10.6.11 ENGINE INSTRUMENTATION:

Engine instrumentation shall include the following: -

a) Lub. Oil pressure gauge.

b) Lub. Oil temperature gauge.

c) Water pressure gauge.

d) Water temperature gauge.

e) Tachometer.

f) Hour meter.

The instrumentation panel shall be suitably resident mounted on the engine.

10.6.12 ENGINE PROTECTION DEVICES:

Following engine protection and automatic shutdown facilities shall be provided: -

a) Low lub. oil pressure.

b) High cooling water temperature.

c) High lub. oil temperature.

d) Over speed shut down.

10.6.13 PIPE WORK:

All pipelines with fittings and accessories required shall be provided for fuel oil, lub. oil and exhaust system, copper piping of adequate sizes shall be used for lub. oil and fuel oil. M.S./G.I. piping will be permitted for exhaust.

10.6.14 ANTI VIBRATION MOUNTING:

Suitable vibration mounting duly approved by engineer-in-charge shall be employed for mounting the unit so as to minimize transmission of vibration to the structure. The isolation efficiency achievable shall be clearly indicated.

10.6.15 BATTERY CHARGER:

Necessary float and boost charger shall be incorporated in the control section of the power and control panel, to keep the battery under trim condition. Voltmeter to indicate the state of charge of the batteries shall be provided.

10.7 CONTROL PANEL:

10.7.1 CUBICAL PANEL:

Contactor shall supply, install, testing & commissioning of Pump control panel with required cables, cable trays & accessories.

- **Panel**

- **1 no. Electric Motor Driven Main Pump**
- **1 no. Diesel Engine Driven Standby Pump**
- **1 no. Electric Driven Jockey Pump**

The main switch board cubicle panel shall be of floor mounted type, totally enclosed, dust and vermin proof made from 2.0 mm CRCA sheet of suitable size duly painted with Powder Coated as per IS code / local fire department's requirement.

The cubical shall comprise of the followings:

- Incoming main M.C.C.B unit of required capacity.
- Outgoing M.C.C.Bs one for each motor.
- Copper busbar of suitable capacity.
- Fully Automatic "**SOFT TYPE** " starter suitable for the motor H.P. with Push Buttons and ON/OFF indicating light one for each motor for all pumps.
- Single phasing preventers one for each motor.
- Ampere meters - one for each motor complete with CTs.
- Voltmeter on incoming main with rotary selector switch to read voltage between phase to Neutral and phase to phase.
- Three neon phase indicating lamps.
- Rotary switch for manual/auto operation.
- All color coded internal and inter-connecting wiring from incoming main to bus bar, switch board panel and power/control cables from switch board cubicle to motors, engine and batteries etc. complete in all respect.
- 9Tank Chemical treatment
- Outer Structure: - 2.0mm MS CRCA Sheet & Load Bearing Members: - 2.0mm MS CRCA Sheet

- Front Door &Cover: - 2.0mm MS CRCA Sheet
- Internal Partition: - 2.0mm MS CRCA Sheet
- Mounting Plate: - 2.0mm MS CRCA Sheet
- Gland Plate: - 2.0mm MS CRCA Sheet
- Danger notice board must be located at control panel.

All switchgears and accessories shall be approved make to relevant IS codes and to the satisfaction of ENGINEER-IN-CHARGE and rating of all equipment must match the KW of motors included. All electrical work to be carried out as per IS standard and CPWD rules/specifications.

10.7.2 EARTHING:

There shall be two independent earthing stations at least 3 meters away from the pump room. Each earth electrode shall consist of GI earth plate 600mmx600mmx6mm thick including accessories and masonry enclosure with cover plate having locking arrangement. All electrical apparatus, cable boxes and sheath/armour clamps shall be connected to the main bar by means of branch earth connection of 25mm x 5mm copper strip. All joints in the main bar and between main bar and branch bars shall have the lapping surface properly tinned to prevent oxidation. The joints shall be riveted and sheathed. The main earthing strip shall be 25 x 5mm copper in 40mm dia G.I. pipe from earth electrode as required.

Earth plates shall be buried in a pit 1.2 x 1.2m at minimum depth of 3 meters below ground. The connections between main bar shall be made by means of these 10 mm studs and fixed at 100mm centers. The pit shall be filled with coke breeze, rock salt and loose soil. A G. I pipe of 29mm dia with performations on the periphery shall be placed vertically over the plates to reach ground level or watering.

A brick masonry man hole 30x30x30cms size shall be provided to surround the pipe for inspection. A bolted removable link connecting main bar outside the pit portion leading to the plates shall be accommodated in this manhole for testing.

Earthing shall be done complete as per NBC / CPWD / IS specifications.

10.7.3 CABLING:

All cables from switch board panel to the motors shall be PVC insulated FRLS and PVC sheathed FRLS armoured aluminum conductor power cables of 650/1100 V grade conforming to IS:1553. The cables of required size shall be suitable for laying on surface of wall or in flooring with suitable clamps. Necessary cable trays shall deemed to be included in this item as per site requirements.

The termination shall be with brass compression glands suitable for PVC sheathed armored aluminium conductor cable of 1.1 KV "A' grade of the required size.

Refer electrical tender for further detailing & make list.

11.0 AIR VESSEL FOR FIRE PUMPS:

Provide air vessel from 8mm M.S. sheet with dished ends and suitable supporting legs, with required necessary valves and connection with required accessories.

The vessel shall be 450mm X 2000mm long, suitable for working pressure 10 kg/cm², Hydro test at 15 kg/cm², Joint efficiency 0.85, Radiography longitudinal seam 100%, Circumferential seam 10% spot.

12.0 PRESSURE GAUGE:

Contractor shall provide 150 mm dia Pressure Gauge at each pump delivery line & common delivery header or

as per standard practice.

- Range - 0 - 15 Kg / cm²
- Bourdon material – Nonferrous – AISI – 316
- Case & Bezel - Cast Aluminium Stove enameled Black weatherproof Case with inner screwed bezel of ABS plastics and Case and Bezel made of AISI 304/316.
- Glycerin filled, screwed, nipple, isolation valve, U-type stainless steel siphon tube and complete with necessary as required.

13.0 PRESSURE SWITCH:

Contractor shall provide Pressure Switches for automation of fire pumps.

- Cover - ABS, plastic
- Switch contacts – SPDT
- Ingress protection – IP 67

14.0 STRAINER:

Contractor shall provide strainer at water tank suction side as per drawing / BOQ with required accessories.

- Material - Cast Iron IS 210 Gr. FG 200
- Trim - S.S. Screen/SS 304 having 1.2mm perforation
- End Details: Flanges as per BS 10 Table E
- Body Test Pressure: 21 kg/cm²

15.0 VALVE CHAMBER:

Providing and laying Brick Masonary Valve Chamber of inside dimension 0.9M x 0.9M x 1.2M deep with 9" thick wall 20mm thick plastered from inside and 6mm thick MS cover with handle. Top cover to be painted with Red oxide primer and shall be capable of with stand 20 tone load.

16.0 TESTING OF THE SYSTEM:

All piping shall be tested to hydrostatic test pressure of **15 Kg/Cm²** for 2 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the PDEU's Representative.

Piping required subsequent to the above pressure test shall be re-tested in the same manner.

System may be tested in sections and such sections shall be securely capped.

The PDEU's Representative shall be notified well in advance by the Contractor of his intention to test a section of piping and all testing shall be witnessed by the PDEU's Representative.

The Contractor shall make sure that proper noiseless circulation of fluid is achieved through the system concerned. If proper circulation is not achieved due to air bound connections, the Contractor shall rectify the defective connections. He shall bear all the expenses for carrying out the above rectification including the tarring-up and re-finishing of floors, walls etc. as required.

The Contractor shall provide all materials, tools, equipment, instruments, services and labor required to perform the test, and shall ensure that the plant room and other areas are cleaned up and spill over water is removed.

The Contractor shall give the pressure test of head for hydrant at ground level and also for hydrant at terrace level.

All air shall be trapped from the pipeline through hydrants, Hose Reel& air valves. Each section of the pipe shall be slowly filled with the water & allow to stand the water for few hours with the ends closed.

Flushing of underground connections: Underground mains and lead-in connections to system risers shall be flushed before connections made to piping in order remove foreign materials which may have entered the underground during the course of installation. For hydrant system the flushing operation shall be continued until water is clear.

17.0 COMMISSIONING OF SYSTEM:

Before commissioning, the entire system shall be flushed to ensure that any earth /foreign matters which might have entered during installation are taken out. For this, pump may be operated, and valves opened at different locations.

As soon as the work is complete, the system shall be commissioned and made available for use. Requirement of firefighting installations is equally important during occupation of the building. If the building is to be occupied in part, firefighting system of building completed shall Commissioned by isolating the system of under construction portion of the building.

The firefighting system shall be maintained and manned from the very first day of its Commissioning.

Any defects noticed during the warranty period shall be promptly attended by the Contractor and availability of the system at all time is to be ensured.

18.0 ACCEPTANCE TEST:

At the time of taking over, the hydrant system shall fulfil the following acceptance tests: -

Starting up of the pressure suction (Jockey Pump): The pressure switch shall be set at 9.0 kg/cm^2 at the lower limit and 10 kg/cm^2 at the upper limit. The system drain shall be opened to cause a drop in the pressure. The Pump shall start as soon as the pressure gauge needle falls down to 9.0 kg/cm^2. The pump shall also stop automatically when the system has been pressurized again up to required pressure (10 kg/cm^2).

All these tests mentioned above shall be repeated after one-hour interval. The result of all the tests shall be identical again. After the system has satisfactorily withstood the above tests, it can be taken over from the contractor.

19.0 START-UP / SYSTEM TESTING:

It will be the responsibility of the tendered to cause interim/stage inspection by the CFO during execution of the work as and when so called for by the Employer / Architect and shall carry out any rectification / modification as may be suggested by the State Fire Officer (CFO).

Soon after the work is completed, the contractor shall inform the CFO in writing with a copy to the Architect / Employer for getting the complete system including all sub system and instrumentation, control etc. thoroughly inspected and tested for satisfactory performance. After satisfactory completion of tests of the systems by the CFO the contractor shall be required to submit in built drawings on tracing cloth to the Architect which have been so approved.

The contractor shall also be responsible for getting the system and equipment tested and approved by other Statutory Authorities like the Area Fire Officer or the State Fire Services as may be required.

20.0 HANDING OVER:

All commissioning and testing shall be done by the Contractor to the complete satisfaction of the Engineer-in-Charge / Consultants, and the job handed over to the PDEU. Contractor shall also hand over to the PDEU all maintenance and operation manuals and all items as per the terms of the contract.

C. CODES & STANDARDS

Sr. No.	Code	Description
A	**INDIAN STANDARD (IS)**	
1	IS 325	Induction motors - 3 – phase
2	IS:636	Fabric Reinforced Rubber Lined Hose
3	IS:844	First Aid Hose Reel
4	IS 900	Installation and Maintenance of Induction Motor
5	IS:903	Fire Hose Delivery Couplings, Branch Pipe, Nozzles And Nozzle Spanner
6	IS:908	Fire Hydrant stand post
7	IS:909	Underground fire hydrant sluice valve type
8	IS:1239	Steel Tubes & Fittings - up to 150 mm (Part I & II)
9	IS:2190	Selection, installation and maintenance of First aid fire extinguishers.
10	IS:2871	Specification for branch pipe, universal, for firefighting purposes
11	IS:3589	Steel Tubes - above 150 mm
12	IS:3844	Installation and maintenance of internal Fire hydrants and hose reel on premises
13	IS:5132	First Aid Fire Hose
14	IS:5290	Landing valves
15	IS:5312	Check Valves
16	IS:10211	Anti-corrosion treatment for underground pipes
17	IS:13095	Butterfly valves
18	IS: 14846	Sluice valves
19	IS:15301	Installation and Maintenance of Fire Fighting Pumps
20	IS:15105	Design and Installation of Fixed Automatic Sprinkler Fire Extinguishing Systems
21	IS:15683	Portable fire extinguishers - Performance and construction
B	**National Building Code (NBC)**	

D. LIST OF APPROVED MAKES

SR. NO.	ITEM DESCRIPTION	MATERIAL
1	Air Release Valve	Newage-Surendranagar / Winco / Sant / Swati
2	Air Vessel	Anu Designer / Diamond Machinery / Lalit Engineers
3	Batteries	Exide / AMCO / Amar Raja
4	Butterfly Valves, Sluice Valve and Non return Valve	Leader / Sant / Zoloto
5	Branch pipe & Coupling	Newage-Surendranagar / Winco / Swati
6	Centrifugal Pumps	Wilo / Kirloskar / Xylem
7	Coating wrapping material for Underground pipe	IWL / STP / Tikidan
8	Diesel Engine	Greaves / KOEL / Caterpillar / Eicher / Mahindra
9	Fire Bridged Inlet Connection	Newage-Surendranagar / Winco / Swati
10	Fire Extinguishers	Kanex / Ceasefire / Minimax
11	Ball Valve	Leader / Sant / Zoloto
12	Hydrant Valve	Newage-Surendranagar / Winco / Swati
13	Hose Pipe	Newage-Surendranagar / Winco / Swati
14	Hose Reel drum	Newage-Surendranagar / Winco / Swati
15	Hose reel	Newage-Surendranagar / Winco / Swati
16	Hose Box	Newage-Surendranagar / Winco / Swati
17	Hume Pipe	Alcock / Indian Hume pipe
18	M.S./G. I. pipes	TATA / Jindal / SAIL
19	Motor	ABB / CGL / Siemens / BHEL
20	Pressure gauge	H. Guru / HD / Wika
21	Pressure switch	Honeywell / Indfoss / Switzer / System Sensor
22	Power and Control cable	Finolex / Havell's / Polycab
23	Panels	CPRI Approved
24	Strainer	Sant / Leader / Zoloto
25	Paint	Asian paint / Burger / Nerolac

26	Hangers supports / Anchor Fastener / Pipe Supports	Hilti / Fischer / Hitech
27	Forged fittings	United forged / Metal Lloyds / VS