CLARIFICATIONS TO TENDER SPECIFICATION BHEL PSSR SCT 1388			
Some of the bidders raised quries in the above tender and our clarifications are furnished below for your reference.			
SUB	Construction of General Civil works in Main plant and other allied structures including architectutal works at Phase III Refineries project for MRPL-CPP Mangalore.		
S.No	Ref /BOQItem No	Query by the bidders	BHEL CLARIFICATION
1	NIT	Regarding the previous experience for Pre qualification ,shall we consider multistoried framed structured buildings of morethan 4 storeys as infrastructure projects anywhere else with completion of 17000 cum RCC in a single year .	As per PQR
2	12.3	Terrace water proofing works. The technical specification vide 6782-380-16-48-JS-01-Rev A, Pg-59 of 73 are not available.	Enlosed for itemk no 12.3 for your information
3	6.5a,6.7	Drawings needed for the structural steel columns	For item no 6.5a%6.7 -drawings will be provided during execution.Major structural steel is not envisaged in this tender
4	3.11	For conducting UPV test ,No.of test per cum of concrete to be mentioned	For item no 3.11-as per standard practice and IS 13311(part-I) specification
5	6.1	scope of supply of MS pipe is to be mentioned . contractor supply or BHEL supply.	As per item specification
6	6.5,6.5a	The foundation hardwares are tobe supplied by whom?	As per item specification
7	6.3	Structural steel supply is whose scope?	As per item specification
8	6.3,6.4,6.5,6.5a,6.7	Proper drgs are needed.	Required standard drawings enclosed in Vol II(tech spec).Other drawings will be provided during execution.bidders to follow standard practice.
9	7.4	Please confirm the unit for Half brick masonry.	CUM
10	7.5	Please confirm the unit for Damp proof course.	SQM
11		Please provide the the total (general) drawings.	Required standard drawings enclosed in Vol II(tech spec).Other drawings will be provided during execution.bidders to follow standard practice.
12	18.10,18.11	Please give the drgs and complete specification fr thiese items of works.	Drawings will be provided during execution.bidders to follow standard practice.
13	18.16	Please provide the buried pipes make and is it supplied at site or supply from BHEL Stores	Asper item specification
14	19.1,19.2	R.C.C /STEEL post are to be included under this item or that will be paid and measured seperately.	As per item specification only.Will be paid separately
15		shall we submit the price Bid in printed format?	As per tender conditions

S.No	Ref /BOQItem No	Query by the bidders	BHEL CLARIFICATION
16	2.1 B	Extra over 2.1(a) for every addl lead of 100mm or part thereof within Battery limit.What is the Battery limit	within the plant permisses
17	2.3(b)	Extra over 2.2(a) for every aadn lead of 1km or part thereof.There is no items like 2.2(a) in the BOQ.Does it relate to 2.3(a)	2.3(a) only
18		Cement specified as OPC/PPC/PSC/SRC-what does SRC stand for?	Sulphat Resistant cement
19	3.4(a)	Paving concreteM30 - What is the thickness?What is size of grooves to be left for sealing joints?Please furnish EIL drawing 7-65-0404 for our reference	Available in technical specification page 69/349
20	3.4(b)	Paving concreteM25 - What is the thickness?What is size of grooves to be left for sealing joints?Please furnish EIL drawing 7-65-0404 for our reference	Available in technical specification page 69/349
21	3.8	Pre-cast RCC trench covers M30 of varying thickness-Please clarify the range of thickness of covers proposed	Please quote as per rate Schedule
22	6.1	Please give EILDrg:7-75-0037/R03&7-68-050/R05 for MS pipe hand rails to see the various elevations involved and details of section	Available in technical specification page 79/349,85/349
23	13.10	Item No 13.9&13.11 are shown and 13.10 is not there in BOQ-Please confirm about the absence ofitem 13.10 in BOQ	Quote as per rate schedule
24	Nil	EIL spec no 6-68-0033Rev05 for fire proofing of structural steel members with insitu concreting-Please provide the specification	Available in technical specification page 63/349
25	13.2&13.3	Drawing7-75-0070&7-75-0071-for pressed steel doors drawings to be provided	Available in technical specification page 95/349,96/349
26	13.3	Drawing7-75-0008&7-75-0009-preferred steel air tight doors- drawings to be provided	Available in technical specification page 80/349,81/349
27	13.4	PVC panel doors-what is the size of frames to be used& shutter thickness	As per standard practice
28	13.6	EIL drawing 7-75-0001 for wooden flush doorsto be provided	Available in technical specification page 82/349
29	13.11	EIL drawing 7-75-0014/7-75-0015 aluminium windows drawing-operable,fixed fixed double drawins to be provided	Available in technical specification page 83/349,84/349

S.No	Ref /BOQItem No	Query by the bidders	BHEL CLARIFICATION
30	13.12	Aluminium partitions drawing 7-75-0014 drawing to be provided	Available in technical specification page 83/349
31	13.13&13.14	Aluminium framed doors& ventilator specification 6782-380-16-48&S-01-RevA drawing to be provided	This is only specification
32	15.4	Drg 7-75-0068 for roof drain heads	Available in technical specification page 91 to 94/349
33	15.5	There is no sub item (e) pl confirm	As per rate schedule vol III
34	17.3(a),(b)	Drg6782-000-16-47-3-021 ev1 for WBM 100mm&75mm thick	Available in technical specification page 97/349
35	17.7	precast interlock concrete blocks M20 for floor paths-what is the thickness of Blocks	As per rate schedule vol III
36	18.2	Drawing no 7-75-0051&7-75-0052 for transformer gate-drg needed	Available in technical specification page 331&332/349
37	18.3	Diameters of Anchor fasteners are given but not their respective lengthPl furnish the lengths of embedment of rods	As per BOQ
38	nil	Drawing no 6782-000-16-47-3-025 revB -Drg for bitumen sand carpet to be given	Available in technical specification page 98/349
39	nil	Pl vide BOQ item no 3.11 where rate for conductiong UPV testing of concrete is asked based on per cum.However UPV testing is charged on per SQM basis for rafts & foundations on per number for columns,beams and per unit area for slabs & on CORE extracted for paving concrete. Hence to give our quote on CUM will not fit to the rate asked in BOQ based on CUM.As such we would quote rates as said above for each member.Hence we request you to take this item as QRO item(Quote Rate only)	Not acceptable
40	nil	Pl vide BOQ item no 3.10 -item of controlling of temperature of freshly aid concrete to less than 23deg C using ice etc.In this regard we should not br insisted on putting up of cooling plant machineries as this would be very costly for a small quantity of 1000cum.We would restrict making arrangements to bring ice to site and cool the concrete as desired in your specifications	Not acceptable
41	11.2&11.5 to 11.9,12.3,13.3,13.4	Provide EIL specification 6782-380-16-48-JS-01-Rev A	Enlosed for your information
42	17.8	Provide specification for item no 17.8	As per item specification/standard practice
43	nil	We request you to provide the drawings for the buildings which are mentioned in this scope of works to enable us to quote the tender competitively	Required standard drawings are enclosed in Vol-II(Tech spec).Other drawings will be provided at the time of construction only. Bidder to quote as per standard practice.

S.No	Ref /BOQItem No	Query by the bidders	BHEL CLARIFICATION
44	nil	whether design is in our scope for this project-please clarify	Design is not in the scope of bidder
45	nil	Kindly issue the approved vendor list for fire proofing works,UPV test,Etc	No approved vendor list is available for Fire proofing works & UPV tests. It has to be carried out as per item specification and standard practice
46	12.3,12.4	Kindly mention of the thickness os APP modified bitumen water proofing item	For items 12.3 & 12.4 - As per item specification only. EIL specification 6782-380-16-48-JS-01-Rev A (Pages from 37 to 73 enclosed for your information)
47	12.3	provide the technical specification pages from 59 to 73	Enlosed for your information
48	12.2	Please clarify the unit of measurement is CUM or SQM	SQM
49	All sanitary items	Provide the specific make and NO	As per item specification
50	Water and power	provide water and electricity on free of cost	As per tender conditions
51	nil	In CW pump House and forebay the depth of excavation will be more and some special type of dewatering will be required depending upon the ground water table.Hence we request you to provide us the size of the above structures and founding level along with geo technical/borelog details.Incase the above is not furnished ,we request you to consider dewatering as a separate item.	No separate type of dewatering is envisaged in this tender
52	18.13	Size of lock fix for item 18.13	Bidder to quote as per general practice
53	3.7a&b	The depth is to be filled with sealant or with backer rod and sealant	As per item specififcation
54	6.3&6.10	Please clarify the scope of supply of material for this items	As per item specififcation
55	6.11a&6.11b	Please provide thickness of fire proofing structural steel members or pl.inform whether we can take the thickness from EIL Spec no:6-68-0033rev05.For item 6.11a whether we have to take expanded metal sheet welded mesh tie wires nuts over plates	Bidder to quote as per item specififcation /as per general practice
56	6.1	Whether we have to follow drawing no 7-75-0037/r03 or 7-68-051/rev05 for item 6.1	As per item specification
57	7.2,7.3,7.4	The item description stipulates bricks of compressive strength 75kg/sqcm where as EIL spec stipulates class 5.0N/sqmm.As proposed brick wall may not be a load bearing one,we request to change the BOQ description to 5.0N/sqmm.In case the above cannot be accepted ,then fly ash bricks may pl be permitted	As per item specification
This also form part of the tender .Hence the bidders are requested to submit this clarification list with duly signed along with the tender .ALL OTHER CONDITIONS REMAIN UNCHANGED. AGM/Contracts			

Testing of the bricks shall be done as per IS:5454 and IS:3495. Water absorption shall not be more than 20% by its dry weight when soaked in cold water for 24 hours.

Locally available bricks of non modular size (230x115x75mm) in place of bricks of modular size (190x90x90mm) can be used in case the bricks satisfy the other requirements of IS:1077 (corresponding class as defined above).

5.8 Stone

5.8.1 General

All Stones used for masonry works shall conform to the requirements of following BIS codes.

Method of identification of natural building stones	IS:1123
Recommendations for dimensions and workmanship of natural building stones for masonry work	IS:1127
Recommendations for dressing of natural building stones	IS:1129

5.8.2 Quality of Stones

Stones shall be hard, dense, strong, sound, durable, clean and uniform in colour. They shall also be free from veins, adherent coatings, injurious amounts of alkalies, vegetable matters and other deleterious substances such as iron pyrites, coal, lignite, mica, sea shells etc. As far as possible stones from one single quarry shall be used for anyone work. The strength of stones should be adequate to carry the imposed load and shall meet all the requirements of IS:1905, taking into account the appropriate crushing strength of stone and type of the mortar used. The percentage of water absorption, when tested in accordance with IS:1124, shall not exceed 5 percent.

The length of the stone shall not exceed 3 times the height. Width of stone on base shall not be less than 150mm and in no case exceed $^{3}/_{4}$ th thickness of the wall. Height of the stone shall not be more than 300mm.

5.9 Admixtures

5.9.1 General Requirements for Admixtures

- All concrete admixtures shall comply with the following Indian standards:

Specification for integral cement water proofing compounds.	IS:2645
Specification for other admixtures for concrete.	IS:9103

  In case of non-availability of any IS code for testing and acceptability criteria, relevant American, British or German Code shall be applicable.

- No admixture shall impair the durability of the concrete nor combine with the ingredients to form harmful compounds nor increase the risk of corrosion of reinforcement. Use of admixtures shall not reduce the dry density of concrete. Once the proportion of admixtures have been established, strict check shall be maintained not to alter the proportions of ingredients and water-cement ratio of the Design Mix during execution.

- The chloride contents in admixtures shall not exceed 2% by mass of the admixture or 0.03% by mass of the cement.

- Admixtures which do not meet the requirements stipulated in this document shall not be used.

5.9.2 **Water Proofing Compounds**

- The permeability of the specimen with the admixture shall be less than half of the permeability with a similar specimen without the use of these compounds. These compounds shall be used in such proportion as recommended by manufacturer but in no case it shall exceed 3% by weight of cement.

- The initial setting time of the cement with the use of these compounds shall not be less than 30 minutes and final setting time shall not be more than 10 hours. Tests shall be carried out in accordance with IS:4031.

- Compressive strength of the specimen at 3 days shall not be less than 160kg/cm^2 nor 80% of the 3 days compressive strength of mortar cubes prepared with same cement and sand only, whichever is higher. Similarly compressive strength at 7 days shall not be less than 220 kg/cm^2 nor less than 80% of the 7 days compressive strength prepared with the same cement and sand only, whichever is higher. The test to determine the compressive strength shall conform to IS:4031.

5.10 **Water Bars (Water Stops)**

5.10.1 PVC water bars shall be used in reinforced concrete construction of liquid retaining structures or any other structure to safeguard them from hydrostatic pressure and water leakage and any relative movement between two parts of the structure due to thermal loading shrinkage or differential movement of foundations. These shall be preformed and shall provide a permanent water tight seal along the entire joint in the poured concrete structures. These shall also be flexible enough to withstand deflection/ displacements at joints arising due to variation of temperatures or settlement of foundations.

5.10.2 Performance requirements of PVC water bars shall meet the requirements of IS:12200. These shall be of an approved make and of ribbed/serrated/plane type with a bulb at the centre. The thickness and width of water bars shall in no case be less than 5mm and 150mm respectively. However, for concrete sections greater than 300mm thick, the width of water bars shall not be less than 230mm.

5.11 **Bitumen/bituminous Materials**

Bitumen to be used for various types of work shall meet all the requirements of relevant BIS codes as given below:

Specification of Paving Bitumen.	IS:73
Specification for bitumen mastic for flooring (Grade IV)	IS:1195
Specification for Bitumen felts for water proofing and damp proofing.	IS:1322
Specification for Bituminous compounds for water proofing	

and caulking purposes.	IS:1834
Specification for preformed fillers for expansion joint in concrete pavements and structures.	IS:1838
Specification for bitumen mastic for use in water proofing of roofs	IS:3037
Specification for bitumen primer for use in water proofing and damp proofing.	IS:3384
Specification for Bitumen Mastic for Tanking and Damp proofing.	IS:5871
Specification for Glass fibre base coal tar pitch & bitumen felts	IS:7193
Code of practice for damp proofing using bitumen mastic	IS:7198
Specification for bitumen Mastic, Anti Static and electrically conducting grade.	IS:8374

Tests and acceptable criteria shall be as per relevant BIS codes.

5.12 **PVC Pipes**

PVC Pipes shall conform to the requirements of IS:4985.

5.13 **Wood/timber**

5.13.1 Wood recommended for platforms of cold vessels or below cold vessels/ exchangers shall be hard and shall be of group A, grade I, and shall have safe permissible stress of 7N/mm^2 in compression, perpendicular to grains on outside location as per IS:883. General characteristics like durability, treatability etc. shall conform to IS:883 and IS:3629.

5.13.2 Timber required to be used for form work shall be fairly dry before use. It should maintain its shape during the use and even when it comes into contact with moisture from the concrete. Storage of Wood/Timber shall be as per the requirements of IS:4082.

For proper identification and selection of suitable timber for form work, following codes shall be referred.

Classification of commercial timbers and their zonal distribution	IS:399
Specification for ballies for general purposes	IS:3337
Specification for Ply wood for concrete shuttering work	IS:4990

5.14 **Anti-termite Compounds**

5.14.1 Chloropyrifos emulsifiable concentrates (1%) conforming to IS:8944 shall be used for treatment of soil for protection of buildings against attack by subterranean termites.

5.15 **Polysulphide Sealants**

5.15.1 All Polysulphide Sealants shall conform to IS:12118. Test conditions and requirements shall be as given in the above referred BIS code.

6.0 CONSTRUCTION REQUIREMENTS

6.1 **Construction**

6.1.1 All concrete works shall be carried out as per the provisions of IS:456, IS:3370, IS:2974 and other relevant BIS Codes. Concrete mix proportioning and design mix; sampling and strength test of concrete, production and control of concrete, tolerances and placing of reinforcement and for cover; transporting, placing, compacting and curing etc, inspection and testing of structure (including requirement of non-destructive testing) shall be as specified in IS:456.

6.1.2 Continuous concreting shall be done for structures supporting dynamic equipment as per the provisions of IS:2974.

6.1.3 The damp proof course shall be laid in two layers of equal thickness and each layer given two coats of hot bitumen on top (grade A90/S90 conforming to IS:73) at the rate of 1.7 kg/m^2. Dry sharp sand shall be sprinkled evenly over the top layer of bitumen before hardening.

6.1.4 Form work and stripping of form work shall be as per the provisions of IS:456.

6.1.5 Assembly of reinforcement in RCC structures shall conform to IS:456.

6.1.6 Fabrication of all structural steel works shall be carried out as per the provisions of IS:800/801/802/806 and other relevant BIS codes. Fabrication shall include cleaning, straightening, cutting, bending, holding, bolting, welding, machining, painting, marking, assembling, erecting, inspecting and testing etc. Welding procedure and welder qualification shall be as per IS:800 and/or referenced BIS codes only.

6.1.7 Erection of all structural steel works including supply of plant & equipment, storing and handling, setting out, field connections, field welding and security during erection shall conform to IS:800/801/802/806.

6.1.8 All masonry works shall be carried out as per the provisions of IS:1597/2212/4326 and other relevant BIS codes.

6.1.9 The limits of dimensional tolerances for all works shall be as given below:

For Plain and Reinforced Cement Concrete Structures:

(a) Deviation from specified dimensions of cross section of columns and beams. - 6mm to +12mm

(b) Deviation from dimensions of footings (see Note below)

(i) Dimensions in plan -12mm to +50mm

(ii)	Eccentricity	0.02 times the width of the footing in the direction of deviation but not more than 50 mm.
(iii)	Thickness	±0.05 times the specified thickness.

Note: Tolerances apply to cast-in-situ concrete dimensions only, not to positioning of vertical reinforcing steel or dowels.

(c) Deviation in length (major dimension of single unit)

up to 3m	± 6mm
3m to 4.5m	± 9mm
4.5m to 6m	±12mm
additional deviation for every subsequent 6m	± 6mm

(d) Deviation in straightness or bow (deviation from specified line) for a single or continuous member), e.g, beam, column or slab edge.

Up to 3m	6mm
3m to 6m	9mm
6m to 12m	12mm
additional for every subsequent 6m	6mm

(e) Deviation in squareness shall be measured taking the longer of two adjacent sides as the base line.

The shorter side shall not vary in its distance from a perpendicular so that the difference between the greatest and shortest dimensions exceeds 6mm. For this purpose, any error due to lack of straightness shall be ignored. Squareness shall be checked with respect to the straight lines that are most nearly parallel with the features being checked. When the nominal angle is other than 90 degrees, the included angle between check lines shall be varied accordingly.

(f) Deviation in twists shall be within a limit such that any corner shall not be more than the limit given below from the plane containing other three corners:

Up to 600mm wide and up to 6m in length	6mm
over 600mm wide and for any length	12mm

(g) Maximum deviation in flatness from a 1.5m straight edge placed in any position on a nominally plain surface shall not exceed 6mm.

For Steel Structures:

(a) Columns and tower-type structures

- Deviation of column axes at foundation top level with respect to true axes.

i) In longitudinal direction	±5mm
ii) In lateral direction	±5mm

- Deviation in the level of bearing surface of columns at foundation top with respect to true level. ±5mm

- Out of plumb (verticality) of column axis from true vertical axis measured at top:

  i) Up to and including 30m height ±H/1000 or ±25mm whichever is less.

  ii) Over 30m height ±H/1200 or ±35mm whichever is less.

- Deviation in straightness in longitudinal & transverse planes of column at any point along the height . ±H/1000 or ±10mm whichever is less

- Difference in the erected positions of adjacent pairs of columns along length or across width of building prior to connecting trusses/beams with respect to true distance. ±5mm

- Deviation in any bearing or seating level with respect to true level ±5mm

- Deviation in difference in bearing levels of a member on adjacent pair of columns both across & along the building ±5mm

Note 1) Tolerance specified for out-of-plumbness should be read in conjunction with 'Deviation in straightness....' & 'Difference in the erected positions.....'.

Note 2) 'H' is the column height in mm.

Note 3) Tolerance limits as given under clause (a) above for steel structures are applicable to concrete columns/pedestals also.

(b) Trusses

- Shift at the centre of span of top chord member with respect to the vertical plane passing through the centre of bottom chord. ±1/250 of height of truss in mm at center of span or ±15mm whichever is less

- Lateral shift of top chord of truss at the centre of span from the vertical plane passing through the centre of supports of the truss ±1/1500 of span of truss in mm or ±10 mm whichever is less

- Lateral shift in location of truss from its true position. ±10mm

- Lateral shift in location of purlin from true position. ±5mm

- Deviation in difference of bearing levels of truss from the true level ±1/1200 of span of truss in mm or 20mm whichever is less.

(c) Gantry girders and Rails

- Shift in the centre line of crane rail with respect to centre line of web of gantry girder $\pm \left[\frac{\text{web thickness of girder(mm)}}{2} + 2\text{mm} \right]$

- Shift of alignment of crane rail (in plan) with respect to true axis of crane rail at any point ± 5 mm

- Deviation in crane track gauge with respect to true gauge.

  i) For track gauge upto and including 15 m ± 5 mm

  ii) For track gauge more than 15m ± [5+0.25(S-15)] subject to maximum ±10mm, where S in metres is true gauge.

- Deviation in the crane rail level at any point from true level ±10 mm

- Difference in level between crane track rails (across the bay) at

  i) Supports of gantry girders 15 mm

  ii) Mid span of gantry girders 20 mm

- Relative shift of crane rail surfaces (at a joining) in plan and elevation 2 mm

6.1.10 Construction of all other items of works shall conform to relevant Indian Standards and sound engineering practices.

6.1.11 The Contractor shall be responsible for the complete safety pertaining to all construction works.

7.0 SPECIFIC REQUIREMENTS

7.1 GENERAL

7.1.1 Apart from the conditions mentioned in the Design requirements given in the document, the following shall be strictly adhered to.

7.1.2 Cable/pipe trenches & precast slab covers shall be designed to withstand the load of hydra-crane. Seating surface of the slab shall be at least 100mm wide with structural ISA50x50x6 edge protection embedded through out the length of the trench.

7.1.3 Only steel shuttering shall be used for civil construction.

7.1.4 Contractor shall make necessary arrangement for placing the anchor bolts in position before concreting. Whenever there are more than four foundation bolts, these shall be fixed by using template. In case bolts are not available at site at the time of casting of foundation, proper pockets shall be left as per direction of the Engineer-in-charge.

7.1.5 Contractor to ensure isolation of structures/equipments with difference of temperature for free expansion while providing interconnecting platform and for connection to the stair structure.

7.1.6 Contractor shall ensure lateral stability by providing box/built up sections for columns wherever it is not feasible to provide vertical bracing in either direction.

7.1.7 Sub-station building shall be provided with anti termite treatment.

7.1.8 All designs, detailing & construction shall strictly conform to enclosed standards, specifications & drawings. However drawings marked "Issued for Information only" are for only guidance to the contractor.

7.1.9 Contractor shall furnish the BULK MTO for cement and High Strength Deformed TMT bars (*diameter wise*) and Structural Steel (*section wise*) within 45 days from the date of receipt of LOI/TOI. It shall also be updated at 50% & 90% stages of engineering progress and shall be submitted to owner/owner's representative for information.

7.1.10 Sequence of construction is to be shown on the AFC drawings by indicating construction joints wherever required.

7.1.11 The minimum diameter of reinforcement bar for slabs, beam stirrups and column ties shall be 8 mm and for footing slabs and vertical walls it shall be 10 mm. The maximum spacing of these bars shall be restricted to 300 mm c/c.

7.1.12 No equipment shall be directly supported on suspended floor slab. Suitable arrangement of beams shall be provided underneath to support the equipments.

7.1.13 The foundation design shall be based on approved Geotechnical investigation recommendations. Geotechnical investigation shall be in scope of the bidder. However, boreholes of nearby areas are enclosed for reference only for the bidder.

7.1.14 Contractor shall depute his concerned Civil-Structural design engineer to owner/owner's representative review office as and when required for review of his documents. During such reviews involving computer aided analysis/design/drafting of structures, the Contractor shall make his own arrangement of Personal Computer (PC) in the form of Lap-top in the premises of owner/owner's representative review office. This is required to expeditiously resolve all the comments including those involving the use of PC by Contractor in his submission. The Contractor shall ensure that these PC's are fully operational along with necessary software already loaded including the input/output/drawing files of the structures being reviewed. The Contractor shall revise and re-submit the analysis/design and drawings as required during review.

7.2 PAINTING OF STRUCTURAL STEEL WORKS

7.2.1 Painting on structural steel shall be as per specification enclosed elsewhere.

7.3 REVIEW OF DESIGN AND APPROVED FOR CONSTRUCTION (AFC) DRAWINGS

7.3.1 Complete structural design and AFC drawings for the following structures shall be got reviewed by owner/owner's representative in detail before taking up any construction activity at the work site:

a) Design Basis/Geotechnical investigation report/Foundation recommendations.
b) Gas Turbine Generators/HRSG/Steam Turbine Generator/Utility Boiler foundations
c) Chimney for Utility Boilers (Typ.)
d) Bypass stacks for GTG & HRSG foundation (Typ.)
e) Control room building (Blast proof)
f) Substation building (Typ.)
g) Shed for GTG & STG with EOT crane (Typ.)
h) FD & ID fan foundations (Typ.)
i) Pipe Racks (Typ.)

For all other works/buildings/structures, requisite number of prints (as mentioned elsewhere) of design calculations and AFC drawings shall be sent simultaneously to owner/owner's representative for information and to site for construction.

Submission of typical review category documents shall be taken up prior to corresponding information category documents. Owner/owner's representative comments on typical review category documents shall be duly taken care in information category documents as well before issuing them for construction.

7.3.2 The contractor shall furnish the quantities of different grades of concrete, reinforcement and structural steel in the respective AFC drawings. Bar Bending schedule for all RCC drawings shall be submitted by the contractor along with the AFC drawings.

ENCLOSURE I

FACTORS OF SAFETY FOR FOUNDATION DESIGN

Type Of Structure	Minimum Factor Of Safety Against Overturning		Minimum Factor Of Safety Against Sliding		% Weight Of Overburden Over Projected Plan Area Of Footing
	With Wind Or Seismic	Without Wind Or Seismic	With Wind Or Seismic	Without Wind Or Seismic	
All Buildings/ Structures/Eqpts. in Units	1.5	2.0	1.5	1.5	100
Pipe Rack (Offsite)	1.5	2.0	1.5	1.5	50$
Flood Light Mast	1.5	-	1.5	-	50$
Retaining Wall	1.5	2.0	1.5	1.75	100
Tall vessels/columns	1.5	2.0	1.5	1.5	100
Transmission Tower/Switch yard structures	1.5	2.0	1.5	1.75	50$
Blast Resistant Structures	1.5	2.0/1.2#	1.5	1.5/1.5#	100

\# With blast pressure

$ In case area is paved, overburden shall be based on NGL (for area under filling) or 600mm below HPP whichever is lower. In case of unpaved area, it shall be w.r.t. FGL.

Minimum Factor of safety against UPLIFT shall be 1.2 for all structures. (Note: In case of sumps, lining weight shall not be included).

PART – B : ARCHITECTURE

CONTENTS

1.1 BUILDING REQUIREMENT

The Buildings shall be designed on the basis of basic requirements furnished in this clause (including attached drawings referred in the clause) and **Design Basis** elaborated elsewhere in the bid package.

Provisions for LAN (Local Area Networking cabling) shall be considered for the building as per the Owner requirements. Necessary detailing for concealed conduiting through flooring, wall panels/walls, ceiling/ false-ceiling etc. shall be provided during the detail engineering.

Provisions for proper and aesthetically pleasing landscaping shall be considered for all the buildings as per the Owner requirements.

In case of conflict or contradictions between building requirement & design basis, provisions of the former shall override. The Buildings shall be sized in accordance with the Owner/ PMC approved GA drawings prepared on the basis of functional, maintenance, safety & statutory requirements as given in the drawings attached with Tender.

1.2 SPECIFICATION OF ARCHITECTURAL FINISHES

1.2.1 GENERAL

(a) For any aspect of item not covered in the document, the contractor shall follow instructions of the engineer-in-charge and execute the work as per relevant IS codes/ recommendations of approved manufacturer/ good engineering practice without any cost or time implication to **Owner/PMC. Contractor shall refer only to the relevant part of the specifications given below as per the Building Finishes described before.**

(b) All materials shall be of first quality conforming to the specifications & IS or equivalent with IS marks and shall be obtained from the approved Manufacturer. The Contractor shall get the materials approved by the Engineer - In - Charge before ordering & procurement. The Contractor shall furnish necessary certificates etc. as asked by the Engineer - In - Charge. Further to that he shall get the materials tested from approved test house if asked by the Engineers - In - Charge & submit the test certificate at his own cost for which no extra payment shall be made to him. The Engineer - In - Charge shall have the right to reject all or any of the materials intended to be used and such materials shall be immediately removed from the site by the Contractor at his own cost without any claim for compensation etc. due to such rejection.

(c) Workmanship shall be to the satisfaction of the Engineer- In- Charge. The contractor shall follow the specifications, relevant Codes & Manufacturer's guidelines for achieving desired level of workmanship as per specification & good engineering practice. Any executed work not conforming to the specification or not to the satisfaction of the Engineer -In-Charge shall be rectified by the Contractor as directed by the Engineer -In-Charge. No extra payment shall be made to the Contractor for such rectification. The contractor shall use only first quality approved material for all items.

(d) All specifications of various finishing items include construction supervision; supply of all materials, labours, tools tackles, scaffoldings etc. and are applicable for all heights, locations etc.

(e) For specifications of construction water, sand, cement, bricks/ stone, aggregates etc. reference shall be made to the Civil/ Structural specifications attached in the bid document.

(f) All specialised items of work (e.g. Aluminium Doors and Windows, Waterproofing, Overdeck Insulation, Precoated roof sheeting/ cladding, False ceiling, False Flooring, Partitioning and Panelling, Expansion joint sealing etc.) shall be got executed by the Contractor only through authorised applicators/ sub contractors of approved manufacturer/ vendor. The contractor shall submit list of such authorised applicators/ sub contractors for approval before execution of such items.

1.2.2 FLOOR FINISHING

Reference shall be made to the following Indian Standards for any further information etc. not covered in the specification. In case of any conflict/contradiction, provision of specification shall override.

IS: 4971	Recommendations for selection of Industrial floor finishes.
IS: 1237	Specification for Cement concrete flooring tiles.
IS: 777	Specification for glazed earthenware wall tiles.
IS: 2571	Code of practice for laying in situ cement concrete flooring.
IS: 4631	Code of practice for laying of epoxy resin floor toppings.
IS: 5491	Code of practice for laying in situ granolithic concrete floor topping.
IS: 4441	Code of practice for use of silicate type Chemical resistant mortars.
IS: 4443	Code of practice for use of resin type chemical resistant mortar.

(A) Cement Concrete Flooring

Cement concrete flooring shall be laid in average 25mm thickness over sub base (as per structural drawings/ specifications) and shall generally conform to IS: 2571. The flooring shall be laid in panels and shall consist of:

(a) 25 mm thick base course of M-15 grade cement concrete (with 6mm and down size stone aggregate) laid on the sub-base in panels (each panel not exceeding 1 Sq. Mtr. in area) in desired shape and pattern. The panels shall be bound by 3x20mm PVC strips panel dividers; fixed in position with their top at proper level maintaining the required levels, slopes, linearity etc. as required. Base course shall be laid in alternate panels. Before laying the base course, neat cement slurry @ 2.75Kg. of cement per Sq. Mtr. of area shall be applied (brushed) over the prepared sub base surface. Cement concrete shall be placed in position and beaten with trowel, including tamping and finishing smooth. Finishing of the surface shall follow immediately after completion of laying of base. The bed for flooring shall be prepared either level or sloped as per drawings and as instructed by Engineer-in-charge.

(b) Neat cement @ 2.75Kg. per Sq. Mtr. mixed with water to form a thick slurry applied over the base course (when the concrete is green), spread over the surface, pressed twice by means of iron floats; once when the slurry is applied and second time when the cement starts setting. The junction of floor with wall plaster, cladding, skirting shall be rounded off uniformly upto a radius of 25mm unless otherwise mentioned.

Each finished portion of floor, on completion shall be kept wet with ponding for a minimum period of 7 days.

(B) Cement Concrete Granolithic Flooring

Cement concrete granolithic flooring shall be laid in overall 40mm thickness over sub base (as per structural drawings/ specifications) and shall generally conform to IS:5491 in workmanship. The flooring shall be laid in panels and shall consist of:-

(a) 25mm base Course (Under layer) of M-15 grade Concrete (shall generally conform to Civil structural specifications) laid over sub base in panels (each panel not exceeding 1 Sq. Mtr. in area) in desired shape and pattern. The panels shall be bound by 3x30 PVC strips panel dividers; fixed in position with their top at proper level maintaining the required levels, slopes, linearity etc. as required. Base course shall be laid in alternate panels. Before laying the base course, neat cement slurry @ 2.75Kg. of cement per Sq. Mtr. of area shall be applied (brushed) over the prepared sub base surface. The borders of the panels shall have mitred joints at the corners of the room and intermediate joints shall be in straight line with panel joints. Cement concrete shall be placed in position and beaten with trowel and finished smooth. Beating shall cease as soon as surface is found covered with cream of mortar. Necessary slope shall be provided.

(b) 15mm thick Wearing top layer of cement mortar 1:3 (1 cement: 3 course sand by volume) which shall be laid within 15 minutes of laying the first layer. The cement and aggregates for the top layer shall be mixed dry. After mixing, sufficient quantity of washed sand and water shall be added to make the mix plastic but not flowing. The top and bottom layer shall firmly grip together. The base course shall be free of excessive moisture before starting the floor finishing. Use of dry cement, cement sand mixture sprinkled on the surface to stiffen the concrete or absorb excessive moisture shall not be permitted.

(c) While the concrete is still green, cement @ 2.75 kg per Sq.M of floor area shall be mixed with water to form a thick slurry and spread over the surface. It shall be pressed twice by means of iron floats, once when the slurry is applied and second time when the cement starts setting. The junction of floor with wall plaster, cladding, skirting shall be rounded off uniformly upto a radius of 25mm unless otherwise mentioned.

Each finished portion of floor, on completion shall be kept wet with ponding for a minimum period of 7 days.

(C) Heavy Duty Cement Concrete Flooring

Heavy duty Cement concrete flooring shall be laid in overall 50mm thickness over sub base (as per structural drawings/ specifications); shall generally conform to IS: 5491 in workmanship. The flooring shall be laid in panels and shall consist of:-

(a) Base Course (Under layer) 35mm thick of cement concrete (1 cement: 1.5 coarse sand: 3.5 stone aggregates of 10mm to 6mm size by volume) laid over sub base in panels (each panel not exceeding 1 Sq. Mtr. in area) in desired shape and pattern. The panels shall be bound by 3x40mm PVC strips panel dividers; fixed in position with their top at proper level maintaining the required levels, slopes, linearity etc. as required. Base

course shall be laid in alternate panels. Before laying the base course, neat cement slurry @ 2.75Kg. of cement per Sq. Mtr. of area shall be applied (brushed) over the prepared sub base surface. The borders of the panels shall have mitred joints at the corners of the room and intermediate joints shall be in straight line with panel joints. Cement concrete shall be placed in position and beaten with trowel and finished smooth. Beating shall cease as soon as surface is found covered with cream of mortar. Necessary slope shall be provided.

(b) Wearing Top layer/ Finishing layer shall be of cement, hardener and stone aggregate mix of 15mm thickness laid over the base course. Unless otherwise mentioned, one part of approved quality hardener and four parts of cement by weight shall be mixed dry. This dry mixture shall be mixed with stone grit of 6mm and down size in the ratio of 1 hardener and cement mixture : 2 stone grit by volume. Just enough water shall then be added to the mix.

The mixture so obtained shall then be laid on the base course within 2 to 4 hours of latter's laying. It shall be firmly pressed into bottom concrete so as to have a good bond with it. After the starting of initial setting, the surface shall be finished smooth and true with steel floats.

Each finished portion of floor, on completion shall be kept wet with ponding for a minimum period of 7 days.

(D) Cement Plaster Skirting

Cement plaster skirting shall be laid with cement mortar (1 cement:3 coarse sand by volume) shall be of 18mm thickness. The surface on which the skirting is to be applied shall be prepared and skirting shall be laid. The junction between flooring and wall shall be rounded off to a radius of 25mm if not otherwise mentioned.

While the mortar is still green, cement @ 2.75Kg per square metre shall be mixed with water to form a thick slurry and applied over the mortar. It shall be pressed twice by means of iron floats, once when the slurry is applied and second time when the cement starts setting. The flooring shall be cured for 7 days.

(E) Tile Work (Glazed/ Ceramic/Vitrified Porcelain)

Glazed vitreous tiles shall conform to IS: 777. Ceramic tiles for flooring shall be matt finished and non slip type. All tiles shall be decorative type of approved shade, pattern, texture and design and of approved manufacturer. . The sizes of the ceramic tiles shall generally be 300x300x8mm for flooring and 100x200x6mm or 300x200x6mm for walls (dado). Pigments to be admixed with mortar for grouting the joints shall conform to Table -1 of IS: 2114. The tiles shall be laid over a coating of approved neoprene based adhesive (as per manufacturer's specification) laid on base floor/ wall plaster. The joints of the tiles shall be flush pointed with cement paste (white cement and pigment conforming to IS:2114, Table-I) matching the shade of colours. The tile work shall be suitably cured.

(F) Acid Resistant Tiles Flooring

The tiles shall be vitrified ceramic tiles of approved size as per approved manufacturer's specification and shall be homogeneous having following properties:-

S.No.	Property	Values	Norms
1	Water Absorptions	±0.5%	ASTM C 373
2	Scratch Resistance	> 6	ASTM C 373
3	Chemical Resistance	Unaffected	ASTM C 650
4	Abrasion Resistance	> 100	ASTM C 501
5	Breaking strength	1400 kg/sq.cm	ASTM C 648
6	Density	> 2.0 Gm/CC	

The base course for flooring shall be Cement Concrete flooring/ Cement Concrete granolithic flooring and for skirting/ dado it shall be Cement plaster and background surface shall be prepared as per clause no. 5.2 and IS:4443.

Tiles shall be fixed on the prepared surface over a bitumen priming layer, bitumen mastic layer and resin type chemical resistant mortar. The bitumen shall conform to IS:702 and laying of bitumen mastic shall conform to 1S:1196.

Joints shall be allowed to set for 24 hours. The floor shall then be washed as per manufacturer's specifications to totally remove all marks from tile surface.

(G) Decorative vitrified porcelain flooring

The tiles shall be vitrified porcelain tiles, mirror polished, of approved size as per approved manufacturer's specification and shall be homogeneous having properties similar to vitrified ceramic acid resistant tiles. The fixing of tiles shall be similar to ceramic tiles.

(H) Kota Stone Floor Finish

Kota Stone Flooring shall be laid in minimum 40mm overall thickness over sub base (as per structural drawings/ specifications). The Kota Stone slabs shall be of selected quality and shade, hard, sound, dense, homogenous in texture, free from cracks, decay, weathering and flakes. These shall be machine cut to the requisite size and thickness and chisel dressed. For flooring and skirting/ dado/ riser the thickness of the stone slabs shall be 25mm and 18mm respectively. Skirting shall normally be 125mm high unless specified otherwise.

The slabs shall have smooth top (exposed) face before being laid. Before starting the work, the contractor shall get the samples of slabs approved by Engineer-in-charge. Each slab shall be machine cut to the required size and shape and fine chisel dressed at all edges to full depth and machine rubbed to a smooth surface finish. All angles and edges of the slabs shall be true square and free from chippings giving a plane and smooth surface.

Preparation of base shall include making it rough, cleaning thoroughly and applying neat cement slurry @ 2.75 kg of cement per Sq.M. of area to receive the mortar. Cement mortar shall be 15mm thick !:6 (1 cement: 6 Coarse sand by volume) for flooring and 12mm thick 1:3 (1 cement: 6 Coarse sand by volume) for skirting. The mortar shall be laid for fixing one slab at a time. The slab shall be washed clean before laying. It shall be laid over cement mortar bedding on top, pressed, tapped gently to bring it in level. It shall be then lifted and laid aside. Top surface of the mortar then shall be corrected by adding fresh mortar at hollows and depressions. The mortar then shall be allowed to harden and cement slurry of honey like consistency @ 4.4.kg of cement per Sq. M shall be spread over the mortar. The edges of the slabs shall be buttered with white cement (with necessary pigment)

grout to match the shade of the slabs. The slabs shall then be gently placed in position and tapped with wooden mallets till it is properly bedded in level. The joints shall be as fine as possible. Surplus cement on the surface of the slab shall be removed. The slabs in flooring shall continue for not less than 10 mm under the plaster/skirting. The finished surface shall be true to levels and slopes as instructed by the Engineer-in-Charge. The slabs shall be laid in patterns as per drawings and size shall not be less than 400 x 275mm, which shall be uniform. Cut size may be used along periphery as required. Curing, as required shall be done.

Grinding shall be commenced when the joints are properly set. Unevenness at the meeting edges of slabs shall be removed by fine chiselling. Grinding shall be done by machines except for skirting and small areas. First grinding shall be done with Carborundum stones of 48 to 60 grade grit fitted in the machine. Water shall be properly used during grinding. When the floor has been uniformly rubbed, it shall be cleaned with water baring all pin holes. It shall then be covered with a thin coat of cement mixed with pigments to match with colour of the Kota stone. This grout shall be kept moist for a week. Thereafter the second grinding shall be started with Carborundum stone of 120 grit. Grinding and curing shall follow again. Final grinding shall be with Carborundum of grade 220 to 350 grit using water in abundance. The floor shall be washed clean with water, oxalic acid powder shall then be dusted at 35 gms/sq. m. on the surface rubbed with machine fitted hessian bobs or rubbed hard with woollen rags. The floor shall then be washed clean and dried with a soft cloth or linen. If any stone slab is disturbed or damaged, it shall be refitted or replaced and properly jointed and polished.

1.2.3 DOORS AND WINDOWS

(A) Aluminium Glazed Doors, Windows And Ventilators

Aluminium glazed doors/ windows/ ventilators shall be made of extruded tubular electrostatically powder coated (min. 30 microns)/anodised Aluminium sections conforming to IS : 733 and IS : 1285 of 'INDAL' or approved equivalent manufacturer with 6.3mm laminated safety glass conforming to I.S.: 2553 fixed with rubber lining or EPDM gasket and extruded anodised aluminium beading.

Extruded aluminium sections used for various application shall have minimum weights as under.

a. Doors

1. For fixed frames		
i) Sides & Top members	:	1.975 Kg/RM
ii) Lock rail		1.594 Kg/RM
iii) Bottom rail	:	3.495 Kg/RM
2. For shutter frame		1.202 Kg/RM
3. Glazing clips (beading)	:	0.182 Kg/RM

b. Window/Ventilator

1. For fixed frames	:	0.639 Kg/RM
2. For shutter frame	:	0.636 Kg/RM
3. Glazing clips (beading)	:	0.165 Kg/RM
4. Coupling bars	:	0.933 Kg/RM
5. Member for fixing the frame	:	0.463 Kg/RM

The frames shall be fixed to masonry by means of Aluminium lugs fixed to the frame by counter sunk brass machine screws and grouted with M-15 grade concrete in minimum 150 x 150 x 50 mm sized hole in the masonry. In case of RCC, the frames shall be fixed with 12mm dia dash fasteners in case of concrete. Any steel item coming in contact with Aluminium shall be galvanised.

Aluminium glazed doors shall be provided with cup pivots (of aluminium alloy conforming to IS designation NS-4 of IS 737 and IS designation of A-5-M of IS : 617) riveted to outer and inner frames to permit to swing through an angle of 85 degree.

Following hardware shall be provided for the doors.

1. Heavy duty & hydraulically operated double or single action adjustable door closer conforming to IS : 6315
2. 250mm and 150mm long, 10mm dia Aluminium tower bolts as per IS: 204 one each for each shutter.
3. Brass body 6 lever mortise lock as per IS : 2209
4. Aluminium door handle for each shutter for each side.

(Note: All Aluminium fittings/ fixtures shall be of same finish as that of doorframe & shutter)

Side hung window shutters shall be fixed to the frame with Aluminium alloy friction hinges and shall be complete in all respects including accessories, fittings fixtures of same finish as that of window frame & shutter, handles of cast aluminium conforming to IS designation A-5-M of IS : 617 mounted on a handle plate riveted to opening frames, Aluminium Tower bolts, peg stays for ventilators etc. Wherever specified, decorative aluminium safety grills of approved design shall be provided which shall be screwed to the main frame.

(B) Steel Doors

Steel doors shall consist of :

(a) Pressed steel door frame of overall 125x 65mm size conforming to IS : 4351 and made of 16 SWG pressed steel sheet bent to required shape using bending machine to form solid/ true mitred edges/ corners, stiffened with 50 x 5mm thick MS flat spacers welded to the frame facing the wall/ column @ 600mm c/c maximum vertical spacing. The frame shall be fixed to the masonry by means of 300 x 25 x 6 mm thick MS hold fast welded to the spacer and grouted with M-15 concrete in minimum 350 x 100 x 100 mm sized hole in the masonry. In case of concrete, the frames shall be fixed by 96mm long, 12 mm dia metallic counter sunk type dash fasteners through the frame & spacers. Provision for hinges, locking arrangement and other hardware shall be provided in the frame by machine cutting of required size cutouts in the frame and welding/ screwing to 3 mm thick MS pad plates already welded over the cutout from behind. The frame shall be thoroughly cleaned of rust, mill scale, dirt, oil etc. and then finished with 2 or more coats of approved quality synthetic enamel paint of approved shade over a priming coat of approved red oxide zinc chromate primer. The hollow frame shall be packed with PCC to fill the cavity without gap.

(b) Pressed steel door shutter shall be made with 18 gauge steel sheets formed by machine bending in the form of hollow box (overall 40mm thick)

welded at meeting of the sheets with pad plate of 3mm thick MS flat all along the perimeter. The shutter shall be braced with channel shaped 35mm wide horizontal stiffeners by folding 16 gauge MS sheets @ 500mm c/c fixed by flush riveting. 3mm thick MS pad plates shall be welded inside at required locations for fixing of hardware. The cavity inside shall be packed with rigid PU foam/ phenolic foam or glass wool insulation to fill into the box cavity without gap.

For double shutters, an MS angle (25x 45x 3mm thick) shall be welded to one of the shutter providing a minimum 25mm wide rebate for the other shutter at the meeting point.

The shutters shall be fixed to the door frame by means of heavy duty MS butt hinges of 150mm size conforming to IS : 1341 @ 500mm c/c maximum.

Each door shutter shall have following accessories.

1. Spring loaded pressure die cast zinc alloy door stopper.
2. Heavy duty, MS aldrop 400mm long for double shutter & 300mm long for single shutter.
3. 12mm dia, 300mm long pressure die cast zinc alloy handles on both sides.
4. 12mm dia, 250mm long MS tower bolt at top and 12 mm dia 150mm long at bottom.
5. 3- way spring loaded locking & latching system.
6. 150mm x 300mm Vision panel with 16 gauge MS beading bent to 'Z' shape & 4mm thick plain glass conforming to IS : 2853.

The entire shutter including all accessories, fittings & fixtures etc. shall be painted with 2 or more coats of approved quality synthetic enamel paint of approved shade over a coat of approved quality red oxide zinc chromate primer.

(C) Wooden Flush Doors

Flush doors shall consist of:-

(a) Pressed steel door frame of overall 125x 65mm size conforming to IS : 4351 and made of 16 SWG pressed steel sheet bent to required shape using bending machine to form solid/ true mitred edges/ corners, stiffened with 50 x 5mm thick MS flat spacers welded to the frame facing the wall/column @ 600mm c/c maximum vertical spacing. The frame shall be fixed to the masonry by means of 300 x 25 x 6 mm thick MS hold fast welded to the spacer and grouted with M-15 concrete in minimum 350 x 100 x 100 mm sized hole in the masonry. In case of concrete, the frames shall be fixed by 96mm long, 12 mm dia metallic counter sunk type dash fasteners through the frame & spacers. Provision for hinges, locking arrangement and other hardware shall be provided in the frame by machine cutting of required size cut outs in the frame and welding/ screwing to 3 mm thick MS pad plates already welded over the cut out from behind. The frame shall be thoroughly cleaned of rust, mill scale, dirt, oil etc. and then finished with 2 or more coats of approved quality synthetic enamel paint of approved

shade over a priming coat of approved red oxide zinc chromate primer). The hollow frame shall be packed with PCC to fill the cavity without gap.

(b) Flush door shutters shall be factory made and overall 35mm thick consisting of solid core block board bonded with phenol formaldehyde synthetic resin conforming to IS : 848. The shutters shall be faced on both sides with 3 mm thick commercial plywood finished with 1 mm thick laminate of approved shade & make. 35 x 20mm second class Teakwood lipping shall be provided all around the shutter by means of approved quality neoprene based adhesive and nailing @ 300mm (maximum). Teakwood lipping shall be French polished (lacquer finish) as per specifications. The shutters shall be fixed to the frame by means of 125mm long MS butt hinges conforming to IS: 1341 @ 600mm c/c maximum.

Teakwood used for lipping etc. shall be second class Indian teakwood (conforming to IS : 4021) of good quality, well seasoned and free from defects such as cracks, dead knots, sapwood etc. and shall be with no individual hard & sound knots more than 15 Sq.cm in area and the aggregate area of such knots not exceeding 2% of area of the piece. The wood shall be fairly closed grains having not less than 2 growth rings per Cm. Width in cross section.

Following hardware of approved quality and shade shall be provided in each shutter:-

1. Heavy duty, overhead hydraulically operated door closer conforming to IS: 3564.
2. Anodised aluminium tower bolts as per IS : 204, 10mm dia 250mm long (at top) and 150mm long (at bottom), one each for each shutter on either side.
3. Brass body 6 lever mortise lock as per IS : 2209 including pair of handles of pressure die cast zinc alloy (satin finished)
4. 3mm thick plastic kick/push plate (150mm high at bottom for entire width & 200mm x 100mm at handle location).
5. Zinc alloy pressure die cast chromium plated spring loaded door stopper with heavy duty rubber shoes.
6. 150mm x 300mm Vision panel with of 4mm thick plain glass conforming to IS: 2853 fixed with second class Teakwood beading (not for toilet doors).

(D) Steel Windows and ventilators

Steel windows, ventilators shall in general conform to IS:1038 and IS:7452. Rolled steel sections for the fabrication of steel windows, ventilators shall conform to IS:7452. Glass panels for glazing purpose shall be 4mm thick (wt. 7.2 kg/ Sq.M)

The profile and type of windows, ventilators (glazed, partly glazed/ 1ouvred, side hung/ top hung/ fixed shutter, composite) shall be as per approved drawings.

The frames shall be constructed of sections cut to size and mitred. Corners shall be welded to form a fused welded joint. Process of welding shall be flash butt welding. The welded joints shall be grinded to square and flat edges.

Where larger units are to be formed by coupling individual units, the mullions, transoms shall be bedded in mastic to ensure weather tightness. Mastic shall be applied liberally to the channels of the outside frame sections before assembly, and the two units being coupled shall be drawn together tight with clamps, the mastic

being squeezed out and cut off neatly when the units shall be screwed together tight.

Where fixed glazing units are placed over openable units a push fit weather bar shall be provided.

Before glazing, all opening parts shall be checked for their operational smoothness. The frame shall be completely cleaned and bedding putty shall be placed in the rebate before glazing. Glass then shall be cushioned into the bedding and shall be fronted with front putty in a manner so as to enable the painting to be done upto the sight line. The back putty oozing out over the glazing rebate shall be cut off square and smoothed down.
For panels exceeding 600 x 300 mm in size, glass shall be secured by special glazing clips inserted in holes already provided in the steel sections, before applying the front putty.

For glazing of very large areas, rust proof steel beading with mitred corners shall be provided with screws @ 10 cm. from each corner and @ 20 cm. apart from each other. Putty shall be provided to the face of the bead in contact with glass, in addition to back putty.

Side hung shutters shall be connected to the frame by means of friction hinges. The handle for side hung shutters shall be of pressed brass mounted on a steel handle plate welded to the opening shutter frame and shall not be removable easily after glazing. The handle shall have a two point nose, which shall engage with a brass striking plate on the fixed frame in a slightly open as well as in a fixed position.

In case of fixing with masonry, holes for fixing the lugs/hold fasts shall be cut at required locations. In case of concrete or stone, the frames shall be fixed by means of dash fasteners. In case of masonry, the lugs shall be grouted in the holes with cement concrete, M-15 Grade when fixing to steel work, mastic shall be applied to the sill of the opening and the unit shall be placed on it with the jambs and head buttered with mastic and the unit shall be fixed with special fixing dips or with nuts and bolts.

All the steel surfaces shall be thoroughly cleaned free of rust, mill scale, dirt, oil etc. by sand and shot blasting and then painted with 2 or more coats of approved quality & shade synthetic enamel paint over a coat of approved quality red oxide zinc chromate primer.

12mm M.S. square safety bars (welded to fixed frame horizontally @ 100mm c/c) shall be provided wherever specified.

(E) Steel Rolling Shutter

MS rolling shutters shall conform to IS: 6248 and shall be constructed with interlocking lath sections formed out of cold rolled 0.9mm thick, 80mm wide steel strips for shutter width upto 3.5 M, or 1.25mm thick, 80mm wide steel strips for shutter width beyond 3.5 M, jointless MS channel section of 3.15mm thickness for guide, MS girders & bottom rail, shutter suspension stud with pully & cage, top rolling springs, locking arrangement etc. all complete as per manufacturers approved drawings. The entire shutter including all accessories shall be painted with 2 or more coats of approved quality & shade synthetic enamel paint over a

coat of approved quality red oxide zinc chromate primer. All the damaged surfaces of wall, columns, plastering etc. shall be made good.

Rolling shutters shall be mechanically operated type, when the size of the shutter exceeds 9 Sq. M and shall be complete with all accessories for mechanical operation as per approved manufacturers design & drawings.

Wherever specified the Rolling shutters shall be electrically operated; complete with all accessories, electrical motor, cabling etc. as per approved manufacturers design and drawings

Wherever specified the Rolling shutters shall be grill type or partly grill & partly solid type or fully solid type depending on ventilation requirement.

1.2.4 PLASTERING

(A) Plain Cement Plaster

Plain Cement plaster shall be provided in following thickness:

a. 12mm thick in 1:6 cement mortar for all plumb of the internal masonry walls & RCC Columns coming in line (flush) with this side of wall.

b. 15mm thick in 1:6 cement mortar for rough side of internal masonry walls RCC Columns coming in line (flush) with this side of wall.

c. The external plastering shall be with waterproof compound (cement mortar mixed with approved acrylic waterproof compound @ 1 Kg. per 50 Kg. of cement) 18mm thick cement plaster in 1:6 cement mortar for all external surfaces as indicated.

d. 6mm thick in 1:4 cement mortar for all RCC ceiling, beam etc. However if the undulation in ceiling is beyond 6mm thick plaster, extra thickness of plaster shall be applied without any extra cost to give a smooth and fair surface to the satisfaction of Engineer-In-Charge.

e. Sand face plaster wherever required as per architectural treatment.

The plastering work shall include preparation of background surface which shall consist of cleaning of all dust, loose mortar droppings, traces of algae, efflorescence or any other foreign matter by water or by brushing, roughening up of smooth surfaces by wire brushing or hacking, trimming of projections whenever necessary. The surface shall be washed off and well wetted before applying the plaster.

For external plaster, the plastering shall be started from top floor and carried downwards. Internal plastering shall start with ceiling. Plastering shall be applied evenly in specified thickness. The entire surface shall be finished smooth by means of trowel or wooden float.

All the brick/stone masonry and RCC joints shall be provided with 20 gauge chicken wire mesh stretched tight and fixed with G.I. type nails before plastering.

20mm x 10mm grooves (horizontal and vertical) shall be provided in perfect straight line & plumb in plastering as per drawings and instructions of Engineer- In - Charge.

Curing shall be started 24 hours after finishing the plaster. The plaster shall be kept wet for a period of 7 days. During this period the plaster shall be suitably protected from all damages at the contractor's expense by such means as approved by the Engineer-in-charge. The date of execution of plastering shall be marked on the plastering to ensure the proper duration of curing.

The plastering shall include all scaffolding, damage rectification etc. complete.

(B) Sand Face Plaster

Sand face plaster shall consist of 13mm thick 1:4 cement mortar (1 cement: 4 coarse sand by volume) under layer and top layer of 7mm thick 1:2 cement mortar (1 cement: 2 coarse sand by volume)

Preparation of background surface, workmanship, curing etc. shall be same as plain cement plaster.

The first layer shall be started from top floor and carried downwards. Before the first layer hardens, surface of it shall be roughened up by edges of wooden tapers and close dents shall be made on the surface. The subsequent layer shall be applied over the first layer after the first layer has been allowed to set for 3-5 days depending on weather conditions. The surface shall not be allowed to dry during this period.

All the brick/stone masonry and RCC joints shall be provided with 20 gauge chicken wire mesh stretched tight and fixed with G.I. (U) type nails before plastering.

20mm x 10mm grooves (horizontal/ vertical) shall be provided in perfect straight line & plumb in plastering as per drawings and instructions of Engineer- In - Charge.

Curing shall be started 24 hours after finishing the plaster. The plaster shall be kept wet for a period of 7 days. During this period the plaster shall be suitably protected from all damages at the contractor's expense by such means as approved by the Engineer-in-charge. The date of execution of plastering shall be marked on the plastering to ensure the proper duration of curing.

The plastering shall include all scaffolding, damage rectification etc. complete.

1.2.5 ROOF TREATMENT/ WATERPROOF COATING

(A) APP Bituminous membrane Water proofing

Material:

The water proofing membrane shall have a non-woven polyester membrane coated on both side with APP (Atactic polypropylene) modified bitumen. It shall have a Black finish with a very thin polyethylene foil on both sides It shall be in rolls of 1x10m for continuous laying on large lengths. When installed, it shall form an impervious, flexible blanket, which accepts normal structural movement without breaking or cracking.

Workmanship:

a) Preparation of surface:
The roof surface (or screed) shall be thoroughly cleaned with a wire brush and all foreign matter etc. shall be removed. Well-defined cracks on the surfaces shall be cut to a 'V' section, cleaned and filled up flush with a paste of filling compound and cement in the ratio of 1:2. The finished surface shall be perfectly dry and any dampness should be allowed to evaporate.

b) Laying:
The membrane shall be laid on the perfectly dry prepared surface by torching-on method with a gas torch. All joints shall have an overlap of 75mm which shall be torch sealed. The overlap shall be done in a manner, which does not hinder water flow along the roof slope. The membrane shall be finished with bituminous base aluminium paint.
The waterproofing shall be continued up to the parapet/wall for a minimum of 600mm over the finished roof surface. It shall be continued into rain water pipes by at least 100mm.

c) Cement Screed:
Plain cement concrete (1:2:4) of 25mm min. thickness with 24 SWG chicken wire mesh shall be laid to slope in panels not exceeding 6 m.sq. area per panel over the roof slab. The joints between panels shall be raked out neatly (after stipulated curing period) to a min. 6mm x 6mm V-groove and filled up with an approved quality sealant compound. Drain outlet shall be provided for all spouts/ rain water pipes by suitable rounding, filling and sloping of PCC. At the junction of the roof and parapet or any other vertical surface, a fillet of 75mm radius shall be formed in cement mortar (1 cement: 4 coarse sand).

The finished work shall be measured in M.Sq of area for the purpose of payment.

A guarantee of 10 years shall be provided by the manufacturer against the performance of the finished waterproof coating.

1.2.6 WHITE/ COLOUR WASHING, PAINTING, POLISHING ETC.

Reference shall be made to the following Indian Standards for further information etc. not covered in the specification. In case of conflict/ contradictions provisions of the specification shall override.

IS : 6278 :	Code of practice for white washing and colour washing.
IS : 2395 :	Code of practice for painting concrete, masonry and plaster surfaces.
IS : 712 :	Specification for building limes.
IS : 55 :	Specification for Ultramarine blue for paints.
IS : 63 :	Specification for whiting for paint and putty.
IS : 5411:	Specification for plastic Emulsion paint for interior use.
IS : 2338:	Code of practice for finishing of wood, and wood based materials.
IS : 5410:	Cement paint, colour as required.
IS : 384:	Brushes, paints and varnishes, flat.
IS : 486:	Brushes, sash, tool, for paints and varnishes.
IS : 110:	Ready mixed paint, brushing, grey filler enamels for use over primers.
IS : 426:	Paste filler for colour coats.
IS : 345:	Wood filler, transparent liquid.

IS : 3585: Ready mixed paint, alum. brushing priming water resistant for woodwork
IS : 426: Paste filler for colour coats.
IS : 106: Ready mixed paint, brushing, priming for enamels, for use on metals.

All materials required for the execution of painting work shall be obtained direct from approved manufacturers and shall be brought to the site in makers drums, bags etc. with seals unbroken.

In case of ready mixed paints, thinning if necessary, the brand of thinner shall be as per recommendations of the manufacturer.

Paint shall be applied by brushing or spraying. Spray machine used may be of high pressure type or low pressure depending on the nature and location of work. The paint containers, when not used shall be kept close and free from air.

After the finishing of work, the adjacent surfaces not intended to be washed/ distempered/painted/polished, shall be thoroughly cleaned of all paint patches and shall be finished in accordance with surface finishing of such surfaces.

(A) White/ Colour Washing

White washing in general shall conform to IS:6278. Scaffolding shall be erected for white washing in such a way that no part of the scaffolding shall rest against the surface to be white/ colour washed. The surface shall be thoroughly cleaned of all dirt, dust, mortar dropping and other foreign matter before white wash is to be applied. Surfaces already white/colour washed shall be broomed down to remove all dust, dirt, loose scales of lime wash or other foreign matters.

All damaged portions of the surface plaster shall be removed to full depth of plaster in rectangular patches and plastered again after raking the joints in masonry properly. Such portions shall be wetted and allowed to dry before any operation. All holes, cracks, patches etc. not exceeding 0.1 sq. m. in area shall be made good with material similar to that of the surface. Surfaces affected by efflorescence, moss, fungi, algae, lichen etc. shall be treated in accordance with IS: 2395.

The fat lime conforming to IS: 712 shall be slaked at site and shall be mixed and stirred with about 5 litres of water for 1 kg. of unslaked lime to make thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 4 kg of gum dissolved in hot water shall be added to each cubic metre of lime cream. Approved quality ultramarine blue (for white wash) conforming to IS: 55 @ 3 gram per kg. of lime shall be added to the solution. The whole solution shall be stirred thoroughly before use.

For colour washing sufficient quantity of colour wash enough for the complete job shall be prepared in one operation to avoid any difference in colour. Mineral colours of approved shade and quality not affected by lime shall be added to the white wash solution in proportions as directed by Engineer-in-charge. Solid lumps etc. in the colour powder shall be ground to fine powder, sieved and mixed evenly and thoroughly to the white wash solution.

White/ colour wash shall be applied with "MOONJ" brush to the in minimum 3 number of coats. The operation for each coat shall consist of stroke of the brush from the top to down wards, another from the down to upwards over the first stroke, similarly one stroke horizontally from right and another stroke from the left. Each

coat shall be allowed to dry before the next coat is applied. The white washing on ceiling should be done prior to that on walls.

Surfaces of doors, windows, floors etc. shall be protected from being splashed upon. Such surfaces shall be cleaned of white/ colour wash splashes.

(B) Oil Bound Distempering

The oil bound distempering work shall consist of:-

(a) Preparation of surface:-

The surface shall be thoroughly brushed free from dust, dirt, grease, mortar droppings, other foreign matter and shall be made smooth by sand papering. In case of distempering over existing distempered surface, the existing distempering shall be scrapped by steel scrapers leaving a clean surface. All nails shall be removed. Pitting in plaster shall be made good with plaster of Paris mixed with distemper of colour to be used. The surface then shall be rubbed down again 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. The surface affected by moss, fungus, algae, efflorescence shall be treated in accordance with IS: 2395. Any unevenness shall be made good by applying putty made of plaster of Paris mixed with water including filling up the undulation and then sand papering the same after it is dry. Scaffolding wherever required shall be erected in such a way that no part of the scaffolding shall rest against the surface to be painted.

(b) The primer coat:-

The primer coat shall be alkali resistant primer or distemper primer and shall be of the same manufacture as oil bound distemper.

(c) Base preparation:-

After the Primer coat, the base preparation shall include applying two or more coatings of oil based putty in paste form made from chalk powder mixed with linseed oil, white zinc, varnish etc. as per manufacturers recommendations. After each coat of putty, sandpapering of the surfaces shall be done.

(d) Application of Distemper:-

After the base preparation coats have dried, the surface shall be lightly sand papered and dusted off avoiding rubbing off of the primer coat. The distemper shall conform to IS: 428 and shall be diluted with water or any other prescribed thinner recommended by the manufacturer. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed by immediate vertical strokes, which together shall constitute one coat. The subsequent coats shall be applied after at least 24 hours between consecutive coats to permit proper drying of the preceding coat. The finished surface shall be even and uniform without patches, brush marks drops etc. Application of a coat in each room shall be finished in one operation.14 cm double bristled distemper brushes shall be used. After each days work brushes shall be thoroughly washed in hot water with soap solution and hung down to dry.

Surfaces of doors, windows, floors etc. shall be protected from being splashed upon. Such surfaces shall be cleaned of distemper splashes.

(C) Plastic Emulsion Paint

The Plastic Emulsion paint work shall consist of:-

(a) Preparation of surface:-

The surface shall be thoroughly brushed free from dust, dirt, grease, mortar droppings, other foreign matter and shall be made smooth by sand papering. In case of plastic emulsion paintwork over existing distempered/ emulsioned surface, the existing distempering/ emulsion shall be scraped by steel scrapers leaving a clean surface. All nails shall be removed. Pitting in plaster shall be made good with plaster of Paris mixed with plastic emulsion of colour to be used. The surface then shall be rubbed down again with a fine grade sand paper and made smooth. A coat of plastic emulsion shall be applied over the patches. The surface shall be allowed to dry thoroughly. The surface affected by moss, fungus, algae, efflorescence shall be treated in accordance with IS: 2395. Any unevenness shall be made good by applying putty made of plaster of Paris mixed with water including filling up the undulation and then sand papering the same after it is dry. Scaffolding wherever required shall be erected in such a way that no part of the scaffolding shall rest against the surface to be painted.

(b) The primer coat:-

The primer coat shall be alkali resistant primer or emulsion primer and shall be of the same manufacture as plastic emulsion paint.

(c) Base preparation:-

After the Primer coat, the base preparation shall include applying two or more coatings of oil based putty in paste form made from chalk powder mixed with linseed oil, white zinc, varnish etc. as per manufacturers recommendations. After each coat of putty, sandpapering of the surfaces shall be done.

(d) Application of Plastic Emulsion Paint :-

After the base preparation coats have dried, the surface shall be lightly sand papered and dusted off avoiding rubbing off of the primer coat. The plastic emulsion paint shall conform to IS: 5411 (Part- I) and shall be diluted prescribed thinner recommended by the manufacturer. Minimum two coats of plastic emulsion paint shall be applied with brushes in horizontal strokes followed by immediate vertical strokes, which together shall constitute one coat. The subsequent coats shall be applied after at least 24 hours between consecutive coats to permit proper drying of the preceding coat. The finished surface shall be even and uniform without patches, brush marks drops etc. Application of a coat in each room shall be finished in one operation. 14 cm double bristled distemper brushes shall be used. After each days work brushes shall be thoroughly washed in hot water with soap solution and hung down to dry.

Surfaces of doors, windows, floors etc. shall be protected from being splashed upon. Such surfaces shall be cleaned of splashes.

(D) Plaster Of Paris Punning

Plaster of Paris punning shall be applied over roughened plastered surfaces. Superior quality Plaster of Paris of approved make shall be mixed with water to obtain paste like consistency and shall be applied on walls, ceiling etc. in sufficient thickness to give an absolutely smooth, plumb and straight surfaces.

(E) Waterproof Cement Paint

Scaffolding shall be erected for white washing. The surface shall be thoroughly cleaned of all dirt, dust, mortar dropping and other foreign matter before white wash is to be applied. Surfaces already white/colour washed shall be broomed down to remove all dust, dirt, loose scales of lime wash or other foreign matters.

Scaffolding, Preparation of Surface shall be same as white wash. The surface so prepared shall be thoroughly wetted with clean water before the paint is applied.

Waterproof cement paint of approved make shall be mixed with water and stirred to obtain a thick paste, which shall then be diluted to brushable consistency. The proportion of mixture shall be as per manufacturer's recommendation. The paint shall be mixed in such quantity, which can be used up within an hour of mixing to avoid setting and thickening of the paint.

The surface shall be treated with minimum two coats of waterproof cement paint. No less than 24 hours shall be allowed between two coats and subsequent coats shall be applied only after the preceding coat has become hard to resist marking by subsequent brushing. The finished surface shall be even and uniform in shade without patches, brush marks, paint drops etc. Cement paints shall be applied with a brush with relatively short stiff hog or fibre bristles.

Curing shall be started after the paint has hardened. Curing shall be done by sprinkling with water two or three times a day. This shall be done between coats and for at least two days following the final coat.

(F) Painting of Steel and Other Metal Surface

Reference shall be made to IS :2524 and IS:1447.

The surface, before painting, shall be cleaned of all rust, scale, dirt and other foreign matter with wire brushes, steel wool, scrappers, sand paper etc. The surface shall then be wiped finally with mineral turpentine, which shall then be removed of grease etc. The surface then shall be allowed to dry.

In case of GI surface, surface so prepared shall be treated with Mordant solution (5 litre for about 100 sq.m.) by rubbing the solution generously with brush. After about half an hour, the surface if required shall be retouched and washed down thoroughly with clean cold water and allowed to dry.

Approved quality primer and paint in specified numbers of coats shall be applied as per manufacturer's recommendations either by brushing or spraying. Each subsequent coat shall be applied only after the preceding coat has dried.

1.2.7 ROOFING

Reference shall be made to the following Indian Standards for information etc. not covered in the specification. In case of any conflict/contradiction, provisions of specification shall override.

IS 1230: Cast iron rainwater pipes & fittings.

The roof slope shall be as specified and in general not pitched flatter then 1:5. The normal pitch if not specified shall be 1:2. Materials shall be supplied by approved manufacturer. The items supplied shall be free from cracks, chipped edges or corners or other damages. Storage and safety precautions shall be taken to avoid damage to the accessories.

A) C.I. Rain Water Pipes

C.I. rain water pipes shall be 100mm dia or 150mm dia (as specified/ indicated in drawings); shall conform to I.S:1729. The pipes shall be provided complete with necessary clamps, connections, bends, Tees, other accessories (as per approved manufacturers specifications) and shall be jointed with spurn yarn and cement mortar 1:2 (1 cement: 2 fine sand by volume). Embedded rain water pipes shall be suitably embedded/ encased in masonry/ cement concrete (M-15) with nominal reinforcement.

(B) Precoated Galvanised Steel Sheet Roofing/ Cladding

The base metal of the roofing shall be Cold rolled in high tensile Galvalume Steel of 550 MPA yield stress conforming to IS:513, IS:14246 and ASTM A446 Grade E. The substrate shall have hot dip metallic coating of aluminium- zinc alloy (150 grams per sq. mtr. total on both sides, coating class AZ150 as per per ASTM A792). The bottom unexposed surface shall then be coated with alkyd backer of minimum 7 microns. Top exposed surface shall have SMP (Silicon Modified Polyester) paint system Minimum 20 microns top coat applied over 5 microns primer. The top coat shall be in specified colour.

The precoated galvalume steel sheets shall meet the following performance standards

Pencil Hardness:	F minimum
Formability:	2-3 t
Specular Glass (60 deg): (ASTM D523)	20- 35%
Impact Resistance:	Greater than 10J
Salt spray test:	750 hours
QUV-Wealterometer Test:	1000 light hours
Humidity Test:	1000 hours
Temperature Resistance:	100 C
Fire performance:	Class I

The SMP coated steel sheet in standard colour under normal well washed conditions of exposure shall not show any cracking, flaking or peeling of paint film for at least 10 years. Colour change during service, determined according to ASTM D2244 should not exceed 5E hunter lab units on light colours.

The profiles shall have a depth of not less than 28mm and pitch of 190mm. Overall sheet thickness shall be minimum 0.50mm. Minimum weight of the sheet shall be 5.2 kg/ Sq.M

All roofing accessories like ridge, gutters, north light curves etc. shall be fabricated out of precoated sheet of same thickness (as for roof sheeting) and as per manufacturer's specifications. Metallic Fasteners and Fixing accessories shall be corrosion proof (polyester polymer coated). Self drilling screws/ fasteners with integral washers and EPDM seals, and nylon colour caps and joint sealants shall be provided for fixing of sheets as per approved manufacturer's specifications. Non metallic fasteners shall be of neoprene. Sealants shall be natural cure type and of cold setting variety.

Wind ties shall be of 40 mm x 6 mm flat iron section and other size as specified. These shall be fixed at the two eaves end of the sheet. Fixing shall be done with the same loose bolts which secure sheets to the purlins. Slot holes shall be cut in the wind ties to allow for temperature variations. The wind ties shall be painted with two or more coats of synthetic enamel paint of same shade as that of sheeting over a coat of approved primer.

1.2.8 SANITARY FITTINGS AND FIXTURES

Reference shall be made to the following Indian Standards for any further information etc. not covered in the specification. In case of any conflict/ contradiction provisions of specification shall override.

IS-2556: Specification for Vitreous Sanitary appliances (Vitreous-China, Part 1-15).
IS-774 : Specification for Flushing Cistern for Water Closets and Urinals.
IS-781: Specification for Cast copper alloy screw down bib taps and stop valves for water services.
IS-2064: Code of Practice for Selection, Installation and Maintenance of Sanitary appliances.

All glazed earthen ware shall be of approved make, colour and of one piece construction. All metallic fixtures like taps, stop cocks, soap holders etc. shall be CP brass and approved make. All wall fittings shall be fixed with nylon sleeve and CP brass screws and washers.

(A) Indian Type Water Closet

Squatting Pan shall be 550mm x 440mm Orissa Pan conforming to IS: 2556 Part-III with integrated footrests. The closet shall be fixed in the floor with 150 mm thick sand cushion and shall be connected with 100 mm dia CI `S' or `P' trap. The closet shall also be fitted with 10 litres valve less syphonic type glazed earthenware flushing cistern, conforming to IS: 774, and complete with all accessories like 15 mm dia. PVC inlet connection pipe 450mm long (with 15mm dia CP Brass stop cock and brass union), PVC ball valves, C.P Brass handle, telescopic 32 mm dia GI telescopic flushing pipe with union, 15 mm dia GI overflow pipe with mosquito proof net and fixed with glazed earthenware cover.

The cistern shall be fixed on MS brackets at a minimum height of 2150 mm from top of pan. All exposed metallic surface shall be painted with two coats of synthetic enamel paint of approved quality over a coat of red oxide zinc chromate primer (primer is not required for GI pipes).

One number heavy grade approved quality CP Brass bib cock conforming to IS: 781 (with necessary connections) shall be provided with each WC.

The work shall include providing and fixing water-closet and flushing cistern with all accessories, breaking wall and floors and making good the same, all inlet and outlet connections of cistern and water closet, finishing of solder joints, painting and testing of all connections etc. complete.

(B) Wash Down (European) Type Water Closet

Wash down water closet shall be of pattern-1 conforming to IS:2556 Part-II. Water Closet shall be of one piece construction, double trap syphonic type. This shall be fixed with plastic seat and cover as per IS:2548 of approved make and colour, fixed with CP brass hinges and rubber buffers and an integral 100 mm dia 'S' or 'P' trap with antisyphonage vent horn.

A low level earthenware cistern conforming to IS:774 of about 10 litres capacity, with 15mm dia PVC inlet pipe (with 15mm dia CP Brass stop cock) and brass union with wiped solder joint, internal overflow arrangement, 40 mm dia CP brass flushing pipe. CI or MS supporting brackets shall be fixed with the water closet. The closet shall be fixed firmly in the floor with matching cement mortar. All exposed metallic surfaces shall be painted with two coats of synthetic enamel paint of approved quality over a coat of red oxide zinc chromate primer. The clearance between top of pan and bottom of cistern shall not exceed 300 mm.

One number heavy grade approved quality CP Brass bib cock conforming to IS: 781 (with necessary connections); one number approved quality CP Brass Toilet paper holder (fixed to wall with wooden cleats, CP Brass screws) shall be provided with each WC.

The work shall include providing and fixing of all fittings, breaking floors and wall, making good the same, making inlet and outlet connection to the cistern and the closet, testing of joints, painting the exposed metallic surface with two coats of synthetic enamel paint over a coat of primer etc. complete.

(C) Urinals

Half stall type urinal shall be of size 610mm x 400mm x 380mm and conforming to IS:2556 Part VI. Urinals shall be of single piece construction with integral flushing box rim. These shall be mounted on walls. The flushing inlet pipe shall be of CP brass 15 mm dia and waste pipe 32 mm dia GI, 750 mm long shall be embedded in wall. Necessary unions and CP bottle trap shall be provided in the waste line.

Rawl plugs with CP brass screws shall be used for fixing the urinal. Fixing shall ensure that no liquid is left over in the pan after flushing. Unless otherwise indicated height above finished floors shall be 600 mm.

Urinals shall be connected to glazed earthenware automatic flushing glazed earthenware cisterns either individually, or in groups. Where individually connected to flushing cistern, the cistern capacity shall be 5 litres. For two urinals, one cistern of 10 litres capacity and for three urinals, one cistern of 15 litres, capacity shall be provided.

Cistern inlet shall be 15 mm dia PVC pipe with brass union. Outlet pipe from cistern shall be 25mm CP brass main, with 15 mm CP distributor pipe of sufficient lengths

to reach each bowl. Where individual cisterns are provided the outlet shall be of 15 mm CP brass.

The work shall include urinals inlet and outlet pipes, flushing cistern, breaking and making good the walls and flooring, making inlet and outlet connections including all related G.I. piping work (embedded in wall), painting exposed brackets and exposed metallic parts with two coats of synthetic enamel paint of approved quality over a coat of red oxide zinc chromate primer etc. all complete.

All The Urinals shall be separated by Marble partitions (of minimum 19mm thick White Makrana marble slabs; each partition in one piece) of minimum size 1000mm x 600mm. These partitions shall be inserted upto 100mm depth in the wall and fixed with cement mortar 1:3 (1 cement: 3 coarse sand by volume) and suitable sized M.S. Channel (embedded in wall with grouting) at bottom. The M.S. Channel at bottom shall be finished with two coats of synthetic enamel paint of approved quality over a coat of red oxide zinc chromate primer.

(D) Wash Basins

This shall be flat back wash basin (with require number of tap holes and conforming to IS: 2556 Part-IV) with anti splash rims on three sides, of size 550mm x 400mm size. Wash basins shall be of one piece construction including a combined overflow having an area of not less than 5 Sq. cm. shall be provided in the front or back of the bowl and it shall be so designed as to facilitate cleaning of the overflow. This shall be fitted on CI or MS brackets. Brackets shall conform to IS: 775. The brackets shall be given two coats of synthetic enamel paint or aluminium paint, over a coat of approved primer. Each wash basin shall be provided with 15mm dia CP brass pillar cock of approved make, rubber plug with CP brass chain, 32mm CP Waste fitting of standard pattern with 32mm dia G.I. pipe, CP Brass bottle trap, CP Brass 15mm dia stop cock etc. complete with all related accessories, fittings and fixtures. The wall side shall be fixed well flushed with the plaster or wall and the joint if any, shall be properly stopped with an elastomeric sealant. The top of rim of the wash basin shall be fixed at 800 mm above finished floor level, unless otherwise specified.

The work shall include provision and fixing of wash basin with all accessories, providing stop cocks and pillar cocks, breaking and making good walls, fixing and making inlet and outlet connections for stop cock, pillar cock and waste pipe, providing & fixing MS brackets painted with two coats of synthetic enamel paint of approved quality over a coat of red oxide zinc chromate primer etc. complete.

Following fixtures of approved quality shall be provided for each Wash Basin.

1. Mirror : Round edged Mirror of 5.5mm thick (minimum size of 400mm x 550mm)plain glass with 6mm thick AC sheet backing, beveled edged.

2. Glass Shelf : 600mm x 120mm x 4mm thick Glass shelf with CP brass bracket & guard rails ; fixed on wall.

3. Towel Rail : Chromium plated brass towel rail of 20mm dia, 600mm length & 1.25mm thickness.

4. Liquid soap container :Chromium plated Liquid soap container.

All the fixtures shall be fixed to the wall at identified locations with wooden cleats and CP Brass screws including cutting walls, making good the same etc. complete.

(E) Glazed Chinaware Sink

This shall be white glazed vitreous china Lab sink/kitchen sink of 610mm x 450mm x 250mm size conforming to IS : 2556, Part-V. It shall be fixed with approved quality M.S./C.I. brackets conforming to IS : 775. One 15mm dia CP brass bibcock, 15mm dia PVC connection, C.P. brass chain with 40mm dia GI pipe connected to floor trap with unions shall be provided. All exposed metallic surfaces shall be painted with 2 coats of approved shade and quality synthetic enamel paint (ICI or approved equivalent) over a priming coat of approved quality red oxide zinc chromate. All necessary cutting of floor, walls, counter etc. shall be made and then finished etc. all complete.

(F) Stainless Steel Sink

The stainless steel Kitchen/Laboratory sink shall be of approx. size 610mm x 450mm 200mm and made of min. 1mm thick stainless steel sheet of `Salem Steel' or equivalent. It shall be supported on M.S. brackets conforming to IS: 775. One 15mm dia C.P brass long body bib cock (if fixed to wall) or swivel type pillar cock (if fixed to counter) shall be provided. 15mm dia PVC/ G.I. connections to floor trap with unions shall be provided. All exposed metallic surfaces shall be painted with min. 2 coats of synthetic enamel paint of approved make and shade over a coat of red oxide zinc chromate primer. All necessary cutting of floor, walls, counter etc. shall be made and then finished etc. all complete.

1.2.9 FALSE CEILING, FALSE FLOORING. UNDERDECK INSULATION ETC.

A) Aluminium Lineal False Ceiling

Aluminium lineal false ceiling shall consist of:-

(a) Panel Carriers:-

These shall be roll- formed out of coated steel/ 0.95mm thick aluminium alloy; 32mm wide and 39mm deep with cut-outs to hold panels in a module of 90mm/ 100mm; all complete as per manufacturer's standard details and specifications. When two or more carriers are to be joined, they shall be joined together by means of carrier splices which will clip on to holes in the sides of the carriers and hold them firmly in place while maintaining the required module. The carriers shall be suspended from roof by 4mm dia. galvanised steel wire rod hangers, with height adjustment springs of stainless steel. Hangers shall be fixed to roof by "J" hooks and nylon inserts. Edge profiles shall be "L" shaped roll- formed out of 0.6mm aluminium alloy with coating.

(b) Panels:-

Panels shall be 84mm wide, 16mm deep, roll formed out of 0.5mm aluminium alloy 5050 or 3005. The aluminium panels shall be chromatised and stove enamelled (coil coated) on both sides in approved shade. Panels shall be factory cut in lengths upto 5 metres to suit site dimensions. As per air- conditioning requirements,

for return air, (wherever required) perforated panels shall be used, which shall have 2mm dia holes at 5mm centre to centre staggered in uniform pattern and symmetrically located in the middle of the panel face.

The ceiling shall be erected in continuous manner as per approved manufacturer's recommendations, specifications etc. The false ceiling shall have perfect levels, linearity etc. as required. Necessary cut outs for Electrical, AC and other fixtures shall be provided as per drawing and in co- ordination with relevant construction activities.

(B) Cavity (False) Flooring (with Particle Board)

The False flooring system shall consist of

(a) Pedestal base plate made of galvanised Mild steel and shall be of 100 mm x 100mm size and 8mm thick.

(b) Pedestal stud 30 mm dia made of galvanised mild steel seamless pipe and having threads at top and bottom for attaching the top head attachment and fixing to base plate.

(c) Top head attachments made of pressure die cast aluminium alloy of shape and thickness as per drawing; and shall be provided with check nuts at bottom portion for attaching the top head threads in the stud allowing for adjustment upto 25mm up & down.

(d) Channel stringers made of galvanised, machine cut, cold rolled mild steel channels of size 40 mm x 40 mm and 3.15 mm thickness.

(e) Floor panels of size 610 mm x 610 mm in general and of 35 mm thickness; made of unveneered, 3 layer flat pressed, teakwood particle board (conforming to IS :3087 bonded with BWP type phenol formaldehyde synthetic resin conforming IS: 848 and categorised as class-I for `Surfaces of very low flame spread' as per IS-1642); finished on the underneath side with 0.05mm thick Aluminium foil turned up and extended by minimum 12mm along the perimeter; finished on top with 2mm thick high pressure laminate and along four sides with hard PVC lipping as per drawing. 12mm x 12mm x 75mm long, 2mm thick Aluminium channel cleats shall be provided on middle of four sides of the panels for lateral stability.

False flooring pattern shall be as per approved drawing. Pedestal base plates shall be fixed to the base floor by 6mm dia, 40mm long dash fasteners as per the grid.
The pedestal stud locations shall ensure the grid work as per flooring pattern which in general shall be of 610 mm x 610 mm dimension. The length of the pedestal studs shall be such that clear cavity between false flooring and base flooring is of desired depth.

The top head attachments shall be inserted into the studs and shall be adjusted to obtain proper level of the finished floor panels by means of the adjustment nuts.

Stringer channels then shall be fitted onto the top heads in position to form the supporting grid work for the floor panels checking the level once again by adjusting the nut position if necessary. Now the check nut shall be finally tightened to secure the final level. Floor panels as specified shall be placed over the stringer channels.

Each floor panel shall be marked with positional numbering on the underneath. The finished floor panels shall be perfectly leveled, aligned without any gaps in between the panels.

Each individual panel shall be removable maintenance purpose.

Necessary cut-outs shall be made in the panels for cable routing, control panel fixation etc. as per drawing.

Necessary ramps, slopes, steps etc. shall be also provided for as per drawing. Around a control panel/ rack, the residual space left out shall be filled up with cut panels of uniform size as required to fully close the gap between the adjacent full panel and the control panel base channel. In this case the part floor panel shall extend upto the full width of the base channel and the cut size shall be determined accordingly. An additional row of jack pedestals shall be provided along the cut out on which the edge of the floor panel shall rest and over which the base channel of control panel shall be placed. It shall not directly rest on the jack head pedestal or grid channels.

The cavity between false flooring and base floor shall be properly cleaned and made dust free. The floor shall be finally coated with polyurethane based coating

The finished false flooring shall be able to serve for a distributed load of 1250 kg/Sq.M.

(C) Underdeck Insulation

a) **Phenolic Foam Underdeck Insulation**:-

Phenolic Foam Underdeck insulation shall be of rigid slab of 25mm thickness and approx. 1000mm x 500mm size as specified and shall conform to IS: 13204. It shall have density of 32 kg /Cu. Mtr. and K Value of 0.034 w/mk at 53 deg. mean temperature. The insulation shall be classified as ` Non Combustible ' as per BS 476, part 5 and >Class I= for surface spread of flame as per BS 476 ,part 7. It shall be prelaminated on both sides with kraft paper.

The entire soffit of slab and beams shall be thoroughly cleaned. Bituminous primer or zinc chromate primer shall be applied evenly @ 0.5 kg/m^2 over the entire surface. Hot bitumen or CPRX adhesive shall then be applied on the insulation panel @ 1.5 kg/Sq.M. The panels shall be pressed in position and further secured by dash fasteners.

The underdeck insulation shall be fixed only after all fixtures like hooks, clamps, cleats etc. for light fixtures, ducts etc. have been fixed in the ceiling.

b) **Polyisocyanurate Foam Underdeck Insulation**

Polyisocyanurate foam (PIR) shall be rigid slabs of size 1000 x 1500mm and thickness of 30mm conforming to IS:12436 having density not less than 32 kg./ Cu. M., thermal conductivity (K- value) not more than 0.023 w/mk measured at 10 deg. C. The slabs shall be covered on one side with glass fibre tissue/ Aluminium foil having 50mm overlap. The insulation shall be

classified as >Non Combustible= as per BS 476, part 5 and >Class I= for surface spread of flame as per BS 476, part 7.

First, holes in R.C.C. slab/ beam shall be drilled and nylon rawl plugs of size 8 x 25mm shall be inserted (5 nos. for each slab- One each at 4 corners and one at center). Entire R.C.C surface shall be thoroughly cleaned of all dust, dirt and loose particles by wire brushing. Then a coat of bituminous primer @ 0.5 Litres/ Sq.M. shall be applied to bare R.C.C.surface and allowed it to dry. After the primer has dried, hot blow grade bitumen of 85/25 grade or cold adhesive CPRX shall be applied on R.C.C.surface and to the two surface of each PIR panel and shall be pressed in position while the bitumen is still tacky. The PIR panels shall be secured in position with the help of G.I. screws (No. 8 x 75mm long) fixed into rawl plugs and G.I washers 25mm dia. Facing side of the panels shall be the one covered with fibre tissue/ Aluminium foil. The overlaps shall be covered with approved quality sealing compound (MAS-94 or equivalent). Chicken wire mesh 24G x 19mm shall then be fixed to G.I screws and tightened with lacing wire.

The underdeck insulation shall be fixed only after all fixtures like hooks, clamps, cleats etc. for light fixtures, ducts etc. have been fixed in the ceiling.

1.2.10. MISCLLENEOUS ITEMS

(A) Plinth Protection (Without Drain)

The plinth protection (all round the buildings- without drain) shall consist of a layer (150mm thick) of compacted sand and over that 100mm thick M-15 grade concrete top layer laid to slope. The top concrete layer shall be trowel finished, cured etc. complete. The work also includes carrying out the necessary excavation, disposal of surplus earthwork etc.

(B) Cinder Filling

All the sunk R.C.C slabs shall be provided with cinder filling comprising of:-

(a) Plastering the R.C.C. slab top, sides etc. with 18mm thick cement plaster 1:6 (1 cement: 6 sand by volume) mixed with approved waterproof compound @3% of cement by weight and finishing with a floating coat of neat cement slurry @ 2.75 kg. per sq. Mtr, finishing, curing etc. The work includes preparation of base surface as described in Plastering item.

(b) Filling with Cinder concrete 1:10 (1 cement : 10 cinder of 12mm and down grade) including consolidating, finishing, curing etc. complete.

(C) Sealing of Expansion Joints

All expansion joints (25mm wide) of the building shall be sealed with premium grade Silicon sealant (SILPRUF of GE Silicons or equivalent) consisting of the following:-

(a) The surfaces over which it is to be applied shall be totally dried and cleaned of all dirt, oils, mortar droppings, all loose material etc. by vigorous wire brushing and wherever necessary by grinding and blast cleaning (sand or water).

(b) A backup material or joint filler tapes (as per approved manufacturers specifications) shall be fixed in the expansion joint.

(c) A coat of primer as per approved manufacturers specifications (specially developed for use with Silicon sealant material) shall then be applied over the surface.

(d) Silicon sealant shall be applied by means of cartridge- type caul gun, either hand or air pressure activated. The sealant shall be applied in a continuous operation, horizontally in one direction and vertically from bottom to top of joint opening. The sealant shall be applied in excess so that a positive pressure adequate to properly fill and seal the joint is created. The sealant shall be struck with light pressure to spread the material against the back up material and the joint surfaces properly. The sealant shall be tooled to slightly conclave surface. As the work progresses, the excessive sealant shall be removed. The masking tape shall be removed immediately after tooling. The sealant shall be cured as per approved manufacturers recommendations.

Entire work shall be carried out as per as per approved manufacturers specifications and recommendations.