

PROPOSED WORKS FOR DEMOLISHING & DISPOSAL OF OLD BUILDINGS, PROVIDING BADMINTON COURT & RAMP WITH GI ROOF FOR COUNTER IN RAMANATHAPURAM CAMPUS, JIPMER, PUDUCHERRY

Volume- III
TECHNICAL SPECIFICATION

Tender No: HLL/IDD/CHN/19-20/033
Dated: 31st January 2020



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Technical specification:

Common Points:

Contractor should submit the shop drawing for all the works within 10 days of receipt of work order / LOA to Engineer – in - charge and should get prior approvals before executing any type of works along with coordination layout. The contractor should not deviate from the approved drawing at any point of time, in case of deviation while executing proper authorization should be obtained before proceeding further. Decision of HLL stands final.

The contractor should follow the following procedures:

1. **MAR** – Material Approval Request (Before procurement of any materials the contractor should submit MAR request along with necessary supporting documents to HLL Engineers and the makes should be as per list of approved makes specified in the tender document. Any materials procured without approval will be rejected at any point of time)
2. **Sample Tag** – After obtaining MAR, the contractor should submit sample tag along with samples (detailed specification can be submitted instead of samples for materials with high procurement values)
3. **MIR** – Material Inspection Request – After supplying of materials at site, the contractor should submit MIR request for verification of materials (the materials should be as per approved MAR and sample tag). Items deviating against authorized MIR will be rejected at any point of time.
4. **IR** – Inspection Request – The contractor should submit Inspection request on day to day basis for inspecting the works carried out.
5. **Billing** – Billing should be as based on the actuals executed at site and the contractor should submit the bills based on HLL billing format along with supporting documents (Dc copy, bill invoice, MAR, Sample tag, MIR, test reports, etc) for the items claimed in the respective bill. 3 sets of original bill and 2 sets of copy should be submitted.
6. All document formats pertaining to the work should be of HLL formats and the same can be issued on request.
7. 3rd party testes through NABL aggregated labs should be carried out for the necessary items executed at site by the contractor as per the direction of HLL without any additional costs.
8. 5 sets of following documents should be submitted during completion/ handing over of the project
 1. As built drawings (Hard & Soft copy),
 2. Inventory list,
 3. Warranty certificates
 4. Statutory approvals, if any
 5. Manuals
9. Spares, keys or any other components related to the equipment/ materials installed should be handed over with a list along with separate tags.
10. Hindrance register should be maintained at site.
11. All the debris, remaining should be cleared from the same and disposed within campus lead not more than 4 KM. And the completion certificate will be issued only after clearing the site and making it good.
12. Installation, Testing & Commissioning report for all the works should be provided as per HLL formats.

Hot work permit:

Hot work permit must be obtained prior to the starting of work from concern

department of JIPMER.

Supervision:

Contractor shall depute their team of engineer for the supervision of installation, testing, commissioning & handing over at site of work. List of Engineers along with their bio data should be submitted to project office before commencement of the works. And the team should maintain records of daily progress and report the same to HLL Engineers on regular basis. Prior permission for the works carried should be obtained from HLL. All the Engineers should be available at the site during execution of work until handing over without fail.

1. Civil Engineer-Degree holder – 1 no. with min 5 years' experience or Diploma Holders – 02 no's with min 8 years' experience.
2. Project Manager – Degree holder 1 no. with min 12 years' experience in same type of work.

Security & Storage:

The contractor is responsible for storage & security of all the materials, equipments, piping, wiring and all related accessories till the time of handing over to the customer.

Power & Water:

The contractor should make his own arrangement for electricity & water.

Working Hours & Damages of existing property:

As the work is being executed in running hospital building, at most care should be taken during execution of works. Damages caused to the existing property should be rectified at own risk and cost with war foot basis. Time Schedule for the works to be carried should be submitted prior to the work. The job specified and scheduled shall be completed and reported on daily basis, waste materials relating to the job should be cleared on daily basis.

Labour camp:

Labour camp will not allow inside the campus and the contractor should take sole responsibility for workers stay outside the campus. Workers should not use any type of alcohol/smoking related items inside the campus.

Co-ordination with Other Agencies

The contractor shall co-ordinate with all other agencies involved in the building work so that the building work is not hampered due to delay in his work.

Structural Alterations to Buildings

(i) No structural member in the building shall be damaged/altered, without prior approval from the competent authority through the Engineer-in-charge.

(ii) Structural provisions like openings, cutouts, if any, provided by the department for the work, shall be used. Where these require modifications, or where fresh provisions are required to be made, such contingent works shall be carried out by the contractor at his cost.

(iii) All such openings in floors provided by the Department shall be closed by the contractor after installing the cables/ conduits/ rising mains etc. as the case may be, by any suitable means as approved by the Engineer-in-charge without any extra payment.

(iv) All chases required in connection with the electrical works shall be provided and filled by the contractor at his own cost to the original architectural finish of the buildings.

TECHNICAL SPECIFICATIONS AND CONDITIONS- CIVIL WORKS

1. BRICK WORK

- a. Bricks used in the work shall be obtained from kilns to be got approved from the Engineer in charge and shall be best quality well burnt ground moulded bricks as available in the vicinity. They shall have a compressive strength of not less than 75 Kgs/sq.cm and an absorption percentage of not more than 15 (Fifteen) % of its dry weight when immersed in water for 24 hours. In all other respects they shall conform to the provision in Latest CPWD Specifications for works.
- b. Both the face of wall of thickness more than 23cm shall be kept in the proper plane. Walls of half brick thickness or less shall be measured separately and paid in sqm.
- c. Bricks wall beyond half brick thickness shall be measured in multiple of half brick (i.e. more than 115mm or equivalent) which shall be deemed to be inclusive of mortar joints. In all other respects they shall conform to the provision in relevant specifications of the work.
- d. For mortar, use of PP Cement shall be preferred.

2. CEMENT PLASTER: - The use of PP Cement shall be preferred.

3. WOOD WORK:

- a. Timber required for manufacture of chowkhats and shutters for doors, windows, ventilators, partitions etc shall be Forest Stewardship council (FSC) certified wood and it shall be seasoned and preservative treated.
- b. The moisture contents of the wood used in the work shall not be more than that stipulated in the relevant clause of Latest CPWD Specifications for works. The rate quoted for various items shall be inclusive of kiln seasoning and preservative treatment of wood. In all other respects the wood used in the work shall conform to the provision in latest CPWD specification for works.
- c. The sample of species to be used shall be deposited by the contractor with the Engineer-in – charge before commencement of the work. The contractor shall produce cash voucher and certificate from standard kiln seasoning plant operator about the timber section to be used on the work having been kiln seasoned by them failing which it would not be so accepted as kiln seasoned.
- d. Glass :-
 - i. Transparent sheet glass (Float glass) conforming to IS 1761 – 1970 shall be used.
 - ii. Minimum thickness shall be governed as under, unless otherwise specified in the item.

AREA of Glazing	Max. Unsupported length	Thicknes s
For glazing area up to 0.5 sqm	120 cm	4 mm
For glazing area more than 0.5 sqm	120 cm	5.5 mm

- iii. Glazing for toilet and in fixed ventilators shall be of frosted type.

e. Shutters:-

- i. Factory made shutters, as specified shall be obtained from factories to be approved by the Engineer – in - charge and shall conform to IS 2202 (Part –I) 1977. The contractor shall inform well in advance to the Engineer – in – charge the name address of the factory from where the contractor intends to get the shutters manufactured.
- ii. The contractor will place order for manufacture of shutters only after written approval of Engineer – in – charge in this regard is obtained. The contractor is bound to abide by the decision of the Engineer – in-charge. In case the factory already proposed by the contractor is not found competent to manufacture quality shutters, the Engineer – in – charge will recommend the name of another factory from the approved list.
- iii. The contractor will also arrange stage wise inspection of the shutters at factory with the Engineer in charge or his subordinate authorized representatives. Contractor will have no claim, if the shutters brought at site are rejected by the Engineer in charge in part or in full lot due to bad workmanship / quality or damages caused during their shifting from factory to site. Such shutters will not be measured and paid and the contractor shall remove the same from the site of work within 7 days after the written instruction in this regards are issued by the Engineer in charge or his authorized representatives.

4. STEEL GRILL WORK:

- a. All steel grills shall be according to the detailed drawings and obtained from approved suppliers. These shall conform to Latest CPWD Specifications for works.
- b. In case of grills an approved quality priming coat of zinc chromate shall be applied over and above a shop coat of primer. Nothing extra shall be payable for providing shop coat primer, but the zinc chromate primer, if additionally required, will be paid for separately.

5. ALUMINIUM WORKS

- A. The scope of the work is the fabrication, supply and erection at site of all types of Aluminium glazed doors, windows and ventilators in accordance with the drawings and specifications.
- B. The supply and erection will include all parts such as but not restricted to frames, tracks, guides, mullions, styles, rails, couplers, transoms, rails, plates glazing bars, glass, hinges, arrangement, spring catches, cord and pulley arrangements, spring catches, cord and pulley arrangements door closers floor springs etc., required for the whole work whether the parts/ items are individually and specifically referred to in the schedules/ specifications/drawings or not provided that the supply and installation of such parts can be inferred there from and are necessary to make the work complete, unless separate provision is made in the bills of quantities for supply to such parts/items.
- C. The doors, windows, ventilators, will be fabricated to suit the finished clear openings in the building/structure which the tenderer will himself measure.

D. Materials:-

- i. The members will be made out of aluminum alloy corresponding to IS:733 and will consist of extruded sections and of other shapes, and to sized gauges as shown in the drawings/ described in accordance with the relevant IS codes. The members shall be chosen to provide strength/ stability and maximum resistance to wear and tear.
- ii. The Sections will be as per approved makes, extruded sections. As indicated in the drawings the tenderer should specifically mention which sections he is using. The weight of sections and the corresponding catalogue numbers are mentioned. The IS specifications are to be strictly adhered.
- iii. The extruder using recycled materials may be preferred.
- iv. The alloy of extruded aluminum should be BS or IS old HE9, Alcon 50 SWP. to this effect test certificate has to be provided for the extruder.

E. Finishing:

- i. The extruded aluminum section has to be mechanically finished to remove all scratches; extrusion marks etc and subsequently thoroughly cleared in all alkali baths prior to anodizing.
- ii. The polyester powder coating, as required, as per item of work, shall be of desired shade with minimum average thickness to 50 microns or other shades as required and to this effect the tenderer must have to produce test certificate from authorized institutions Bureau of Indian Standard.
- iii. The polyester powder coated material should be properly wrapped in gummed tape before fabrication to avoid scratches during fabricated and erection shall be kept protected till handing over.

F. Fabrication:

- i. Before commencing the fabrication the contractor shall submit to the Engineer – in - charge for their approval detailed shop drawings, based on the Architectural drawings and corresponding specification showing junctions, fittings, accessories such as hinges flush bolts, locks, latches, latching arrangements, peg stays, rotor arms, anodize pivots gaskets rubber packing door felts, mastic, sealant etc., including fixing and sealing arrangements . Type and method of scaffolding he intends to use, Fabrication is to be taken up only after approval by the Engineer – in - charge and in accordance with the approved drawings. Sections for fabrication of door/ window/ventilators etc shall be as per architectural drawings or as approved by the Engineer – in - charge.
- ii. A sample of finished door / windows/ ventilator railing etc. shall be fabricated as per the shop drawings approved by the Engineer – in - charge for final approval before under taking mass production/ fabrication,
- iii. The doors, window, ventilators and partitions shall be as per thickness given in the approved shop drawings, Polyester Powder coating shall be as specified in the item specifications.
- iv. All materials shall conform to relevant IS. Codes and in the absence of IS code, they should correspond to the best engineering practice; decision of the the Engineer – in - charge shall be final and binding on the contractor.
- v. Fabrication shall be done true to the drawing/ sample approved and in correspondence to the finished openings at the site. All joints shall be mitred at the corners, true right angles,

and joints to be finished neatly to hairlines, with concealed fasteners, wherever possible joints shall be made in concealed locations.

- vi. All fabricated/finished items shall be packed and carted properly to site to prevent any damage in transit. On receipt at site they shall be carefully stacked in protected storage to avoid distortion/damage.
- vii. Site installation shall be with concealed screws, self-tapping or other approved fasteners or may be by welding, due precautions shall be taken to avoid any distortion/ discoloration /damage to the finished items.
- viii. Wood work faces /parts coming in contact with masonry shall before shifting to the site be given a heavy coat of alkali resistance bitumen paint. Steel items coming in contact with other incompatible materials shall be given a thick coat of zinc chromate primer.

G. Glazing: Glazing shall be done with flawless sheet glass of best approved quality without waviness, distortion, coloration / discoloration, of specified thickness in sizes as shown in the drawings, fixed as required with special glazing clips, putty, neoprene/PVC gaskets. All glass shall be cleaned thoroughly before they are fixed in position. Unless otherwise specified the minimum thickness shall be 5 mm thick.

6. FLOORING:

- a. The flooring in the building shall be as per the approved floor finish drawings and laid in such a way that limits in floor levels would not exceed the limits provided in the latest CPWD specifications or manufactures specifications.
- b. Wherever Vitrified Tile flooring is done, it shall be with multy grade/range 1st Quality tiles.
- c. Slope in floors shall be provided as per architectural drawings, else the levels at any place when checked over a distance of one meters in any direction should not show variation in floor level more than 3 mm.
- d. Rate for the items of flooring is inclusive of provision of sunken flooring and finishing edges of the same in bath kitchen, toilets, cutting holes for traps/ pipes etc., and nothing extra shall be paid on this account unless otherwise specified.
- e. Protective layer to be provided of any type of flooring and nothing extra shall be paid on this account.

7. FALSE CEILING: -

- a. False ceiling items in general are carried out as per the description of the item in the Bill of quantities and also as per the manufacturer's specifications / as directed by the Engineer – in – Charge.
- b. Location of particular type of false ceiling shall be as per relevant drawing, in its absence written approval of the Engineer – in - charge shall be obtained.
- c. The false ceiling tiles from manufacturers using recycled materials shall be preferred.

8. MINERAL FIBRE CEILING TILE

a. 16 mm Mineral Fibre ceiling Tile

i. Material

Ceiling tiles shall be of made of mineral fibre of dimension 595x595mm with 16 mm

thickness humidity resistance 99% Thermal conductivity $K = 0.052-0.057$ w/mK colour white, fire performance UK Class 0/Class 1 (BS 476 pt -6&7) suitable for green building application (GRIHA Criteria 17 & 29 SWAGRIHA 12) with recycled content not less than 30 % and light reflectance not less than 85%. NRC of 0.55 to 0.6. The tile and grid should carry a limited warranty of one year against sag.

ii. Frame

The frame work shall consist of G.I. ' T ' Sections for Main runners 15x38x3000mm length, Cross runners of 15x32x1200mm & 15x32x600mm size, 0.33 mm thickness as specified in the item with galvanization of 120 gsm (minimum) and perimeter wall angle of 0.40mm (minimum) thick gauge having equal flanges of size 24x24mm made from precoated G.I. Coil length of 3.0m fixed to the wall with the help of plastic rawl plugs at 450mm centre to centre with 50mm long dry wall SS screws. The frame work shall be executed in a manner so as to form a grid of 600x600mm as specified in the item.

iii. Fixing of Ceiling Tiles

The frame work shall be suspended from ceiling by L shape level adjuster hangers made of G.I. Of size 85x25x25x2mm having die cut slit for sliding into main T section, also having precut hole so that 6mm fully threaded MS rod length upto 1000mm goes through it and pierces into M6 dash fasteners (Galvanising of 80 gsm minimum) of 6 mm dia 50mm long, fixed to the slab and then tightened with check nuts, subsequently the bottom of 6 mm rod will be tightened with check nuts for adjusting the line & level. The tile shall be laid on 15x32mm wide T section flanges colour white having rotary stitching on all T sections i.e. the main runner, 1200 mm & 600 mm cross Tees with a web height of 32 mm and load carrying capacity of 7.57Kgs/m².

iv. Measurements

Length and breadth of superficial area of the finished work shall be measured correct to a centimetre. Area shall be calculated in square meter correct to two places of decimal. No deduction will be made to openings of areas upto 40 square decimetre nor shall extra payment be made either for any extra material or labour involved in forming such openings. For openings exceeding 40 square decimetre in area, deduction in measurements shall be made but extra payment will be made for any extra material or labour involved in making such openings.

v. Rate

The rate shall include the cost of all the materials and labor involved in all the operation described above including scaffolding etc, if any required.

b. 20mm Mineral Fibre Ceiling Tile

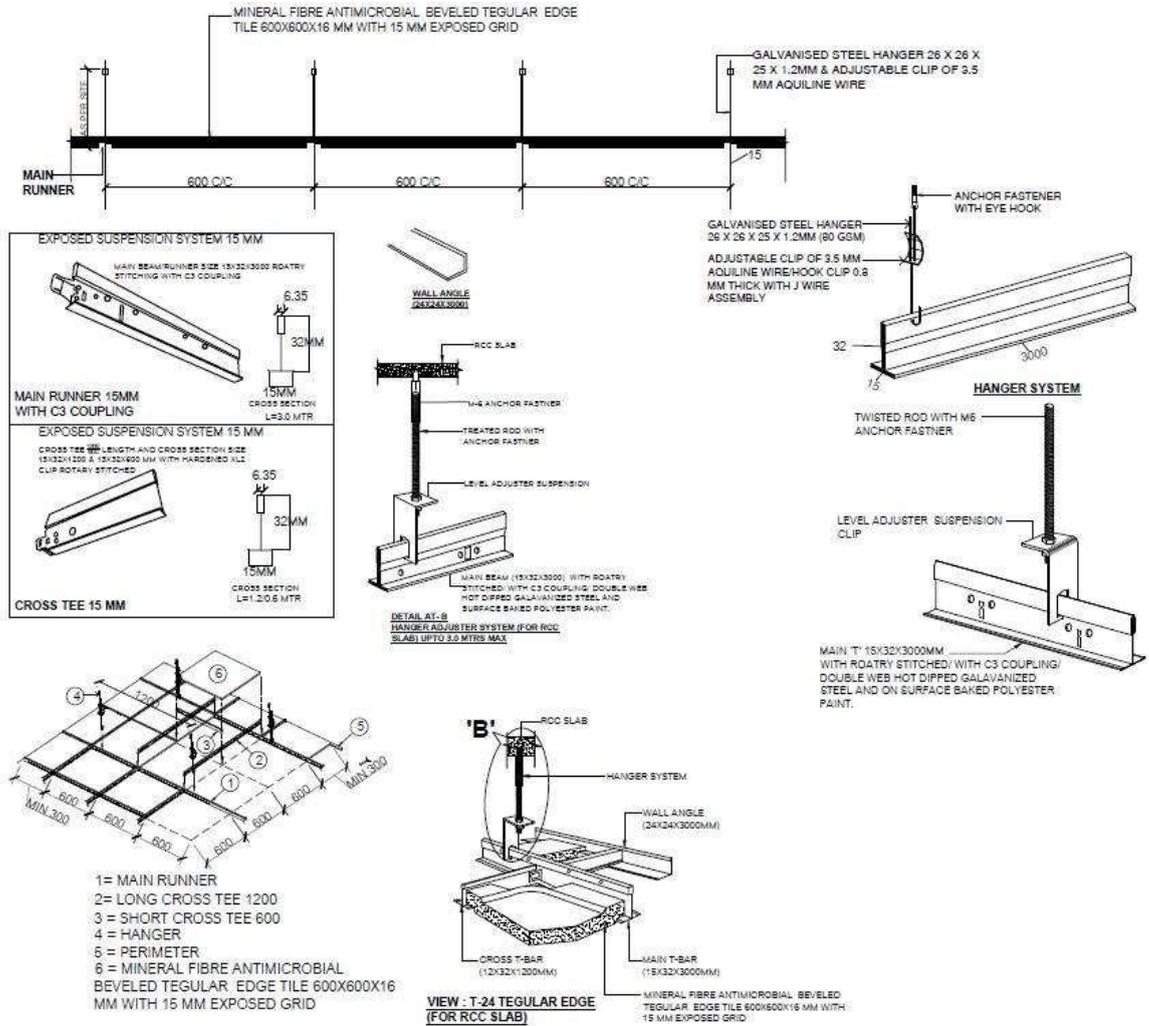
General specification for providing and fixing mineral fibre false ceiling tiles item to be same as **mentioned** in para i. to v. of para a. above except the thickness of mineral fibre tile will be 20 mm and NRC value 0.7.

c. 16mm Antimicrobial Ceiling Tile

General specification for providing and fixing 16 mm thick beveled tegular mineral fibre false ceiling tiles item to be same as **mentioned** in para i. to v. of para a. above except the tile will be Anti-microbial false ceiling tiles.

e. 16mm Antimicrobial Ceiling Tile

General specification for providing and fixing 16 mm thick beveled tegular mineral fibre false ceiling tiles item to be same as mentioned in para i. to v. of para a. above except the tile will be Anti-microbial false ceiling tiles.



9. LIGHT WEIGHT CALCIUM SILICATE FALSE CEILING TILES

a. 15mm Tegular edged light weight calcium silicate false ceiling tiles

i. Material

15 mm thick tegular edged light weight calcium silicate false ceiling tiles with integral densified calcium silicate reinforced with fibre and natural filler false ceiling tiles of Size 595x595 mm of approved texture, design and patterns having NRC (Noise Reduction coefficient) of 0.50 (minimum) as per IS 8225:1987, Light reflectance of 85% (minimum). Non combustible as per BS: 476 (part-4), fire performance as per BS:476 (part 6 &7), humidity resistance of 100%, thermal conductivity <0.043 W/mK as per ASTM 518:1991. The tests shall have average density of 370 kg/m³ (minimum) as per ECBC code 2007. The tile shall be primer coated on both sides and the fair surface shall be having a factory finish in two coats of white dispersion type solvent free paint.

ii. Frame

The frame work shall consist of G.I. ' T ' Sections for Main runners 24x38x3000mm length, Cross runners of 24x32x1200mm & 24x32x600mm size, 0.33 mm thickness as specified in the item with galvanisation of 120 gsm (minimum) and perimeter wall angle of 0.40mm (minimum) thick gauge having equal flanges of size 24x24mm made from precoated G.I. Coil length of 3.0m fixed to the wall with the help of plastic rawl plugs at 450mm centre to centre with 40mm long dry wall SS screws. The frame work shall be executed in a manner so as to form a grid of 600x600mm as specified in the item.

iii. Fixing of Ceiling Tiles

The frame work shall be suspended from ceiling by L shape level adjuster hangers made of G.I. Of size 85x25x25x2mm having die cut slit for sliding into main T section, also having precut hole so that 6mm fully threaded MS rod length upto 1000mm goes through it and pierces into M6 dash fasteners (Galvanising of 80 gsm minimum) of 6 mm dia 50mm long, fixed to the slab and then tightened with check nuts, subsequently the bottom of 6 mm rod will be tightened with check nuts for adjusting the line & level. The tile shall be laid on 24x32mm wide T section flanges colour white having rotary stitching on all T sections i.e. the main runner, 1200 mm & 600 mm cross Tees with a web height of 32 mm and load carrying capacity of 7.57Kgs/m².

iv. Measurements

Length and breadth of superficial area of the finished work shall be measured correct to a centimetre. Area shall be calculated in square meter correct to two places of decimal. No deduction will be made to openings of areas upto 40 square decimeter nor shall extra payment be made either for any extra material or labour involved in forming such openings. For openings exceeding 40 square decimetre in area, deduction in measurements shall be made but extra payment will be made for any extra material or labour involved in making such openings.

v. Rates

The rate shall include the cost of all the materials and labor involved in all the operation described above including scaffolding etc, if any required.

b. 15mm thick integral densified micro edged light weight calcium silicate false ceiling tiles

i. Material

15mm thick integral densified micro edged light weight calcium silicate false ceiling tiles with integral densified calcium silicate reinforced with fibre and natural filler false ceiling tiles of Size 595x595 mm of approved texture, design and patterns having NRC (Noise Reduction coefficient) of 0.50 (minimum) as per IS 8225:1987, Light reflectance of 85% (minimum). Non combustible as per BS: 476 (part-4), fire performance as per BS:476 (part 6 &7), humidity resistance of 100%, thermal conductivity <0.043 W/mK as per ASTM 518:1991. The tests shall have average density of 370 kg/m³ (minimum) as per ECBC code 2007. The tile shall be primer coated on both sides and the fair surface shall be having a factory finish in two coats of white dispersion type solvent free paint.

ii. Frame

The frame work shall consist of G.I. ' T ' Sections of 25 micron hot dipped galvanised iron section of 0.40mm thick on Silhouette profile, rotary stitched double webbed white with 6mm reveal profile (white/black) comprising of Main runners 15x42x3000mm length, Cross runners of 15x42x1200mm & 15x42x600mm size to form grid module of size 600x600mm. Galvanised iron perimeter wall angle of size 22x19x0.4mm of length 3000mm to be fixed on periphery wall/partition with the help of plastic rawl plugs at 450mm C/C and 40mm long dry wall SS screws. The work shall be carried out as per specifications, drawing and as per direction of Engineer-in-Charge.

iii. Fixing of Ceiling Tiles

The frame work shall be suspended from ceiling by L shape level adjuster hangers made of G.I. Of size 85x25x25x2mm having die cut slit for sliding into main T section, also having precut hole so that 6mm fully threaded MS rod length upto 1000mm goes through it and pierces into M6 dash fasteners (Galvanising of 80 gsm minimum) of 6 mm dia 50mm long, fixed to the slab and then tightened with check nuts, subsequently the bottom of 6 mm rod will be tightened with check nuts for adjusting the line & level. The tile shall be laid on 15x42mm wide T section flanges colour white having rotary stitching on all T sections i.e. the main runner, 1200mm & 600mm cross Tees with a web height of 42 mm and load carrying capacity of 7.57Kgs/m².

iv. Measurements

Length and breadth of superficial area of the finished work shall be measured correct to a centimetre. Area shall be calculated in square meter correct to two places of decimal. No deduction will be made to openings of areas upto 40 square decimeter nor shall extra payment be made either for any extra material or labour involved in forming such openings. For openings exceeding 40 square decimetre in area, deduction in measurements shall be made but extra payment will be made for any extra material or labour involved in making such openings.

v. Rates

The rate shall include the cost of all the materials and labor involved in all the operation described above including scaffolding etc, if any required.

10. SAMPLES OF MATERIALS:

- a. Sample of all materials/ fittings and fixture to be used in the work such as doors, windows, tiles, sanitary, water supply, drainage fittings and fixtures shall be submitted well in advance by the contractor for approval from the Engineer-in charge of work in writing before placing orders for the entire quantity required for completion of work. Samples approved by the EIC shall be kept in Sample Room under the charge of Engineer-in-Charge and shall retain till completion of work.
- b. Finished items in respect of typical portion of works of repetitive nature such as typical room, toilet, railing, door, window or any other work desired by the engineer-in- charge shall be prepared by the contractor to the satisfaction of Engineer-in – charge and got approved from him in writing before the commencement of these items for the entire work.
- c. The requirements for preparation of samples shall be observed and fulfilled by the contractor well in advance to avoid any detriment to the general progress of work. In other words, this will not be allowed to have any effects on the general progress of work or on any of the terms and conditions of the contract. No claims of any kind whatsoever including the claims of extension of time will be entertained due to the incorporation of this requirement.

11. VARIATION IN CONSUMPTION OF MATERIALS:

The variation in consumption of material shall be governed as per CPWD specification and clauses of the contract to the extent applicable.

12. MISCELLANEOUS:

Materials manufacture by reputed firms and approved by Engineer – in charge shall only be used. Only articles classified as “First Quality” by the manufactures shall be used unless otherwise specified. Preference shall be given to those articles which bear ISI certification marks. In case articles bearing ISI certification marks are not available the quality of sample brought by the contractor shall be judged by the standards laid down in the latest CPWD specifications. For items not covered by the latest CPWD specification, relevant ISI standards shall apply.

13. TESTS:

- a. Materials brought at site of work shall not be used in the work before getting satisfactory test results for Mandatory tests as per relevant provisions in Latest CPWD Specifications for works. Normally, part rate payment shall be allowed in the running account bills only if the materials are tested and test results are found to be satisfactory to by the Engineer-in-charge. These tests shall be got done from laboratories approved by Engineer-in - charge or the laboratory set up by the contractor at site as per directions of Engineer-in - charge.
- b. The Engineer-in - charge of work shall check the test results and satisfy himself before allowing any payment in the running /final bill.

SPECIAL CONDITIONS FOR ELECTRICAL SERVICES

1.0 GENERAL

The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The requirement offered by the contractor shall be complete in all respects. Any materials or accessories which may not have been specifically mentioned, but which are usual and necessary for the satisfactory and trouble free operation and maintenance of the equipment shall be provided without any extra cost of the purchaser. This shall also include spares for commissioning of the equipment.

2.0 The contractor shall obtain all sanctions (electrical loads, approval of drawing/ ESS/ D.G.'s estimator/ approval of meter room etc. from the concerned authorities and permits required for the electrical installation work. All actual fee payable in this regard will be reimbursed against receipt/documentary evidence. On completion of work, the contractor shall obtain NOC from SEB & Director of Safety of the concerned state; a copy of the same shall be delivered to HITES. Contractor shall be responsible for handing over to SEB and other authorities shall be responsibility of contractor till commissioning and getting electricity in the complex.

The HITES shall have full power regarding the materials or work got tested by independent agency at the electrical contractor's expenses in order to prove their soundness and adequacy. The contractor will rectify the defects/suggestions pointed out by HITES/ independent agency at his own expenses.

The installation shall comply in all respects with the requirements of Indian Electricity Act 1910, Indian Electricity Rules (IER) 1956 and other related Laws and Regulations as amended up to date, thereunder and special requirements, if any, of the State Electricity Boards etc. The bidder is liable to furnish the list of authorized licensed persons/ employed/deputed to carry out the works/perform the assigned duties to fulfill the requirement of Rule No.3 of IER 1956 as amended up to date.

3.0 DRAWINGS

- i) The list of drawings along with these specifications is given in Annexure. These drawings are meant to give general idea to bidder regarding the nature of work covered by these specifications.
- ii) Any information/data shown/not shown in these drawings shall not relieve the contractor of his responsibility to carry out the work as per the specifications. Additional information required by the bidder/tenderer for successfully completing the work shall be obtained by him.
- iii) Shop Drawings

The contractor shall prepare detailed coordinated electrical shop drawing indicating lighting/lighting fixtures, convenience outlets, D.G.'s, H.T., Transformer, M.V. Panel Boards/Relay Panel, PCC, DB's, Rising Mains, Cable Schedule with other relevant services and submit to the HITES for approval or the Engineer-in-Charge before commencing the work. The shop drawings shall indicate all setting out details and physical dimensions of all components with wiring and cable details including system operating write up in the system i.e. 33 KV Panel Board, Control and Relay Panel Package Substation, D.G.'s, PCC's, MCC's, cable schedule and routes, manhole trap and fixing details as well as for conduit indicating run and size of wire/cables, outlet/pull/junction boxes etc. with fixing details etc. for the above mentioned work. All work shall be carried out on the approval of these drawings. However, approval of these drawings do not relieve the contractor of his responsibility for providing maintenance free and fool proof system including any missing component/accessories to meet with the

intent of the specifications. Contractor will submit 2 prints for preliminary approval and finally six prints for distribution.

iv) Completion Drawings/As Built Drawings

On completion of the work and before issue of certificate of virtual completion, the contractor shall submit to the HITES 4 sets along with soft copy of 'As Built' drawings (in AutoCAD & PDF format) of the work along with 01 Nos. cloth tracing originals including write up (trouble shooting, installation, operation and maintenance manual with instructions) incorporating all such changes and modifications during engineering and execution along with warrantee & guarantee certificates from manufacturers.

These drawings must provide:

- Run and size of conduit, inspection and pull boxes including routing and locations.
- Number and size of conductor in each conduit.
- Locations and rating of sockets and switches controlling the light and power outlet.
- A complete wiring diagram as installed and schematic drawings showing all connections in the complete electrical system.
- Location of outlets of various services, junction boxes, light fixtures.
- Location of all earthing stations route and size of all earthing conductors.
- Layout and particulars of all cables.
- Location and details of PCC's, MCC's, Feeder Pillars, capacitor control panels, PLC D.G. set panel, UPS panel, and relay panels with description detailed control wiring diagram.
- Location of transformer and its details and control wiring diagram.
- Location of Hume pipe and manhole including HT/LT cable layout and scheduling.
- Location of D.G.'s, exhaust and auxiliary equipment with schematic drawings.
- Layout of cable trays with support and their fixing details.
- Location of all earthing station, route and size of all earthing conductor.
- Layout and particulars of rising mains with fixing details.

v) Position of HT/LT Switch Boards/Transformer & D.G.'S

The recommended position of the switch boards, transformer & D.G.'s as shown on the layout drawings will be adhered to as far as practicable.

The contractor shall submit 2 sets of samples of each type of accessories and apparatus, proposed to be used in the installation at site for approval (drawings or samples) as required shall be submitted by contractor and the choice of selection out of the approved list lies with the HITES. For all non-specified items, approval of the HITES shall be obtained prior to procurement of the same. HITES shall in no way be liable for rejection of the any material due to poor quality, poor workmanship, poor material etc.

4.0 MANUFACTURER'S INSTRUCTIONS

Where manufacturers have furnished specific instructions, relating to the material/equipment to be used on this job, covering points not specifically mentioned in this document, manufacturers' instructions should be followed.

5.0 MATERIALS AND EQUIPMENT

All the materials and equipment shall be of the approved make and design. Unless otherwise called for any approval by HITES's Engineer-in-Charge, only the best quality materials and

equipment shall be used.

The contractor shall fill in the data sheet for capital equipment as attached elsewhere in this document. The Material/Equipment shall be rejected due to not giving / filling in the details of the said equipment.

6.0 GENERAL DETAILS

6.01 Space Heaters & Lighting.

One or more adequately rated heaters thermostatically controlled with On-Off switch and fuse shall be provided to prevent condensation in any panel compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation. CFL lamp shall be provided in any panel compartment.

6.02 Fungistatic Varnish

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

6.03 Ventilation Opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

6.04 Degree of Protection

The enclosures of the Control Cabinets, Junction Boxes and Marshalling Boxes, Panels etc. to be installed shall provide degree of protection as called for in specification / BOQ whenever it is not mentioned it shall be as given below.

- Installed out door: IP-55.
- Installed indoor in air-conditioned area: IP-52.
- Installed in covered area: IP-52.
- Installed indoor in non-air-conditioned area where possibility of entry of water is limited: IP-42.
- For L.T. switchgear (AC and DC distribution boards): IP-52.

The degree of protection shall be in accordance with IS: 13947 (Part-I)/IEC-947 (Part-I). Type test report for degree of protection test, on each type of the box shall be submitted for approval.

6.05 Rating Plates, Name Plates and Labels

Main PCC, PCC's, MDB and auxiliaries items installed in the building are to permanently attach to it in a conspicuous position. A rating plate of non-corrosive material with engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions of equipment in question has been designed to operate and such diagram plates as may be required by the purchaser. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instruction plates, rating plates shall be bilingual with Hindi inscription first

followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided.

6.06 First Fill of Consumables, Oil and Lubricants

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, welding/soldering/brazing material for all copper/G.I. earthing and essential chemicals etc. which will be required to put the equipment/scheme covered under the scope of the specifications, into successful operation, shall be furnished by the Contractor unless specifically excluded under the exclusions in these specifications and documents.

7.0 DESIGN IMPROVEMENTS

The bidder shall note that the equipment offered by him in the bid only shall be accepted for supply. If for any reason, Contractor wishes to deviate from specification, prior permission from HITES will be sought.

If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly in the specification.

8.0 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Purchaser's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary. Such programme shall be outlined by the Contractor and shall be finally accepted by the Purchaser after discussions before the award of Contract. A quality assurance programme of the contractor shall generally cover the following:

- His organization structure for the management and implementation of the proposed quality assurance programme.
- Documentation control system.
- Qualification data for bidder's key personnel.
- The procedure for purchases of materials, parts components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
- System for shop manufacturing and site erection controls including process controls and fabrication and assembly control.
- Control of non-conforming items and system for corrective actions.
- Inspection and test procedure both for manufacture and field activities.
- Control of calibration and testing of measuring instruments and field activities.
- System for indication and appraisal of inspection status.
- System for quality audits.
- System for authorizing release of manufactured product to the Purchaser.
- System for maintenance of records.
- System for handling storage and delivery.

- A quality plan-detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorized representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor/his Vendor's quality management and control activities.

9.0 QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after dispatch of the equipment.

- All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and reports including radiography interpretation reports.
- Welder and welding operator qualification certificates.
- Welder's identification list, listing welders and welding operator's qualification procedure and welding identification symbols.
- Raw material test reports on components as specified by the specification and/or agreed to in the quality plan.
- Stress relief time temperature charts/oil impregnation time temperature charts.
- Factory test results for testing required as per applicable codes/mutually agreed quality plan/standards referred in the technical specification.
- The quality plan with verification of various customer inspection points (CIP) as mutually and methods used to verify the inspection and testing points in the quality plan were performed satisfactorily.

10.0 INSPECTION, TESTING AND INSPECTION CERTIFICATE

- The HITES or duly authorized representative shall have at all reasonable times free access to the Contractor/ Manufacturer's premises or works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection, if part of the works is being manufactured or assembled at other premises or works, the Contractor shall obtain permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
- All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Bidder shall submit the type tests reports for approval. The Contractor shall intimate the HITES the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies. If for any item type test is pending payment would be made on successful completion of type/routine test(s) actually carried out as per HITES instructions.
- The Contractor shall give the HITES thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account. The HITES, unless witnessing of the tests is virtually waived off, will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed with the test which shall be deemed to have

been made in the presence of HITES and he shall forthwith forward to the HITES duly certified copies of tests in triplicate.

- The HITES shall within fifteen (15) days from the date of inspection as defined shall inform in writing to the Contractor of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and make the necessary modifications accordingly.
- When the factory tests have been completed at the Contractor's or Sub-contractor's works, the HITES shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the HITES, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the HITES. Failure of the issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificate shall not bind the HITES to accept the equipment should, it, on further tests after erection, is found not to comply with the Specification. The equipment shall be dispatched to site only after approval of test reports and issuance of clearance by the HITES.
- The contractor shall arrange all necessary instruction and testing facilities free of cost for this purpose including air travel, lodging and boarding expenses.
- For tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be required by HITES or this authorized representative to carry out effectively such tests of the equipment in accordance with the Specification.
- The inspection by HITES and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.
- The HITES will have the right of having at his own expenses any other tests(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests to satisfy that the material comply with the specifications.
- The HITES reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Contractor.

11.0 TESTS

11.01 Charging

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the HITES and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The pre-commissioning tests to be performed as per relevant I.S. given and shall be included in the Contractor's quality assurance programme.

11.02 Commissioning Tests

- The available instrumentation and control equipment will be used during such tests and the Contractor will calibrate all such measuring equipment and devices as far as practicable. However, unmeasurable parameters shall be taken into account in a reasonable manner by the Contractor for the requirement of these tests. The tests will

be conducted at the specified load points and as near the specified cycle condition as practicable. The Contractor will apply proper corrections in calculation, to take into account conditions, which do not correspond to the specified conditions.

- All instruments, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
- Pre-commissioning test shall be carried out as per relevant IS and/or as specified in the relevant clause.
- The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning of the equipment. However necessary fee shall be reimbursed by MoHFW on production of requisite documents.

12.0 PACKAGING

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon/truck/trailer sizes in India should be taken account of the Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. HITES takes no responsibility of the availability of any special packaging/transporting arrangement.

13.0 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

14.0 FINISHING OF METAL SURFACES

14.01 General

All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts and bolts and spring washers shall be electro galvanized. All steel conductors used for earthing/grounding (above ground level) shall be galvanized according to IS: 2629.

14.02 Hot Dip Galvanizing

- The minimum weight of the zinc coating shall be 700 gm/sq.m and minimum thickness of coating shall be 85 microns.
- The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.
- After galvanizing drilling or welding shall be performed on the galvanized parts of the earthing materials. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

- The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IS-2633.
- Sharp edges with radii less than 2.5mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.
 - Coating thickness,
 - Uniformity of zinc,
 - Adhesion test,
 - Mass of zinc coating.
- Galvanized material must be transported properly to ensure that galvanized surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

14.03 Painting

- All sheet steel work shall be degreased, pickled, phosphate in accordance with the IS-6005 "Code of practice for phosphating iron and sheet". All surfaces which will not be easily accessible after shop assembly shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
- After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, staving type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be shoved.
- Powder coating/electrostatic painting of approved shade shall be applied.
- The exterior color of the paint shall be as per shade no.697 of IS-5 or as approved by Engineer-in-charge and inside shall be white or as approved by Engineer-in-charge. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments, if required.
- In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures like electrostatic painting etc. the procedure shall be submitted along with the Bids for HITES's review and approval.

15.0 HANDLING, STORING AND INSTALLATION

- In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented.
- Contractor shall follow the unloading and transporting procedure at site, as well as storing, testing and commissioning of the various equipment being procured by him separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's Engineer(s) and shall extend full co-operation to them.

- In case of any doubt/ misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the HITES. Contractor shall be held responsible for any damage to the equipment consequent for not following manufacturer's drawings/instructions correctly.
- Where assemblies are supplied in more than the one section, Contractor shall make all necessary connections between sections. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.
- The Contractor shall submit to the HITES every week, a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.
- The Contractor shall be fully responsible for the equipment/material until the same is handed over to the HITES in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by HITES, as well as protection of the same against theft, element of nature, corrosion, damages etc.
- The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment, which require indoor storage.
- The words 'erection' and 'installation' used in the specification are synonymous.
- Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.
- The minimum phase to earth, phase to phase and section clearance along with other technical parameters for the various voltage levels shall be maintained as per relevant IS.

16.0 PROTECTIVE GUARDS

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.

17.0 DESIGN CO-ORDINATION

The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

18.0 DESIGN COORDINATION MEETING

The Contractor will be called upon to attend design co-ordination meetings with the Engineer, and the HITES/ MoHFW during the period of Contract. The Contractor shall attend such meetings at his own cost at New Delhi or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during those discussions.

19.0 TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipments.

ELECTRIFICATION SECTION – 1 : INTERNAL ELECTRICAL

WORKS

1. M.S Conduit

All conduits shall be of heavy gauge solid drawn ERW welded manufactured out of 16 (1.6mm) gauge MS Sheet up to 32mm dia and of 14 gauge (2 mm) for sizes higher than this. Both inner and outer surfaces shall be smooth without burrs, dents and kinks. Conduits shall be black stove enameled inside and outside. The cross section of conduit shall be uniform throughout. The welding shall be uniform such that welded joints do not yield when subjected to flattening test. Welded joint shall not break when threaded or bent at an angle. Conduit shall conform to specifications of IS: 9537 (Part-II) and the capacity of conduits shall be in accordance with the standards and shall never be exceeded. The minimum size of the conduit shall be 20mm dia. Care shall be taken to ensure that all conduits are adequately protected while stored at site prior to erection and no damaged conduit shall be used.

2. PVC Conduit

All conduits shall be high impact rigid 2mm thickness PVC heavy duty type and shall comply with I.E.E. regulations for non-metallic conduit 2mm thick as per IS-9537/1983 (Part-III). All sections of conduit and relevant boxes shall be properly cleaned and glued by using epoxy resin glue and the proper connecting pieces. Inspection type conduit fittings such as inspection boxes, drawn boxes, fan boxes and outlet boxes shall be M.S. or otherwise mentioned. Conduit shall be terminated with adopter/PVC glands as required.

3. Accessories

Conduit accessories such as normal bends, unions, circular junction boxes and pull boxes, locknuts etc. shall be heavy gauge type and approved make. Conduit accessories shall conform in all respects to IS: 3837-1966 with latest amendment. Wherever several conduits are running together, adequately sized adoptable boxes common to all runs shall be used to avoid inserting inspection boxes in the individual run. Where it is necessary to segregate wiring metal filler shall be fixed with in the box.

Conduits shall be laid before casting in the upper portion of a slab or otherwise, as may be instructed or in accordance with approved drawings, so as to conceal the entire run of conduits and ceiling outlet boxes. Vertical drops shall be buried in columns or walls. Wherever necessary, chases will be cut by the contractor with the help of chase cutting m/c or by hand. Nothing extra shall be paid to the contractor on this account. In case of exposed brick/ rubble masonry work special care shall be taken to fix the conduit and accessories in position along with the building work. Sufficient depth of the chases will be made to accommodate the required number of conduits. The chase will be filled with cement, coarse sand mortar (1:3) and properly cured by watering for one week.

If a chase is cut in an already finished surface the contractor shall fill the chase and finish it to match the existing finish. Contractor must not cut any iron bars to fix conduits. Conduits shall be kept at a minimum distance of 100mm from the pipes of other non- electrical services. Where the conduit is to be embedded in a concrete member it shall be adequately tied to the reinforcement to prevent displacement during casting, conduits in chases shall be held by steel hooks of approved design at maximum of 100 cm centres. The embedding of conduits in walls shall be so arranged as to allow at least 12mm plaster cover the same. All threaded joints of conduit pipes shall be treated with some approved 'preservative compound' to secure protection against rust.

Suitable expansion joints fittings of approved make and design shall be provided at all the points where the conduit crosses the expansion joint in the building. (Preferably with Pilca metallic watertight conduits). Conduits shall cross at right angles of the joints only.

Separate conduit shall be used for:

- a. Normal light, fan call bell
- b. 16 A power outlets
- c. Emergency Light Point
- d. Fire alarm System
- e. LAN/ Data Network
- f. P.A. System
- g. Telephone System
- h. TV Network
- i. Access Control System
- j. Optical Fibre Cables (OFC)
- k. Or any other services not mentioned here.

Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc. shall be installed in flexible conduits. Flexible conduits shall be formed from a continuous length of spirally wound interlocked wire steel with a fused zinc coating on both sides. The conduit shall be provided with approved type adaptor. A separate and accessible earth connection shall bond across the flexible conduit.

Conduit runs on surfaces shall be supported with metal 1.2 mm thick saddles, which in turn are properly secured on to GI spacer to the wall or ceiling. Fixing screws shall be with round or cheese head and of rust proof materials. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building and shall be painted in color matching the adjoining area. Unseemly conduit bends and offsets shall be avoided by using better appearance. Cross cover of conduits shall be minimum and entire conduit installation shall be clean and with good appearance. For surface work, the boxes shall be raised back pattern type, designed for use with distance saddles to give clearance of 6mm between the back of conduit and the fixing surface.

Where conduits are run on steel work, they will be fixed by means of purpose made GI Caddy clips in manner meeting with the approval of the Engineer prior to the installation being carried out. Other methods of fixing may be agreed in special circumstances, but approval must first be obtained from the site engineer.

The spacing of saddles shall be not more than 600mm centers for up to 32mm diameter conduits and at 750mm for conduit sizes of 40mm diameter and above in case of MS conduit and not more than 600 mm for PVC conduit. In addition, saddles shall be fixed at each side of any bend/Tee, or set at a distance of 200mm from the bend/Tee. The holes in the brickwork or concrete for fixing plugs shall be neatly drilled by means of a masonry drill of the appropriate size.

All the GI sheet steel /passivated boxes used for housing switches, plugs, fan regulator etc. shall be five sided conforming to IS: 5133 Part I-1969. Suitable size of boxes shall be provided a minimum of 2 adjustable fixing lugs on vertical sides. Suitable earth terminal inside each box shall be provided. All fixing lugs shall be threaded to receive standard machined chromium plated brass screws. Sufficient number of knockouts shall be provided for conduit entry. Conduits carrying wires of different circuit can terminate in

common J.B having metal compartments. Necessary GI pull wires shall be inserted into the conduit for drawings wires. In case conduit pipe is required to cross any RCC beam special adapter boxes shall be provided for crossing & nothing shall be paid extra.

Where conduits are used for non-air-conditioned space to air-conditioned space or into a fan chamber or duct, a junction box shall be installed to break the continuity of such conduit at the point of entry or just outside and conduit shall be sealed around the conductors.

Particular care shall be taken during the progress of the work to prevent the ingress of dirt and rubbish such as plaster droppings into erected conduits. Conduit which has become so clogged shall be entirely freed from these accumulations or will be replaced. Screwed plastic or metal caps or turned wooden plugs shall be employed to protect all open ends. Plugs of waste wood, paper, cotton or other fibrous matter shall not be used. All unused conduit entries shall be blanked off in an approved manner and where conduits terminate in adaptable boxes, all removable box covers shall be firmly secured to provide complete enclosure. If considered necessary by the Engineer-in-charge, the conduits shall be swabbed out by drawing swabs of rag through the conduit to remove moisture prior to any cables being drawn in.

All conduit installations must be completed and erected in their totality before they are wired and must be fully rewirable from outlets to distribution boards or trunking systems etc. to which they connect. No wiring of any part of the installation shall be commenced until instructions are received to do so by the Engineer-in-charge at such time as he is satisfied that the wiring will not be damaged due to building operations.

Conduits shall be installed so that they are self-draining in the event of ingress of moisture due to condensation or any other reason. A suitable drainage hole shall be drilled at the bottom of the lowest conduit box in every 9-meter of horizontal run.

PVC bush of good quality shall be used in each conduit termination in a switch box, draw box, lighting fixtures and circular junction boxes.

Exposed conduits running above false ceilings shall be suitably clamped independently along with the dropped ceiling. Perforated straphangers or twisted attachment shall not be acceptable. In no case shall raceways be supported or fastened to other pipe for repair and maintenance. They shall be arranged symmetrically and in the most compact design, in no way unduly criss-crossing each other. Proper spacing shall be maintained when two or more conduits run side by side. The layout of the pipes shall be co-ordinated with other services if any. The junction boxes and conduits used in hazardous areas shall be flameproof type with cast iron construction complete with threaded covers. The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirements by means of special approved type of earthing clamp efficiently fastened to conduit pipe in a workman like manner for a perfect continuity between the earth and conduit.

The conduit system shall be so laid out that it will obviate the use of tees, elbows and sharp bends. No length of conduit shall have more than the equivalent of two-quarter bends from inlet to outlet. The conduit itself being given required smooth bend with radius of bends suiting to the site conditions but not less than 6 times overall diameter.

Outlet boxes shall be of heavy-duty sheet steel installed as to maintain continuity throughout. These shall be so protected at the time of laying that no mortar finds its way inside during concrete filling or plastering. For fluorescent fittings, the outlet boxes heavy duty shall be provided 300mm off centre for a 1200mm fitting and 150mm off centre for a 600mm fittings or as per B.O.Q.

Draw boxes of ample dimensions shall be provided at convenient points to facilitate pulling of long runs of cables. They shall be completely concealed with MS covers flush with plasterwork painted to match the wall. These boxes will be as few as possible and located where found suitable by the HITES.

4. Switch Boxes

The switch boxes shall be zinc passivated & shall not be less than **18 SWG** thick or shall be as called for in BOQ. It will be so designed that accessories could be mounted on integral pedestals or on adjustable flat iron mounting straps with tapped holes by brass machine screw. Leaving ample space at the back and on the sides for accommodating wires and check nuts at conduit entries. These shall be attached to conduits by means of check nuts on either side of their walls. These shall be completely concealed leaving edges flush with wall surfaces. Earthing terminal inside box shall be provided.

Moulded plate switches screw less as specified in item of work shall be provided. No timber shall be used for any supports. Boxes, which come within concrete, shall be installed at the time of casting. Care shall be taken to fix the box rigidly so that its position is not shifted while concreting.

5. Wiring

All the wiring installation shall be as per IS: 732 with latest amendment. PVC insulated Fire Resistant (FR)/ Fire Resistant Low Smoke (FRLS) copper conductor cables as specified in bills of quantity shall be used for sub-circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be twisted copper conductors with thermoplastic insulations of 660/1100 volts grade. Colour Code for wiring shall be followed.

Looping system of wiring shall be used, wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of the HITES. No reduction of strands is permitted at terminations. No wire smaller than 1.5 sq.mm shall be used and shall be as per B.O.Q. Wherever wiring is run through trunkings or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indicating the circuit and DB number shall be used for submains sub-circuit wiring. The ferrules shall be provided at both end of each submain and sub-circuit.

Where single-phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain the wiring fed from more than one phase. In any one room in the premises where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply. Circuits fed from distinct sources of supply or from different distribution boards or through switches or MCBs shall not be bunched in one conduit. In large areas and other situations where the load is divided between two or three phase, no two single-phase switches connected to different phase shall be mounted within one box.

All splicing shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.

Industrial sockets shall be of moulded plastic BoQ and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have self-adjustable spring loaded protective cap. Socket shall have MCB/ELCB/RCCB as specified in the schedule of work.

Maximum number of PVC insulated 650/1100 V grade/copper conductor cable conforming to IS: 694-1990.

Conduit size	20mm		25mm		32mm		40mm		50mm		60mm	
	S	B	S	B	S	B	S	B	S	B	S	B
1.50	7	5	12	10	20	14	-	-	-	-	-	-
2.50	6	5	10	8	18	12	-	-	-	-	-	-
4	4	3	7	6	12	10	-	-	-	-	-	-
6	3	2	6	5	10	8	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	-	4	3	7	6	-	-	-	-
25	-	-	-	-	3	2	5	4	8	6	9	7

Notes:

- 1) The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
- 2) The columns heads 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns heads 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.
- 3) Conduit sizes are the nominal external diametres.

SECTION 2 - TELEPHONE SYSTEM AND LAN WIRING

1. Point Wiring for Telephone System

- (a) The point wiring shall be carried out with telephones wires/cables, 2 pair, un- armoured, PVC insulated and sheath, 0.51 mm dia annealed tinned copper conductor, conforming to ITD specification S/WS-113C armouring and outer sheath as per IS: 1554 (Part -I) in 25 mm steel conduit (one pair always remaining spare for one point). If more than one telephone point has to be provided at one point, multi- core, un-armoured telephone cable shall be used (pairs required are equal to 2 x no. of points) in suitable size conduit. If specifically mentioned in schedule of quantities, instead of ordinary PVC insulated telephone wire as specified above, UTP cable Cat – 5 to be supplied & laid. The item includes providing and fixing/laying of conduit, switch boxes, socket for telephones connection and telephone wires/cables etc..

Minimum diameter of steel conduit for telephone wiring shall be 25 mm.

- (b) The point shall commence from the main telephone tag box/sub tag box and would terminate at outlet box of point. Connection at both ends included in point wiring.
- (c) Steel conduit, accessories, draw out boxes, switch boxes etc. shall be supplied & laid as per the details given at 2.0.
- (d) Each telephone point shall have 1 no. flush type RJ11 telephone jack fixed on 3 mm thick, hylem sheet in MS outlet box (size 100 x 100 mm). More than one telephone socket outlet (maximum 2 nos.) can be fixed on one outlet box, provided these points are at one place and multi-pair (more than 2 pair) telephone cable has been

drawn to this point from tag box. However if specified in schedule of quantities, telephone cord grid plate mounted outlet unit (RJ – 11) with moulded cover plate in recessed galvanised MS box to be provided.

- (e) Joint in telephone wiring (between main tag box/sub tag box and outlet box of point) shall not be allowed and the contractor should bear the wastage of wire if resulted due to this special requirement of telephone system. No looping in telephone system is allowed unless specifically shown in the drawing or instructed by site engineer in the drawing/instruction book.
- (f) Telephone and computer data wiring can be drawn in the same conduit, provided after drawing wires, 50% of conduit cross sectional area is free. However independent PVC insulated telephone & data wire of suitable size shall be used for telephone and computer data.
- (g) To identify each pair of multi-pair telephone wire/cable, PVC indication numbers shall be put on both end of pair just before termination.

2. Point Wiring (Computer Data)

- (a) The point wiring shall be carried out with data cable of 4 (FOUR) pairs (or as specified in schedule of quantities) un-armoured, PVC insulated and sheath, 0.50 mm dia annealed tinned copper conductor (CAT 5e or CAT 6 as specified in schedule of quantities), in suitable size conduit.

The item includes providing and fixing/laying of conduit, switch boxes, socket for computer connection and data wires/cables etc

Minimum diameter of steel conduit for telephone wiring shall be 25 mm.

- (b) The point shall commence from the main junction box or sub junction box at floor of computer data system, and would terminate at outlet box of point. Connection at both ends of cable shall be carried out by purchaser.
- (c) General specification for concealed/surface conduit system of telephone system (clause no. 5.1 (c), 5.1 (d) & 5.1 (g) shall be applicable for this system also.
- (d) Joint in computer data cable (between junction box and outlet box of point) shall not be allowed and the contractor should bear the wastage of cable if resulted due to this special requirement of computer data system.

3. Telephone Cable Work (Underground System)

- (a) The cable shall be suitable for telephone system of suitable pairs (as specified in schedule of quantities), steel armoured, PVC insulated and sheath, 0.51 mm dia annealed tinned copper conductor, conforming to ITD specification S/WS-113C armouring and outer sheath as per IS:1554(Part-I). All telephone cables for underground laying shall be jelly filled type.
- (b) Specification for laying of telephone cable in underground system shall be same as for electrical system (clause no. 4.2,4.3,4.4 and 4.5 and the same shall be followed.

4. Telephone Tag Boxes

These shall be of KRONE type using insulation displacement technique in which there is no stripping or soldering of wire, of MS sheet 14 G with connector suitable for telephone connection. It shall have hinged MS sheet cover. Tag box to be of sufficient size to not only accommodate required KRONES but also space for dressing of wires.

5. Television Point Wiring

- (a) only steel conduit minimum 25mm dia shall be provided and laid for all tv wiring. All specifications for conduiting shall be same as mentioned above.
- (b) Co-axial TV cable of single strand tinned copper conductor of diameter 0.80 mm, complete with metallic shield. Cable having signal loss less than 6 db per 100 Mts. for band 1 UHF should be provided and laid.
- (c) One number TV wall outlet in suitable MS box should be fixed at each receiving end.
- (d) In each 25 mm dia conduit max. 2 nos. co-axial cables should be drawn. There should be the least possible number of bends in the conduit system.
- (e) The samples of TV cable & wall outlet should be got approved before installing.
- (f) Matter to be checked by contractor with purchaser, whether system of each TV point having its own TV antenna is there for the project or cable TV system having common antenna for project is to be followed. This shall be specially applicable if in the project residential quarters are also included. If central cable TV system is their, necessary amplifier, tap-off, and splitters etc. to be provided as per detail drawings and schedule of quantities.

6. Enhanced Category 5 UTP specifications

- a) The UTP shall be 4-pair, with 24 SWG solid or standard copper conductors.
- b) The UTP-based cabling system shall have a 160 MHz channel bandwidth over a maximum distance of 100m (328 ft) and a channel power sum attenuation-to-crosstalk ratio (PSACR) of 9.6 dB@ 100 MHz using an interconnect or BIX cross connect configuration.
- c) The UTP-based cabling system shall use matched components from a single manufacturer, certified to deliver system performance over the lifetime of the application that the cabling system was originally designed to support.
- d) All component used in the UTP-based cabling system shall be warranted for a period of 5 years from date of installation against defects in materials and workmanship.
- e) The UTP-based cabling system shall comply with the following standards:
 - Enhanced Category 5 – TIA/EIA Addendum
 - Category 5 – ANSI/TIA/EIA-568, TIA/EIA
 - TSB67 Class D – CENELEC EN50173
 - Class D – ISO/IEC 11801

7. UTP Outlets

- a) The outlet UTP connection module and its optional cover shall be available in the following colors: grey, almond, white, black, orange, red, yellow, green, blue, purple and brown.
- b) The outlet UTP connection module shall be Power Sum rated, with a power Sum NEXT performance equal to or better than ANSI/TIA/EIA-568 Category 5 pair-to-pair NEXT performance specifications, and shall have a PS5 marking to indicate compliance.
- c) The eight-position outlet UTP connection module shall accommodate six-position modular plug cords without damage to either the cord or the module.
- d) It shall be possible to inspect and/or re-terminate the UTP cable at the outlet through front access at the face plate.

- e) The faceplate housing the outlet UTP connection modules shall have aperture plugs to cover any unused openings in the faceplate.
- f) The faceplate housing the outlet UTP connection module in wall mounted single and dual-gang electrical boxes, utility poles and modular furniture (cubical) access points using manufacturer – supplied faceplates and/or adapters, equipped with front, side or angled-entry options for modular cords.

8. UTP System Testing

- a) There are two primary field test parameters for an UTP-based end-to-end cabling system. These are continuity/wire mapping and a visual inspection, both to be performed by the vendor.
- b) Continuity/wire mapping is used to verify consistency pair-to-pin terminations at each end of a given cable. It also checks for faulty connections in the run. For each of the eight conductors in the cable, continuity/wire mapping indicates:

Continuity of the channel to the remote end.

Shorts between any two or more conductors.

Crossed pairs.

Reversed

pairs.

Split pairs.

Any other wiring.

LAN wiring shall be done with Category 6 (CAT 6) wire, if specifically asked for in BOQ.

9. TELEPHONE TAG BLACK (TTB / IDF)

CAT-5e (enhanced) unshielded twisted pair cable in MS conduit shall be used to have modern structured cabling network for telephone system, to have latest facilities for Internet and also data cabling. All the telephone Jack must terminated on RJ-11 jacks and installed onto a dual Jack faceplate. Telephone RJ-11 Jacks must be terminated with a **BLACK** Connector/Jack.

For LAN CAT 6 UTP cables shall be used for interconnecting the RJ 45 outlets to Intermediate Switch (Hub) or directly to IT room, if the running length limit permits. These Intermediate switch shall be installed in a rack/cabinet and located in electrical room of the respective floors. Fibre Optic cable or CAT-6 UTP cable shall be used for backbone to interconnect the Intermediate switch to IT room's Server rack, as per the design requirement of the specialised Vendor. All the Data Jack must terminated on an 8 wire, 8-position Jack. Each RJ-45 Data Connection will be terminated with a **BLUE** Data Jack

Only conduit routing & wiring shall be provided by the Electrical contractor and the configuration & wiring shall be done by the Vendor for the IT Networking.

EPABX system, with latest technology will be provided to provide Voice Mail & Call Accounting by costing of all calls made by telephones.

A small cabinet for Low current services shall be provided at the false ceiling level to locate all the terminal points like Tel.Tag block, tap-off box for MATV etc., for interconnecting all the low current outlets (jacks). Each tel. outlet shall be provided a separate wire from the room tag block.

Similarly one CAT-5e wire from the floor TTB/IDF shall be provided for each Tel. Outlet proposed.

A Multi pair box as per BOQ Tel. Cable shall be laid from the Service gate to the Telephone switch room MDF for Direct lines from the Service provider. Some of the lines shall be bypassed to EPABX and shall be directly provided to Top management's office & Telephone operators for direct communication to outside. Rest of the lines shall be routed through EPABX for the use of patrons & staff through extensions. The following area/desk shall have direct access to outside Tel. lines:

- a) Telephone Operator's room
- b) Telephone Switch room
- c) Security room
- d) Fire officer room

SECTION 4 - DISTRIBUTION BOARDS & MCBs

1. General

Distribution boards shall be Double Door, of standard make with MCBs as per approved make given. Distribution boards shall be constructed out of steel sheet all weld enclosure with double door IP42 protection and shall be powder coated. Ample clearance between the conductors of opposite pole, between conductors and sheet steel body shall be maintained in order to obviate any chance of short circuit. Removable conduits entry or knockouts plates shall be provided at top and bottom to facilitate drilling holes at site to suit individual requirements. Also on additional/separate adopter box of suitable length and size shall be provided to accommodate wires and cables. No. of conduits etc. and nothing shall be payable on this account. The MCBs shall be mounted on high-grade rigid insulating support and connected by electrolytic copper bus bars. Each incoming MCB isolator shall be provided with solderless cable sockets for crimping. Phase separation barriers made out of arc resistant materials shall be provided between the phases. Bus bars shall be colour coded for phase identification.

Distribution boards shall be recessed in wall niche or if required mounted on the surface of the wall with necessary clamp bolts etc. The mounting height shall not exceed 1200mm from finished floor level. Distribution board shall be provided with proper circuit identification nameplate and danger sticker/plate as per requirements.

All the distribution boards shall be provided with engraved nameplates with 'lighting', 'power' or 'UPS' with DB Nos., as the case may be. Each DB shall be provided with a circuit list giving details of each circuit. All the outgoing circuit wiring shall be provided with identification ferrules giving the circuit number & phase.

Each distribution board shall have a separate neutral connection bar and a separate earth connection bar mounted within the DB each having the same number of terminals as the total number of outgoing individual circuits from the distribution board. Conduit & cable armouring shall be bonded together & connected to the distribution board earth bar.

Where oversized cables are specified due to voltage drop problems, it shall be contractors responsibility to ensure that satisfactory terminal arrangements are provided without an extra cost.

2. Earth Leakage Circuit Breaker

ELCB shall be 4 pole 415 volts 50Hz, 30-300mA sensitivity. These shall be of approved make. The rating of the ELCB shall be as specified in BOQ. These shall be suitable for manual closing and opening and automatic tripping under earth fault circuit of 30- 300mA as specified in item of work. The enclosure of the ELCB shall be moulded from high quality insulating material. The material shall be fire retardent, anti-tracking, non- hygroscopic, impact resistant and shall with stand high temperature. All parts of switching mechanism shall be non-greasing, self-lubricating material so as to provide consistent and trouble free operation. Operation of ELCB shall be independent of mounting position and shall be trip free type. The RCCB shall be protected against nuisance tripping by protective device.

3. Miniature Circuit Breaker

- a. The MCB shall be current limiting type and suitable for manual closing and opening and automatic tripping under overcurrent and short circuit. The MCB shall also be trip free type.
- b. Single pole/three pole versions shall be furnished as required.
- c. The MCB shall be rated for 10 KA/15 KA fault level.
- d. The MCB shall be suitable for its housing in the distribution boards and shall be suitable for connection at the outgoing side by tinned cable lugs and for bus-bars connection on the incoming side.
- e. The terminal of the MCBs and the open and close conditions shall be clearly and indelibly marked.
- f. The MCB shall generally conform to IS: 8828. -1996
- g. The MCB shall have 20,000 electrical operation upto 63A.
- h. The MCB shall have minimum power loss (Watts) as per I.S./ IEC.

TECHNICAL SPECIFICATION - HVAC

1. GENERAL REQUIREMENTS

The Special / Particular Instruction and Conditions of Contract as described in this document are intended to amplify the General conditions of Contract and shall be read in conjunction with specifications of work, drawings and all other documents forming part of this Contract wherever the context so requires. The following clauses shall be considered as an extension and not in limitation of obligation of the Contractor.

All expenses incurred by the contractor in connection with obtaining information or submitting his tender including is visits to the site or efforts in compiling the tender shall be borne by the contractor and no claims for reimbursement shall be tertained.

Notwithstanding the sub-division of the documents into separate sections and volumes every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the contract.

Wherever it is mentioned in the specification, that the contractor shall perform certain work or provide certain facilities, it is understood that the contractor shall do so at his own cost.

The obligation of Contractor in fulfillment of HVAC works are stated below:

1. Procurement, fabrication and supply.
2. Inspection and testing.
3. Expediting and co-ordinating with other agencies.
4. Scheduling and Monitoring.
5. Training the Clientin the Operation & Maintenance of the Plant.
6. Erection, checking and testing.
7. Commissioning.
8. Carrying out performance tests to meet the specification requirement and to the full satisfaction of CLIENT.
9. Providing Guarantee, Maintenance during Guarantee/Defects Liability period&Final documentation.

2. OUTDOOR UNITS

The outdoor unit shall be factory assembled, weather proof casing, constructed from heavy gauge mild steel panels and coated with baked enamel finish. The unit should be completely factory wired, tested with all necessary controls:

Each modular inverter outdoor shall be DC twin rotary compressor/ Scroll.

1. In case of modular outdoor units, the 20 HP outdoor unit shall have at least 1 inverter compressor so arranged that the operation is not disrupted with failure of any inverter compressor and if one inverter compressor malfunctions, other continues to provide emergency operation smoothly till repair is affected.

2. It should also be provided with duty cycling for multiple inverter compressor switching starting sequence for better stability and prolonging equipment life.
3. The outdoor unit shall be modular in design and should be allowed for side-by-side installation.
4. The unit shall be provided with its own microprocessor control panel.
5. The outdoor units should have anti-corrosion paint free base plate for easy mounting of unit.
6. The machine must have a sub cool feature to use coil surface more effectively thru proper circuit/bridge so that it prevents the flushing of refrigerant from long piping due to this effect thereby achieving energy savings.
7. The outdoor unit should be fitted with low noise, aero spiral design fan with aero fitting grill for spiral discharge airflow to reduce pressure loss and should be fitted with DC fan motor inverter type for better efficiency.
8. The condensing unit shall be designed to operate safely when connected to multiple fan coil units.

COMPRESSOR

The compressor shall be highly efficient Rotary/ Scroll type and capable of inverter control. The inverter compressor shall change the speed in accordance to the variation in cooling or heating load requirement:

All outdoor units shall have multiple steps of capacity control to meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.

Oil heater shall be provided in the compressor casing.

REFRIGERANT CIRCUIT

The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valves at condenser end.

The equipment must have in built refrigerant stabilization control for proper refrigerant distribution.

All necessary safety devices shall be provided to ensure the safely operation of the system.

Refrigerant shall be R410a or R 407.

SAFETY DEVICES

All necessary safety devices shall be provided to ensure safe operation of the system. Minimum requirements shall be high-pressure switch, fuse, fan drive overload protector, fusible plug, over load relay, overload protection for inverter.

OIL RECOVERY SYSTEM

Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigeration piping lengths.

The system shall be provided with oil balancing circuit to avoid poor lubrication.

3. INDOOR UNITS

This section deals with supply, installation, testing, commissioning of various type of indoor units conforming to general specification and suitable for the duty selected. The type, capacity and size of indoor units shall be as specified in detailed Bill Of Quantities.

All the indoor units such as Wall split unit, Cassette, ceiling suspended unit, etc., must have inbuilt drain pump provision, if inbuilt is not available, drain pump accessories must be provided.

Indoor units shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the room.

The address of the indoor unit shall be set automatically in case of individual and group control.

In case of centralized control, it shall be set by remote controller.

The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins. Each coils shall be factory tested at 21kg/sqm air pressure under water.

Unit shall have cleanable type filter fixed to an integrally moulded plastic/ Aluminium frame. The filter shall be easily serviceable.

CEILING MOUNTED CASSETTE TYPE UNIT (MULTI FLOW TYPE)

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX-coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight and shall be able to suspend from four corners.

Unit shall have an external attractive panel for supply and return air. Unit shall have four way supply air grilles on sides and return air grille in center.

Each unit shall have high lift drain pump, fresh air intake provision.

Low gas detection system and very low operating sound.

All the indoor units regardless of their difference in capacity should have same decorative panel size for harmonious aesthetic point of view. It should have provision of connecting branch ducts.

CEILING MOUNTED DUCTABLE TYPE UNIT

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & DX coil section .The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for Ductable arrangement.Each unit shall have high lift drain pump, fresh air intake provision.

CEILING SUSPENDED TYPE

Unit shall be suitable for ceiling suspended arrangement below false ceiling.

The unit include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel. Each unit shall have high lift drain pump, fresh air intake provision.

HIGH WALL MOUNTED UNITS

The units shall be wall-mounted type. The unit includes pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

Unit shall have an attractive external casing for supply and return air.

Each unit shall have high lift drain pump, fresh air intake provision.

FLOOR STANDING TYPE

Unit shall be suitable for floor standing arrangement. The unit include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling and heating.

Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.

4. REFRIGERANT PIPING, INSULATION& CONTROL CABLING

All refrigerant piping system shall be seamless copper pipe 18 gauge up to 19.1 mm and hard drawn copper pipe of 1 mm wall thickness beyond 19.1 mm. All fittings shall be copper. The piping shall be carried out following good engineering practice, and shall be neatly and adequately supported at intervals not exceeding 2500 mm.

The bends shall be preferably of long radius bends.

The piping shall be complete with charging connections, suction line insulation, and all other items reasonably considered necessary.

Before joining any piping, the internals shall be thoroughly cleaned, by passing a cloth by means of a cable or wire, through the entire length. The piping shall be continuously kept clean during erection. After the joints are constructed, the entire system shall be blown with dry nitrogen.

Control Cable must be looped between the indoor units and connected to the outdoor machine, then all the outdoor machines are looped then connected to the central remote controller. The looping must be done with 2x1.0sqmm copper wire in a PVC conduit, taken all along the refrigerant line.

The piping quantities indicated in the Schedule are only approximate and for the purpose or proper evaluation of the tenders. It will be the responsibility of the tendered to design the entire piping system, utilizing only those piping indicated under the Schedule.

All piping supports shall be adequately designed and shall have anchor fasteners, vibration isolators etc.

Elastomeric Nitrile rubber insulation of 19mm thickness shall be provided for the refrigerant lines. To protect this insulation, the same shall be covered with poly shield coating with at least two coats of resin and hardener. Fibreglass tape shall be helically wound over this and further shall have two coats of finish resin for smooth finish.

Drainpipes shall be with suitably sized PVC pipes and insulated with 6 mm thick Elastomeric Nitrile Rubber.

U traps, wherever required, shall be provided for the drainpipe

The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm /13 mm thick elastomeric nitrile rubber as specified in BOQ.

Drain pipes carrying condensate water shall be insulated with 6 mm thick elastomeric nitrile rubber insulation.

For proper drainage of condensate, U Trap shall be provided in the drain piping (wherever required). All pipe supports shall be of pre fabricated & pre painted slotted angle supports, properly installed with clamps etc.

List of Approved Makes:

S.No	Details of equipment/ material	Make/Manufacturer
A. CIVIL WORKS		
1.	Acoustical Panelling	ECOTONE/ Armstrong/ Anutone
2.	Adhesive for Ceramic tiles	Cico / Pidilite / Bal Endura / Laticrete/ Fosroc
3.	Adhesive for Wood Work	Fevicol/Vamicol/Dunlop
4.	Aluminium Accessories and Hardware	Classic/ Crown /EBCO /Earl Bihari
5.	Aluminium Composite Panels	Aludecor / Alucobond /Alstone
6.	Aluminium Die-Cast handles & two point locking kit	Giesse / Securistyle / Alu – alpha
7.	Aluminium Extrusion/ Sections	Hindalco / Jindal / Indal
8.	Aluminium Fabricator	To be approved by the Engineer-in-Charge
9.	Anchor Fastner/Dash Fastner	Hilti / Fischer /Bosch
10.	Anti – Termite Treatment	It should be done by permanent members of IPCA as approved by Engineer-in-Charge.
11.	Back up rod	Supreme Industry or equivalent

12.	Batch Mix Concrete (BMC) / Ready Mix Concrete (RMC)	The contractor to install his own computerized batching plant of suitable capacity and arrange for Transit Mixers, pumps etc. as per approval of Engineer – In- Charge. Or The RMC shall be procured from the source as approved by Engineer – in Charge. RMC Producing plants of the main Cement producers shall be preferred
13.	Bitumen	Indian Oil, Hindustan Petroleum, Bharat Petroleum
14.	Cement	ACC / Ultra tech / JK Cement / Jaypee-Rewa / Ambuja / Lafarge / Bangur / Shree/ Dalmia/ Amrit/ STAR/TAJ
15.	Cement: White	Birla White / JK
16.	Clean Room Wall Panels with/ without return air risers, Doors/ windows etc.	CLESTRA/ NICOMAC / HEMAIR / GMP / EPACK
17.	Clear Glass / Clear Float Glass / Toughened Glass	Saint Gobain (SG) / Asahi India Safety Glass Ltd /Modiguard
18.	Concrete Additive	Pidilite / Fosroc / Fairmate / MC Bauchemie/Sika/Cico/
19.	Cover /Spacer Block	Conbextra as manufactured by M/s Fosroc Chemicals India Ltd. or equivalent
20.	Curtain Rod/ Drapery Rod/ Venetian Blinds	Vista work / Mac Décor or equivalent
21.	Crash Guard/ Corner Guard	MDD/TSI/LSR/Radius
22.	Door closer / Floor spring	Hardwyn/Godrej/ Dorma/Doorking/Everite
23.	Door Locks	Godrej / Harrison / Dorma/Link
24.	Door Seal – Woolpile Weather Strip	Anand Reddiplex/ Enviroseal
25.	Door Shutters- Flush	Duro / Greenply/Archidply / Century / Merino
26.	Doors & Windows Fixtures / Fitting.	Everite / Classic/ Crown / Earl Bihari
27.	Epoxy Flooring	Fosroc/ Dr. Beck/ Flamaflor
28.	Extruded Polystyrene Board	Styrofoam by DOW Chemicals / Insuboard by Supreme Industries
	False Ceiling - Calcium Silicate Boards & Tiles	India Gypsum/ Armstrong / Hilux / Saint Gobain (Gyproc)/Aerolite

29.		
30.	False Ceiling - Metal	Armstrong / Hunter-Douglas / USG-Boral/ Saint Gobain/ Unimet
31.	False Ceiling - Mineral fibre	Armstrong / Decosonic / USG-Boral/ AMF/ Saint Gobain (Gyproc)
32.	Fire Rated Doors & Frames	Navair / Shakti-Hormann / Pacific/Promat
33.	Fire Rated Glass	Asahi India Safety Glass Ltd./ Saint Gobain/ Pilkington, Schott, Pyroguard, Glaverbel
34.	Fire Retardant Paint	Viper FRS 881 / Nullifire/ Berger
35.	Fire Seal	Sealz, Alstroflam/ Abacus
36.	Fire: Door Closures, Mortice Dead locks	Becker Fire Solution/ Inersoll Rand/ Dorma/Godrej/ Geze/ Hafele
37.	Fire: D-Type Pull Handles	Becker Fire Solution/ Dorma/ Hardwyn /Godrej
38.	Fire: Hinges,	Becker Fire Solution/ Inersoll Rand/ Dorma/Godrej/ Geze/ Hafele
39.	Fire: Panic Exit Devices	Becker Fire Solution/ Inersoll Rand LCN Series/ Dorma PHA Series/ D-line/Godrej
40.	Fire: Sealant	Birla/ 3M/ Hilti
41.	Fire: Tower Bolts	Suzu/ Nulite, Dorset/ Dorma/Godrej
42.	Floor Hardener	Pidilite / SIKA/ Fairmate / BASF
43.	Glass : Float & Mirror	Modiguard / Atul / Saint Gobain/ Asahi India Safety Glass Ltd / Modi Glass
44.	Glass for Aluminum Doors/ Windows/ Structural Glazing	Modiguard / Saint Gobain / Pilkington/ Asahi India Safety Glass Ltd./Modiglass
45.	Glass Wool / Insulation Boards/Puf InsulatedRoofing	Rockwool / UP Twiga / Lloyd Insulation /Pidilite
46.	GRC Jali	Unistone/ Kuber Fibrostone/Everest Composites/ Birla white
47.	Grout: Non-Shrink	Fosroc / Sikka/Pidilite or equivalent

48.	Grouting Compound	Bal Endura/ Pidilite/ Laticrete/ Unitile
49.	Gypsum Board / Gypsum False Ceiling/ Gypsum Partitions	USG-Boral Gypsum / India Gypsum / Lafarge / Saint Gobain (Gyproc)
50.	Laminates/ Veneers	Century/Archidply/Greenlam/Formica/Sunmica / Merino
51.	Lead Lined Door	REBBON, Kutty's, AHALDA
52.	Modular Grab bars and Disabled Hardware	Dorma / D-line
53.	Modular SS Railing System	Metallica India / D – Line International Denmark / Mobel Hardware
54.	Neutron Shielded Door	Ray-Ban Engg corp/A-Fabco In/A7L shielding INC/Accurate Radiation Shielding
55.	Night Latch	Godrej / Dorma/ Ozone/Harrison/Link
56.	OT: Anti-Fungal paint	Sikka by Liquid Plastic/ Viesmann/ SSK/ TRILUX
57.	OT: Conductive Tile Flooring: ESD-Control Tile Flooring	Tarkett/ Gerflor/ Armstrong/ Forbe/ Trilux
58.	Paints - Cement Based	Snowcem Plus/, Berger (Durocem Extra)/ Nerolac (Super Acrylic)/ TATA Cem, Asian
59.	Paint – Fire Retardent	Viper FRS 881/ Nullifire
60.	Paints - Epoxy paint	ICI Dulux/ Nerolac / Cico / Sikka / BASF / Berger / Pidilite
61.	Paints - Oil Bound Distemper / Acrylic Washable Distemper	ICI Dulux/ Asian (Tractor)/ Berger (Bison)/ Nerolac (Super Acrylic), ICI (Maxlite)
62.	Paints - Other Paints / Primer	ICI Dulux/ Asian/ Berger/ Nerolac
63.	Paints - Plastic Emulsion Paint	ICI Dulux/ Asian/ Berger/ Nerolac
64.	Paints - Plastic Emulsion Paint (exterior)	Asian (Apex Ultima)/ Berger (Weathercoat all Guard)/ ICI (Dulux weathershield max)
65.	Paints - Synthetic Enamel Paints	ICI Dulux (Gloss), Berger (Luxol Gold), Asian (Apolite), Goodlas Nerolac (Full gloss hard drying), Jenson & Nicholson (Borolock)
66.	Paints - Texture paint	Berger / Spectrum / Unilite Heritage /Asian

67.	Paver blocks / Tiles (All Types)	KK / Uni Stone Products (India) Pvt. Ltd/ Hindustan Tiles/ NITCO
68.	Plywood/Block board/Ply board	Duroply / Greenply/ Archidply/ Century/ Kitply/ National / Anchor/ Merino
69.	Polycarbonate Sheets	Danpanlon India/Gallina/ GE Plastic/Tuflite
70.	Pre-coated Galvanised Steel Sheet	Tata BlueScope / Llyod Insulations India Ltd / S.R.Metals
71.	Pre-Laminated Particle Board	Novapan /Century /Green Ply/ Merino
72.	PVC continuous fillet for periphery packing of glazings / Structural/ Glazing	Roop / Anand / Forex Plastic/ Nagalia/Trading Company
73.	PVC Doors	Sintex/ Polyex/ Rajshri
74.	PVC Flooring	Tarkett Floors / LG Floors / Gerflor / Premier Vinyl flooring / Regent / Armstrong
75.	Powder Coating Material pure Polyester	Jotun / Berger / Goodlass Nerolac
76.	PVC Water Stops	Prince /Supreme/ Finolex
77.	RF Shielded Door	ETS Lindgern/ Synchrony Agency/ Huaming EMC India
78.	Reinforcement Steel / Structural Steel	SAIL/ RINL/ TATA Steel Ltd./ Jindal Steel & Power Ltd./ JSW Steel Ltd.
79.	Restroom Cubicles	Merino/ Century/ Greemlam
80.	Sandwich Puff Panel	JSW/SINTEX or equivalent
81.	Sealant: Poly-sulphide	Pidilite / Fosroc / CICO / Sikka
82.	SFRC / RCC Manhole Covers/ Perfect RCC Grating	KK Manholes / SK Precast Concrete/ Advent concreteovision / Daya concrete
83.	Silicon sealants /Weather Sealant / Structural Glazing Sealant	GE- Silicon / Pidilite / Forsoc / Cico /Dow Corning / Sikka/ Wacker
84.	Stainless Steel	Salem Steel/ Jindal or equivalent
	Outdoor Sports Flooring	Great Sports Infra/PORPLASTIC/Sunflex

85.		
86.	Stainless Steel bolts, Screws, Nuts & Washers	Kundan / Puja / Atul
87.	Stainless Steel Clamps	Hilti /Intellotech Konzept or equivalent
88.	Stainless Steel CP Grating	Chilly / Camry/ Neer or equivalent
89.	Stainless Steel D-handles	D-line / Giesse /Dorma
90.	Stainless Steel Friction Stay	Earl Bihari / Securistyle / EBCO
91.	Stainless Steel Hinges	Hettich/ Godrej/ Dorma
92.	Stone Adhesives	Fosroc / Sikka/Pidilite
93.	Sunken Portion Treatment	Choksey / Sika / CICO/ MC Bouchemie / BASF
94.	Super plasticizer	CICO/ Roffes Construction Chemicals/ Pidilite /
95.	Tiles: Ceramic Tiles	Kajaria / Somany/RAK/
96.	Tiles: Glass Mosaic Tiles	MRIDUL/ BIZZARE
97.	Tiles: Glazed (Ceramic) tiles	Kajaria / Somany/RAK/
98.	Tiles: Heat Resistant Terrace Tiles	Thermatek or equivalent
99.	Tiles: Vitrified Tiles (Double / Multi Charged)/ Germ free	Kajaria / Somany/RAK
100.	Vacuum Dewatered Flooring	Tremix / Sun Build / Avcon technics
101.	Veneered Particle Board	Duro / Greenply / Century / Novapan / Action Tesa
102.	Vinyl Flooring	Wonder floor/Responsive or equivalent make
103.	Water Proofing Materials (Bitumenistic)	BASF/ Fosroc / Sikka / CICO / STP/ Pidilite/CHRYSO

104.	Wooden Laminated Flooring	NITCO /Euro / Pergo
105.	Auditorium Chairs	Godrej/Spacewood/Indo
106.	Expansion Joints	Sanfield (India) Ltd., MIGUA, TRISTAR

B. PLUMBING & SANITARY WORKS

1.	Automatic variable temperature control / fixed temperature control faucets	Jaquar / AOS-Robo-U-Tec/ Parry / Angash / Euronics
2.	Central Control	Rain Bird, USA/Toro/Nelson,
3.	Ball Cock	Sant / L&T/Audco/GPA
4.	Ball valves with floats	Zoloto / Leader / Sant/ Audco/GPA
5.	Brass - Stop & Bib Cock	Zoloto / Sant / Jaquar
6.	C. I Pipes & Fittings	Electrosteel/ Kapilansh/ NECO/ RIF/ SKF/BIC
7.	Centrifugally Cast Iron Hubless Pipes & Fitting	NECO/BIC/SKF/Kapilansh
8.	C.I Sluice Valve & Non Return Valve	Kirloskar /Leader /Zoloto/ Audco/ Sant
9.	C.I Valves (Full way, Check and Globe Valves	Leader / Kirloskar / SKF / Zolto / Sant / Castle / Kartar
10.	C.I. Manhole Covers	NECO/R.I.F./B.I.C./HEPCO/SKF/ KAJECO
11.	C.P. Fittings: Mixer / Bib Cock/ Pillar taps/ Angle valve/ Valves Washers / Waste/ Urinal / Spreaders / Accessories etc.	Jaquar /Kohler/ Grohe/Marc
12.	Centrifugally C.I Rainwater Intel fitting , Bronze gratings	NECO/BIC
13.	Centrifugally casted C.I. Pipes	Electrosteel/ Kapilansh/ NECO/ RIF/ SKF/BIC
14.	Chlorinator	Thermax Ltd/ Watcon, Ion exchange/ Sigma DH Combine Inc./ Siemens/ Techcon/ Jesco / Prominent Heidelberg
15.	Chlorine Dosing System	Toshcon / Chloromax
16.	Cockroach Trap	Chilly/ Player/ Camry

17.	Copper Fittings (Capillary)	Yorkshire Imperial, U.K./ Rajco Metal Works Mumbai / IBP Conex Ltd.
18.	Disc Filter	Azud, Spain/ Amaid / Arkal,
19.	Ductile Iron Fittings (IS:9523)	Electrosteel/Kesoram/Tisco/Jindal/HEPCO
20.	Ductile Iron Pipes (IS:8329)	Electrosteel/Kesoram/Tisco/Jindal/HEPCO
21.	E.P.D.M Gaskets	Anand Reddiplex / Enviro Seals / HANU
22.	Forged Steel Fittings & Flanges (For Welded joints)	Rohini /Kanwal/ Vijay Cycle & Steel (VS)
23.	Geyser	Spherehot / Racold / Usha Lexus /Bajaj
24.	Hand Drier	Kopal / Utech Systems / Euronics Automat
25.	HDPE Pipes / Moulded Fittings	Emco /Polyefins/Pioneer Plyfab/ Jain
26.	HDPE Solution tank	Watcon / Ion Exchange / Water Supply Specialist Pvt. Ltd.
27.	Inbuilt Drip Line	Azud/ Rainbrid-USA/ Netafim
28.	Insulation of Hot water pipes	Vidoflex insulation / Superion insulation Kaiflex – Kaimann/Armoflex/Thermafex
29.	Liquid Level Controllers / Indicators	Advance Auto / Sridhan International / Minilec / Radar / Femac / Switzer / 21st Century
30.	Liquid Soap Dispenser	Euronics/Utec/Kopal
31.	MS Saddle with G.I. Riser	Harvel/Alprene/Rain Bird, USA
32.	PVC flushing cistern	Commander / Parryware / Hindware/ Cera
33.	P.R.S. Dials	Rain Bird, USA/ Toro, USA/ Nelson,
34.	P.T.M.T. Fitting	Prince India / Symet/Pryag
	Pipe coat material (pipe protection)	RPG Raychem/Pykote/Makphalt/Lwl

35.		
36.	Pipe Fittings: G.I.	R/Unik/Zoloto/K.S./Sun/Swastik
37.	Pipe:- G.I.	Jindal / Tata / Prakash Surya/SAIL/ Swastik
38.	Pipes & fitting: PVC for SWR Soil, Waste & Vent Pipes and fittings, Type B PVC Casing & Screen Pipes	Prince / Supreme / Finolex
39.	Pipes & Fittings: CPVC	Flowguard/ Astral/ Ashrivad/ AKG/Supreme
40.	Pipes & fittings: UPVC	Finolex / Prince / Supreme / AKG / Kasta / Vector / Astral
41.	Pipes & Gully Trap: Stone ware	Perfect / S.K.F/ R.K/ Hind / Anand
42.	Pipes and Accessories: PE-AL-PE	Kitec/ Jindal/ Kissan/Vista
43.	Pipes: Copper	Rajco Metal works, Mumbai / IBP Conex Ltd.
44.	Pipes: M.S.	Jindal / Prakash – Surya /TATA
45.	Pipes: PP-R (PN – 16)	Amitex Polymers Pvt. Ltd. / Prince/ Supreme
46.	Pipes: R.C.C	Indian Hume Pipe / Pragati Concrete Udyog Daya/ KK / JSP
47.	Plastic seat cover of W.C	Commander/Hindware / Parryware
48.	Polyethylene Storage Tank	Sintex / Polycon/ Fusion
49.	Pop up Connecting Assembly	Rain Bird/Dura/Lasco,
50.	Popup Spray Head	Rain Bird/Toro, USA/Nelson,
51.	RQRC Hydrant	Harvel/Alprene/Rain Bird, USA
52.	RQRC Key	Harvel/ Aqua/ Drip& Drip
53.	Sensor Operated Auto Flushing System Urinals	Jaquar / AOS-Robo/U- tec/Angash/Euronic

54.	SS Gratings/ Soap Dish/Towel Rail etc.	Camry/Glacier/Gem/ Jaquar/ Grohe
55.	Stainless Steel Sink	Hindware / Neelkanth / Nirali / Jayna
56.	Valve Box	Rain Bird, USA/Carson Brook, USA/Dura,
57.	Valve: Air Release	Azud/ API/ Bermad/ BIR/ Kirloskar / Venus / Zoloto
58.	Valve: Butterfly	Zolato/Audco /Sant/ KSB
59.	Valve: Gun metal	Kilburn /Leader /Zoloto/ Sant/ Kartar/ AIP/ Audco
60.	Valve: Flush	Gem/ Jaquar / Marc
61.	Valve: Mainline Isolation	Sant /Leader /Zoloto,
62.	Valve: Pressure Relief	Sant/Leader/ Zolato / Audco
63.	Valve: Sluice / NRV	Kirloskar/IVC/Kilburn /Zoloto/Castle/ Leader / L&T/ Audco
64.	Valve: Solenoid	Rain Bird, USA/Toro/Nelson,
65.	Valve: Non Return	Sant/ Leader/ Zoloto / AIP / Kirloskar/ IVC/ Leader/ Audco
66.	Valves: Gunmetal / C.P brass angle	Zoloto / Leader / Kilburn / Sant / Kartar/ AIP/ Audco
67.	VFD Pump	Jyoti / Crompton/ Kirloskar/ KSB/ Grundfos/ Mather & Platt
68.	Vibration Eliminator Resisto-flex Pads & Connections	Relay Corpn./ Kanwal
69.	Vitreous China Sanitary wares	Hindware / Parryware / Cera / Kohler
70.	Water Cooler	Blue Star/ Voltas/ Usha/ Godrej
71.	Water Meter	Capstan / Kranti/ Anand/ Kant
72.	Water supply pumps	KSB/ Grunfos/ Kirloskar/ Crompton/ Mather & Platt

73.	White Glazed Fire Clay Sink	Hindware / Parryware / Cera
C. Electrical		
1.	Wiring Cables FRLS	Polycab, Finolex, RR Cables, Havells
2.	Modular Switch, Socket & GI Box	Legrand, MK, Wipro, Anchor
3.	DBs, MCBs & MCCBs	Legrand, Schnider, Siemens, ABB, L&T
4.	PVC conduit	Avon Plast, Precision, Clipsal
5.	Exhaust Fan	Vgaurd, Almonard, Havells, Kaithan, Bajaj, Usha, orient
6.	Light Fixtures	Philips, Bajaj, Wipro, Crompton, Havells
7.	Cable Gland & Lugs	Comet, Dowels, Hex
8.	LT cables (XLPE)	Polycab, Universal, Havells
9.	Joining Kit	Reychem, 3M, Xicon
10.	Terminal connector	Connectwell, Elmex
11.	Outdoor Type Box	Sintex, Legrand, Hensel, Rittal
12.	MS & GI pipes	TATA, Jindal, SAIL
Note:-		
1. The contractor will use one of the approved makes as approved by the Engineer -in-charge.		
2. In case of different quality / pattern of same make, the pattern/ quality shall be approved Engineer – in – charge.		
3. This list of makes shall be read with the list of makes provided elsewhere in the Tender Documents . In case of variance, decision of the Engineer-in – Charge shall be final.		
4. For materials/equipment/ to be used in items of work for which approved makes are not given hereinor in the list of makes provided elsewhere in in the Tender Documents, the makes of such materials /equipment shall be as decided by Engineer –in-charge.		
5. If any major equipment is using a small component of make other than that given as a standard component with the equipment, the same shall be accepted subject to approval of Engineer –in-charge.		

END OF VOLUME - III