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**VOLUME – IIB**

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1. Introduction

1.1 Information about the site:
The sites for all buildings for Tripura State Electricity Corporation Ltd is located within Agartala Town itself. All tenderers are advised to visit all the sites proposed for different buildings and collect necessary information from site with prior approval from EPIL prior to submission of the tender.

1.2 SCOPE OF WORK
The Construction of following buildings at different location of Agartala Town have been included in the scope of this tender:

i) Multistoried Office Building at TSECL Corporate Office Complex, Agartala (G+3)
ii) Multistoried Office Building at Banamalipur, 33/11 KV Sub Station Complex, Agartala (G+2).
iii) Inspection Bunglow for TSECL at Banamalipur, Agartala (G+1).
iv) Multistoried Office Building at IGM Sub Division Complex, Agartala (G+2).

The scope of work covers the entire construction work comprising of civil construction of the building, area development, complete sanitary works, internal and area lighting and other electrical works, installation of lift, installation of fire fighting and prevention systems, etc. and handing over the project to EPIL/Client.

GENERAL TECHNICAL SPECIFICATION:

2.0 GENERAL SPECIFICATION
2.1 The work in general shall be carried out as per CPWD specifications, 1996 (volume I to VI) (updated with correction slips issued up to last date of submission of tender) and text of revised CPWD specifications for cement mortar, cement concrete and RCC works, 2002 unless otherwise specified in the nomenclature of the individual item or in the particular specifications for civil works and CPWD specifications, 1994 for Electrical works (Internal) and 1995 for Electrical works (External) (updated with correction slips issued up to last date of submission of tender).

2.2 All Electrical installation shall comply with the requirements of Indian Electricity rules, 1956 and Indian Electricity Act-1910 as amended up to date and bye laws of authority of State Government or any other department.

2.3 All mechanical works related to Public Health Engineering will conform to the requirements of manual of Water Supply by the Ministry of Urban Development and various Indian Standards as listed there-in.
2.4 All electrical works will conform to various Indian Codes as listed in the Technical Specifications.

2.5 For the items not covered under the specifications as stated above, the work shall be done as per relevant IS Codes.

2.6 For the items not covered under any of the specifications stated above, the work shall be executed as per Manufacturer’s specifications/ General Engineering Practice and/or as per direction of Engineer in Charge.

2.7 ADDITIONAL PARTICULAR SPECIFICATION
In the absence of any definite provisions or any particular issue in the aforesaid specification, reference to be made to the latest codes and specifications of BIS, IRC, BS, ASTM, AASHTO and CAN/CAS in that order. Where even these are silent, the construction and completion of works shall conform to sound Engineering practice as approved by Engineer in Charge. In case of any dispute arises out of the interpretation of the above, the decision of the Engineer in charge shall be final and binding on the contractor.

Where ever reference is made in the contract to specific standard codes to be met by the materials, plants and other supplies to be furnished and work performed and tested, the latest edition or revision of the relevant codes in effect shall apply, unless otherwise explicitly stated in the contract. Where such standards and codes are national, or related to a particular country of region, other internationally recognized standards which ensure a substantially equal or higher performance than the standards and codes specified will be accepted subject to the Engineer in charge prior review and written approval. Differences between standards must be fully described in writing by the contractor and submitted to the Engineer in Charge at least 15 days prior to the date when contractor desires the Engineer in Charge’s approval. If the Engineer in Charge determines that such proposed deviation do not ensure substantially equal performance, the contractor shall comply with the standards specified in the documents.

3 PARTICULAR SPECIFICATION OF NON DSR CIVIL AND SANITARY WORKS

3.1 FILLING WITH LOCALLY AVAILABLE SAND
Sand should spread in uniform layer of 150mm thickness and each layer shall be watered up to the full saturation condition and each layer to be compacted with manual/mechanical compacting device to achieve maximum density. After completion of the full depth of filling the surface of the filled sand to be neatly dressed and leveled.
3.2 40MM (AV.) THICK CEMENT 1:2:4 WITH WATER PROOFING COMPOUND:
Cement Concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6mm nominal size) to be laid in proper slope for draining. The surface over which this concrete to be laid shall be cleaned properly before laying. The admixture to reduce permeability of concrete shall conform IS 2645 and the dosage will be as per manufacturers’ recommendation.

3.3 25MM THICK CEMENT 1:2:4 WITH WATER PROOFING COMPOUND:
Cement Concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6mm nominal size) to be laid on vertical surface. The surface over which this concrete to be laid shall be cleaned properly before laying. The admixture to reduce permeability of concrete shall conform IS 2645 and the dosage will be as per manufacturers’ recommendation.

3.4 DECORATIVE INTERCONNECTED FLOOR / PAVEMENT TILES
Interconnected tiles will be of cement concrete of minimum crushing strength of 55 kg/sqm with air entraining or other admixture, approved colouring pigment etc.) high pressed with hydraulic pressing machine. The tiles should have sufficient strength to withstand traffic load. The surface of block shall be non-skid textured surface and abrasion resistance.

The tiles will be fixed over 25mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand) and all the joint to be filled with white cement and matching colour pigment.

3.5 Bored Cast – in – situ piles

Bored Cast – in – situ RCC piles of diameter and length as specified in the schedule of quantities are proposed to be installed. The cut off level for piles may be considered at a level of approximately 1.5m to 2.0m below average ground level of the site for the purpose of the tendering. The contractor shall however have to execute the work as per the final “good for construction” drawings.

Payment shall be made for the length of the pile measured from cut-off level (C.O.L) to the tip of pile only and nothing extra shall be paid for empty boring of the concrete above the C.O.L. and whatever extra is required technically and as per I.S. 2911 (Part I/see 2) shall be included in the rates quoted for relevant items of piling work.

Before tendering the contractor shall inspect the site of work and thoroughly acquaint himself with the site condition. He shall also study the pile layout and general layout as available to get himself satisfied.
Any filling dressing up or excavation required for easy movement of the piling rigs and all precautions necessary for the safety of the works, tools and adjoining structures shall have to be undertaken by the contractor at his own cost. All cost incurred for shifting of rigs, machinery etc. from one location to another shall have to be born by the contractor within the rates quoted by him.

The contractor shall be responsible for the accurate setting out of the works.
All piles shall be bored Cast – in – situ type and installed by the using DMC techniques. High quality sodium based Bentonite as per IS specification shall be used. Concreting by Tremie Technique, using minimum 150mm I.D. Tremie pipes to construct a sound continuous RCC shaft for each pile shall have to ensure.

Boring for all pipes shall be initially done by using a sludge pump/boiler with collar casing of minimum 3.0mtr deep. Thereafter boring shall be progressed by DMC methods using Bentonite slurry of suitable consistency for stabilizing the hole.
The Bentonite used shall be of high quality sodium based montmorillonite as per specification

a) The liquid limit of Bentonite when tested in accordance with IS 2720 (part IV) 1965, shall be more than 350%.
b) The sand contend of the Bentonite power shall not be greater than 7%
c) The Bentonite slurry should be made by mixing it with fresh water using pump for circulation. The density of the fresh Bentonite solution after 24 hours maturing should be about 1.12 gm/cc.
d) The Marsh Viscosity of fresh slurry when tested by a standard marsh cone should be about 37 seconds.
e) The swelling index as measured by the swelled volume after 12 hrs. in abandon quantity of water shall be at least 2 times its dry volume.
f) The pH value of the Bentonite suspension shall be less than 11.5 but not less 8.5

Fresh Bentonite powder brought at site shall be tested for properties enumerated in IS2911Part I/sec 2 and any stock not meeting this standard shall be taken away, replaced by acceptable stock all as per the direction of Engineer – in – charge.
The contaminated slurry shall be suitably processed by appropriate means (Sp. Gr. of the slurry not to exceed 1.12 before re – circulation into the pile bore during progress of boring.)
The Bentonite processing unit with settling tanks of required capacities shall be made adequately planned and constructed based on good engineering practice before starting the job. The consistency of the Bentonite slurry used shall be such as to ensure the stability of hole during boring and till completion of concreting. The Bentonite powder and the slurry made shall be tested at regular intervals and records maintained in the field registered.

The pile bore shall be then be flushed and cleaned through the tremie set using fresh bentonite slurry for a period of not less than 10 minutes or till the slurry from the hole has a specific gravity less than 1.20 and/or Marsh cone value less than 45.

After lowering the reinforcement cage a tremie set (I.D not less than 150mm dia) shall be lower so as to reach the bottom of the bore – hole.

Concreting shall be commenced immediately on completion of flushing. The tremie hopper shall have a minimum capacity of 0.75m³ and it shall be filled up fully using a stopper. The batch of concrete shall discharged in one – go to ensure a minimum 1.5m embedment of the tip (bottom) of tremie within the concrete. This minimum embedment shall be maintained till end of the concreting operation by correct monitoring of tremie pipe cutting in stages. This complete concreting operation shall be preferably completed within 5/6 hours.

Concreting of grade M35 designed mix as per relevant IS codes and with cement consumption not less than 400 kg/cum and having a slump consistent with method of concreting but not less than 150mm shall have to be used. If higher quantity of Cement than minimum is necessary to achieve the desired strength and workability, the same shall have to be used without any extra claim.

The removal of Bentonite muck and bored soil from the site shall be responsibility of the contractor at his own cost to the location as specified by the Engineer – in – charge.

All work shall be as per IS 2911 part /Section 2-1987.

On completion of piling in specific areas the top weak concrete of the pile shaft shall be broken down to the specified cut-off level to expose sound concrete shaft. The pile reinforcement shall project above cut off-level.
All plant, machinery, tools and tackles, collar casing labours etc. required for the completion of the work as per the technical specification and good Engineering practice, within the schedule time of completion, shall have to be provided by the contractor at his own cost.

Pile should be installed as accurately as possible as per the drawings. For vertical piles a deviation of more than 1.5% shall not be permitted. Also a pile should not deviate more than 75mm or D/10, which ever is less for the pile having diameter more than 600mm. In case of piles deviating beyond this limits any additional piles that have to be taken to makeup the deficiencies to be provided by the contractor at his own cost.

**TEST OF PILE**

Routine vertical and lateral load test has to be carried out in single pile to ascertain the capacities of piles and their behaviors. Test shall be carried out as per the requirement of IS 2911, part IV and test result shall be submitted with all details and graphs. Pile for testing be selected by the Engineer – in – charge. The scheme of pile test shall be submitted by the contractor for approved of the Engineer – in – charge prior to making arrangement for tests on selected piles. This approval shall however, shall not relieve the contractor from the responsibility of conducting the test safely and in a technically sound manner.

Initial vertical load test shall be carried out in single pile to ascertain the capacities of piles and their behaviors.

Test shall be carried out as per the requirements of IS 2911 (Part IV) and the test results shall be submitted with all details and graphs. The scheme of pile test shall be submitted by the contractor for approval of the Engineer – in – charge prior to making arrangement for tests on selected piles. This approval however shall not relieve the contractor from the responsibility of the test safety and in a technically sound manner.

**Specification for Bored Cast – in – situ Concrete Piles**

**Codes and standards:**

IS 2911 (Part I/ Section 2) 1979: Bored Cast – in – situ Concrete Piles.
IS 2911 (Part IV) 1985: Load test on piles.
Materials:

Cement: Cement shall conform to IS 8112 or IS 12269 (Grade 43 or 53) or IS 1489 (part 1) (PPC)
Steel: Steel shall conform to IS 1786
Bentonite: Bentonite shall conform to Appendix 'A' of IS 2911 (Part I/Section 2) 1979

Concrete:

Concrete of grade M35 with 20mm and down coarse aggregate as stipulated in I.S. 456 and I.S. 2911 (Part I−sec. 2) 1979 latest revision, with minimum cement content of 400kg/m^3 of concrete and degree of workability will be in very high category, measurement of workability by determination of flow (IS: 9103) may be used, slump greater than 180mm should not be used for piling. Design of Concrete mix to be done and to be got approved by EPI Ltd.

Specified characteristic compressive strength of 150mm cube at 28 days will be 35 N/sqmm.
Concrete is to be tested as per I.S. code 516-1959 (latest Revision).
Contractor should ensure uniform grade and quality of Concrete for the entire project.

Workmanship

Control of pile Installation:

the pile shall bored Cast − in − situ RCC Piles capable of being test for bearing capacity after 28 days of casting. Bored Cast − in − situ Piles shall be adopted by suitable choice of installation techniques e.g. using casing and/or drilling mud, manner of concreting i.e. by direct pouring and placing by buckets or by using tremie method and choice of boring tools in order to achieve a satisfactory installation of piles in the site.

Construction of Piles:

Boring:

Boring may be done by graving the earth or by reverse or direct mud circulation technique. In general the hole shall be kept cased with a lead in tube to prevent ingress of soil. In soils, which are liable to flow, the bottom of casing shall be kept low enough in advance of the boring tools to prevent the entry of the soil into the casing, thus preventing the formation of cavities and settlements in adjoining grounds.

Alternatively, the inflow of ground water and soil shall be controlled by the use of a head of drilling mud e.g. Bentonite suspension.
Wash sample/bailer sample of soil shall be collected for inspection during progress of boring mud soil samples of the founding strata shall be carefully collected and stored for inspection.

The depth of boring shall be determined by sounding and in case of uncased bore diameter of the bore at different depth shall be determined by pantograph or other suitable means as directed by Engineer – in – charge. After completion of boring the holes shall be cleaned by airlift method of flushing with fresh drilling fluid.

**Lowering of reinforcement Cage:**
On satisfactory completion of boring the Reinforcement cage shall be lowered inside the bore holes with sufficient number of cement conc. cover block attached with the lateral links.

The Reinforcement cage should go down into the bore hole and in no case, the cage shall be hammered for lowering. During concreting the Reinforcement cage shall be kept hung by suitable arrangement from the top of the bore hole and not allowed to stand on its own weight on the bottom of the bore holes.

**Concreting:**
In case a hole is bored by use of drilling mud, the specific gravity of the mud suspension near about the bottom of the holes shall, whenever directed, be determined by suitable slurry samples in a first few piles and at suitable intervals of piles and recorded. Consistency of the drilling mud suspension shall be controlled throughout the boring and Concreting operation in order to keep the holes stabilized as well as to avoid concrete getting mixed up with the thicker suspension of the mud.

The Concreting operation shall not be taken up when the specific gravity of bottom slurry is more than 1.2. Concreting shall be done by Tremie method in such cases. The slurry shall be maintained at 1.5m above the ground water level.

The Concreting of piles shall commence immediately after the completion of boring. Should a bore hole, which is not cased, be left unconcreted for more than two hours, it shall be cleaned thoroughly before placing concrete to the satisfaction of Engineer – in – charge.

The bottom of the bore holes shall be cleaned of all accumulated sand, muck and loose materials by controlled air lift flushing with fresh drilling fluid. The tremie pipe shall extend to the bottom of the bore hole at the start and shall be jointed in sections and fitted with
the hopper for receiving the concrete pore at the top of the bore hole. The first charge of concrete shall be pored in the hopper, the bottom opening of which temporarily remains closed by a steel plate placed on top of the opening. The hopper shall have adequate capacity to receive concrete sufficient enough to displace the drilling mud within the tremie pipe and from the bottom of the bore hole. After the hopper is filled up the steel plate shall be quickly removed to allow the concrete to rush into the bore hole and fill it up from the bottom by displacing the drilling fluid from the tremie pipe and the bottom of the bore hole. As concreting progresses the tremie pipe shall be removed in sections ensuring every time that the bottom of the tremie pipe remains embedded in side the concrete for at least 1m. The placing of concrete shall be done in one continuous operation and the tremie pipe shall be held concentric with the bore. The level of concrete shall be checked at frequent intervals to maintain a sufficient head of concrete above the discharge end of tremie pipe. It shall be ensured that sufficient number of mixes are pored to expel the first mix of concrete contaminated with Bentonite such that good concrete is obtained up to 15cm above the cut off level. At all stages of Concreting, care shall be taken to prevent voids and segregation of concrete.

The top of concrete in a pile shall be brought above the cut- off- level to permit removal of laitance and weak concrete before capping and to ensure Concrete at the cut- off-level for the proper embedment into the pile cap. When Concrete is placed by tremie method, Concrete shall be cast to the piling platform level to permit overflow of Concrete for visual inspection or to a minimum of 1 mt. above the cut- off – level. In the circumstances the cut-off- level is below the ground water level the need to maintain a pressure on the unset Concrete equal to or greater than water pressure than should be observed and accordingly the length of extra Concrete above the cut- off- level shall be determined.

Withdrawal of Casting:
Extraction of casing shall be done in such a manner that no necking or shearing of the Concrete in the shaft takes place.

Sequence of Piling:
Sequence of piling shall be such that there is no damage caused to the concrete recently laid in the adjacent pile. Construction of piles shall be done in accordance with the priority of construction of various building. Sequence of piling shall be decided by the Engineer- in- charge.

Finishing of Pile Heads:
The top level of concrete in the pile shall be brought up sufficient above the required level or cut-off-level to allow for slumping or withdrawal of casing tube, and also to have a minimum allowance above cut-off-level for removal of all laitance and weak concrete at the cut-off-level. Any defective concrete at the head of the completed pile shall be cut out and made good with new concrete bonded to the old concrete. Manual chipping of the pile heads may be permitted after three days of pile casting. Pneumatic tools for chippings shall not be used before 7 days after pile casting.

Consumption of Concrete in Piling:
After concreting the actual quantity of concrete shall be compared with the average obtained from observations actually made in the case of a few piles initially casted. If the actual quantity is found to be considerably less, special investigation shall be conducted and appropriate measures to be taken.

Replacement of Defective Bored Piles:
Defective piles shall be removed or left in place without affecting the performance of adjacent piles or capping above an additional pile / more than one piles (as required in considering structural aspect) shall be provided to replace them, as directed by Engineer-in-charge, the cost of replacement and/or provision of additional piles, and additional cost of providing larger size of pile caps and grade/plinth beams as directed shall be borne by the contractor at no extra cost to the employer.

In case of defective boring, the defective bore hole shall be filled up with sand consolidation/concrete (filling material to be decided by the Engineer in charge which will be binding to the contractor) and the position of boring for that pile to be shifted as per direction, if required from structural aspect position of more than one pile may be shifted due to that defective boring, and additional cost of providing larger size of pile caps and grade/plinth beams as directed shall be borne by the contractor at no extra cost to the employer.

Deviation for designed location/alignment/load capacity of piles:
Any deviation from the designed location, alignment or load capacity of any pile shall be noted and adequate measures taken by the contractor well before the concreting of the pile cap and grade/plinth beam, if the deviation are beyond the permissible limit.

Basic properties of Drilling mud (Bentonite):
Properties:
Drilling mud shall be used to keep the sides of borehole stabilized. The drilling mud shall have Thixotropic properties, i.e. gel forming properties. The drilling mud shall have such
properties as to permit formation of filter cake on the inside surface of the bore holes, the thickness of which will depend on the nature of sub-soil deposits. Sodium based Bentonite have ideal properties suitable for use as drilling mud.

**Specification:**
The Bentonite suspension use for piling work shall satisfy the following requirements:

a) The liquid limit of Bentonite when tested in accordance with IS: 2720 (Part- V) shall be more than 300% and less than 450%.

b) The sand contained of the Bentonite powder shall not be greater than 7%.

c) Bentonite solution shall made by mixing it with fresh water using pump for recirculation. The density of the Bentonite solution shall be about 1.12 maximum.

d) The marsh cone viscosity value when tested by a marsh cone shall be about 37 sec.

e) The swelling index as measured by the swelled volume after 12 hrs. in abundant quantity of water shall be at least 2 times its dry volume.

f) The pH value of the Bentonite suspension shall be less than 11.5 but not less than 8.5.

**Loss of Bentonite :**
In the event of a sudden loss Bentonite suspension during boring, the bore hole shall be backfill without delay and instructions of the Engineer-in-charge shall be obtained.

**Removal of Bored Muck:**
All reasonable steps shall be taken to prevent spillage of Bentonite suspension on the site away from the immediate vicinity of the pile. Discarded Bentonite suspension which has been pumped from the boring shall be removed from the site by the contractor at no extra cost to the employer.

**Testing of Concrete:**
Concrete shall be tested to ascertain its cube strength at 7 days and 28 days. The number of piles for which tests cubes are to be taken would be as follows:

<table>
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<tr>
<th>Pile group</th>
<th>Number of piles</th>
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<tr>
<td>2 to 4</td>
<td>1</td>
</tr>
<tr>
<td>5 to 8</td>
<td>2</td>
</tr>
<tr>
<td>Above 8</td>
<td>Every fourth pile</td>
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Six cubes shall be taken in accordance with IS: 1199 for testing a set of 3 cubes after 7 days and the second set of three cubes after 28 days.

The method of testing Concrete cubes shall be in accordance with IS: 516 and the strength requirements of Concrete shall be as specified in IS: 456.

**Procedure for routine load tests on piles:**
Loading shall be carried out up to one and a half (1.5) times the safe load or up to the load at which the total settlement attains a value of 12mm for single piles, which ever is earlier.

The pile head shall be chipped of carefully till sound concrete is met. The projecting reinforcement shall be cut off and the top surface finished smooth and leveled with plaster of paris when required. AMS bearing plate shall be placed on the head of the pile for the jack to rest.

The test shall be carried out by applying a series of downward incremental loads on the test pile.

The loading shall be done by reaction from the kentledge of adequate capacity for the full test load. Test pit shall be excavated by open excavation through all types of soils to required depth. The base of the pit shall be minimum 3m X 3m size with adequate side slope and provision for shoring and dewatering etc. The excavated materials shall be dumped sufficiently away from the edge of the excavation so as not to endanger the stability of pit. After completion of the test, the pit shall be back filled as directed by Engineer – in charge.

The hydraulic jack for transferring the load to the pile shall be capacity 25% in excess of the final test load proposed to be applied and shall be provided with calibrated pressure gauge. The contractor shall furnish to the Engineer – in – charge necessary tests certifies for each dial gauge from approved authority before putting into operation.

Before any load test is performed, the contractor shall obtain the approval of the set up and the load frame from the Engineer – in – charge. Care shall be taken to ensure that the centre of gravity off Kenteledge is on the axis of pile and load applied by the jack is co – axial with the pile.
The M.S plate of 5mm thick shall be set on the pile head such that its surface is perfectly horizontal. A jack shall be inserted between the M.S. plate and the Kentledge frame. The dial gauge shall be placed at equal distance around the pile and shall be fixed to two numbers of datum bars whose ends shall rest on immovable supports. The supports for the datum bars with reference to which the settlement of the pile will be measured shall be at least 5D away clear from the piles, where D is the dia of pile subject to a minimum of 1.5m.

The test loads shall be applied in increments of about 20% of the assumed safe loads.

Each stage of loading shall be maintained till the rate of displacement of the pile top is either 0.1mm in first 30 mins or 0.2mm in first one hour or till 2 h whichever occur first. The test load shall be maintained for 24 hrs.

For each increment, application of load shall be smooth as far as possible. Time and settlement observations shall be made at the commencement and completion of each increment. Settlement observations shall be continued when each increment load is kept constant at about 15 mins intervals. The load on the pile may be removed in one stage by releasing the jack steadily after completion of the test and rebound observations made for 2 hrs.

The safe load on single pile may be removed in one stage by releasing the jack steadily after completion of the test and rebound observations made for 2 hrs. The safe load on single pile shall be calculated as below.

a) Two thirds of the final load at which the total settlement attains a value of 12mm. Unless it is specified that a total settlement different from 12mm is permissible in a given case on the basis of nature and type of structure. In the later case, the safe load shall be corresponding to actual total settlement permissible.

b) 50 percent of the final load at which the total displacement equal 10 percent of pile diameter in case of uniform diameter pile.

Recording of data

Complete records of boring and Concreting process for each file shall be maintained by the contractor and submitted daily in triplicate to the Engineer or his representative at site for their record, one copy of which shall be counter signed by the Engineer – in – charge of his representative and return to the contractor. The following recordings shall be maintained for each pile:
a) Details of piles
   i) Pile number and location
   ii) Existing ground level, cut-off-level and level of top of the casting
   iii) Nominal shaft and inside diameter of casing
   iv) Data and time of setting up of rig at the pile location.
   v) Data and time of start of boring.
   vi) Length of casing driven and depths bored vs time.
   vii) Description and thickness of various strata bored.
   viii) Details of any obstructions encountered (depth from existing ground level, thickness and time taken to penetrate through the same)
   ix) Chiseling depth and time.
   x) Final depth of boring (founding level).
   xi) Standard penetration test at the bottom of the bore hole, if any.
   xii) Date and time of completion of boring.
   xiii) Data and time of start and completion of flashing of the bore hole with fresh Bentonite fluid before Concreting.
   xvi) Time of lowering Reinforcement cage and tremie pipes with total length thereof.
   xv) Date and time of start of concreting
   xvi) Nos. of mixes poured. Level of concrete inside the bore hole and tremie pipes at various stages of concreting.
   xvii) Concrete grade, mix proportion, water cement ratio and slump test results.
   xviii) Empty boring length and concrete length below cut-off-level.
   xix) Results of tests on Bentonite slurry used.

b) Details of Instruments used
   I) Make and specification of jack, pressure gauge and dial gauge.
   II) Capacity of jack.
   III) Calibration of pressure and dial gauge.
   IV) Design load of piles, description of location and identification marks for testing.

c) Test recordings:
The readings for settlement and rebound shall be entered in the form given on the next page.

d) Failure of Test:
If the test fails to show the specified capacity, the cost of replacing the defective pile by a new pile / more than one pile (as required considering design aspect) and consequent additional cost of pile cap, plinth beam etc. as directed shall be entirely to the contractors account.
No payment for pile testing shall be made to the contractor for pile/piles which have failed in the test.

**VERTICAL AND LATERAL LOAD TEST OF PILE:**
Testing of pile will be strictly as per IS 2911 part (IV).

### 4. PARTICULAR TECHNICAL SPECIFICATION FOR ELECTRICAL WORK

#### SCOPE

This specification covers supply of materials, fabrication, and erection, testing and commissioning of Electrical Switch boards, wiring system, light fittings and other associated items required for successful completion of the work. Any equipment, device, component or work not specifically mentioned in this specification but considered essential for proper design and operation shall be included by the tenderer in his offer. Applicable provisions and conditions of contract shall govern the work under the Section.

#### GENERAL

The power supply system in the building & retail outlet stations shall be made available at 415/240 Volts, 50 Hz., A.C. 3 phase 4 wire, earthed neutral from local Electric Supply Authority.

All supply and installation work shall be carried out as per specification and in accordance with the construction drawings and shall conform to requirements called for in the Indian Electricity Rules 1956 with its latest amendment, Indian Electricity Acts and all relevant codes and practices issued by the Bureau of Indian Standard as amended up-to-date. The work shall also comply with the provisions of the general or local set of legislatures and regulations of any local or other statutory authority which may be applicable.

The Contractor for electrical work must possess valid Electrical contractor's License endorsed by the Licensing Board, Directorate of Electricity of concerned State Government for the type of work he shall execute.

The work to be provided for by the Contractor, unless otherwise specified, shall include but not limited to the following:

- **i:** Furnish all labour, supervision, services, materials, supports, scaffolds, construction equipment, tools, plants and transportation etc required for the proper execution of the job as per drawings, specification and schedule of items and get all necessary tests on materials and work conducted at their cost.

- **ii:** Not withstanding the electrical layout shown in the drawing, the contractor shall obtain further approval of the layout at site from the Engineer-in-Charge before commencement of the work.
iii: Furnish samples of materials on display board at site for approval including arranging necessary tests on samples, as directed by the Engineer-in-Charge in an approved Laboratory.

iv: To extend facilities to the Engineer-in-Charge to inspect work and assist them to obtain samples, if they so desire.

v: Furnish general arrangement drawings of the switchboard and other fabrication items, which the Engineer-in-Charge may direct for their approval.

vi: To employ a full time experienced supervisor having electrical supervisor's certificate of competency endorsed by the Licensing Board, Directorate of Electricity of concerned State to supervise the work. The Engineer-in-Charge have the right to stop the work if the contractor's supervisor is not present when the work is being carried out.

vii: To keep the appropriate Electrical Inspector & supply authority be informed from time to time as per the execution programme of the work shall be the responsibility of the contractor and he shall be responsible to ensuring that all work passes their approval.

viii: To provide all incidental items not shown or specified in particular but necessary for proper execution of works in accordance with the drawing, specification and schedule of items.

ix: To maintain the work and keep them maintained till handed over to the owner in proper working condition.

x: Co-ordinate with all agencies including those engaged by the owner for proper execution of the job.

MATERIALS

Materials shall be of the approved make & quality. A list of materials of approved brand and manufacturer is indicated in the annexure. If the list of materials mentioned above stipulates two or more or alternative brands/makes of any product, the decision as to which brand/make shall be used in the work shall be taken by the Engineer in Charge and the contractor shall provide the brand/make so selected without any extra cost.

In case, materials are required to be obtained from any manufacturer other than those listed on account of non-availability then prior approval from Engineer-in-Charge will be necessary, supported by relevant test certificates qualifying the required standard. Further tests as directed by the Consultant shall also be carried out by the contractor at their own cost, if required.

Contractor shall obtain approval from the Engineer-in-Charge of sample of all materials before placing order and the approved sample shall be carefully preserved on the display board in an appropriate manner at the site office for verification by the Engineer-in-Charge.

For standard bought out items, the sizes manufactured by the firms listed shall prevail when there is discrepancy in the sizes mentioned in the schedule without any financial adjustment.

SPECIFICATIONS

Unless specifically mentioned otherwise, all applicable codes and standards published by the Bureau of Indian Standard and all other such publication as may be published
by them after construction work starts, shall govern in respect of design, workmanship, quality and properties of material and method of testing.

SAFETY

All equipment shall be complete with approved safety devices wherever a potential hazard to personnel exists and with provision for safe access of personnel to and around equipment for operation and maintenance functions.

Special care shall be taken to ensure against entry of rats, lizards and other creeping reptiles, which may create electrical short circuit inside live equipment.

DRAWINGS

On completion of all work the contractor shall furnish three copies of Ammonia print along with the original tracing of the following "As built" drawings to the Engineer-in-Charge without any extra cost.

I: Wiring diagram for final power / lighting distribution system showing the rating/ size of switchgear, cables, conduits, lighting fixtures and all accessories for individual installation.

ii Detailed general arrangement drawings of the switchboard complete with dimension in metric units.

iii Drawings showing the route of conduits and cables with sizes, lengths, sources and destination of all cables with the circuit designation number, etc.

iv Drawings showing the balancing of phases with connected load in each circuits, etc.

TEST CERTIFICATES AND INSTRUCTIONS

Unless specifically mentioned otherwise, the contractor shall furnish, in duplicate, Manufacturer's Test Certificate with the delivery of the equipment to the Engineer-in-Charge and Instruction Manual in English for operations and maintenance of equipment wherever required.

TESTING AND COMMISSIONING

Before each field test, the contractor shall obtain the permission from the Engineer-in-Charge and all tests shall be conducted in the presence of duly authorised representative. Records of each test shall be prepared immediately after the test and this record shall be signed by contractor's representative conducting the test and the site engineer attending the test. Copies of their record in quadruplicate shall be handed over to the Engineer-in-Charge.

A certificate in quadruplicate shall be furnished by the contractor countersigned by the certified supervisor under whose direct supervision the installation was carried out and the Engineer-in-Charge. This certificate shall be in the prescribed forms in addition to the test certificate required by the Local Electric Supply Authorities.
COMPLETION OF WORK

Each item of the electrical work shall be considered as complete in all respects only after obtaining permanent service connection from local power supply authority, energising, testing and final commissioning of the complete installation as directed by the Engineer-in-Charge.

Payment on each item of electrical work shall be made as per measurement and proportionate to the quantum of work completed. In the event of any dispute with regard to the proportion of work complete, the decision of the Engineer-in-Charge shall be final and binding to the contractor.

PREAMBLE TO THE SCHEDULE OF WORK

The successful tenderer shall carefully go through the Clauses of Invitation to Tender, Specification, Schedule of Work and drawings and shall include in his rates any sum he may consider necessary to cover the fulfillment of the various clauses contained therein.

Unit prices stated in the schedule of work against the item of work shall be inclusive of all installation, accessories and consumables necessary to complete the said work within the contemplation of the contract. Beyond the unit prices no extra amount will be paid for incidental contingent work and materials.

The quantities mentioned in the schedule of work are probable quantities and it must be clearly understood that the contract is not a lump sum contract, that the probable quantities, the value of the entire tender are only indicative and Employer does not in any way assure the tenderer or guarantee that the actual quantity of work would correspond to the probable quantities in the tender.

No change in unit rate will be admissible on any variation of quantity.

PARTICULAR TECHNICAL SPECIFICATION FOR WIRING SYSTEM

SCOPE

This specification covers supply of materials, erection and commissioning of distribution wiring, connection to distribution boards, cable laying, earthing and miscellaneous items. Applicable provisions and conditions of contract shall govern the work under the section.

GENERAL

Work to be provided for by the Contractor, unless otherwise specified, shall include but not be limited to the following:

i: Furnishing of labour, materials, supports, scaffolds, transportation, etc required for the work.

ii: To provide all incidental items not shown or specified in particular but reasonably be implied or necessary for successful completion of the work in connection with the drawings, specification and schedule of items.

iii: To provide all supervision for proper execution of the work.

iv: To conduct and bear all costs in respect of any test advised.
After completion of supply and installation of wiring system and earthing, if any defect in the material or workmanship is found by the Engineer-in-Charge, the contractor shall remove the same and supply better and approved materials at his own cost.

All precaution against theft and fire shall also be taken by the contractor.

MATERIALS

All materials used in the work shall be ISI approved quality and in its absence conforming to the IS Specification.

WIRING SYSTEM

The electric load of all lights, power outlets, etc. shall be balanced across the three phases.

Generally the final loading of any sub-circuit for lights and fans shall not exceed 800 watts and shall not be connected to more than total 10 fans, lights, socket outlets, etc. Bell push if operated at low voltage shall be fed from a separate circuit of distribution board.

The 16 Amps sub-circuit for power shall be connected to a maximum one 16 Amp. socket outlet or two 6 Amp. socket outlets.

A power circuit shall always be originating from a distribution board or MCB DB and the same shall run in a separate conduit.

The point wiring shall mean wiring from one way of distribution board to point of utilisation of electricity i.e. where the load is applied and this shall include complete wiring from distribution board, supply and fixing of switch board, controlling switches, ceiling rose, batten holder and socket outlet, etc.

Insulated or covered earthing conductors where used, shall have green insulation braiding or covering as appropriate. Under no circumstances shall the colour green be used for other than earthing conductor. In addition where it is required, cables of different colours be used. For identification purposes the following system shall be employed:

| Red or any colour (other than black or green) | For phase or switch wire |
| Black | For Neutral |
| Green | For earth |

Unless otherwise mentioned in the schedule of quantities, single way porcelain/ bakelite terminal connectors with nickel plated brass inserts and screws to suit the conductor size shall be used for intermediate wiring/ joints in junction boxes and in switch boards or by any other method approved by the Consultant/ Engineer-in-Charge.

Distribution wiring in conduit to light, fan, plug points etc. shall be done in looping in system. In this system, no joints or connections shall be made anywhere of the system except at terminating points such as, at terminals of switches, ceiling roses, etc. and in case of socket outlets, at the socket terminals. Intermediate wiring joints of neutral wire in junction boxes will not be permitted.
In the looping back system of wiring on hard wood batten, the wiring shall be done without any junction or connector boxes on the line. All intermediate joints or connections shall be made in the switch board only. Intermediate wiring joints of neutral wire in the junction box will not be permitted.

**CONDUIT WIRING**

All conduit shall be ISI marked and finished with galvanised or stove enamelled surface. All conduit accessories shall be conforming to IS:2667-1988 and be threaded type. Conduit less than 20mm in diameter shall not be used. All conduits shall be 1.4 to 1.8 mm thickness below 32 mm dia. and 1.6 to 2.2 mm thickness for 32 mm dia. and above. The conduit for each circuit shall be erected complete with necessary bushes before drawing in of any wire. Galvanised M.S. Spacer of 3 mm thick minimum shall be used between the conduit saddle and fixing surface. The saddle shall be fixed at an interval of not more than 750 mm apart for vertical run and 600 mm apart for horizontal run.

The joint in conduits shall be made by means of threaded couplers and threaded accessories only to ensure electrical continuity throughout. All pipes after cutting, the threading shall be carefully reamed out with special reamer to remove any burr and then painted immediately with an anti-corrosive preservative after removing all traces of oil or grease. Junction boxes shall be provided with gasketed covers to render them dust and damp proof. The conduit accessories having pull outlet for conductors shall only be used in all conduit installation.

Where specified, P.V.C. conduit conforming to IS: 7537 (Part-III) shall be used. The thickness of P.V.C.conduit shall be adequate to withstand mechanical injuries. PVC conduit accessories conforming to IS: 3419-1976 shall be used along with PVC conduit.

The entire conduit system shall be effectively earthed by means of suitable earthing conductors and the resistance from any point to earth shall not be more than one OHM.

After installation of conduit pipes and fittings are completed in all respects, the exposed outer surfaces of the conduit and accessories shall be painted with two coats of approved enamel paints or aluminium paint over a coat of red oxide primer as required to match the surrounding wall finishing. To protect against rust the bare thread portion shall be painted with anti-corrosive preservative.

**CONCEALED WIRING**

**Making of chase :** The chase in the wall shall be filled up neatly made and be of ample dimensions to permit the conduit to be fixed in the manner desired. In case of buildings under construction, chases shall be provided in the wall, ceiling etc. at the time of their construction and shall be filled up neatly after erection of conduit and brought to the original finish of the wall. Specially for ceiling, conduit shall be laid before casting.

**Fixing of conduit in chase :** The conduit in chase in the wall shall be fixed by means of staples or by means of saddles not more than 60 cm apart. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a long radius which will permit easy drawing of PVC insulated wires. All threaded joints of conduits shall be treated with some approved preservative compound to secure protection against rust.
Inspection boxes: Suitable inspection boxes shall be provided to permit periodical inspection and to facilitate removal of wires, if necessary. These shall be provided with inspection box covers.

Types of accessories to be used: All outlets, such as switches, wall sockets, etc. may be either flush mounting type or of surface mounting type.

The outlet box shall be mounted flush with the wall. The metal box shall be effectively earthed with conduit by an approved means of earth attachment.

Fish wire: 1 x 18 SWG G.I. wire inside the conduit and accessories to be provided with an extension of 250 mm at both the conduit ends.

Conduit laying in floor/ roof slabs before casting: M.S./ G.I./ rigid PVC/ polythene conduit shall be laid straight as far as practicable and properly placed including binding with the steel reinforcement rods with 22 SWG G.I. binding wire so that proper positions of conduits are maintained.

While laying the conduits for concealed wiring in the ceiling / beams / columns / walls before casting, the contractor shall ensure that both ends of the conduit are plugged by means of dead-end sockets or otherwise to prevent the entry of any foreign material against conduit choking.

All precaution must be taken while laying the conduits in the slabs, R.C. walls, columns, etc. and the contractor shall rectify at his own cost, if any defects are found during process of drawing cables through the concealed prelaid conduits.

Each M.S. / G.I. conduit shall be provided with protruding length of 150 mm on free end of the conduits with sockets under the bottom level of slab/ beam.

Each rigid PVC/ polythene conduit shall be provided with protruding length of 150 mm on free end of the conduits under the bottom level of slab/ beam.

There shall be no intermediate joints in one straight run of conduit.

All ceiling outlets shall be terminated in a round M.S./ G.I. circular box (80 mm depth minimum)/ deep box to suit standard size ceiling rose or/ and rectangular M.S. junction box or Fan Hook Box as the case may be.

It will be mandatory for the contractor to get the layouts approved by the Engineer-in-charge/Consultant, measurements are checked when the conduits are laid and bound to steel reinforcement rods, before he can release the work for casting of slabs/ floor/ beams etc.

Connector Boxes, Draw-in-Box, Junction Boxes:

These shall be constructed from 16 SWG M.S. sheet and have M.S. cover. Minimum size for connector box is 150mm x 100mm and for Draw-in-Box is 100mm x 100mm with required depth upto 80mm.

Fan Hook Box: These shall be 100mm dia x 80mm depth, constructed from 14 SWG M.S. sheet and provided with one 12 mm dia. M.S. rod of 300mm long having 'U' bend inside the box.
**Painting** : Both inside & outside wall of switch board, connection box, draw-in-box and other M.S. accessories shall be painted with two coats of anti-corrosive paint in addition to other painting instructions given elsewhere.

**WIRES**

Unless otherwise mentioned in the schedule of quantities, only single core PVC insulated / PVC insulated & sheathed cable consisting of multistrand / flexible copper conductor and of approved manufacturers conforming to relevant I.S. shall be used for wiring in conduit system.

The maximum number of wires drawn in one conduit shall not be greater than the recommended number given in the Table – 1 given in this section.

**P V C INSULATED WIRING LAID ON HARD WOOD BATTEN**

Unless otherwise mentioned in the schedule of quantities only single core PVC insulated wire of 1100 volts grade consisting of multistrand copper conductor conforming to I S :694 shall be used for exposed batten wiring.

All P V C wires shall run on well seasoned perfectly straight hard wood batten varnished on four sides but not less than 10mm finished thick and the width of which is such as to suit total width of cables laid on batten. Prior to the erection, these shall be painted with one coat of varnish. The battens shall be screwed to the walls and ceiling by flat head wood screws to wood plugs or other approved plugs at an interval not exceeding 750mm. The flat head wood screws shall be counter sunk within wood batten and smoothened down with a file.

Link clips shall be conforming to IS:2412-1975 and these shall be so arranged that one single clip shall not hold more than four single core P V C insulated wire upto 2.5 sq. mm, above which a single clip shall hold two single core wire. The clips shall be fixed on varnished wood batten with brass pins spaced at intervals of 100mm in the case of horizontal runs and 150 mm in the case of vertical runs. The link clips shall be made of heavy tinned brass sheet or Aluminium sheet, the thickness being not less than 27 gauge.

Where wires pass through walls/floors these shall be protected from mechanical injury by means of rigid steel conduit. The end of the conduit shall be neatly bushed with bakelite. The conduit shall extent 1.5 mm above the floor and flush with the ceilings or walls.

After erection, the P. V. C. wiring along the batten shall be painted with one coat of synthetic enamel paint of an approved colour.

**INSTALLATION AND WIRING OF DISTRIBUTION BOARD/ MCB DISTRIBUTION BOARD.**

Where fixing of distribution board/ MCB DB on double teak wood board is specified only hinged type wooden board with brass hinge shall be provided and the size of the board shall be such as to match the size of the Distribution board/ MCB DB. A minimum margin of 25 mm shall be provided on all sides of the distribution board/ MCB DB. The outgoing circuit shall be taken out through a horizontal slot at the rear side of the distribution board/ MCB DB enclosure.
Where fixing of Distribution board/ MCB DB on M.S. frame is specified, the frame shall have sufficient mechanical strength to carry the weight of the DB./ MCB DB.

Where fixing of Distribution board/ MCB DB will be of concealed type, the chase in the wall shall be neatly made and be of ample dimensions to permit the DB to be recessed in wall and flushed with finished wall surface.

The cable / wires shall be connected to the terminal only by soldered or crimped lugs, unless the terminal is of such a form that it is possible to securely clamp them without cutting away of cable strands.

All bare conductors shall be rigidly fixed in such a manner that a clearance of at least 25 mm is maintained between conductors and material other than insulating material.

CABLES

TYPE AND QUALITY OF CABLES

Unless otherwise specified in the Schedule of Quantities all wiring cables shall be P V C insulated and P V C sheathed conforming to relevant IS Standard. The conductor of cable shall be of stranded wires of aluminium or copper as specified. All power cables shall be 1100 volts grade, PVC insulated, PVC sheathed and armoured with stranded aluminium conductor. Materials should be obtained from the approved list of manufacturers/ brands as indicated in the document.

HANDLING OF CABLES

It shall be ensured that both ends of the cables are properly sealed to prevent ingress / absorption of moisture by the insulation.

When the cable drums have to be moved over short distances, they should be rolled in the direction of the arrow marked on the drum. While removing cables, the drum shall be properly mounted on jacks or on a cable wheel or any other suitable device, making sure that the spindle, jack, etc. are strong enough to take the weight of the drum.

DEFECTIVE CABLES

Cables with kinks and straightened kinks or with similar apparent defects like defective armouring, etc. shall not be installed.

BENDING RADIUS

Cable runs shall be uniformly spaced, properly supported and protected in an approved manner. All bends in runs shall be well defined and made with due consideration to avoid sharp bending and kinking of the cable. The minimum safe bending radius for all types of P V C cables shall be taken as 12 times the overall diameter of the cable. Wherever practicable, larger radius shall be adopted.

LENGTH OF CABLES

All cables shall be laid in one length. No joint shall normally be made at any intermediate point in through runs of cables, unless the length of the run is more than the length of the standard drum supplied by the cable manufacturer. In such cases where jointing is unavoidable, the same shall be made by means of standard cable joint
boxes/ kits. Before cutting the cables, the requisite length between terminals (including extra length required at loops) shall be carefully measured.

**STRIPPING OF OUTER COVERING**

While cutting and stripping the outer covering (i.e. sheathing of the cable, care shall be taken that the sharp edge of the cutting instrument does not cut or damage the inner insulation of the conductor. The protective outer covering of the cable shall be stripped off near the connecting terminal, the protective covering being maintained upto a point as close a possible to the connecting terminal.

**CABLE LAID IN TRENCHES**

Cables shall be laid generally in accordance with Indian Standard Code of Practice IS: 1255.

**SIZE OF TRENCH**

Unless otherwise mentioned in the Schedule of Quantities, the minimum width and average depth of trench for laying a single cable in ground shall be 460mm and 760mm for L.T. and 1000 mm for H.T. cable respectively. For laying of multiple 11 KV and 6.6 KV grade power cables, horizontal axial spacing shall be 250mm. For 1100 volt grade power cables, the horizontal axial spacing shall be 150mm. However, communication cable shall not be taken in a common trench. Where more than one cable are to be laid in the same trench in horizontal formation, the width of trench shall be increased according to the above stated inter-axial spacing between the cable, (except where otherwise specified). There shall be a clearance of at least 150 mm between the trench edge and axis of the end cable.

**EXCAVATION OF TRENCH AND PREPARATION OF BED**

The trench shall be excavated in reasonably straight line. Where there is a change in direction, suitable curvature shall be provided. Where gradients and changes in depth are unavoidable, these shall be gradual.

Adequate precautions shall be taken during excavation not to damage any existing cables, pipes or similar installations in the proposed route. Where bricks, tiles or protective covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer-in-Charge.

The bottom of the trench shall be level across the width and free from stone, brick bats, etc. The trench shall be then provided with a cushion of fine sand, the thickness of the cushion being not less than 75mm.

**LAYING OF CABLES**

All cables shall be tested for proper insulation prior to laying. The cable drums shall be transported on wheels to the place of work. The cables shall be laid out in proper direction as indicated on the drum using cable drum lifting jacks. In case of higher size cables, the laid out cables shall run over rollers placed at close intervals and finally transferred carefully on to the trenches and racks, care shall be taken so that kinks
and twists or any mechanical damage does not occur in cables. Only approved cable pulling grips or other devices shall be used. The entire length of cable shall, as far as possible, be paid in one operation. However, if this is not possible, the remainder of the cable may be shifted from position by ‘flaking’ i.e. by making one long loop in the reverse direction. For crossing water, gas or sewerage pipes, etc, cables shall be taken above the pipes where minimum 500 mm clearance is not available. The cable shall cross these pipes through RC/ GI pipes at a minimum depth of 750 mm from finished ground level keeping the distance between the utility pipes and pipe carrying cables 300 mm minimum.

While laying cables parallel to building, railway track, utility pipe lines, drainage, sewerage, etc. the minimum clearance shall not be less than 1000mm.

Adequate length of cables shall be pulled inside the switch boards, control panel terminal boxes, feeder pillar etc. so as to permit neat termination of each core.

**SURPLUS CABLE**

At the time of original inspection, approximately 1 meter of surplus cable (in the form of a loop or otherwise) shall be left at each entry or exit of the cable at a pole or at the pillar box, or near any terminal as may be directed by the Consultant / Engineer-in-Charge.

**PROTECTIVE COVER FOR CABLES DIRECTLY BURIED IN GROUND**

Except where otherwise directed by the Consultant/Engineer-in-Charge, the cable (for the entire length in trench) shall be protected by a layer of bricks laid flat on top and shall be provided at least by 75 mm sand cushioning both at top and bottom. This brick protection shall cover all the cables in the trench (single cable or multiple cables, in horizontal formation). In case of a single cable, the brick protection shall consist of one brick flat (with the length along the width of the trench) and supported on two lines of brick-on-edge, one on each side of the cable (with the length of the bricks along the length of the trench).

For multiple cables in horizontal formation, in addition to the two outer lines of brick-on-edge, there shall be additional lines in between adjacent cables. The top cover of brick flat shall extend to cover all the cables, each brick being supported on the lines of brick-on-edge.

**BACK FILLING OF TRENCH**

After laying of cables the remaining portion of the trench shall be back filled with good excavated soil and well rammed in successive layers not exceeding 300 mm depth each and duly compacted to the satisfaction of the Consultant/Engineer-in-Charge. Surplus soils of excavation shall be removed or disposed of as per direction of the Engineer-in-Charge.

All material like sand, brick and clamp, etc. shall be supplied by the contractor. The cable laying rate shall be inclusive of all these items.

**CABLES LAID THROUGH PIPE SLEEVES**

Entry of cable from underground trenches to the building or tunnel shall be through pipe sleeves. Necessary precaution shall be taken to make entry point fully water
tight by properly sealing the pipe sleeves in a manner approved by the Engineer-in-Charge.

Where cables are required to cross roads, railway tracks and surface drains, they shall be taken through pipe sleeves at a minimum depth of 1000 mm.

**LAYING OF CABLES ON RACK/ TRAY/ BRACKET/ HOOKS/ MASONRY TRENCH**

Where cables are required to be laid directly along structure walkway, walls, ceiling, they shall generally be taken exposed on brackets, cable racks, trays, hooks laid along building structure. Spacing of saddles/hooks shall be such that the cables are straight and shall not exceed 750 mm.

The cable rack/trays shall be ladder type / pre-fabricated perforated type and bends / curvature shall be smooth and suitable for bending the largest cable running in the rack/tray. The cable rack/trays shall be suitably installed on the building structure with proper support at regular intervals.

Cable rack/trays shall be so arranged that they do not obstruct or impair clearance of passage way.

Where there is possibility of mechanical damage cable racks/trays shall be adequately protected by sheet steel cover.

Unless otherwise specified in the schedule of quantities the rack/trays shall be painted with corrosion resistant paint and finished with enamel paint of shade battleship grey or any other colour shade acceptable to Consultant/Engineer-in-Charge.

**CABLE ROUTE MARKER**

Cable route markers shall be provided at each joint, entry to buildings, each turn, either side of the road crossings and at 30 meter intervals for straight cable runs and at location directed by the Engineer-in-Charge.

The cable marker shall be of cement concrete slab of R.C.C.type (1:2:4) and of size 600mm x 300mm at the bottom and 500 mm x 200 mm at the top with a thickness of 100 mm with marking 'CABLE' and shall be laid flat at finished ground level centered over the cables for easy identification.

Unless otherwise specified in the schedule of quantities, galvanised Iron type cable route marker of size 100mm dia 50 mm thick G.I. Plate with marking 'CABLE' thereon welded to 35 mm x 35mm x 6mm angle iron 600mm long fixed in a rigid manner may also be used as approved by the Engineer-in-Charge.

All materials like cable route marker, sand and cement, etc. for fixing the same to be supplied by the contractor. The cable laying rate shall be inclusive of all these items.

**CABLES TERMINATION**

Power cable termination shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamp near the terminals. All power cables shall be terminated to the circuit breaker, switch fuse units, busbars, etc. by means of suitable sizes crimping type or soldering type cable socket / lugs / ferrules and empire tape upto palm of the cable lug. PVC tape shall not be used directly, because of its poor thermal stability. It may however, be used over the empire tape. Control cables shall be terminated by crimping or directly clamped in the terminal blocks by screws.
When pinching the smaller size conductor directly in the terminal bore of the switches, the individual strands shall be fanned out and cleaned by wire wool or emery paper and the cleaned surface shall be coated with a thin layer of oxide inhibiting grease. The conductor shall be tightened fully to the terminal bore but over tightening shall be avoided.

For connection to busbars and other terminals, brass or cadmium plated nuts/ bolts and washers shall be used. Copper cables shall never be terminated directly on aluminium busbar. Suitable measure shall be taken to avoid heating due to bimetallic contacts.

A selection chart of crimping type cable lugs for various combination of cables/ busbar/ fuse switch terminals is shown below:

<table>
<thead>
<tr>
<th>Material of busbar/ switch terminals</th>
<th>Material of Cables</th>
<th>Material of crimping lug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium</td>
<td>Aluminium</td>
<td>Aluminium over tin plated copper</td>
</tr>
<tr>
<td>Copper</td>
<td>Aluminium</td>
<td>Aluminium lug with copper plated palm</td>
</tr>
<tr>
<td>Silver/tin plated copper</td>
<td>Aluminium</td>
<td>Aluminium or tin plated copper</td>
</tr>
<tr>
<td>Aluminium</td>
<td>Copper</td>
<td>Tin plated copper</td>
</tr>
<tr>
<td>Copper</td>
<td>Copper</td>
<td>Copper or tin plated copper</td>
</tr>
</tbody>
</table>

**EARTHING**

All non current carrying metallic part of various electrical equipments as well as cable armouring, metallic conduit, cable racks/ trays, brackets, supporting structures, etc. shall be effectively earthed by not less than two separate and distinct earth connection in accordance with Indian Electricity Rules, and the relevant Indian Code of Practice for earthing 3043-1987.

**EARTH ELECTRODE**

**PIPE ELECTRODE**

The earth electrode for earthing station shall comprise G.I. pipe 'B' Class of 50mm internal diameter and 3 Mtr long in one single piece with holes 12mm dia on all sides at 150 mm centre, upto a minimum height of 2.5 metre from bottom. Removable caps / wire mesh funnel shall be provided at the top of pipe to facilitate pouring of water. Suitable clamps made of 40mm x 6mm galvanised M.S. flats complete with bolt and nut shall be provided with the electrodes at 100 mm from the top end for connecting earth conductor. No joints will be allowed in the earth electrode. The electrode shall be driven at least 2 metre clear from masonry structure and the distance between two electrode shall be not less than 2 metre when installed in parallel and preferably placed twice the length of the electrode i.e. 6 metre. A masonry inspection pit of inside dimension 300mm x 300mm x 300mm deep (unless otherwise stated) shall be built with 125 mm thick cement mortar (6:1) brick work both inside and outside plastered with 20mm thick and neatly cemented 1.5 mm thick, inside top and outside around the top of the earth pit, so that the top of the G.I. pipe is 250 m below the...
finished ground level and the opening on top shall be provided with C.I. manhole ring having lockable C.I. cover fixed & flush with the outside finished ground level.

**PLATE ELECTRODE**

Where plate electrode for earthing is to be employed, the size of the plate shall not be less than 600 mm x 600 mm x 6.3 mm for G.I. plate in thickness and 600 mm x 600 mm x 3.15 mm thickness in case of copper plate.

The plate shall have a drilled hole 14 mm dia. at the centre. The G.I. flat of not less than 40 mm x 6 mm (1 no. 25 mm x 6 mm G.I. flat for lightning conductor installation) should be connected to the plate by means of a 65 mm long 12 mm dia galvanised bolt, double nuts using double galvanised washers. In case of copper plate, copper flat of not less than 25 mm x 6.0 mm shall be used as the earth lead. The flat shall first be fastened on one side of the plate, leaving adequate length of flat, which shall be taken over to the other side i.e. to the earth busbar, switchboard, pole, continuous earth wire for O.H. line, service bracket, lightning arrester or the object to be earthed and be fastened as per the details of IS:3043-1987. No joint on the earth lead conductor is permitted. Every care shall be taken to ensure that the ends of the wire/ flats have been securely clamped by the bolt on cleaned surface of the plate and establish a good electrical contact.

The plate shall be buried vertically at a minimum of 3.6 M below the ground level for sandy soil and 2.0 m below the ground level for normal soil. In order to place the same at the prescribed depth, the dimension of pit to be excavated shall be 900 mm x 900 mm x 4 m deep. The G.I. plate shall be placed in position by the contractor only after the inspection of excavated pit and approval is obtained from the Consultant/ Employer.

After placing the plate the earth lead conductor shall be protected by means of a continuous length of G.I. pipe (Class B) having 50 mm dia (minimum) bore or route depending upon the size of the lead, right from the plate upto a height of 600 mm metre (2 ft.) above ground level. The whole length of pipe shall be filled with bituminous compound of approved make and brand. The molten compound shall be poured from the top end of the pipe and topped upto overflowing.

A masonry inspection pit for the earth station of inside dimension approximately 300 mm x 300 mm x 300 mm depth (unless otherwise stated) shall be built with 125 mm thick cement mortar (6:1) brick work with 1st class bricks, both inside and outside plastered with 20 mm thick and neatly cemented 1.5 mm thick, inside, top and outside around the top of the earth pit. The opening on top shall be provided with C.I. manhole ring having lockable C.I. cover fixed and flush with the outside finished ground level.

Electrodes shall be buried at least 2 meter away from masonry structure/ building/ pole or object to be earthed. However, earthing electrodes for L.C. installations should be as close to the down conductors as possible. Electrodes when installed in parallel, shall not be placed less than 2 meter apart and preferably placed at distance greater than 6 meters.

All the excavations shall be duly back filled, dressed and rammed.

**EARTH BUSBAR**

**GALVANISED M.S. FLAT**

Unless otherwise specified in the schedule of quantities, the earth bus bars shall be of heavily galvanised M.S. Flat of cross section 50mm x 6mm having adequate number of
drilled holes with 10mm galvanised steel bolts, nuts, plain and spring washers for securely connected the earth leads and the continuity of conductor. The bulbar shall be fixed on wall, having clearance of 6mm from wall with spacing insulators with 13mm dia G.I. rag bolts, spaced about 50mm apart.

COPPER FLAT

To be used, as specified in the schedule of items, where earthing requirements are more stringent, with use of brass bolts, nuts, washers for connections.

EARTH LEAD CONDUCTOR

The earth lead for each electrode shall be 7/10 S.W.G stranded G.I. wire connected securely to the earth electrode and earth bulbar. The earth lead shall be mechanically protected with a continuous length of 25mm dia G.I. Pipe (Class 'B') right from the electrode to the earth bulbar and the pipe shall be filled with bituminous compound.

Galvanised M.S. Flat earth conductor directly buried in ground shall generally be taken at a depth of 600 mm and shall be provided with one coat of bituminized paint, one layer of half lapped bituminized tape and a final coat of bituminized paint to prevent corrosion.

The earth conductor when laid inside building/ sub-station shall be taken either exposed on cable racks/ trays, walls, ceiling, etc. or embedded in concrete depending on installation. Galvanised M.S. saddles clamped to M.S. flat spacers with tapped holes shall be used for clamping earth conductor. Flats shall be supported at intervals not exceeding 500 mm and stranded wires at intervals of 300mm.

Connection of earthing leads to earth electrodes and termination of flat earth continuity conductor to equipment shall be made by means of bolting. Connection of stranded earth wire to earth bus as well as to equipment shall be made through crimping type lugs and bolting. Jointing and tapping of flat earth conductor shall be done by means of welding.

The earth resistance from any point of the earthing system shall not be more than one ohm.

WORKMANSHIP AND INSTALLATION WORK

The workmanship shall be of good commercial quality and all supply material and installation work shall be completed to the full satisfaction of the Engineer-in-Charge.

PARTICULAR TECHNICAL SPECIFICATIONS FOR LIGHTNING PROTECTION SYSTEM

SCOPE

This specification covers supply of materials, fabrication and erection of Lightning protection system comprising air terminations, horizontal conductors, down conductors and earth electrodes. Applicable provisions and conditions of contract shall govern the work under the section.
GENERAL

Work to be provided for by the Contractor, unless otherwise specified, shall include but not be limited to the following:

i: Furnishing of labour, materials, supports, scaffolds transportation, etc required for the work.

ii: To provide all incidental items not shown or specified in particular but reasonably be implied or necessary for successful completion of the work in connection with drawings, specifications and schedule of items.

iii: To provide all supervision for proper execution of the work.

After completion of supplying and installation of lightning protection system, if any defect in the material or workmanship is found by the Engineer-in-Charge the contractor shall remove the same and supply better and approved materials at his own cost to the satisfaction of the Engineer-in-Charge.

All precaution against theft and fire shall also be taken by the contractor.

MATERIAL

All material used for lightning conductors, down conductors, earth termination network, etc. of the protection system shall be reliably resistant to corrosion or be adequately protected against corrosion and generally conforming to IS:2309.

The entire lightning protection system shall be mechanically strong to withstand the mechanical forces produced in case of a lightning stroke.

HORIZONTAL AIR TERMINATION CONDUCTOR

Unless otherwise specified air termination shall be horizontal conductor. The horizontal air termination shall be so inter-connected that no part of the roof is more than 9 meters away from the nearest horizontal conductor. For flat roof horizontal conductor shall generally be provided along the outer periphery of the roof. The conductor shall be exposed to atmosphere.

All metallic protections, vent pipes, railways etc. on or above the main surface of the roof shall be properly bonded to the air termination network.

DOWN CONDUCTOR

Down conductors shall follow the most direct path possible connecting the horizontal air termination conductor and the earth termination i.e. the ground electrode avoiding sharp bends, up-turns and kinks. Joints shall as far as possible be avoided in down conductors.

JOINTS

The joints in the lightning protection system shall be avoided as far as possible. There shall be no joints in the down conductor below ground level. Where joints are necessary they shall be mechanically and electrically effective and shall be so made as to exclude moisture completely.

The joints may be soldered, riveted or bolted and mentioned in the schedule of work. With over-lapping joints the length of the overlap shall not be less than 50 mm for all types of conductor. Contact surface shall first be cleaned and then inhibited from
oxidation with a suitable non-corrosive compound. Strips shall be tinned, soldered, welded or brazed and at least double riveted. Bolted joints shall not be used on test points or on bonds to existing metal. For rust protection the welded joints shall be treated with barium chromate. Welded surface shall then be painted with red lead and aluminium paint.

**TESTING POINTS**

Each down conductor shall be provided with a testing point in a position convenient for testing but inaccessible for interference. No connection, other than one direct to an earth electrode shall be made below a testing point.

**EARTH TERMINATIONS**

Each down conductor shall have an independent earth termination and arrangement of isolation for testing purposes. The earth termination shall be located as close as practicable to the down conductor. Inter connections with other termination of the conductor system and with other buried metal services and earth terminations shall be made with G.I. tape laid directly at an average depth of 700 mm below finished ground level for the purpose of equalising the potential distribution in the ground.

**EARTH ELECTRODE**

Earth electrode shall be constructed and installed as specified in Part-B. The pipe/plate electrode shall be driven into the ground as close as practicable but outside the circumference of the structure.

**FIXING OF CONDUCTOR**

Unless otherwise mentioned in the Schedule of Quantities the wall shall be drilled and plugged with teak wood pins of not less than 50mm long by 25mm square inner and 19 mm square outer surface. The void shall be finished according to the nature of wall surface with cement plaster.

Conductors shall then be securely attached to the building to be protected by galvanised steel fasteners of 2mm thick which shall be substantial in construction and wood screws and approved by the Engineer-in-Charge.

**EARTH RESISTANCE**

Properly made earth connections are essential for effective functioning of a lightning protection system and every effort shall be made to provide ample contact with the earth so that the earth resistance can be kept as low as possible.

The whole of the lightning protection system shall have a combined resistance to earth not exceeding 1 ohm.

**WORKMANSHIP AND INSTALLATION WORK**

12.1 The workmanship shall be first class and all supply material and installation work shall be completed to the full satisfaction of the Engineer-in-Charge.
CONTRACTORS RATE TO INCLUDE

Apart from other factors mentioned elsewhere in this contract, the rates for the above shall include for the following:

i: All labour, materials, tools and construction equipment required for proper execution of job

ii: Scaffolding including erection and removal

iii: Making good of all damaged civil work, if any

PARTICULAR TECHNICAL SPECIFICATION FOR ELECTRICAL EQUIPMENT

SCOPE

This specification covers supply of materials, fabrication, erection, testing and commissioning of switch boards, Distribution boards, Meter board, Lighting equipment, Switches, socket outlets and miscellaneous items. Applicable provisions and conditions of contract shall govern the work under the section.

GENERAL

The contractor shall have to submit manufacturer's Test Certificate for switchboards, switch fuse units, meters, fuse fittings, circuit breaker, isolating switches and other items as directed by the Engineer-in-Charge.

After completion of such supply and installation work of the electrical equipment, if any defect in the material or workmanship is found by the Engineer-in-Charge, the contractor shall remove the same and supply better and approved materials at his own cost.

All precaution against theft and fire shall also be taken by the contractor.

The contractor shall provide complete supervisions for proper execution of the work.

MATERIALS

All materials used in the work shall be of ISI marked wherever available, and of approved make and quality and in its absence conforming to the I.S. Specification.

For fabricated equipment, special care shall be taken to make the enclosed equipment proof against entry of creeping reptile, which may create electrical short circuits inside the live equipment.

L.T. MAIN DISTRIBUTION SWITCH BOARD /DIST. SWITCH BOARD

The 415 Volt main distribution switch board shall have incoming unit fed from L.V. side of transformer/main distribution board.

STANDARDS

The equipment shall be designed to confirm to the requirements of I.S: 4237, I.S: 2147 and I.S: 375.
CONSTRUCTION

The main L.T. P.C.C board shall be of totally enclosed, topicalised, vermin proof, free standing, cubical type dead front minimum 2.0 mm thick sheet steel construction with angle iron frame work housing incoming ACB/ MCCB/ SDFU, requisite number of outgoing ACB, MCCB, fuse switch or switch fuse units, busbars, Switch board shall be readily extensible on both sides. The L.T. terminal of the transformer shall be connected to the incoming terminal of the MCCB/Air Circuit Breaker through adequate number and size of aluminium conductor 1.1 KV grade PVCA cable.

The incoming and outgoing functional units shall be arranged in multi-tier formation, to provide a compact switch board having a pleasant appearance. Each unit shall be accommodated in a separate compartment having gasketed hinged door which shall be interlocked with the operating mechanism so as to prevent opening of the door when the switch is in the 'ON' position and also to prevent closing of the switch with the door not properly secured.

The 'ON' and 'OFF' positions of the switch handle shall be distinctly indicated by proper marking. Modular construction shall be adopted to cater for different units with each cubicle having a busbar chamber and cable compartment. The maximum height of the devices on the panel shall not exceed 2000 mm.

Suitably engraved identification levels shall be provided on each unit.

When switch board of floor or wall mounting type is specified instead of cubicle type with incoming and outgoing Fuse switch units or switch fuse units, the board shall comprise a suitable length of Busbar chamber. The board shall have provision for future extension. The floor stands or wall bracket shall have sufficient mechanical strength to carry the weight of the entire switch board.

The height shall be such that maximum operating height of the top unit shall not exceed 1800 mm.

BUSBAR

The main horizontal busbar shall be air insulated and made of high conductivity, high strength aluminium alloy or electrolyte copper complying with the requirements of grade E 91 E of IS 5082. The current density in each busbar shall not exceed 160 Amp. per sq. cm. for copper of 125 amp. per sq. cm. for aluminium.

The main phase busbar shall have continuous current rating throughout the length of power control centre and the neutral busbar shall have a continuous rating of at least 50% of the phase busbar.

Large clearance and creepage distance shall be provided on the busbar system to minimise the possibility of a fault.

The busbar and vertical risers horizontal connectors shall be fully insulated with PVC sleeve or tape to prevent accidental touch.

The busbar including neutral and earth bar shall be short circuit tested for fault withstand of 60 KA RMS for one second as per IS:8623 for factory Built Assemblies.

In no case, the rating of busbars shall be less than the Incoming Circuit Breaker or switch.
Busbar should be supplied with insulating material such as Permali, Hylam, and support shall be sufficient close and robust and support should permit - sufficient movement for compensation of comparative stress in the event of short circuit.

**AIR CIRCUIT BREAKER**

The circuit breaker would be constructed in modular construction or would be enclosed in cassettes, designed for easy Switch Board Construction. The formed and welded steel construction should be given corrosive resistance treatment following fabrication work.

The breaker would have three distinct position, service/ test/ isolated within the cubicle, achieved by a racking cam and slide rails, simplifying inspection and from this position breaker should be able to withdrawn from housing. With door closed, the breaker should be withdrawn to test and isolated position.

The contact system should be designed to ruggedly and to effectively utilize the magnetic force generating in the current path ensuing high short time withstand current and interrupting capacity and reducing the let through energy. The ACB should be provided with separate set of arcing contacts and main contacts ensuring high mechanical and electrical life. Arc chutes on arcing contacts with de-ionisation plate should be provided. The contact tips should be made of Silver Nickel Alloy and arcing contact tips are of Silver Tungsten Alloy.

ACB should be suitable for manual or Motor wound stored charge spring closing mechanism. ACB should be provided with static trip release, inherent safety interlocks, such as safety shutters and door interlock, "OFF" & "ON" indicator auxiliary switches and contacts. ACB should be complete with overload protection, short circuit protection, under voltage trip, auxiliary contacts and instruments as specified in the schedule.

The ACB should comply with Indian Standard Specification I.S. 2516-1977 and IEC 157 and should be certified by CPRI.

**MOULDED CASE CIRCUIT BREAKER**

The MCCB should comprise of a switching mechanism, contact system, arc extinguishing device and the tripping unit, contained in a compact moulded case and cover.

The insulating case and cover shall be made of high strength, heat resistant, flame retardant thermo setting material, providing interphase insulation of a very high dielectric strength and an insulated enclosure with high withstand capability against thermal and mechanical stresses with protection against any fire hazards.

The trip free toggle mechanism should ensure that the trip command overrides all other commands.

MCCB should employ a maintenance free contact system designed to minimize the let through energies while handling abnormal currents. The special sintered contact tip should provide a wiping action, high resistance to erosion during interruption and a stable contact for normal service current.

A series of grid plates should be mounted in parallel between supports of insulating material. The profile of the de-ion steel plates extends directly over the contacts and draws the arc from the moving contact up into the divider chamber, thus confining, dividing and extinguishing the Arc.
The handle position should give positive indication of whether the MCCB is ‘ON’ (top), ‘OFF’ (bottom) or ‘TRIPPED’ (midway).

The tripping element provided on each pole of the MCCB should operate on a common trip bar because of which it does not create single phasing in the event of a fault on any of the phases.

The base design ambient temperature of the MCCB should be 40 degree C.

When specified the MCCB should be fitted with under voltage protection, earth fault protection, alarm & auxiliary switch etc.

**FUSE SWITCH UNIT**

The fuse switch units shall be of double break type suitable for load break duty, with quick make and break mechanism and front drive mechanism, generally conforming to IS:4064 -1978 having fully shrouded contacts. All switch contacts shall be self aligning, spring loaded, silver plated. The isolators shall be connected on the busbar side or incoming side and fuses on the load side. However, fully withdraw able carriage to facilitate quick fuse link replacement is preferred.

The individual fuse switch units shall be either triple pole and neutral or single pole and neutral as specified with a front operating handle. The fuse links shall be non-deteriorating HRC type complying with IS:2208-1962 and having rupturing capacity of 80 KA at 415 Volts.

The units which are to be installed separately should be totally enclosed fully shrouded sheet steel clad/cast steel casing.

**INSTRUMENTS**

The measuring instruments shall comply with IS:1248 in all respects.

Moving iron, square, flush mounting type instruments shall be used for measuring A.C. Voltage and currents.

The instruments shall normally be mounted on the hinged door of an all welded fabricated sheet steel housing of rigid construction to allow easy access to small wirings. Circuits shall be protected by H R C type fuse links complying with IS: 9224 (Part-II) -1979. The fuses shall be mounted near the tap-off point from the main connections so that a fault in the instrument wiring does not affect the main supply. Small wiring shall be of 660 Volt grade single core flame retardant low smoke PVC insulated cable with copper conductor having minimum size 2.5 sq. mm. These shall be coloured coded for identification of circuits. The instruments shall be of approved make & acceptable to the Consultant/ Engineer-in-Charge.

**CABLE TERMINATIONS**

Separate cable compartment with doors having bolted cover plates shall be provided to facilitate cable termination to individual units. The design shall ensure generous availability of space for easy installation and maintenance of cabling and adequate safety for working in one vertical section without coming into accidental contact with live parts in an adjacent section. The compartments shall have detachable cover plate with gaskets at the bottom of the cable compartment unless specified otherwise. Cable glands and
lugs of suitable sizes shall be provided for cable termination. Suitable arrangements shall be provided in the compartment for clamping of the cables.

**EARTHING**

G.I./copper flats shall run the entire length of the switch board. Two bolted type earthing terminals shall be provided in the board for connecting to the earth grid.

**METAL TREATMENT**

All steel materials used in the construction of the switch board shall undergo a rigorous rust proofing process comprising alkaline digressing, descaling in dilute sulphuric acid, cold rinsing, recognised phosphating process. Passivating and drying with compressed air in dust free atmosphere. It shall then receive two coats of highly corrosion resistant enamel paint of approved shade.

**DISTRIBUTION BOARD**

The distribution board shall comply with IS: 2675-1983 and B.S. 214 in all respects.

The distribution board shall be housed in a dust and vermin proof metallic enclosure fabricated from 2mm thick all welded sheet steel suitable for wall / column mounting and complete with a door of rigid construction fitted with dust protecting gasket, and robust fasteners. The enclosure shall have suitable provision for fixing of switch fuse units, fuse fittings and neutral bar on high grade rigid insulating support. The fuse fittings shall be connected by a tinned copper busbar. Each fuse bank shall be provided with a cable socket for the incoming cable. The socket shall be situated centrally and must be covered by an insulating shroud for safety. Phase separation barriers made out of arc resistant materials shall be provided between the fuse banks. All bare current carrying parts shall be protected with a bakelite sheet of 3.5 mm thick to prevent accidental contact.

The distribution board of single phase and neutral type shall be fitted with an earth bar for termination of each continuity conductor of outgoing circuits.

In case of concealed system, the boxes are to be flushed with the wall and the cover shall be made from 5 mm thick opal acrylic sheet or 3 mm thick decorative white top bakelite Electrical switch board cover of Hylam make.

The sheet steel parts shall undergo a rigorous rust proofing process comprising alkaline degreasing, descaling in dilute sulphuric acid, cold rinsing and a recognised phosphating process. The steel work shall then receive two coats of high corrosion resistant primer paint before final painting by application of synthetic enamel paint.

**MINIATURE CIRCUIT BREAKER DISTRIBUTION BOARDS (MCBDB)**

**SPN MCB DISTRIBUTION BOARDS (SPN MCBDB)**

The SPN MCB Distribution Board (SPN MCBDB) shall be housed in rust protected sheet steel enclosure shall be designed to provide protection against ingress to IP42 of IS-2147. This shall also be provided with the add - on acrylic door/ double door (Metallic) when specified. The MCB DB shall be supplied complete with tinned copper busbar of adequate rating and incorporating Isolator; MCB or equivalent RCCB as incomer. MCB’s shall be mounted onto specially designed din channel. The special mounting channel shall permit easy removal - even of - MCB in the middle of the bank without disturbing other MCBs.
The incomer phase shall accept 35 sq.mm cable while the neutral shall accept 16 sq.mm cables. The consumer unit shall have provision of 20 mm/ 25 mm knockouts at top and bottom and two 32mm/ 25 mm knockout on sides facilitates wiring space making for flexibility and convenience of wiring.

TPN MCB DISTRIBUTION BOARD (TPN MCBDB)

The TPN MCB Distribution Board (TPN MCBDB) shall be fabricated from CRCA sheet. This shall be painted in aesthetically appealing two-tone powder coated finish. The TPN DB shall have provision for incorporating isolator, MCB or RCCB as incomer. The busbar shall be integral type single piece busbar (Cu) and coupling links. The MCBs shall be arranged in two vertical banks with switch lever operating in horizontal plane for on-off switching. Specially designed mounting channel for quick shop fitting and easy removal shall be fitted.

The sheet steel enclosure fitted with add-on acrylic door/ double metallic door shall be provided with protection against ingress IP42 or IS:2147. The incomer phase shall accept upto 35 sq.mm cable while the neutral shall accept 16 sq.mm cables.

Two conduit entry plates at top and bottom shall be provided to facilitate drilling conduit holes at site to suit site requirements. The TPN DB shall conform to IS: 8623 for factory built assembly

METER BOARD

Unless otherwise mentioned in the schedule of quantities the Meter Board shall house a kwh meter in a dust and vermin proof metallic enclosure fabricated from 2 mm thick all welded sheet steel suitable for wall mounting. The door shall be secured by fasteners, enabling dust protecting gasket to be compressed easily. The kWh meter shall be of approved make and the same shall be mounted on a rigid insulating support. There must be a viewing aperture on the M.S. door covered with a 2mm thick clear acrylic sheet for easy meter reading and it shall be possible to seal the enclosure against unauthorised opening.

The sheet steel enclosure shall undergo rust proofing process and painting as specified in Part-B.

FUSE CUT OUTS

The fuse cut outs shall be totally enclosed, metal clad suitably for mounting on flat vertical surface and shall be provided with a screwed top cover. It shall be possible to seal the enclosure against unauthorised opening.

PUSH BUTTONS AND CONTROL SWITCHES

All push button switches shall be of sturdy design suitable for all types of control circuit. Unit construction shall be adopted so as to have any desired arrangement of contact.

Control and selector switches shall be of sturdy design with modular construction comprising rotary type switch with pistol grip or twist type operating handle and a number of switching elements operated by a single shaft and shall have suitable position indicator to show that the switch is in selected position.
The push button and control switch shall be of approved make.

**CONTACTOR UNITS**

The contactor unit shall comply with IS:2959 in all respects.

The main contactor unit shall be of robust in design having double break bounce free type contacts and pressure type terminal clamps. The contacts shall be made of antiweld silver cadmium oxide. The coil shall be vacuum impregnated, backed with inter-layer paper insulation and finally moulded in hard resin.

The contactor units shall be of approved make.

**LIGHTING EQUIPMENT**

The luminaires for fluorescent lamps shall be shop assembled, fully wired and suitable for 1 No. 4 ft. tube or 2 Nos. 4 ft. tubes as the case may be. The salient features of these luminaires are basic channels/ rails, 240 volt ballasts with copper winding wire, spring loaded bi-pin type lamp holders, glow type starters and condensers. Reflectors and/ or decorative covers shall be supplied as specified in the Schedule of Quantities.

The luminaires for incandescent lamps shall be as specified in the schedule of quantities and approved by the Engineer-in-Charge before the same is used.

The incandescent Bulkhead type fittings shall be of cast aluminium alloy body, finished by application of synthetic enamelled silver grey paint outside, white insides, with front glass, wire guard, tropicalised gasket, B. C. Lamp holder and suitable for use with 100 Watt G.L.S. Lamp. The fittings shall have tapped 19mm E.T. for conduit entry.

The Highbay luminaires for sodium/ mercury vapour/ metal halide lamps shall be integral type unit having a spun aluminium canister at the top for housing control gear, terminal block for the incoming supply, earthing terminal and suspension arrangement. The luminaire shall have reflectors of spun anodized aluminium with a secular finish and suitable for use with 150/250 / 400 watt HPSV / HPMV lamp as the case may be.

The Post-top lantern type luminaires shall have a die-cast aluminium electrical unit/ housing with provision for pipe entry from below, a canopy made of spun aluminium and an opal white acrylic diffuser resistant to ultraviolet radiation and heat. The luminaire shall be rain proof, insect tight and fully wired upto the terminal block and suitable for use with 70/ 80/ 125 watt HPMV or 100 watt GLS Lamp as specified in the schedule of quantities.

The flood lighting luminaires shall have a rugged construction housing made of cast aluminium alloy of low copper content for corrosion resistant, highly polished and anodised aluminium reflector for beam control, a heat resistant front glass with gasket and terminal block. To facilitate aiming and fixing, bracket shall be provided on the housing. The luminaire shall be rain proof, and suitable for use with 1000 W tungsten halogen lamp or 250 / 400 Watt HPSV lamp/ metal halide lamp as specified in the schedule of quantities.
The ballasts for fluorescent tube shall conform to IS: 1534 & IS:1534(Part-I) 1977 and the same for high intensity discharge lamps shall conform to IS:6616-1982 and these shall have high grade synthetic enamelled copper winding wires, quality grade insulation materials, good quality low hysteresis loses electrical stampings, and complete unit shall have polyester filling. The ballasts shall be suitable for use on single phase 240 Volts 50 Hz. A.C. system and of approved make.

The capacitors shall comply with IS: 1569-1976 and be of hermetically sealed type.

EXHAUST FANS

The Exhaust fans shall conform to IS:2312-1967 and suitable for operation on 230/240 Volt single phase. 50 Hz. A.C. system. The fans shall be ring mounted type designed to give maximum air volume changes under free air flow conditions.

SWITCHES

Light and fan switches shall be rated for 6 amp. 250 volts and of Piano-key type and suitable for flush mounting on sheet steel board with moulded bakelite cover (manufactured by switch manufacturer). The switches shall be of approved make & acceptable to the Engineer-in-Charge. The switches shall comply with relevant I.S.

SOCKET OUTLET AND PLUG

These shall be of 3 pin type and of rating 6 amps (for light) and 16 amps. (for power). Each socket outlet shall be complete with controlling switch and plug top. Protective fuse links shall be provided with 16 amps. power socket outlet. The socket outlets shall have piano-key type switches of approved make and acceptable to the Engineer-in-Charge. The socket outlet and plug shall comply with the relevant I.S. specifications.

SWITCH BOXES

Sheet metal (16 SWG) switch boxes/ connection boxes with 3 mm thick bakelite top cover flushed in wall by housing the box after cutting brick wall. Sheet metal boxes shall be treated against corrosion by passivation or other approved method.

FEEDER PILLAR

The feeder pillar shall be of the floor mounting type, totally enclosed and weather proof. The cubicle shall be fabricated out of heavy gauge sheet steel of thickness not less than 10 gauge with suitable side frames and 12 gauge stiffeners.

Hinged doors of not less than 3mm thick shall be provided at the front and rear of the cubicle to provide access for installations, operations, tests and inspection. All doors shall be fitted with dust excluding gaskets. The door shall also be fitted with suitable locking arrangement to prevent unauthorised opening. The cubicle shall be designed for mounting over cement concrete plinth by the roadside and shall be of substantial construction capable of withstanding the vibration normally experienced due to vehicular traffic.
The sheet steel materials used in the construction of the cubicle shall undergo a rigorous rust proofing process comprising alkaline degreasing, descaling in dilute sulphuric acid, cold rinsing and a recognised phosphating process. After metal treatment, the interior of the cubicle shall be painted with two coats of air drying red lead primer followed by two coats of air drying anti-condensation paint. The exterior of the cubicle shall be painted with two coats of red oxide primer and finished by application of two coats of enamel paint or any other colour shade acceptable to Engineer-in-Charge.

Ventilation louver in the form of finely divided wire mesh shall be provided on the two sides to ensure natural ventilation.

**TUBULAR POLE/G.I. PIPE POLES**

Where tubular steel pole are specified (either swaged or stepped), the same should be manufactured and supplied as per I.S. 2713 part I to III - 1980. Where G.I. pipe pole are specified the same should be approved to I.S.

**LOOP-IN JUNCTION BOX**

The junction boxes shall be drip proof type dust and vermin proof construction fabricated from 2mm thick sheet steel having internal dimensions of 200 x 150 x 130mm depth for single phase distribution system and 250 x 200 x 130 mm depth for three phase distribution system. These shall have moulded Bakelite base connector block with anti-vibration nickel plated brass terminals of suitable size and rating and porcelain fuse fittings.

**MANUFACTURER’S DRAWING**

The successful tenderer shall submit for approval General arrangement and dimensioned drawings for Power and Lighting distribution switch board, Motor Control centre, Bus-duct arrangement, Miniature circuit breaker distribution board, Distribution board, Interlocked Switch socket outlets, Clock switch control panel, T P Power Cable junction box and cable rack etc. as required in three sets before commencing manufacture.

**WORKMANSHIP AND INSTALLATION WORK**

The workmanship shall be of good commercial quality and all supply materials and installation work shall be completed to the full satisfaction of the Engineer-in-Charge.

**MANDATORY TEST**

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<th>Nature of Test</th>
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<tr>
<td></td>
<td></td>
<td>b. Site Test - IS:10028(part-II)1981 All Routine Test including temperature rise Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>L.T. Switch Board, Dist. Board, Power Control Panel, Feeder Board</td>
<td>a. Shop Test - IS: 4237 2500V to withstand for 1min. and Clearance and creepage to be check.</td>
<td></td>
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<td></td>
<td></td>
<td>b. Site Test - IS: 5039 Do</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A.C.B</td>
<td>a. Shop Test - IS 2516 (Part I &amp; II)1985 Shop test to be witnessed by NBCC. Test certificate to be produced.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test - Do Operation of the breaker : Operation of protective devices; Indicating lamp to be checked.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MCCB</td>
<td>a. Shop Test - IS: 2516 (Part I &amp; II)1985 Manufacturers Test Certificate to be furnished</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test - Do Operation of the breakers to be tested.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>RCCB</td>
<td>a. Shop Test - IS: 12640 Manufacturers Test Certificate to be furnished</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Wires/ Cables</td>
<td>a. Shop Test - IS : 694 IS : 1554 Manufacturers Test Certificate to be furnished</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Diameter of each strand of wires/ cables - IS: 8130 Diameter to be measured at site before use to confirm the correctness of the wire/ cables.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>c. Overall diameter - IS: 694 IS: 1554 Do</td>
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<tr>
<td></td>
<td></td>
<td>d. Resistance - IS: 8730 Resistance of 100M of wires/cables to be measured.</td>
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</tr>
</tbody>
</table>
5. PARTICULAR TECHNICAL SPECIFICATION FOR PASSENGER ELEVATOR

| Load – Kgs | 544 Kg (8 Persons) |
| Speed – mps | 1.00 |
| Travel – mtrs | Ground Floor to 3rd Floor |
| Stops & Openings | 4 Stops, 4 Openings (All openings on the same side) |
| Power Supply | 400 Volts 3 Phase 50 Hertz. Alternating Current |
| Control | A.C. Variable Voltage Variable Frequency (with close loop) |
| Operation | Simplex Full Collective (with/without Attendant) |
| Machine | Geared placed directly above the hoistway |
| Car Enclosure | Stainless steel in hairline finish. |
| Car Panels | Stainless steel mirror/ hairline finish |
| Handrails on three sides | Stainless steel mirror/ hairline finish |
| False Ceiling | S.S |
| Flooring | Granite/ Vitrified |
| Car Entrance | Protected by centre opening sliding stainless steel door in hairline finish |
| Size ( W x H) – mm | 900 x 2100 (approx) |
| Hoistway Entrances | Protected by centre opening sliding stainless steel doors in hairline finish |
| Size ( W x H) – mm | 900 x 2100 (approx) |
| Door Operation | Automatic with ACVVVF Door Operator & Multi-Ray Electronic Door Detector System |
| Details | 1. Luminous hall button with digital hall position indicator at all floors |
| | 2. Car operating full height panel with luminous buttons, digital car position indicator combined with direction arrows, overload warning indicator |
| | 3. Battery Operated Alarm Bell & Emergency Light |
| | 4. Fireman’s switch at main lobby |
| | 5. Automatic Rescue Device |
6. TECHNICAL SPECIFICATION OF FIRE PROTECTION AND FIRE ALARM SYSTEM

INTENT OF SPECIFICATION & SYSTEM DESCRIPTION

It is not the intent to specify completely herein, all details of design and construction of the equipment / system. However, the equipment / system shall conform, in all respect, to high standard of engineering and be capable of performing continuous commercial operation in a manner acceptable to the purchaser, who interpret the meaning of drawing and specification and shall have the right to reject any work or materials, which in his judgment is not in full accordance therewith.

SCOPE OF WORK.

The Fire Protection and Fire Alarm System of the Project should be in line with the schedule of prices, furnished herewith. The complete work should also comply with the system description, technical specification / data, etc. as furnished hereinafter and the bill of material for instant scope of work can be referred from schedule of prices. Any additional equipment, material, service which are not specifically mentioned but required to make the system complete operational and acceptable to the Owner/Local authority shall be deemed to be included in the scope and be furnished without any extra cost to purchaser.

Manufacture or Procure, Supply, Delivery to site, Storage, Installation, Testing, Commissioning, Performance Demonstration at site and handing over to purchaser the complete fire protection and fire alarm system for the instant work.

Supply of all the equipment / material should be completed in all respects i.e. all necessary accessories like initial packing / gasket / lubricant / fuel, special tools, first charge of refill, commissioning spare, etc., as may be needed for proper installation and operation, irrespective of whether specifically mentioned in the technical specification or not.

Furnishing of all necessary documents as may be needed during the course of complete execution of the job viz. construction drawing along with wiring diagram for Control Panel and Annunciation Panel as may be required for the Fire Protection and Fire Alarm System including as erected drawing, operation / maintenance manual, manufacturer’s test certificate-dimensioned drawing indicating part number - material specification, etc.

In the interest of standardisation, client reserves the right of selecting a particular manufacturer of fire protection equipment / component and the Tenderer / Contractor should supply the same of the particular make, if so required.

Providing anti-corrosive treatment for buried piping and painting for above ground piping / equipment including supply of auxiliary steel members as necessary along with associated civil work related to above / under ground piping and cabling such as excavation, backfilling, construction of brick masonry chamber with manhole cover for under-ground valve, chipping of foundation for pump / other equipment & grouting, opening in brick wall for routing of pipe / cable and sealing the opening.
Tenderer if desired to make visit the site before submission of this offer, may do so with prior intimation to EPIL.

**CODES & STANDARDS.**

All the systems and equipments within the scope of this tender shall be of reputed proven makes, designed and manufactured in accordance with the stipulations of latest versions of Indian Codes or recommendations of W.B.F.E.S / T.A.C. / F.O.C. / N.F.P.A.

When an equipment is offered conforming to standards other than those listed below, it shall be clearly brought in Schedule of Deviation.

01. IS:1646 : Code of practice for fire safety of building (general), Electrical Installations.
02. IS:1648 : Code of Practice for fire safety of buildings (general), Fire Fighting Equipment and its Maintenance.
03. IS:3034 : Code of Practice for Fire of Industrial Buildings, Electrical Generating and Distributing Stations.
04. IS:884 : First Aid Hose Reel for Fire Fighting (For Fixed Installations).
05. IS:2171 : Portable Fire Extinguisher, Dry Powder Type.
06. IS:2878 : Portable Fire Extinguishers, CO₂ type.
07. IS:1239 : Part - I : Mild Steel Tubes (upto 150mm).
   Part - II : Mild Steel tubular and other wrought steel pipe fittings.
08. IS:778 : Gunmetal gate, globe and check valves for general purposes.
10. IS:14846 : Sluice Valve for water works purposes (50 to 1200mm size) – Specification.
11. IS:5312 : Swing Check type Reflux (Non-Return) Valves.
12. IS:940 : Portable Fire Extinguisher, Water CO₂ Type.
13. IS:10204 : Portable Fire Extinguisher, Foam Type.
15. IS:1520 : Horizontal Centrifugal Pumps for clear, cold and fresh water.
17. IS:8423 : Controlled Percolation Hose for fire fighting.
19. IS:2062 : Structural Steel (Fusion / Welding Quality ).
26. IS:3589 : Mild Steel Tubes (200mm and above).
### APPROVED LIST OF MATERIALS

<table>
<thead>
<tr>
<th>SL.No</th>
<th>NAME OF ITEMS</th>
<th>LIST OF APPROVED MANUFACTURERS / BRAND / APPLICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIVIL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cement</td>
<td>ACC/ GRASIM/ AMBUJA/ ULTRATECH/ LAFARGE/ STAR/ TOPCEM/ CROWN/ HOLYCEM</td>
</tr>
<tr>
<td>2</td>
<td>Reinforcement Bars</td>
<td>Fe500 grade TATA, SAIL, RINL.</td>
</tr>
<tr>
<td>3</td>
<td>White Cement</td>
<td>JK, BIRLA WHITE</td>
</tr>
<tr>
<td>4</td>
<td>Ceramic Floor Tiles</td>
<td>Premium quality NITCO, JOHNSON, VERMORA, KAJARIA</td>
</tr>
<tr>
<td>5</td>
<td>Ceramic Tiles for Dado</td>
<td>Premium NITCO, JOHNSON, VERMORA, KAJARIA</td>
</tr>
<tr>
<td>6</td>
<td>Vitrified/ Rectified Tiles</td>
<td>Premium Quality NITCO, JOHNSON, VERMORA, KAJARIA</td>
</tr>
<tr>
<td>7</td>
<td>Glass Mosaic Tiles</td>
<td>Italia, Lamosaic, Littleglass</td>
</tr>
<tr>
<td>8</td>
<td>Float Glass</td>
<td>Modi, Saint Gobin, Indo-Asahi, Guardian</td>
</tr>
<tr>
<td>9</td>
<td>Concrete Interlocking Pavement Tiles</td>
<td>Wondercrete, Eurocon, AP Galaxy, Ultra, Lovely, Stylish Interlocking Pvt. Ltd.</td>
</tr>
<tr>
<td></td>
<td>and Concrete Paver Block</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Flush Door/ Block Board/Prelaminated</td>
<td>Kit ply, Greenply, Tower, Century, Anchor</td>
</tr>
<tr>
<td></td>
<td>particle board/ Plywood/ decorative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>veneers</td>
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</tr>
<tr>
<td>12</td>
<td>Cylindrical locks/ locks</td>
<td>Godrej, Ramson</td>
</tr>
<tr>
<td>13</td>
<td>Extruded Aluminium sections</td>
<td>INDAL, JINDAL, HINDALCO</td>
</tr>
<tr>
<td>14</td>
<td>Aluminium Composite Panel</td>
<td>Alstrong, Aluco-bond, Aludecor, Durabuild</td>
</tr>
<tr>
<td>16</td>
<td>Reflective Glass for glazing</td>
<td>AIS, Saint Gobian, Pilkington</td>
</tr>
<tr>
<td>17</td>
<td>Minarel board false ceiling</td>
<td>Armstrong/ AMF / OWA</td>
</tr>
<tr>
<td>18</td>
<td>UPVC rain water pipes with fittings</td>
<td>Oriplast, Supreme, Finolex</td>
</tr>
<tr>
<td>19</td>
<td>Polycarbonate Sheet</td>
<td>GE Plastic or Equivalent</td>
</tr>
<tr>
<td>20</td>
<td>Exterior type acrylic based paint</td>
<td>Excel Total of Nerolac, Apex ultima of Asian Paint or equivalent of ICI</td>
</tr>
<tr>
<td>21</td>
<td>Wall Putty</td>
<td>Birla, JK</td>
</tr>
<tr>
<td>22</td>
<td>Distemper</td>
<td>Asian Paint, Berger, ICI, Nerolac</td>
</tr>
<tr>
<td>23</td>
<td>Plastic emulsion Paint</td>
<td>Premium emulsion of Asian Paints, Delux acrylic emulsion of ICI, Rangoli fashion of Berger, Allscape of Nerolac</td>
</tr>
<tr>
<td>24</td>
<td>Synthetic Paint</td>
<td>Asian Paint, Berger, ICI, Nerolac</td>
</tr>
<tr>
<td>25</td>
<td>Zinc Chromate Primers</td>
<td>Shalimar, Asian Paint, Berger, ICI</td>
</tr>
<tr>
<td>27</td>
<td>Chemical / Mechanical Anchor Fastners</td>
<td>HILTI, FISCHER</td>
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<tr>
<td>28</td>
<td>Hydraulic door closer</td>
<td>Hardwyn make (Eddy) or equivalent</td>
</tr>
<tr>
<td>29</td>
<td>Floor spring for aluminium door</td>
<td>Hardwyn, Garnish</td>
</tr>
<tr>
<td>30</td>
<td>Fittings for Aluminium doors and windows</td>
<td>Ebco, Doorline</td>
</tr>
<tr>
<td>31</td>
<td>Water Proofing Compound/ Admixtures</td>
<td>Choksey, Sika Qualcrete, Degussa, Fosroc, ROFFE, CICO</td>
</tr>
<tr>
<td>32</td>
<td>Epoxy Grout for tile fixing</td>
<td>Laticrete, Bal endula or equivalent</td>
</tr>
<tr>
<td>33</td>
<td>Auditorium Chairs</td>
<td>Featherlite, Godrej, Rana Chairs</td>
</tr>
<tr>
<td>34</td>
<td>Specialist vendor for Structural glazing works</td>
<td>Aline Curtain Walls Pvt Ltd., Alunilite Pvt Ltd, Alumax Designtech System, Annex Window covering and Dressings, McCoy Architectural Systems Pvt Ltd. or other specialist vendors having adequate experience of similar work with prior approval of EIC.</td>
</tr>
<tr>
<td>35</td>
<td>M.S Tubes for space frames</td>
<td>TATA</td>
</tr>
<tr>
<td>36</td>
<td>Specialist Vendors for Space Frame Works.</td>
<td>Alumax Designtech System, Annex Window covering and Dressings, McCoy Architectural Systems Pvt Ltd. Amiya Corporation or other specialist vendors having adequate experience of similar work with prior approval of EIC.</td>
</tr>
</tbody>
</table>

**SANITARY ITEMS**

Sanitary Fittings and Fixtures:

<p>| | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Vitreous China and Fire Clay Sanitaryware:</td>
<td>Parryware, Hindustan Sanitaryware, Neycer, Cera</td>
</tr>
<tr>
<td>2</td>
<td>PVC Cistern (with all fittings and accessories):</td>
<td>Parryware, Commander</td>
</tr>
<tr>
<td>4</td>
<td>Plastic Seat Covers with frame</td>
<td>Parryware, Commander</td>
</tr>
<tr>
<td>5</td>
<td>CP brass fittings and Accessories:</td>
<td>Essco, Jaquar, Mark</td>
</tr>
<tr>
<td>6</td>
<td>Stainless-Steel Sinks (with or without drain-board and having integrated waste fittings)</td>
<td>Nirali, AMC, Parryware, Kingston, Neelkanth, Prestige</td>
</tr>
<tr>
<td>7</td>
<td>Soil Pipes and Fittings:</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Centrifugally Cast (spun) Iron Pipes &amp; fittings</td>
<td>NECO or approved equivalent make conforming to IS: 3989</td>
</tr>
<tr>
<td>9</td>
<td>Sand Cast (spun) Iron Pipes &amp; fittings (conforming to IS: 1729)</td>
<td>AMC, ALC, Bengal Iron</td>
</tr>
<tr>
<td>10</td>
<td>Pig Lead (for caulking of joints)</td>
<td>Locally available best quality with minimum 99% purity</td>
</tr>
<tr>
<td>11</td>
<td>Water Supply Pipes and Fittings:</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>G.I. Pipes</td>
<td>TATA, JINDAL,</td>
</tr>
<tr>
<td>13</td>
<td>G.I. Fittings</td>
<td>R, KS, HB, Unix</td>
</tr>
<tr>
<td>13</td>
<td>Centrifugally Cast Iron Pressure Pipes (LA class) and Fittings with</td>
<td>Electrosteel, Keshoram, IISCO</td>
</tr>
<tr>
<td>SL.No</td>
<td>NAME OF ITEMS</td>
<td>LIST OF APPROVED</td>
</tr>
<tr>
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</tr>
<tr>
<td>14</td>
<td>UPVC pipes</td>
<td>Oriplast, Supreme, Finolex</td>
</tr>
<tr>
<td>15</td>
<td>Gunmetal Valves</td>
<td>Leader, Zoloto, Annapurna, Sant</td>
</tr>
<tr>
<td>16</td>
<td>Cast Iron Valves</td>
<td>Venus, Upadhyay, Sarkar, Ghosh Engineering, Sant, Castle</td>
</tr>
<tr>
<td>17</td>
<td>Strainers</td>
<td>Locally available best quality material matching with concerned valve</td>
</tr>
<tr>
<td>18</td>
<td>PVC Pipes and strainers for Tubewell (Medium casing pipe and matching thickness strainers conforming to IS: 12818)</td>
<td>Oriplast, Supreme, Finolex</td>
</tr>
<tr>
<td>19</td>
<td>MS Top nipple Pipe for Tubewell</td>
<td>Locally available best quality material having minimum thickness of 8 mm</td>
</tr>
<tr>
<td>20</td>
<td>Lift Pump set</td>
<td>BE/ Kirloskar Pumps, Crompton/Siemens Motors</td>
</tr>
<tr>
<td>21</td>
<td>Submersible Pump set</td>
<td>KSB Pump &amp; Motor, KALAMA Pumps &amp; Motor</td>
</tr>
<tr>
<td></td>
<td>Instruments &amp; Electricals</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Pressure Gauge &amp; Pressure Switch</td>
<td>H. Guru, Danfoss, Fiebig</td>
</tr>
<tr>
<td>23</td>
<td>Water proof flat Cable</td>
<td>Finolex or equivalent</td>
</tr>
<tr>
<td>24</td>
<td>Electrical accessories to Motor Control Panel</td>
<td>L&amp;T, Siemens, GE</td>
</tr>
<tr>
<td></td>
<td>Sewerage and drainage</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Stoneware pipes and fittings</td>
<td>Hind Ceramic, Orind or equivalent.</td>
</tr>
<tr>
<td>26</td>
<td>Vitreous China Sanitary Ware</td>
<td>Parry, Cera, Hindustan</td>
</tr>
<tr>
<td>27</td>
<td>Plastic W.C seats</td>
<td>Commeander, Patel</td>
</tr>
<tr>
<td>28</td>
<td>GI Pipes</td>
<td>Tata, Jindal, NEZONE</td>
</tr>
<tr>
<td>29</td>
<td>GI fittings</td>
<td>HB, Zoloto, K.S</td>
</tr>
<tr>
<td>30</td>
<td>Stainless Steel Sink</td>
<td>Neelkantha, AMC, Corba</td>
</tr>
<tr>
<td>31</td>
<td>Mirror</td>
<td>Modi, Atul, Silver, Gold Fish, Jolly</td>
</tr>
<tr>
<td>32</td>
<td>C.P Pillar cock, Bibcocks, stop-cocks and other CP fittings</td>
<td>Essco, Jaquar, Mark</td>
</tr>
<tr>
<td>33</td>
<td>Brass Bib &amp; Stop cock</td>
<td>GPA, SANT, L &amp; K</td>
</tr>
<tr>
<td>34</td>
<td>Valves</td>
<td>Leaders, Kent, Zoloto</td>
</tr>
<tr>
<td></td>
<td>Soil, Waste &amp; Rainwater pipe and fittings</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Unplasticised-PVC</td>
<td>Oriplast, Suprime, Finolex, Prince</td>
</tr>
<tr>
<td>36</td>
<td>Sand Cast</td>
<td>RIF, BIG, NECO</td>
</tr>
<tr>
<td>37</td>
<td>Stonaware Pipes &amp; Gully</td>
<td>Perfect, Burn, RK</td>
</tr>
<tr>
<td>38</td>
<td>RCC Pipe</td>
<td>Laxmi, Sood &amp; Sood, Jain &amp; Co.</td>
</tr>
<tr>
<td>39</td>
<td>C.I. S/S Pipes</td>
<td>IISCO, Kesoram, Electro Steel</td>
</tr>
<tr>
<td>40</td>
<td>PVC Tank</td>
<td>Sintex, Patton or equivalent</td>
</tr>
<tr>
<td>41</td>
<td>Fountains</td>
<td>Premier Fountains or equivalent</td>
</tr>
<tr>
<td>MANUFACTURERS / BRAND / APPLICATORS</td>
<td></td>
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<tr>
<td><strong>ELECTRICALS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Contactor</td>
<td>Siemens, ABB, L&amp;T, GE, Schneider, BCH</td>
<td></td>
</tr>
<tr>
<td>2 TPN switch fuse unit / switch disconnector fuse unit with HRC fuses</td>
<td>Siemens, L &amp; T, GE, C&amp;S, Schneider, ABB, HPL, Standard</td>
<td></td>
</tr>
<tr>
<td>3 DP/SPN SFU/ SDFU with HRC fuse</td>
<td>LK, HPL, Standard, L&amp;T, Siemens, Gerard, C&amp;S</td>
<td></td>
</tr>
<tr>
<td>4 All moulded fuse with HRC fuses/Distribution fuse board with HRC fuses</td>
<td>Siemens, Larsen &amp; Toubro, GE, C&amp;S</td>
<td></td>
</tr>
<tr>
<td>5 KWH Meter</td>
<td>Alstom, HPL-SOCOMEC, Jaipur, L&amp;T</td>
<td></td>
</tr>
<tr>
<td>6 Motor Starter</td>
<td>Siemens, L &amp; T, Schneider (CG), GE, T &amp; C., BCH.</td>
<td></td>
</tr>
<tr>
<td>7 Rewireable type porcelain Switchgear, fuse fittings</td>
<td>GE, Standard, Gerard, HPL</td>
<td></td>
</tr>
<tr>
<td>8 Changeover Switch</td>
<td>L &amp; T, ELECON/ Gerard, Havels, Standard</td>
<td></td>
</tr>
<tr>
<td>10 Earth Leakage current circuit breaker</td>
<td>Merlin Gerin, L &amp; T, Hager, Siemens, Gerard,C&amp;S, Legrand, North-West</td>
<td></td>
</tr>
<tr>
<td>11 1100 Volts grade PVC/ XLPE insulated steel armoured and over all PVC sheathed cables with size in sq.mm embosed on cable surface</td>
<td>NICCO, Fort Gloster, National, CCI, Polycab, Crystal, KEI</td>
<td></td>
</tr>
<tr>
<td>12 PVC insulated stranded/ flexible copper conductor wire with size in sq.mm. embosed on cable surface (for internal wiring)</td>
<td>Finolex, L&amp;T, R.R. Kabel, Polycab, Rajanigandha, Mescap</td>
<td></td>
</tr>
<tr>
<td>13 Rigid PVC Conduit</td>
<td>B.E.C., AKG, Precision, Gerard, Harsh</td>
<td></td>
</tr>
<tr>
<td>14 Black stove enamelled conduit and galvanised steel conduit with ISI marked embosed on conduit surface</td>
<td>B.E.C., NIC, AKG,</td>
<td></td>
</tr>
<tr>
<td>15 Electrical Switch Board cover with white top Lamination</td>
<td>Hylam or equivalent</td>
<td></td>
</tr>
<tr>
<td>16 Metal clad socket &amp; plug having scraping earth arrangement</td>
<td>Hager, Schneider (CG), L &amp; T, Gerard, C&amp;S, Legrand</td>
<td></td>
</tr>
<tr>
<td>17 250 Volt 6 Amp. Piano reed type switch/ Buzzer Push (Flush type), 250 Volt 16 Amp. 3 Pin socket with switch combined</td>
<td>Anchor, CPL, Precision, SSK, Magic. Color</td>
<td></td>
</tr>
<tr>
<td>18 250 Volt 6 Amp. Ceiling rose, 250 Volt 16 Amp 3 pin socket with switch combined</td>
<td>Anchor, CPL, Precision, SSK, Magic</td>
<td></td>
</tr>
<tr>
<td>19 Modular type 10 A &amp; 16 A switch. 10</td>
<td>MK blenze, Roma woods,</td>
<td></td>
</tr>
<tr>
<td>SL.No</td>
<td>NAME OF ITEMS</td>
<td>LIST OF APPROVED MANUFACTURERS / BRAND / APPLICATORS</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>FIRE FIGHTING AND PREVENTION WORKS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A &amp; : 16 A socket, front plate, mounting box,Regulator/Dimmer</td>
<td>Legrand Mosaic,</td>
</tr>
<tr>
<td>20</td>
<td>Modular Electronic Regulator/Dimmer (2 module)</td>
<td>MK blenze, Roma woods, Legrand Mosaic</td>
</tr>
<tr>
<td>21</td>
<td>Clock switch/time switch</td>
<td>L &amp; T, Hager, GIC, Legrand</td>
</tr>
<tr>
<td>22</td>
<td>‘CLIP ON’ Terminal assembly</td>
<td>Tosha, Elmex</td>
</tr>
<tr>
<td>24</td>
<td>ON/OFF Rotary Switch/ Selector Switch/ programme switch</td>
<td>Siemens, Hager, Larsen &amp; Toubro, Kaycee</td>
</tr>
<tr>
<td>25</td>
<td>Cable Glands</td>
<td>COMIC, Raychem or equiv.</td>
</tr>
<tr>
<td>26</td>
<td>Cable Tray</td>
<td>Pilco, MEK orequiv.</td>
</tr>
<tr>
<td>27</td>
<td>Battery</td>
<td>EXIDE, STANDARD</td>
</tr>
<tr>
<td>28</td>
<td>Fluorescent light fittings (All types) &amp; lamp.</td>
<td>Wipro, Philips,Thorn, K-litr, Bajaj</td>
</tr>
<tr>
<td>29</td>
<td>Decorative wall bracket/ ceilingmounted Luminaire for PL /incandescent lamp</td>
<td>Wipro, Philips,Thorn, K-litr, Metal Coats, Bajaj</td>
</tr>
<tr>
<td>30</td>
<td>Fluorescent Street Light Luminaire &amp; lamp</td>
<td>Wipro, Philips,Thorn, K-litr, Metal Coats, Bajaj</td>
</tr>
<tr>
<td>31</td>
<td>Halogen spot luminaire &amp; lamp</td>
<td>Wipro, Philips,Thorn, K-litr, Metal Coats, Bajaj</td>
</tr>
<tr>
<td>32</td>
<td>Metal halide luminaire &amp; lamp</td>
<td>Wipro, Philips,Thorn, K-litr, Metal Coats, Bajaj</td>
</tr>
<tr>
<td>33</td>
<td>Lamp Holder (Pendent racket or Batten)</td>
<td>Anchor, SSK, Magic</td>
</tr>
<tr>
<td>34</td>
<td>Exhaust Fan</td>
<td>G.E.C., Crompton, Polar, EPC, Usha</td>
</tr>
<tr>
<td>35</td>
<td>Ceiling Fan</td>
<td>Decorative fan of Crompton, Polar, Khaitan</td>
</tr>
<tr>
<td>36</td>
<td>Busbar Trunking/Rising Main</td>
<td>Control &amp; Switchgear (C &amp; S), Zeta.</td>
</tr>
<tr>
<td>37</td>
<td>Ammeter/Voltmeter selector switch</td>
<td>Kaycee, L&amp;T, Switron</td>
</tr>
<tr>
<td>38</td>
<td>Relay</td>
<td>Alsthom, GE, L&amp;T, Syntron, Control Group</td>
</tr>
<tr>
<td>39</td>
<td>Current Transformer</td>
<td>Kappa, L&amp;T, C&amp;S, AE, SIEMENS</td>
</tr>
<tr>
<td>40</td>
<td>Capacitor</td>
<td>L&amp;T, Manual, EPCOS</td>
</tr>
<tr>
<td>41</td>
<td>Decorative Street Light Poles</td>
<td>Metal Coats, KLITE</td>
</tr>
<tr>
<td>42</td>
<td>Sodium vapour, Murcury vapour MHL fittings and lamps</td>
<td>Philips, Crompton, Wipro</td>
</tr>
<tr>
<td>43</td>
<td>Cable Jointing Kit</td>
<td>Frontec, Raycham, M-seal, Denson</td>
</tr>
<tr>
<td>44</td>
<td>Passenger Elevator</td>
<td>Otis / Kone/ Thyssenkrupp</td>
</tr>
<tr>
<td></td>
<td>MS/ GI pipes</td>
<td>TATA/Jindal / BANSAL / Prakash Surya</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Supplier/Mark</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>Sluice/NRV</td>
<td>Leader/ Sant/ Kalpana / Venus/ Audco</td>
</tr>
<tr>
<td>3</td>
<td>Air Release Valve</td>
<td>Leader/ Sant/ Kalpana / Venus/ Audco</td>
</tr>
<tr>
<td>4</td>
<td>Fire Hydrant Valve</td>
<td>Newage/ Superex./Asco Strumech/ Venus</td>
</tr>
<tr>
<td>5</td>
<td>GM Coupling</td>
<td>Ghosh Engg. / ISI Marked</td>
</tr>
<tr>
<td>6</td>
<td>Fire Pump / Jockey Pump Pumps</td>
<td>Kirloskar or Mather &amp; Platt or K.S.B or Beacon</td>
</tr>
<tr>
<td>7</td>
<td>Electric Motor</td>
<td>Kirloskar, Crompton, Siemens, ABB</td>
</tr>
<tr>
<td>8</td>
<td>Fire Extinguisher</td>
<td>Deflame / Bharat / Newage / Minimax / Cease fire</td>
</tr>
<tr>
<td>9</td>
<td>Rubber tube for hose reel</td>
<td>Dunlop / Jyoti / Padmini / Maruti</td>
</tr>
<tr>
<td>10</td>
<td>Paint</td>
<td>Asian / J &amp; N / Berger</td>
</tr>
<tr>
<td>11</td>
<td>Hose Box and Swinging Hose Reel</td>
<td>Firechief / Newage / Vijay</td>
</tr>
<tr>
<td>12</td>
<td>Anti vibration elimentors</td>
<td>Dunlop / Kanwal / Resitoflox</td>
</tr>
<tr>
<td>13</td>
<td>GM Sismese connection</td>
<td>Ghosh Engg. / Zenith</td>
</tr>
<tr>
<td>14</td>
<td>Pressure Switch</td>
<td>Indfoss / System Sensor / Vexma Trafag</td>
</tr>
<tr>
<td>15</td>
<td>Pressure guage</td>
<td>H.Guru / Feibig / Vexma Trafag / Switcher / Manometer / AN Instrument</td>
</tr>
<tr>
<td>16</td>
<td>Wire</td>
<td>Finolex / RR cab;e / Mescab / Rajanigandha</td>
</tr>
<tr>
<td>17</td>
<td>PVC Conduit</td>
<td>BEC / Steelcraft / Precision / AKG / BEC</td>
</tr>
<tr>
<td>18</td>
<td>Switch gear</td>
<td>L &amp; T / EE / Siemens</td>
</tr>
<tr>
<td>19</td>
<td>Foot Valve with Strainer</td>
<td>H.Sarkar / Venus</td>
</tr>
<tr>
<td>20</td>
<td>Motors</td>
<td>ABB / Crompton / GEC/ KEC</td>
</tr>
<tr>
<td>21</td>
<td>Cables</td>
<td>NICCO / Gloster / CCI / Polycab / KEI</td>
</tr>
<tr>
<td>22</td>
<td>Cable end termination</td>
<td>Dowell / Comet</td>
</tr>
<tr>
<td>23</td>
<td>Manual Call Points</td>
<td>Philips, Agni, Minimax, KAC</td>
</tr>
<tr>
<td>24</td>
<td>Detector Smoke</td>
<td>APOLLO, HOCHKI, FIRE SCAN, Systems Sensors</td>
</tr>
<tr>
<td>25</td>
<td>Detector Fire</td>
<td>Apollo,U.K. or System Sensor, U.K.</td>
</tr>
<tr>
<td>26</td>
<td>HOOTER</td>
<td>Philips, Minimax, Agni</td>
</tr>
<tr>
<td>27</td>
<td>Panel for fire alarm system</td>
<td>Philips, Agni, Minimax, Madhu Electric (acceptable by local F.B. authority.)</td>
</tr>
<tr>
<td>28</td>
<td>Zonal Panel</td>
<td>Philips, Agni, Minimax</td>
</tr>
<tr>
<td>29</td>
<td>Main panel with ACB’s – (Febriclator)</td>
<td>L&amp;T,GE Power Control, Siemens, Madhu Electric</td>
</tr>
<tr>
<td>30</td>
<td>C.I. Valves</td>
<td>H. Sarkar / KSB / Audco / Kalpna (Sluice / Butter Fly / Non-return / Check)</td>
</tr>
<tr>
<td>31</td>
<td>M.S. / G.I. Pipe</td>
<td>Jindal or Tata.</td>
</tr>
<tr>
<td></td>
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<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>32</td>
<td>G.M.Valves.(gate / globe / check )</td>
<td>Leader or bearing ISI mark.</td>
</tr>
<tr>
<td>33</td>
<td>Hydrant / Landing Valve</td>
<td>Newage/ Superex./Asco Strumech/ Venus</td>
</tr>
<tr>
<td>34</td>
<td>63mm Fire Fighting Hose</td>
<td>C.R.C. or Newage Superex./Asco Strumech/ Venus</td>
</tr>
<tr>
<td>35</td>
<td>20mm Rubber Hose</td>
<td>Diamond, Padmini, Maruty</td>
</tr>
<tr>
<td>36</td>
<td>Pump Starting Panel</td>
<td>L &amp; T / Electro Allied / Siemens/ ABB</td>
</tr>
</tbody>
</table>

8. **LIST OF TENDER DRAWINGS :**

1. SK/EPI/TSECL/AGARTALA/TENDER-01
2. SK/EPI/TSECL/AGARTALA/TENDER-02
3. SK/EPI/TSECL/AGARTALA/TENDER-03