TENDER DOCUMENT

TENDER No.: DLI/ENGG/PI-ESIC-RO/KOL

FOR

CONSTRUCTION OF REGIONAL OFFICE BUILDING / ESI MB FOR EMPLOYEES’ STATE INSURANCE CORPORATION (ESIC)

AT

SALT LAKE, KOLKATA

VOLUME – IIB

ADDITIONAL SPECIFICATIONS

EXECUTING AGENCY

ENGINEERING PROJECTS (INDIA) LIMITED

(A GOVT. OF INDIA ENTERPRISE)

Core-3, Scope Complex, 7, Institutional Area,

Lodhi Road, New Delhi-110003

TEL NO: 011-24361666, 24366226 FAX NO. 011- 24363426
# INDEX

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INTRODUCTION</td>
<td></td>
</tr>
<tr>
<td></td>
<td>INFORMATION ABOUT SITE</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>SCOPE OF WORK</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>GENERAL TECHNICAL SPECIFICATION FOR R.C.C. WORKS FOR FOUNDATION, SLAB, BEAM, WALLS, COLUMN, AND OTHER STRUCTURAL MEMBERS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GENERAL SPECIFICATION AND ADDITIONAL PARTICULAR SPECIFICATION</td>
<td>3-20</td>
</tr>
<tr>
<td></td>
<td>PARTICULAR SPECIFICATION OF NON DSR CIVIL AND SANITARY WORKS</td>
<td>21 - 29</td>
</tr>
<tr>
<td></td>
<td>PARTICULAR TECHNICAL SPECIFICATION FOR ELECTRICAL WORK</td>
<td>29 - 77</td>
</tr>
<tr>
<td></td>
<td>PARTICULAR TECHNICAL SPECIFICATION FOR FIRE FIGHTING AND PREVENTION SYSTEMS</td>
<td>77 - 83</td>
</tr>
<tr>
<td></td>
<td>LAN SYSTEM</td>
<td>84 -</td>
</tr>
<tr>
<td></td>
<td>6. APPROVED LIST OF MATERIALS</td>
<td>87 - 94</td>
</tr>
<tr>
<td></td>
<td>7. LIST OF TENDER DRAWINGS</td>
<td>95</td>
</tr>
</tbody>
</table>
1. Introduction

1.1 Information about the site:
The Site is located in Block GB, Salt Lake, Kolkata. The site is located at the heart of Salt Lake, well connected with roads. The total area of land is approx. 8000 sq.m. There are few structures within the site, which along with the services need to be demolished.

1.2 SCOPE OF WORK
The proposed Office building complex is comprising of two six storied structures of identical character, one for ESIC and the other for ESIMB. The complex also proposed to have a convention centre with a 300 capacity auditorium, and two conference halls with allied facilities. A large central atrium along with space frame and skylight is located at the center.
The scope of work covers the entire construction including initial demolition of existing structure (no separate payment shall be made for demolition work and shifting of service lines if required), different heads are as follows:

1. Pile and Pilecaps
2. Civil and Structural works.
3. Finishing Works (internal and external).
4. Internal and external electrification.
5. Electrical substation and Generators.
6. Sanitary, water supply and drainage works.
7. Interior works.
8. Local Area Networking.
10. Auditorium sound and projection system, auditorium stage lighting, stage crafting.
11. Area development, landscaping, roads and pavement.
12. Other misc. works as required.

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.

2.7.1 TECHNICAL SPECIFICATION FOR PILE AND PILE CAPS

Scope of work:

The building foundation is proposed to be on bored cast – in – situ R.C.C. piles. The scope of work involves broadly the followings:

- Construction of Bored cast-in-situ piles
- Earthwork excavation and or filling
- Cast in situ RCC works in pile caps and grade beams

Soil Data:

A complete copy of the soil investigation report is available for inspection of the intending tenders at the office of the Engineering Projects India Ltd., New Delhi in addition the Tenderers may carry out soil test at their own cost at site for their satisfaction. The tenderers are required to ensure capacity of pile as mentioned in the soil report / drawing.

Setting out:

The layout for all the pile caps, grade beams and piles shall be made by the contractor at his own cost. Making bench mark pillars and reference line pillars etc. and maintaining them up to completion of the work and there – after handing them over to the engineer – in – charge shall be the responsibility of the contractor. No extra payment
shall be made on this account, the layout of the pile shall be approved by the engineer-in-charge.

PARTICULAR SPECIFICATION

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.

TO ENSURE AND ASSESS QUALITY OF PILE, LOW STRAIN NON DESTRUCTIVE INTEGRITY TEST OF PILES TO BE CONDUCTED OVER AND ABOVE ROUTINE LOAD TEST. THE NUMBER OF INTEGRITY TEST WILL BE ATLEAST 20% OF THE TOTAL NUMBER OF PILE. NO EXTRA PAYMENT WILL BE PAYABLE TO THE CONTRACTOR FOR THESE TESTS. THREE SETS OF REPORT OF INTEGRITY TESTS TO BE GIVEN BY THE CONTRACTOR TO EPIL.
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) (Ultratech, ACC, Grasim or Lafarge)
Steel         : Steel shall conform to IS 1786, (TATA or SAIL)
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/m3 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 for 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 Thixotrophic 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 re-circulation. 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>
<thead>
<tr>
<th>Pile group</th>
<th>Number of piles</th>
</tr>
</thead>
<tbody>
<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>
</tr>
</tbody>
</table>

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 Kentledge 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 jack shall be inserted between the M.S. plate and the kentledge frame. The dial gauge shall at equal distance around 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).
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.
3 PARTICULAR SPECIFICATION OF NON DSR CIVIL AND SANITARY WORKS

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

3.2 SPACE FRAME
a. Space frame at Roof level: Preparation of shop drawings, material list, schedule of bolts and nuts, erection drawings, supply of all raw materials, fabrication of space frame tubular structures (1M to 1.2M grid and approx. 1.2m heigh) with PU coated ERW tubes and cast iron nodes of required diametre (not less than 100mm), loading, transporting and delivery at site, erection of the space frame structure at 7th floor height (approx. 30m), horizontal purlins of required size and anchoring the structure with concrete beams / vertical concrete / brick walls / support as per drawing at appropriate location, all steel members including the nodes to be PU coated, all works as per specification and drawings inclusive of tools, tackles, labour etc. The scaffolding / supporting system for fabrication / erection at approx. 30m height from GL to be considered within the rate. Complete as per direction of Engineer in charge. (Prior to start the work, Vendor to get approval from EPIL for detailed fabrication drawings and design of space frame based on existing Architectural & Structural drawings)

b. Space frame at 8 to 10m level: Preparation of shop drawings, material list, schedule of bolts and nuts, erection drawings, supply of all raw materials, fabrication of space frame tubular structures (approx. 0.75m grid and heigh) with PU coated ERW tubes and cast iron nodes of required diametre (not less than 75mm), loading, transporting and delivery at site, erection of the space frame structure at 2nd floor height (approx. 10m), horizontal purlins of required size and anchoring the structure with concrete beams / vertical concrete / brick walls / support as per drawing at appropriate location, all steel members including the nodes to be PU coated, all works as per specification and drawings inclusive of tools, tackles, labour etc. The scaffolding / supporting system for fabrication / erection at approx. 10m height from GL to be considered within the rate. Complete as per direction of Engineer in charge. (Prior to start the work, Vendor to get approval from EPIL for detailed fabrication drawings and design of space frame based on existing Architectural & Structural drawings)
3.4 CERAMIC / VITRIFIED / RECTIFIED TILES
The fixing procedure of tiles will be as specified in CPWD specifications. The tiles shall conform relevant IS standard. The size and thickness of tiles will be as specified in Bill of Quantities.

3.5 LAMINATED FLOOR
9 / 11mm thick laminated floor, skirting with tongue and groove system of grade AC5 / AC6 with inbuilt 3mm Multilayer composite sound block fixed on floor with approved adhesive including fixing of beads, levelling etc. complete. The material should conform different criteria stipulated in EN / ASTM / DIN Standard.

3.6 EXPANSION JOINT SEALANT
The specified gap of the expansion joint to be made uniform by cement mortar of appropriate strength, after curing is over, the mortar surface to be cleaned from all dust, dirt, lump of mortar, any grease materials etc. The depth of the expansion joint to be adjusted as per specified depth with suitable filler board. The surface of the expansion joint to be painted with manufacturer's approved primer. Polysulphide based sealant compound shall be used as per specified width X depth to seal the joint. The total process of execution shall be as per manufacturer’s specification and instruction of Engineer in Charge.

3.7 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 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.

3.8 HIGH PRESSED CLAY TILES ON WALL
Fixing High pressed clay tiles of approved brand on wall on prepared plastered surface with adhesive of Sika-ceram / Balendura -durafix silver star or equivalent, including racking off joint and making good the same with matching coloured approved sealent compound, protective silicon paint over total laid surface over a coat of acrylic smooth exterior grade paint of matching shade
etc. complete maintaining true line level etc. as per direction of Engineer-in-charge

3.9 GLASS MOSAIC TILES
Fixing 20mm x 20mm glass mosaic tiles of texture series of approved brand of approved colour and texture on wall facia etc. at any height. Before fixing tiles the base surface to be prepared in true to line and level any depression etc. to be rectified properly.

3.10 STAINLESS STEEL RAILING:
The railing is of two components:
   a. The Balustrade
   b. The railings.
The Decorative Balusters shall be fabricated out of 12mm thk. 100mm wide, 1000mm high MS plate, in any shape as per architectural design, either linear or curve. The balusters shall be machine cut, machine polished and shall have 12mm thk base plate of 100mm x 75mm as per architectural design. The base to have 2mm thk SS covering of matching design. The balusters shall be provided with punch of required size and shape to accommodate stainless steel rails (horizontal/inclined) of specified diameter. Punch shall be so designed and cut accurately that there are no visible gap when the stainless steel tube is passes through it either horizontally or in inclined manner. The workmanship shall be of best quality available in the country. Balusters shall be powder-coated / PU coated of approved colour, and the coating shall be of exterior grade. Stainless steel seamless tube of grade 304, continuously welded and grinded smooth polished smooth/rough, bend/curved at turning as per design, fixed/welded with the balusters complete as per architectural drawing. The Decorative Side Balusters shall be fabricated out of 12mm thk. 100mm wide, 125mm long MS plate, in any shape as per architectural design, either linear or curve. The balusters shall be machine cut, machine polished and shall have 12mm thk base plate of 100mm x 75mm as per architectural design and with 2mm thk SS covering as per design. The balusters shall be provided with punch of required size and shape to accommodate stainless steel rails (horizontal/inclined) of specified diameter. Punch shall be so designed and cut accurately that there are no visible gap when the stainless steel tube is passes through it either horizontally or in inclined manner. The balusters to be fixed with floor/wall as the case may be with hidden type metal fastner.
3.11. **STRUCTURAL GLAZING**

The Structural glazing system will be designed using WICSKY 4N brand of WINCONA Germany. The spacing of mullions and transoms will be in accordance with the drawings provided by EPIL. However the maximum spacing of the mullions shall not be more than 1200mm C/C. The plan form of the glazing will be either linear or curvilinear or both as per architectural design. The vendor to submit structural design calculation as per latest revision of IS code along with shop/fabrication drawings with all details and get it approved by EPIL prior to execution of the work.

Structural Glazing system will be provided and fixed (with partly openable shutter if required) with 6mm thk toughened reflective glass of approved make. Fixtures, Aluminium section etc all will be as per standard design and specification of WICSKY 4N system and as specified in detail in the Bill of Quantities. The system to be completely water tight.

3.12 AUTOMETIC SLIDING GATES.

The Gate of 2mt. in height X 4.5mt.in width, The external frame of tubular pipes will be of TATA make GI tubular pipe of 60 X 3.2 mm. dimensions, The inside frame, for supporting the GI sheets in the middle, should be of non-TATA make tubular pipes of dimension 50 X 3.2 mm, The middle portion should have two GI sheets covering both face of the Gate. The GI sheet will be of 1.6 mm thickness. The Top and Bottom ventilators should be of GI tubular pipe of non-TATA make of dimension 32 X 3.2 mm. The Sliding Gate will be PU Coated.

**SPECIFICATION OF THE SYSTEM: motorized unit of the sliding gate**

1. **Drive unit:** Automatic Sliding Gate System should be designed for heavy duty Operations. It should consist of shaft, crank, clutch, motor-reduction gear with worm gear on ball bearings, which should be sealed in water proof oil filled chamber for maintenancefree and long lasting performance. The operation of drive unit should be silent and should require no maintenance. An adjustable clutch should deliver the required thrust for quiet operation. The Irreversible electro-mechanical unit should keep the gate securely locked while a special passkey should provide release for manual operation during power failure.

2. **Accessories:** Two double ball bearing metalone rollers should be there for bottom alignment and six ball bearing metalone rollers for side support, V-rack equal to the length of the gate. MS column support for rollers,
I section (girder) with MS rod should be part of the gate. These will be part of the system.

3. **Control Panel**: The Control Panel should be Microprocessor based electronic control panel which should control the direction and timing of gate movement. The control panel should be equipped with the

- Control panel should take signal from either push button or remote control which one part of the system.
- If sliding gate is in close position, first signal from remote or push button should open it. Second signal if given while the gate is still opening, should STOP it and third signal should CLOSE it. Similarly if a signal is given after the gate is fully opened then it should close the gate. A second signal if given while gate is closing should stop the gate and third signal should open it again.
- Point should be provided in control panel for indicator light that should automatically flash when gate is opening or closing.
- Optical Sensor (optional) should be used as safety device. It should send signal only when there is an obstruction while gate is closing to stop its movement.
- Mechanical limit switches should be used to switch off the power supply when gate has either fully opened or fully closed. Inbuilt software in control panel should also cut off power supply after a preset time to provide independent back up safety.

4. **Electrical Motor**: The Motor should be 220V / 0.5 HP, reversible, AC Motor with 930 rpm with 370 W.

5. **Push Button**: The system should be activated by touching a single piano type push-button for opening, closing and stopping in-between thereby keeping the guard free to pay more attention to security checks.

6. **Remote Control**: Radio frequency based remote control should activate the gate from the distance of 50 - 100 ft depending upon local environmental conditions.

7. **Auto close mode**: If auto close mode is selected in control panel, the gate should close automatically after a preset time of 10sec - 70 sec.

8. **Weight**: Approx 1000KG

The job will be design & executed by Godrej or authorized vendors of M/S Godrej.

---

### 3.13 TECHNICAL SPECIFICATION of MODULAR PARTITIONS/ WORKSTATIONS
Modular Workstation will be comprising of modular partition panels with frame, table top, side units, wire management systems running with the partition at two levels, one at skirting level & another at table top level or as specified in drawing. The complete system would be free standing, rigid without any attachment to walls/floor. Complete system could be completely knockdowned and reassembled with different configuration. The minimum thickness of panel will be min. 65mm.

Frames: - The frame work shall be made of Knockdown metal frame comprising of vertical sections made from min. 1.5 mm CRCA MS (D Grade) formed into channels. The channels to have front tear drop slots in them at suitable interval to accept tile claddings. It should also have slots at different heights for fixing tabletop brackets, storage units, shelves accessory brackets etc. The top Horizontal member of this frame shall be made from M.S square pipe of min. wall thickness 1.2 mm & the bottom Horizontal member of this framework will M.S section of wall thickness 1.5 mm. All frameworks will be powder coated in approved colour to a thickness of 40 – 50 microns.

The frames are fixed with aluminium trims. These trims are finished in a epoxy powder coating finish. The connectors at the top of the frames are made out of plastic end trim holders.

Raceway :- The partition panel shall have an intermediate metal raceway above the work surface consisting of powder coated (of approved shade) CRCA MS “C” section of required size and to be located on both side of panels having cut-outs of required size for installation of electrical switch board. The partition panel shall have another metal Raceway fascia as bottom skirting consisting of powder coated CRCA MS “C” section, to be located horizontally on both sides of panels.
The workstation shall have proper wire management where the cable / wires are carried inside the panels and are accessible through metal raceways located at bottom & intermediate level of the panel.

Each panel to be provided with glide screws at the base for adjusting the level of the partition up to +20 mm to allow for variation in the flooring level. The partition panels shall be connected in 2way, 3way, 4way layout as the case may be with 2way, 3way, 4way M.S connecter brackets and the junctions are covered by powder coated aluminium extrusions of alloys. End panels shall be finished by an end trim made of aluminium alloy of approved size. Each extrusion shall be covered with metal caps from the top.

Tiles Cladding :-

9 mm (min.) thick pre laminated particle board conforming to IS – 12823 – 1990 edge banded by PVC edge banding and fitted with nylon buttons on the rear side for fixing to partition frame and with stiffners for additional strength. Pre-laminated Cladding to be made on both sides of partitions below the intermediate raceway.

Fabric tiles constructed out of 10 mm (min.) thick Medium Density fiber Board (MDF) and covered with approved fabric. Fabric Tiles to be cladded to the partition frame above the intermediate raceway on both side of frame. Fabric shall so fixed that it could be open easily if required for maintenance.

Magnetic tiles constructed out of 1.2 mm thick Galvanized sheet and covered with fabric of choice, will be fixed with partition where mention in BOQ/ Drawing.

Work surface shall be made of 25 mm thick pre laminated particleboard (exterior grade) of approve make of shade conforming to I.S 12823 – 1990. Bottom shall have a backing lamination of min 0.6 mm thickness. The edge of
work surface shall be provided with machine pressed 2mm thick PVC lipping glued with hot melt EVA glue.

One side of work surface shall be mounted on to the partition panels for workstation by means of appropriate cantilever brackets made from CRCA grade D steel as per IS – 513 – 1994 duly pre-treated and powder coated in black colour and the other side of worktop shall be supported on gable end or otherwise as shown in drawings or as mentioned in BOQ. All work surface shall be provided with circular cut-outs as per requirement and these cut-outs shall be provided with ABS covers. Modesty panel of required width will be provided whereever required.

Plastic keyboards pull out tray made of ABS shall be provided as per requirement. It shall have in built LHS/RHS mouse pad. The said tray shall be mounted on telescopic sliding channels.

### 3.14 SEWAGE TREATMENT PLANT

Providing, installation, testing commissioning Sewage treatment plant of capacity 45KLD with Fluidized Aerobic Bed Reactor system of approved make, consists of following parts:

- Bar screen chamber,
- Oil & grease trap,
- FAB,
- Tube settler tank,
- Sludge drying bed,
- Chlorine Contact Tank etc.

All the mechanical & Electrical parts / equipments etc. strictly as per manufacturer’s specification. All the pipes, valves, pressure gauges etc. should conform relevent Indian standards. Electrical layout with DB, Control panel wiring etc. as per manufacturer’s layout / as approved by the Engineer in charge.

The treated sewage characteristics should conform the acceptable limits as per Indian standard. The scope also includes design of plant supply of P&I diagram, sewage treatment plant layout, General arrangement drawings for civil units.

The Operation and maintenance upto one year will be the responsibility of the contractor.
4. 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 Consultant / 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 Consultant / Engineer-in-Charge in an approved Laboratory.

iv: To extend facilities to the Consultant / 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 Consultant / 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 Consultant / 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 Consultant/ Employer 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 Consultant 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 Consultant/ Employer 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 Consultant/ Employer.

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 Consultant 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 Consultant 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 site engineer 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 Consultant/ 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 owner's site engineer. This certificate shall be in the prescribed forms in addition to the test certificate required by the Local Electric Supply Authorities. Recommended completion certificate's Format is given in Appendix 'A'.

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 Consultant/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 Consultant/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.

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 Consultant / 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:

<table>
<thead>
<tr>
<th>Colour</th>
<th>Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red or any colour (other than black or green)</td>
<td>For phase or switch wire</td>
</tr>
<tr>
<td>Black</td>
<td>For Neutral</td>
</tr>
<tr>
<td>Green</td>
<td>For earth</td>
</tr>
</tbody>
</table>

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 P.V.C 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

This system of wiring shall comply with all the requirements of surface conduit wiring system specified in Causes 5.1 to 5.6 in addition to the following points:
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 (as specified in BOQ) 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 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 up to a point as close as 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 Consultant/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 ‘falking’ 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 Consultant/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 Consultant/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 Consultant/Engineer-in-Charge.

The cable marker shall be of cement concrete slab of R.C.C.type (l: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 Consultant/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>Material</td>
<td>Copper</td>
<td>Aluminium</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Copper</td>
<td>Aluminium</td>
<td>Aluminium or tin plated copper</td>
</tr>
<tr>
<td>Silver/tin plated copper</td>
<td>Aluminium</td>
<td>Tin plated copper</td>
</tr>
<tr>
<td>Aluminium</td>
<td>Copper</td>
<td>Copper or 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 galv. bolt, double nuts using double galv. 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 metre 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 metre apart and preferably placed at distance greater than 6 metres.

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 busbars 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 busbar 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 busbar. 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 busbar 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.

WORKMANNERSHIP 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 Consultant/ Engineer-in-Charge.

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 Consultant/Engineer-in-Charge the contractor shall remove the same and supply better and approved materials at his own cost to the satisfaction of the Consultant/Engineer-in-Charge.

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

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 Consultant/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

The workmanship shall be first class and all supply material and installation work shall be completed to the full satisfaction of the Consultant/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

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 Consultant / 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 Consultant / 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 multitier 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 2000mm.

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 withdrawable 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 assemblie

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 bipin 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 Consultant/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 up to 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.

**CEILING FANS AND REGULATORS**

The ceiling fans and regulators shall conform to IS: 374-1979. The fans shall have totally enclosed capacitor start and run motors suitable for operation on 230/240 Volt, single phase, 50 Hz. A.C. system. The regulator shall have an ‘ON’ -'OFF’ position next to the lowest speed contact and shall be provided with at least five running positions.

**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 Consultant/ 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 Consultant / 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 Consultant/Engineer-in-Charge.

Ventilation louvers 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 swagged 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 verminproof 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.

**WORKMANSHP 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 Consultant/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 fabricating and fixing of above stated items.

ii: Scaffolding including erection and removal.

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

iv: Necessary modification of pre-laid conduit including supply & fixing of Metal/ PVC conduits and accessories, chase cutting, etc. as required to complete the work.

### MANDATORY TEST

<table>
<thead>
<tr>
<th>SL. No</th>
<th>Item Description</th>
<th>Nature of Test</th>
<th>Approved Specification</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H.T. Switchgear</td>
<td>a. Shop Test</td>
<td>IS: 10118,(Part-III)1982</td>
<td>All Routine Test including High Voltage Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>IS: 13118 –1991 IEC: 56-187</td>
<td>All Routine Test including High Voltage Test</td>
</tr>
<tr>
<td>2</td>
<td>Power Transformer</td>
<td>a. Shop Test</td>
<td>IS:2026-1977</td>
<td>All Routine Test including temperature rise Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>IS:10028(part-II)1981</td>
<td>All Routine Test including temperature rise Test</td>
</tr>
<tr>
<td>3</td>
<td>L.T. Switchboard, Dist. Board, Power Control Panel, Feeder Board</td>
<td>a. Shop Test</td>
<td>IS: 4237</td>
<td>2500V to withstand for 1min. and Clearance and creepage to be check.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>IS: 5039</td>
<td>Do</td>
</tr>
<tr>
<td>4</td>
<td>A.C.B</td>
<td>a. Shop Test</td>
<td>IS 2516 (Part I &amp; II)1985</td>
<td>Shop test to be witnessed by NBCC. Test certificate to be produced.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>Do</td>
<td>Operation of the breaker : Operation of protective devices; Indicating lamp to be checked.</td>
</tr>
<tr>
<td>5</td>
<td>MCCB</td>
<td>a. Shop Test</td>
<td>IS: 2516 (Part I &amp; II) 1985</td>
<td>Manufacturers Test Certificate to be furnished</td>
</tr>
<tr>
<td>6</td>
<td>RCCB</td>
<td>a. Shop Test</td>
<td>IS: 12640</td>
<td>Manufacturers Test Certificate to be furnished</td>
</tr>
<tr>
<td>8</td>
<td>Wires/ Cables</td>
<td>a. Shop Test</td>
<td>IS: 694 IS: 1554</td>
<td>Manufacturers Test Certificate to be furnished</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Diameter of each strand of wires/ cables</td>
<td>IS: 8130</td>
<td>Diameter to be measured at site before use to confirm the correctness of the wire/ cables.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Overall diameter</td>
<td>IS: 694 IS: 1554</td>
<td>Do</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Resistance</td>
<td>IS: 8730</td>
<td>Resistance of 100M of wires/cables to be measured.</td>
</tr>
<tr>
<td>9</td>
<td>Conduit Thickness</td>
<td></td>
<td>IS: 9537</td>
<td>Only ISI marked conduit to be used.</td>
</tr>
<tr>
<td>10</td>
<td>Earthing Earth Electrode Resistance</td>
<td></td>
<td>IS: 3043-1978</td>
<td>Resistance to be measured.</td>
</tr>
</tbody>
</table>

**NOTE:**

1. It is the Contractor’s Responsibility to arrange for all Instruments for measurement and testing of above.

2. EPIL reserves the right to get any item tested by approved Test Laboratory for which all costs will have to be borne by the Contractor. All the costs for testing of materials to be borne by the contractor.

5. **TECHNICAL SPECIFICATIONS OF SUB – STATION EQUIPMENT AND D.G. SET**

**H.V.SWITCHGEAR**

Construction:
The HV switchgear panel shall be of totally enclosed tropicalised, dust and verminproof, pressed sheet steel floor mounting cubicles. The rear and top of the cubicle shall have bolted covers. It shall be possible to form a complete line up of panels by joining individual cubicles which shall be easily extensible. The busbars shall be of copper of electrolytic grade as mentioned in the detail specification. It shall have continuous current carrying capacity as specified. The busbar shall be properly shrouded with PVC sleeves or tape or shall be resin cast to prevent accidental touch and their supports shall be so arranged as to withstand effectively electromachanical stress in the event of a short circuit.

All the steel materials used in the construction of the panel should have undergone a vigorous rust proofing process which must comprise alkaline degreasing, descaling in dilute sulphuric acid and a recognized phosphating process, the steel work shall then receive two coats of high corrosion resistant primer paint and finished by application of synthetic enamel paint of approved shade.

All instruments, relays and indicating lamps shall be flush mounted on the front panels of the switch board to allow easy access to small wirings. All potential circuits should be protected by HRC fuse links. The fuses should be mounted near the tap-off points from the main connections so that a fault in the instruments wiring does not effect the main supply. The instruments shall be of Alstom / Automatic Electric / I.M.P / Universal electric / GEC/ Ashida.

All control wiring within the panel shall be of 660V grade single core, fire resistant PVC cable with copper conductors having minimum size 2.5 sq.mm and conforming to IS 694-1977. The control wiring shall be properly bunched and cleated with no joints or lapping made between two terminations. Not more than two connections shall be made at any one terminal. The wires shall be arranged and supported in such a manner that there shall be no strain on terminations.

The panel wiring shall be accessible from the front where control devices are mounted on the door, flexible cables shall be provided with loops and anchored around the door hinges to prevent breaking of wires.

All control wiring shall be brought out to terminal blocks with screw type connections. 10% spare terminals shall be provided on each block. The terminal blocks for control cables shall be completed with terminal studs, links, nuts, spring washers, label carrier etc. Terminal blocks shall be provided for connection to external equipments. Power terminal blocks shall be segregated from control terminals.

All terminals as well as terminations at various control devices shall be provided with ferrule having engraved black numbers.

System : 11KV, 350MVA, Current rating as per BOQ, 3 phase, 3 wire, 50 cycles AC

11KV Metal Clad, Vertical/Horizontal Isolation, Horizontal Drawout, floor mounted, indoor type, Single panel Vacuum Circuit Breaker Switchboard comprising of:

Fabricated Indoor Housing
800 A single pole isolating plugs & sockets
Set of automatic safety shutters
1 – 800 Amps triple pole type Vacuum Circuit Breaker suitable for a rupturing capacity of 350 MVA at 11 KV, fitted with manual operated independent spring charged type mechanism with mechanical ON/OFF indicators having 1 no. 110V DC Shunt trip coil
Set of mechanical interlocks
Auxiliary switch (4NO + 4NC)
Rectifier Condenser Unit
3 – 100/50/5-5A ratio, double Core Current Transformer, 15VA output at 5P10 accuracy for protection and class-1 for metering
1 – 11KV/110V ratio 3 phase 3 limb star/star connected draw out type resin cast Potential Transformer with 100 VA per phase output at Class-1 accuracy along with HT/LT fuses, shutters etc
1 – Digital Multimeter for indication of Amp, KV, KW, KVAR, KWH, Hz
1 – Triple pole non directional shunt trip OCEF relay having 2 O/C element of setting 50-200% and 1 no. E/F element of setting 20-80%
1 – Push button for emergency Trip
2 – Indication lamp (RED/GREEN) for breaker ON/OFF indication
1 – White lamp with push button for healthy trip indication
1 – Rear entry cable termination arrangement of 185 sq. mm XLPE cable
1 – Side entry cable box suitable for termination arrangement of 185 sq. mm XLPE cable

**DISTRIBUTION TRANSFORMER**

**DRY TYPE TRANSFORMERS**

Scope
This specification covers design, manufacture, testing and supply at site of following power transformers including fittings and accessories in accordance with the requirement laid down in relevant IS codes and I.E rules.

Standards The dry type transformer shall comply with the latest edition of the following and other relevant Indian standards:

- IS:1271 - Classification of insulating materials
- IS:2026- Power transformer General (Part I)
- IS:2026- Power transformers – temperature rise (Part II)
- IS:2026- Power transformer – insulation level and dielectric test (Part III)
- IS:2099- High voltage porcelain bushing
- IS:3202- Code of practice for climate proofing
Component
The equipment shall be brand new & complete in all respects. Any material or accessories, not mentioned specifically but requirement of which is normal or necessary for satisfactory and trouble free operation and maintenance shall be supplied with the equipment.

Design Basis
The transformer shall be designed for continuous operation at the specified conditions:

<table>
<thead>
<tr>
<th>Type</th>
<th>AN / Indoor type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector group</td>
<td>Dyn 11</td>
</tr>
<tr>
<td>Voltage variation</td>
<td>± 10%</td>
</tr>
<tr>
<td>Frequency variation</td>
<td>± 5%</td>
</tr>
<tr>
<td>Combined voltage and frequency variation</td>
<td>± 10%</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>45°C</td>
</tr>
<tr>
<td>Altitude</td>
<td>Less than 1000 m</td>
</tr>
<tr>
<td>Climate</td>
<td>Hot and humid</td>
</tr>
<tr>
<td>Neutral LV</td>
<td>Solidly earthed</td>
</tr>
</tbody>
</table>

Transformer shall be dry type and designed for natural cooling.
The transformer shall be capable of operating continuously at rated output without exceeding the temperature rise limits as given below:
Winding by resistance method - 55°C
Transformer shall operate with minimum noise and vibration.
Transformer shall be designed to suppress harmonic contents particularly third and fifth, noise on communication and undesirable circulating currents between the neutrals at different transformer stations.
The transformer shall be designed for minimum no-load and load losses.

Tap changer:
The transformer shall have off-circuit tap changer which will be operated by an external 3 phase gang operated switch. The operation will be done by a hand wheel available at standing height from the ground level. The tap changer will be provided with tap indicator and pad lock arrangement. The changing contacts shall be silver plated and held in position securely under strong spring pressure to avoid contact pitting.

Core and coils:
Transformer may be of core or shell type. The core shall be built up with interleaved grade, non aging, low loss, high permeability, grain oriented, cold rolled silicon steel laminations properly treated for core material. The coils shall be made from continuous and smooth electrolytic copper conductor of high conductivity and 99.9% purity. The core and coil assembly shall be fixed in a manner to prevent shifting or deformation in any condition and natural cooling should be such to reduce hot spot of the winding. All leads from the windings to the terminals and bushings shall be rigidly supported to prevent injury from vibrations or short circuit stresses. The core clamping frame shall have lifting eyes and core assembly shall be effectively earthed to transformer tank.

Construction
Transformer tank shall be of welded sheet steel construction and provided with gasketed steel cover plates. Base shall be suitably reinforced to prevent any distortion during lifting, base channels shall be provided with skids and pulling eyes to facilitate handling. All fasteners and bolts etc. shall be galvanised or zinc passivated. All surfaces to be painted shall be thoroughly cleaned, descaled, made free from rust. External surface shall be given a priming coat of rust resisting paint followed by two finishing coats of approved shade. Paint shall be suitable to withstand specified atmospheric condition.

Terminals and Marshaling Box: Windings shall be brought out and terminated on outdoor cable boxes/bus duct which will be as specified on the data sheet. Glands shall be suitable for XLPE cable / PVCA cable complete with armour clamps. Cable lugs shall be non-soldering tinned copper crimping type. Marshalling box shall be weatherproof and dust tight. All protective devices and alarms shall be wired by means of PVC insulated armoured cables upto the marshalling box. Terminals shall be Elmex type or equivalent. Removable gland plate with compression type glands shall be provided. Neutral of the star connected secondary winding shall be brought out to a secondary terminal. An extra neutral bushing shall be provided for neutral grounding of transformer.

Accessories: Accessories as specified on the data sheet, shall be included in the scope of supply on this point and shall specifically be noted. Thermometer pocket with mercury in glass thermometer (0-120°C). All controls, alarms, indication shall be wired up to terminal blocks inside.

Transformer Fittings : The transformer shall be fitted with all standard, special fittings and accessories as per IS

- Inspection covers
- Rating, diagram and tap connection plates (to be positioned so that it is visible from front of the transformer)
- Terminal marking plate
: Two earthing terminals
: Lifting lugs, jacking pads and haulage lugs
: Thermometer pocket for additional thermometer
: Bulb type thermometer
: Under carriage with Bi–directional flat rollers with locking and bolting device
: Winding temperature indicator with alarm and trip contact
: Marshalling box complete with all instruments, accessories and fittings as required for the transformer to be mounted on the front of the transformer.

Tools and Tackles

Any special tools and tackles required for installation and maintenance shall be supplied with the transformer.

4.12 Tests

(A) Type test: The supplier shall submit temperature rise result on a similar type and rating transformer for approval of purchaser.

(B) Routine test: The following routine tests as per IS:2026 shall be conducted at the manufacturer’s premises in presence of purchaser’s representative.

(a) Measurement of winding resistance
(b) Measurement of voltage ratio and check of voltage vector relationship
(c) Measurement of impedance voltage/short circuit impedance (principal tapping) and load loss
(d) Measurement of no – load loss and current
(e) Measurement of insulation resistance
(f) Dielectric tests

TECHNICAL PARTICULARS

Transformer

1. No. of Transformer As per BOQ
2. Rated Output (KVA) As per BOQ
3. Voltage ratio (KV) 11/0.433
4. Rated frequency (Hz) 50
5. Phase 3
6. Vector Group Dyn 11
7. Duty Continuous
8. Maximum Efficiency -
9. Type AN
10. No. of windings Two
11. Impedance % 5.0
12. Winding Insulation Uniform
13. Neutral Solidly earthed from separate bushing
14. Tap Changer on HV side Off Load
15. No. of taps ± 5% in steps of 2.5%
16. Service Indoor
17. Parallel operation Required
18. Site condition Hot & Humid
19. Ambient temperature 45°C
20. Terminal arrangement
   HV (11KV GRADE) As per BOQ
   LV(1.1 KV GRADE) As per BOQ

4.13 Dry Type Transformer

The following provisions shall be made in case of supply of Dry Type Transformer.

1. Dry Type Transformer shall be encapsulated type, naturally cooled (AN) and moisture proof. Insulating material used in the construction shall be of low smoke emitting type, low flammability and free of toxic gas emission.
2. The transformer shall be suitable for indoor use.
3. The transformer shall conform to requirement of IS:11171-1985 for dry type transformer.
4. Coil insulation of transformer shall be glass fibre reinforced conforming to Class ‘F’. Coils shall be so insulated that impulse and power frequency voltage stresses are minimum and shall withstand even the severest of temperature fluctuation.
5. Temperaturerise above 50°C:
   a) in winding by resistance: 90°C
6. Enclosure whenever used, shall be fabricated from sheet steel of 2 mm thickness (min.). Degree of protection shall be at least IP 23, with the necessary vermin proofing.

7. Fittings and Accessories

Each transformer shall be equipped with fittings and accessories, as listed below:

1. Maximum winding temperature monitoring device with electrically separate sets of contacts for alarm and trip, along with temperature sensing element embedded L.V windings of all three phases (trip and alarm settings shall be separate).

2. Handling & lifting lugs for both enclosure and core coil assembly.

3. Jacking pad for core coil assembly.

4. Flat type bi-directional rollers with locking arrangement for core-coil assembly.

5. Inspection cover for cable end box.

6. Door handle operated safety limit switch with 1 NO + 1 NC contact.

7. Ground bus.

8. IP-54 marshalling box.

9. Rating and terminal marking plate.

10. All indication, alarm, trip contacts provided shall be rated for 0.5A at 220V DC and 5A at 240.

**Data Sheet**
(To be filled in by Vendor)

**Distribution Transformer (DRY TYPE)**

<table>
<thead>
<tr>
<th></th>
<th>Make</th>
<th>Type</th>
<th>Reference Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>1.1</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>1.2</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>1.3</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
</tbody>
</table>

64
2.0 Rating

2.1 Rated output KVA :

2.2 Type of cooling :

2.3 Rated voltage V
   H.V :
   L.V :

2.4 Rated current A
   H.V :
   L.V :

2.5 No. of phases :

2.6 Rated frequency Hz :

2.7 Vector group reference :

3.0 Temperature

3.1 Reference ambient temp. Deg.C :

3.2 Temperature rise over reference ambient
   a) In winding by resistance Deg.C :

3.3 Hottest spot temp. in winding
   limited to Deg.C :

4.0 Tapping

4.1 Type :

4.2 Capacity :

4.3 Range – steps x % variation :

4.4 Taps provided on H.V winding :

5.0 Insulation Level KV/KVp :

5.1 H.V :

5.2 L.V :

5.3 L.V neutral :

6.0 Impedance at Principal Tap
   Rated Current and Frequency :

6.1 Impedance :

6.2 Reactance :

6.3 Resistance at 75 Deg.C :

7.0 Guaranteed Losses at Principal Tap Full Load and 75 Deg.C

7.1 No. load losses KW :
7.2 Load losses KG:
8.0 Efficiency at 75 Deg.C and 0.8 Power Factor Lag
8.1 At full load %:
8.2 At ¼ full load %:
8.3 At ½ full load %:
9.0 Regulation at full load and 75 Deg.C
9.1 At unity power factor :
9.2 At 0.8 power factor lagging :
10.0 No load current referred to H.V
10.1 At 90% rated voltage Amps:
10.2 At 100% rated voltage Amps:
11.0 Details of Enclosure/Tank
11.1 Material :
11.2 Thickness (Side/Bottom/Cover) mm:
11.3 Degree of protection :
11.4 Tank pressure test for one hour kg/cm sq:
11.5 Tank vacuum test for one hour mm of Hg:
12.0 Core
12.1 Type – Core / Shell :
12.2 Core material :
13.0 Coils
13.1 Type of coils
a) H.V :
b) L.V :
13.2 Conductor material :
14.0 Tap Changer
14.1 Provided with
a) Tap position indicators :
b) Padlocking provisions :
14.2 All contacts silver plated :
15.0 Bushing
15.1 Type :
15.2 Reference standard

15.3 Voltage class

16.0 Terminal connections
16.1 H.V
16.2 L.V & N
16.3 L.V Neutral

17.0 Marshalling Box
17.1 Suitable for
Indoor
17.2 Degree of protection
17.3 Provided with removable gland plate/conduit knock out

18.0 Accessories
18.1 Each transformer furnished with fittings and accessories as per Annexure

19.0 Approximate Overall Dimension
19.1 Length mm
19.2 Breadth mm
19.3 Height mm

20.0 Approximate Weights
20.1 Core and Coils Kg
20.2 Total weight Kg

---

**MV SWITCH BOARDS (LT Panel)**

3.1 Particulars of the system

Operating voltage : 433 V
Frequency : 50 Hz
Phase : 3 ph. 4-wire
Neutral : Solidly earthed

Fabrication & approval for manufacturer

The MV switch boards shall be factory fabricated from 14 SWG CRCA sheet,(AS SPECIFIED IN boq) totally enclosed, dust tight, vermin proof, indoor free standing, floor mounting and fully compartmentalised cubicle construction.
The panel manufacturer shall have a pre-painting 7 tank process for sheet treatment.

The design and construction of switch board shall generally conform to relevant IS. The busbar chamber shall be extensible on both sides. The cable alley shall be provided at the back side.

The successful tenderer shall take prior approval for the panel builder/fabricator along with G.A. drawing of MV panel before start of fabrication of MV panel.

**Busbars**

Rating of busbars

<table>
<thead>
<tr>
<th>No. of busbars</th>
<th>3 phase and neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulating voltage</td>
<td>1.1KV</td>
</tr>
<tr>
<td>Normal current</td>
<td>as specified in the BOQ</td>
</tr>
</tbody>
</table>

Construction of busbars

The busbars shall be air insulated electrolytic grade copper/Aluminium (as per boq) bars enclosed in a sheet steel chamber. Busbar arrangements shall comply with relevant IS. Busbars connection shall be done with high tensile bolts. Busbar shall be sleeved with heat shrinkable sleevings of red, yellow, blue and black colours.

The feeder details shall be as per Schedule of Quantities/Bill of Quantities (BOQ).

**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 IS: 1554 (PART-I)1988 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.

**EARTHING**

**GENERAL REQUIREMENT** : Separate pair of earthing with interconnection between two earth stations, for each LV system, Neutral, Transformer, HT gear have to be provided and connected to individual major equipment in substation including DG.

The neutral points of L.V system and all exposed metal parts of the electrical equipments in the substation shall be connected to earth electrodes by not less than two separate and distinct connection in accordance with Indian Electricity Rules, and the relevant Indian Code of practice for earthing I.S. 3043---1987.
EARTH ELECTRODE:
Earthing the installation with Cu. plate of size 600 mm x 600mm and 3mm in thickness for equipment and neutral earthing respectively complete with 15mm dia and 60mm length galvanized iron bolt, double nut washer, buried such that the top edge is at a depth of 3000 mm below ground level including supply and fixing 19 mm dia (Class B) G.I. water pipe with funnel fitted with wire mesh masonry inspection pit of 300mm x 300mmx and 300mm covered with locking arrangement having firmly grouted on base frame, charcoal and salt around the G.I. earth plate as required and restoring the surface duly rammed as per I.S. Code of Practice for earthing IS-3043 – 1987 (for details please refer fig 15 of IS3043-1987).

A masonry inspection pit shall be built with 125 mm thick cement mortar brick work both inside and outside plastered 20mm thick and neatly cemented 1.5 mm thick, inside top and outside around the top of the water pipe so that the top of the GI Pipe is 250mm below the finished ground level and the opening on top shall be provided with CI hinge cover fixed flushed with the outside finished ground level.

EARTH BUS AND EARTHLEAD: The earth busbars shall be of heavily galvanized GI Flat of cross section as specified in the schedule of quantities having adequate number of drilled holes with 15mm galvanized steel bolts, nuts and spring washers for security connecting joints shall be either riveted bolted or welded. All joints shall be either riveted bolted or welded. For rust protection the welds should be treated with barium lead and aluminium paint in turn and afterwards coated with bitumen. Main earth busbar shall be fixed on wall surface to allow for making permanent or temporary connections. The earth lead shall be 2Nos. 50mm x 6mm galvanized M.S. flat connected securely to the earth busbar.

EQUIPMENT EARTHING: For earthing the substation equipments viz. Transformer, H.T. switch-gear panel L.T. P.C.C. board and Diesel Generator set galvanized M.S. flat, unless otherwise specified, shall be used as earth continuity conductor. The same shall run on wall, floor, etc as required. Earth continuinity conductor shall be securely connected to the metal framework of the equipment and earth busbar cable of gland/box of HT cable.

SPARES
The tenderer shall include in this tender and provide with the equipment sufficient quantity of commissioning spares required for proper erection and commissioning of the equipment until final acceptance. Further more the tenderer shall submit a list of recommended spares and quote separately prices of spares required for one years operation of each equipment.

TESTING & COMMISSIONING
Before each test on any apparatus the contractor shall obtain the permission from the site Engineer and all tests shall be prepared immediately after the test and this record shall be signed by contractors representatives 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.
Before starting the testing of various equipment, the contractor shall ensure that the erection works have been carried out and completed in all respects. The contractor must ensure that all safety gadgets are in position and all the earthing connections are proper and rigidly connected.
The contractor shall take all safety precautions as per standard code of practice and manufacturer’s recommendations to prevent danger to the testing and other personnel in the vicinity of testing equipment. The contractor shall
cordon off the area where high voltage tests are in progress and put up appropriate danger boards on all the sides.
The contractor shall bring the testing equipment to site and make available for testing to be the carried out whenever required. The following are the minimum requirements:

- Insulation resistance measuring equipment constant pressure type megger 500V, 1000V, 2500V and 5000V.
- Avometer
- Clip on Ammeter, Voltmeter, AC and DC type
- Phase Sequence meter
- Thermometers
- Earth resistance measurement megger
- High voltage or high pressure testing equipment

On completion of the electric installation and before handing over except H.V. Test on Switchgear, transformer and primary injection test on current transformer all I.E. Rules and relevant I.S. at no extra cost. The HV and primary injection tests shall be performed by the contractor if required by the EPI/Client.

A certificate in quadruplicate shall be furnished by the contractor countersigned by the supervisor under whose direct supervision the installation was carried out and the EPI Engineer.

After the installation is tested and approved by the authorities, the contractor shall arrange necessary clearance from the Electrical Inspector, Directorate of Electricity, Pollution Control Board and provide all assistance to the owner/EPI for obtaining the service connection and commissioning the Substation at no extra cost.

MAKE OF EQUIPMENT

Technical literature about the type of equipment offered by the tenderers shall be enclosed with their offer. Make of all the equipment must be clearly mentioned against each item from the approved list of manufacturers. Recommended list of manufacturers is given in the list of approved make.

MANUFACTURERS DRAWINGS

The contractor shall submit for approval general arrangement and section drawings showing equipment clearances, entry location of power and control cables in four sets before commencing manufacture. After obtaining approval of the above drawings, the manufacturer shall supply four sets of certified drawings including the following:

- Single line and schematic diagrams for switchboards,
- Internal wiring diagrams with all relevant terminal markings of each electrical components.
- General arrangement drawings showing front and side views, complete with dimension,
- Drawings not mentioned above but necessary for complete installation and efficient operation of the equipment;

MANUFACTURERS TEST CERTIFICATE AND INSTRUCTIONS
The contractor shall supply two sets of the followings along with the delivery of the equipments.

- Test certificate for each item of equipment,
- Manufacture catalogue for spare parts with specification and drawings.
- Instruction in English language for operation and maintenance of the equipment.
- Complete list of equipment indicating individual items with rating, capacity and services etc.

**SUB –STATION LAYOUT**

The contractor shall elaborate in consultation and in agreement with EPI, the detailed drawings showing the general arrangement of sub-station layout indicating switchgear room, transformer room, cable trenches, earth station room, Location of D.G Set etc.

**DRAWING ON COMPLETION OF WORK**

On completion of all works the contractor shall furnish two sets of prints of all drawings incorporating all changes that might have been effected during the execution of the work.

**INSPECTION**

Client/ EPIL shall be at liberty to carry out periodical inspection of the various equipment at the manufacturers works during the course of manufacture. The contractor shall submit periodical reports on the progress of manufacture and erection.

**GUARANTEE AND WORKMANSHIP**

The contractor shall furnish guarantee indicating that the equipments supplied and installed shall give the specified results and outputs as required in the specification.

The contractor shall rectify the defects free of cost for a period of one year from the date of commissioning of the equipment.

The workmanship shall be good quality and all supply, installation and commissioning work shall be completed to the full satisfaction of the Engineer-in-charge.

**DELIVERY**

The tenderer shall quote the best and earliest delivery. The delivery shall be quoted for site basis. The time schedule for delivery and erection of equipment shall be indicated in the tender.

**APPENDIX - B**

**SCHEDULE OF SITE TESTS**

**Particular of Test**

A. H.T Switchgear/Switches,
   Insulation resistance of main circuit tested by using 1000 Volt magger for Switchgear upto 1000V and 2500V megger for high voltage (IS-3072-1973),
   Insulation resistance of auxiliary and control circuit by using 500V megger(IS-3072-1975),
   H.V. Test (IS- 3072-1975),
Operation checks (IS 3072-1975),
Tests on protective relays (IS-3072-1975)
Secondary injection test,
Tripping an Inter-tripping test.

B. Transformer

H.V. Test (IS-2026-1977)
Insulation resistance of each winding to earth using 1000V megger for winding upto 1000V and 2500V megger for higher voltage (IS 2026-1977)

Insulation resistance using 1000V megger for equipment connected to main circuits and 500V megger for equipment connected to auxiliary and control circuits.

D. Cables and Wires,
Insulation resistance using 2500V megger for circuits above 1000V and 500V megger for auxiliary and control circuits,
Pressure testing or 11/6.6 KV cable terminations.

MANDATORY TEST

<table>
<thead>
<tr>
<th>SL. No</th>
<th>Item Description</th>
<th>Nature of Test</th>
<th>Approved Specification</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H.T. Switchgear</td>
<td>a. Shop Test</td>
<td>IS: 10118,(Part-III)1982</td>
<td>All Routine Test including High Voltage Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>IS: 13118 –1991 IEC: 56-187</td>
<td>All Routine Test including High Voltage Test</td>
</tr>
<tr>
<td>2</td>
<td>Power Transformer</td>
<td>a. Shop Test</td>
<td>IS:2026-1977</td>
<td>All Routine Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>IS:10028(part-II)1981</td>
<td>All Routine Test including</td>
</tr>
<tr>
<td>3</td>
<td>L.T. Switch Board, Dist. Board, Power Control Panel, Feeder Board</td>
<td>a. Shop Test</td>
<td>IS: 4237</td>
<td>2500V to withstand for 1min. and Clearance and creepage to be check.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>IS: 5039</td>
<td>All Routine Test</td>
</tr>
<tr>
<td>4</td>
<td>A.C.B</td>
<td>a. Shop Test</td>
<td>IS 2516 (Part I &amp; II)1985</td>
<td>Test certificate to be produced.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>Do</td>
<td>Operation of the breaker : Indicating lamp to be checked.</td>
</tr>
<tr>
<td>5</td>
<td>MCCB</td>
<td>a. Shop Test</td>
<td>IS: 2516 (Part I &amp; II) 1985</td>
<td>Manufacturers Test Certificate to be furnished</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Site Test</td>
<td>Do</td>
<td>Operation of the breakers to be tested.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>RCCB</td>
<td>a. Shop Test</td>
<td>IS: 12640 Manufacturers Test Certificate to be furnished</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Wires/ Cables</td>
<td>a. Shop Test</td>
<td>IS : 694 IS : 1554 Manufacturers Test Certificate to be furnished</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Diameter of each strand of wires/ cables</td>
<td>IS: 8130</td>
<td>Diameter to be measured at site before use to confirm the correctness of the wire/ cables.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Overall diameter</td>
<td>IS: 694 IS: 1554</td>
<td>Do</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Resistance</td>
<td>IS: 8730</td>
<td>Resistance of 100M of wires/cables to be measured.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Conduit Thickness</td>
<td>IS: 9537</td>
<td>Only ISI marked conduit to be used.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Earthing Earth Electrode Resistance.</td>
<td>IS: 3043-1978</td>
<td>Resistance to be measured.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>KWH meter</td>
<td>a. Shop Test</td>
<td>Manufacturers Test Certificate to be furnished</td>
<td></td>
</tr>
</tbody>
</table>

NOTE:

It is the contractors responsibility to arrange for all instruments for measurements of above
EPIL reserves the right to get any item tested from approved test laboratory for which all cost shall be borne by the contractor.
All the costs for testing of materials to be born by Contractor.

**Technical Specification for Diesel Generator Set with Acoustic Enclosure**

Electric Generating set including Engine and A.C. Generator on M.S. frame duly bolted, coupled, aligned, tested and housed within the acoustic enclosure complete with the followings:

Automatic Electric Start Diesel Engine, generally at 1500 R.P.M., multi cylinders, Turbo Charged after cooled, Radiator Cooled, 4 Stroke, heavy duty, power generation diesel engine as per IS 1002/ BS 5514/ISO 3046, complete as per manufacturers standard scope of supply with the following accessories:
Flywheel with Flywheel housing
Inlet manifold and oil bath air cleaners
Gear type Lube. Oil pump
Lube of filter
MICO/BOSCH fuel injection system with injector pump Nozzles

Mechanical Governor
Fuel filter (Double bowl)
Exhaust manifold (uncooled)
Radiator with fan
Exhaust silencer (heavy absorption type)

**Automatic Electric starting arrangement consisting of**

Starter motor
Battery charging alternator

**Engine instrument panel consisting of**

Starting push button
Lub. Oil temp. gauge
Lub. Oil pressure gauge
Water temperature gauge
Battery charging Ammeter
Tacho cum hour meter

**Engine protection unit against**

Low lube oil pressure
High water temperature

**A.C. Generator**

Suitable rating alternator, brush less type, capable of developing the required output at 3 phase, 0.8 p.f., 415 volts, 50hz, when running at 1500 rpm under N.T.P> conditions in accordance with BS:2613, insulation class will be ‘H’, voltage Regulation + 1%.

**Control Panel**

Standard Alternator Control Panel fabricated out of sheet steel angle, iron structure, acid treated for anti corrosion, floor mounting, cubicle pattern, dust and vermin proof, complete with internal wiring and with the followings:

1 x 415 V, suitable rating, 4 Pole MCCB
1 x AC Ammeter with selector switch – 96 x 96 sqmm
1 x AC Voltmeter with selector switch – 96 x 96 sqmm
1 x Frequency meter – 96 x 96 sqmm – Reed Type
1 x KWH meter, C.T. operated, 3 phase, 4 wire unbalanced type
6 x Current Transformers of suitable rating
4 x Instrument Control Fuses HRC type
2 x Indicating lamps “SET ON” / “LOAD ON”
1 x 2 point annunciator with Accept and Reset push button for LUB OIL LO and WATER TEMP HI indication.
1 set TPN copper bus links for incoming and outgoing cable termination
2 x Earth Studs

Operational catalogue, spare parts catalogue, Installation guideline catalogue.

ACCESSORIES

Base Frame
The Diesel Engine and the A.C. Generator will be mounted on a suitable base frame of sturdy to minimize vibration and ensure easy maintenance.

Fuel Tank
Daily service fuel tank of sheet metal of suitable capacity complete with drain valve, air vent inlet, oil level indicator and outlet connection.

Batteries
12V Battery (Dry and uncharged) of 180 Amp-Hr capacity along with leads for connection and battery charger of suitable capacity.

ACOUSTIC ENCLOSURE

The Acoustic Enclosure shall be compact, modular construction and of sleek design with low noise level of 75 dB (A), at a distance of 1 Meter from canopy in free field conditions. The Enclosure shall be Soundproof, weatherproof and environment friendly and the design shall be approved by ARAI, the nodal agency of CPCB. The Enclosure shall be designed to withstand extreme weather condition and should be suitable for installation in the open air. The steel outer surface shall be fabricated from 1.6 mm CRCA sheet steel with heavy duty fabricated base frame. All joints shall be sealed with fireproof neoprene gaskets to withstand high temperature and pressure. All high temperature exposed surfaces shall be insulated by glass wool with aluminum cladding. Necessary protection and safety devices shall be provided to limit the temperature rise to 50 C. Attenuators shall be placed in the hot air outlet and cold air inlet. Residential type exhaust silencer shall be mounted on the Enclosure. The Enclosure shall be powder coated after pretreatment as per 7 tank method. Necessary illumination arrangement shall be provided in side the Enclosure. Emergency Stop facility shall be provided in the Enclosure.

LIST OF APPROVED MAKES

<table>
<thead>
<tr>
<th></th>
<th>H.T. Switch-Gear</th>
<th>Siemens, CromptonGreaves, BIECCO, ALSTOM, ABB, Electrotecnica</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Distribution Transformer</td>
<td>Eastern Transformer &amp; Equipment, Volt Amp, TRUVOLT, MARSONS</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Brands/Manufacturers</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Diesel Engine</td>
<td>CUMMINS, GREAVES, TIL</td>
</tr>
<tr>
<td>4</td>
<td>A.C. Alternator</td>
<td>KRILOSKER, CROMPTON, STAMFORD</td>
</tr>
<tr>
<td>5</td>
<td>ACB, MCCB, SFU, CFS, HRC Fuse</td>
<td>Siemens, ABB, L&amp;T, GE, Schneider, C&amp;S</td>
</tr>
<tr>
<td>6</td>
<td>Contactor</td>
<td>Siemens, ABB, L&amp;T, GE, Schneider, BCH</td>
</tr>
<tr>
<td>7</td>
<td>Relay</td>
<td>ALSTOM, Siemens, L&amp;T</td>
</tr>
<tr>
<td>8</td>
<td>MCB DB, MCB, RCCB</td>
<td>MDS, Siemens, Hager, ABB, Havells</td>
</tr>
<tr>
<td>9</td>
<td>Ammeter, Voltmeter, PF Meter</td>
<td>AE, IMP, L&amp;T</td>
</tr>
<tr>
<td>10</td>
<td>Ammeter/ Voltmeter selector switch</td>
<td>Kaycee, L&amp;T, SWITRON</td>
</tr>
<tr>
<td>11</td>
<td>11 KV XLPE (E) Aluminium Cable</td>
<td>Fort Gloster, CCI, NICCO, Havells, Asian Cables, Polycab</td>
</tr>
<tr>
<td>12</td>
<td>1100 Volts grade PVC insulated steel armoured and over all PVC sheathed cable.</td>
<td>Fort Gloster, CCI, NICCO, Havells, Asian Cables, Polycab</td>
</tr>
<tr>
<td>13</td>
<td>1100 V grade PVC insulated stranded/ flexible copper conductor wire with size in sq.mm. embossed on cable surface.</td>
<td>Finolex, R.R. Kable, L&amp;T, Havells, Rajnanigandha</td>
</tr>
<tr>
<td>14</td>
<td>Rigid PVC Conduit with ISI marked and accessories</td>
<td>PRECISION, BEC, Harse</td>
</tr>
<tr>
<td>15</td>
<td>Galvanised Steel Pipe</td>
<td>Tata Iron &amp; Steel Co., Jindal, Bansal</td>
</tr>
<tr>
<td>16</td>
<td>Current Transformer</td>
<td>Crompton Greaves, L &amp; T, Kappa</td>
</tr>
<tr>
<td>17</td>
<td>Clock Switch/ Time switch</td>
<td>General Industrial Control Pvt. Ltd., L&amp;T, MDS</td>
</tr>
<tr>
<td>18</td>
<td>Fluorescent light fittings</td>
<td>Philips, Bajaj, Crompton</td>
</tr>
<tr>
<td>19</td>
<td>Sodium Vapour, Mercury Vapour, MHL light fittings and lamps.</td>
<td>Philips, Bajaj, Crompton</td>
</tr>
<tr>
<td>20</td>
<td>Change Over Switch</td>
<td>Havells, L&amp;T, GE, HPL, Indo Asian</td>
</tr>
<tr>
<td>21</td>
<td>Modular Type Switch, Socket, Fan Regulators, Bell Push</td>
<td>CRABTREE, SCHNEIDER, ABB, SIEMENS, MK</td>
</tr>
<tr>
<td>22</td>
<td>Other not covered</td>
<td>As approved by</td>
</tr>
</tbody>
</table>
7. PARTICULAR TECHNICAL SPECIFICATION FOR FIRE FIGHTING AND PREVENTION SYSTEMS

01.00 PORTABLE FIRE EXTINGUISHERS.
01.01 All the portable extinguishers shall be of free standing type and shall be capable of discharging freely and completely in upright position. Each extinguisher shall have the instructions for operating the extinguisher on its body itself and shall be supplied with initial charge with accessories as required.

01.02 Portable type extinguishers shall be provided with suitable clamps for mounting on walls or columns and shall be painted with durable enamel paint of fire red colour, conforming to relevant Indian standards or NFPA standard 10.

01.03 The Water CO₂ type extinguisher shall comprise of suitable thickness sheet body coated with leaded tin alloy internally and externally (by electrolytic deposition process), an inner container, a CO₂ gas cartridge, a plunger rod for CO₂ release and other accessories. It shall conform to IS:940.

01.04 Foam type extinguisher shall comprise of suitable thickness sheet steel body coated with leaded tin alloy internally and externally (by electrolytic disposition process), inner receptacle of lead coated brass, polished gun metal fittings with a locked handle. It shall conform to IS:10204

01.05 Carbon-di-oxide type extinguisher shall comprise of high pressure steel cylinder body with wheel type valve, braided reinforced hose, non-conducting horns and accessories, wheeled trolley or mounting clamp, etc. It shall conform to IS:2878.

01.06 Dry chemical extinguisher shall comprise of suitable thickness sheet steel body coated with leaded tin alloy internally and externally (by electrolytic deposition process), an inner container, a carbon-di-oxide gas cartridge, a plunger rod for carbon-di-oxide release, a high pressure hose, a nozzle, a nozzle holder, wall mounting brackets and other accessories. It shall confirm to IS:2171. The powder shall confirm to IS:4861 or IS:4308.

01.07 Any other kind of portable fire appliances provided shall confirm to NFPA standard 10 and of approved make.

02.00 FIRE WATER PUMP
02.01 The pump shall be of horizontal centrifugal type and designed for continuous operation at its best efficiency point. The pump shall have continuously rising head characteristic from operating point towards shut-off. The drive unit of the pump shall be suitably rated, so that the same can take the load of full open condition. The pump set alongwith its drive unit shall run smoothly without undue noise and vibration. Parts of pump like impeller, shaft sleeve, wearing ring etc. shall be of non-corrosive metal.

02.02 Under certain conditions, there may be occasions when fluid flow through the pump would be reversed, as in case of loss of power to the pump drive. The pump should be so designed that the impellers and other accessories are not
damaged under such conditions of flow reversal. The coupling between pump and motor shall be of pin bush type.

03.00 ELECTRIC MOTOR.
03.01 Notwithstanding anything stated in this specification, the motor has to satisfy the requirement of the mechanical system during normal and abnormal conditions. All induction motors shall be of squirrel cage type and shall conform to the latest applicable Indian Standard (IS:325) & IEC.

03.02 The motors shall be suitable for continuous duty in the specified ambient temperature and the enclosure shall be dust proof as per IS:4691 and equivalent to IP-22 (for Motor above 15 KW) or IP-54 (for Motor 15KW & below). The starting current of the motor at rated voltage shall not exceed six (6) times the rated full load current subject to tolerance as given in IS:325.

04.00 PUMP STARTING PANEL.
04.01 The panel should be of free standing floor / wall mounting consols as required and out of CRCA sheet steel. Suitable terminal blocks shall be provided for termination of external cable / wires. The panel feature shall be able to match the system description or philosophy for water based fire protection system.

04.02 The panel shall be suitable to accept electric feeding of 440 (± 10%) Volts, 3 phase & 50HZ (± 5%) A.C. supply. The panel shall have the visual indication for power supply and of pump status. The starting interlock of the pump motor shall meet the system philosophy. The starter for Fire Pump shall be of Star-Delta type and that of Jockey Pump shall be of D.O.L. type.

04.03 The make of components and SLD of the panel shall be in accordance with the approval of Purchaser / Architect / Consultant.

05.00 HYDRANT / LANDING VALVE.
05.01 The Hydrant Valve (Alloy Steel) should conform to IS:5290 type ‘A’ and should be suitable for indoor or outdoor installation. The hydrant valve must be completed in all respect i.e. with blank cap & chain. It should have flanged inlet suitable for 80mm Nb and oblique type female instantaneous coupling outlet of 63mm size to receive male coupling as per IS:903.

06.00 PIPING
06.01 Mild Steel Black Pipe should be as per IS:1239, Part-I, medium grade / IS:3589 (6mm thick). The complete piping system should withstand hydraulic test pressure equal to 1.5 times of maximum working pressure. Piping to be laid overground shall be supported properly on wall / column / beam / floor to suit site condition. Piping to be buried under ground shall be provided with protection of the outer surface, against soil corrosion by using one wrap of 3mm thick anticorrosion tape.

06.02 Outer surface of overground pipes shall be thoroughly cleaned of mill scale, rust etc. by wire brush, there after, one coat of red lead primer shall be applied. Finally two coats of synthetic enamel paint of approved colour shall be applied.

07.00 BRANCH PIPE WITH NOZZLE
07.01 The Branch Pipe (Alloy Steel) with Nozzle should conform to IS:903. The branch pipe should have male inlet connection of 63mm size at one end and other end should be threaded with a nozzle of 18mm bore.
08.00  HOSE WITH COUPLING.
08.01  63mm size controlled percolation hose should conform to IS: 8423 / IS: 636 and of 7.5M/15M long. Both the end of the hose should be properly riveted and G.I. wire bounded with pair of male & female Alloy Steel Hose Coupling as per IS: 903.

09.00  FIRE SERVICE INLET (4 -WAY / 3 -WAY).
09.01  Fire Service Inlet connection should generally conform to IS: 904 and complete with four / three 63mm dia instantaneous type gunmetal inlets with built-in check valves and 150mm Nb / 100mm Nb connection for installation with the fire main.

10.00  SWINGING HOSE REEL.
10.01  First aid fire fighting swinging Hose Reel should conform to IS: 884 and complete with reputed make 20mm dia rubber hose of 30 M / 33 M. long. It should be powder coated and should be complete in all respect i.e. with swivel joint, nozzle, etc.

11.00  SLUICE VALVE / GATE VALVE
11.01  Valves 40mm and below shall be heavy pattern gunmetal valves with cast iron wheel tested to 16 Kg./Cm² pressure. Valves shall be leader or equivalent make.
11.02  Sluice Valves 50mm and above shall be cast iron double flanged with non rising spindle. Sluice valves below ground shall be provided with suitable valve chamber. Sluice valves in exposed locations i.e. pumps house etc. shall be provided with cast iron wheels. Sluice valves shall conform to IS: 14846 class PN 1.0 / PN 1.6. Sluice valves shall be of approved make.

12.00  BUTTER FLY VALVE.
12.01  The valve shall be of cast iron double flanged with lever operated. The valve shall generally conform to IS: 13095, Class PN 1.0 / PN 1.6 and shall be of approved make.

13.00  NON-RETURN VALVE
13.01  Non-Return valve shall be of cast iron double flanged & Swing Check type. The valve should have a permanent “Arrow” inscription on its body to indicate direction of flow of water. The valve shall generally conform to IS: 5312. The pressure rating of the valve shall be in accordance with the system design and the make shall be of approved type.

14.00  ANALOGUE ADDRESSABLE TYPE FIRE ALARM SYSTEM.

The fire detection and alarm system shall be designed to facilitate accurate identification of the source of heat / smoke / fire in their early stages to minimize occurrences of false alarms due to faulty equipments, electrical transients, system faults etc.

Facilities are provided to constantly monitor and check the following circuits and fault conditions:
The power supply to the loop/s
For open-circuit, short-circuit, earth fault and any other fault condition in the loop wiring
For communication failure and errors in all cards and loops.
For faults in keyboard.
Monitoring of all devices status to create a table of each 1 analogue channel for event analysis

All devices i.e. Detectors, MCP’s, etc. shall be installed on the same loop.

Any event i.e. Fire, fault or warning shall be recorded with time, date and place of occurrence in the memory of FACP.

Provision shall be done at the fire alarm control panel to silence the alarm sounders but the visual indication shall remain until the system is reset.

The main fire alarm control panels shall be located either in the Control Room or at the Ground Floor. The main FACP shall be capable of accommodating 99 detectors and 99 devices per loop.

All major component of fire alarm system shall be product of a single manufacturer and shall conform to the requirement of EN 54 / NFPA 72, LPCB / UL approved and be designed in line with EN 54, BS 5839, NFPA 72 Fire alarm systems CODE OF PRACTICE FOR SYSTEM DESIGN, INSTALLATION AND SERVICING. The power supply breakers for FDA system shall be marked “DO NOT DISCONNECT FIRE ALARM SUPPLY”

The Fire Alarm System consists of the following elements.
1) **Analogue Addressable Photo-Electric Smoke Detectors** for the above and below false ceiling areas pertaining to Meeting Rooms, Cabins, Stores, Offices, Open Work-station areas and areas alike.
2) **Analogue Addressable Thermal Detectors** to detect unusual rate of rise of temperature for Basement areas, Electrical installation areas, Kitchen, Pantries and areas alike.
3) All fire sensors shall mount on a common base to facilitate the changing of sensor type if building conditions change.
4) If the Fire Alarm Panel determines that the sensor is in alarm, the Fire Alarm Panel shall command the sensor LED to remain on to indicate alarm.
5) Each sensor shall be capable of being tested for alarm via command from the Fire Alarm panel.
6) Each sensor shall respond to Fire panel scan for information with its type identification to preclude inadvertent substitution of another sensor type. The Fire Alarm panel shall operate with the installed type but shall initiate a mismatch (trouble) condition until the proper type is installed or the programmed sensor type changed.
7) Each sensor shall respond to Fire Alarm Panel scan for information with an analogue representation of measured fire related phenomena (smoke density, particles of combustion, temperature). Such response proves end-to-end sensor including the operation of the sensor electronics.
8) The detector shall meet the requirements of either EN 54 or shall be listed with LPCB. It shall be possible to test the detector’s working both from the panel as well as locally by means as designed by the Contractor and approved by the Engineer-in-charge. The approved coverage per detector for unhampered areas shall not be less than 50 Sq. M. The detector shall be capable of being reset automatically after any alarm condition.

9) **Addressable Manual Call Points** are proposed to be installed at each Exit Staircase, Lobby areas on each floor to comply with relevant standard / norms or recommendation of local fire brigade authority.

10) Each device shall be assigned a unique address via easily understood decade (01 to 99) switch. Address selection via binary switches or by jumpers is not acceptable. Devices that take their address from their position in the circuit are unacceptable because if devices are later added, existing addresses, descriptors and commands need to be reprogrammed.

11) Each device shall contain screw terminals with rising plates for positive termination suitable for 1.5 Sq.mm. copper conductor wire.

12) The Fire Panel shall be capable of displaying the address of the occurrence of the smoke and shall be capable of activating Hooters. It shall have the provision for external actuation like ventilation fan control, fire damper control, if any and system should provide Open Protocol in case connectivity is required with BMS (Building Management System).

It shall be possible to program the Fire Panel such that meaningful alphanumeric descriptions can be assigned to each Detector Address. This shall be useful in identifying the location of Fire very quickly and easily.

13) It is important to note the ESSENTIAL REQUIREMENT from the system mentioned as under. As it has been stated the SYSTEM REQUIREMENT ARE ESSENTIAL IRRESPECTIVE OF WHETHER ANY OF THE DEVICES OR COMPONENTS MENTIONED ARE PRESENTLY BEING USED AS PER BILL OF MATERIAL / QUANTITY OR A FUTURE REQUIREMENT.

Every detector should be loop powered and addressable by itself.
Every Manual Call point should be loop powered and addressable by itself.
Every Sounder / Hooter should be loop powered and addressable by itself.

Every Linear Beam Detector should be loop powered and addressable by itself.
Every Zone Monitor Interface (for connecting to Conventional detectors and Devices) should be loop powered and addressable by itself.
No separate power supply should be used for the Sounders / Hooters which are supposed to be only loop powered. The system thus is general will be based on only loop cable.
No separate Addressable interface unit / module should be used for the Sounders / Hooters which are supposed to be self Addressable type.

No separate Addressable interface unit / module should be used for the Zone Monitor Interface (for connecting to Conventional detectors and Devices) which are supposed to be self Addressable type.
Every Module in general Monitor module, Mini / Micro Monitor Module, Control Module, Isolator Module etc. should be loop powered and addressable by itself.
Panel configuration should strictly follow EN – 54 in terms of failure of devices if quantity are more than 512.

The alarm sounder shall consist of necessary solid state electronic circuit or printed circuit card, suitable to accept impulse from fire alarm panel. If required, necessary line matching transformer shall also be included with the sounder. The speaker of the sounder shall preferably be housed in a suitable box.

15.00 P.A. SYSTEM
15.01 Suitable Public Address System comprising microphone & amplifier unit shall be coupled with the fire alarm system in such a way that the P.A. System will come into operation in case of fire alarm, having the manual override facilities.

16.00 SAFETY SIGNAGE (EXIT SIGN WITH ARROW / FLOOR NUMBER & FIRE ORDER)
16.01 The “Exit” Board & “Arrow” marking to indicate direction of escape route shall be of size 150mm X 300mm & 150mm X 150mm and Floor Number shall be of size 150mm X 200mm. The signage shall be of Photoluminescent nature. The signage shall get charged from the existing light present in the area and shall come alive to glow as soon as the light goes out by the luminous crystals containing mainly zinc sulphide in protective glass-like shell which is non toxic & non radioactive or non hazardous. The intensity of glow in the dark of the said signage shall decrease continuously but should last not less than 4 hours and strongest glow should produce during first 30 minutes of darkness.

16.02 The Fire Order should be on Acrylic sheet of approximate size 450mm X 300mm. The Fire Order / Notice should be printed by bright lettering.

IT WILL BE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN NOC FROM DIRECTORATE OF FIRE SERVICES AFTER SATISFACTORY EXECUTION OF THE WORK.

@@@@@@@@

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.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.
<table>
<thead>
<tr>
<th>No.</th>
<th>IS</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>IS:884</td>
<td>First Aid Hose Reel for Fire Fighting (For Fixed Installations).</td>
</tr>
<tr>
<td>05</td>
<td>IS:2171</td>
<td>Portable Fire Extinguisher, Dry Powder Type.</td>
</tr>
<tr>
<td>06</td>
<td>IS:2878</td>
<td>Portable Fire Extinguishers, CO₂ type.</td>
</tr>
<tr>
<td>07</td>
<td>IS:1239</td>
<td>Part - I: Mild Steel Tubes (upto 150mm). Part - II: Mild Steel tubulars and other wrought steel pipe fittings.</td>
</tr>
<tr>
<td>08</td>
<td>IS:778</td>
<td>Gunmetal gate, globe and check valves for general purposes.</td>
</tr>
<tr>
<td>09</td>
<td>IS:13095</td>
<td>Butter Fly Valve.</td>
</tr>
<tr>
<td>10</td>
<td>IS:14846</td>
<td>Sluice Valve for water works purposes (50 to 1200mm size) – Specification.</td>
</tr>
<tr>
<td>11</td>
<td>IS:5312</td>
<td>Swing Check type Reflux (Non-Return) Valves.</td>
</tr>
<tr>
<td>12</td>
<td>IS:940</td>
<td>Portable Fire Extinguisher, Water CO₂ Type.</td>
</tr>
<tr>
<td>13</td>
<td>IS:10204</td>
<td>Portable Fire Extinguisher, Foam Type.</td>
</tr>
<tr>
<td>14</td>
<td>IS:2190</td>
<td>Code of practice for selection, installation and maintenance of portable First-Aid Fire Appliances.</td>
</tr>
<tr>
<td>15</td>
<td>IS:1520</td>
<td>Horizontal Centrifugal Pumps for clear, cold and fresh water.</td>
</tr>
<tr>
<td>16</td>
<td>IS:5290</td>
<td>Landing / Hydrant Valve.</td>
</tr>
<tr>
<td>17</td>
<td>IS:8423</td>
<td>Controlled Percolation Hose for fire fighting.</td>
</tr>
<tr>
<td>18</td>
<td>IS:903</td>
<td>Fire Hose Delivery Couplings, Branch Pipe, Nozzles &amp; Nozzle spanner.</td>
</tr>
<tr>
<td>19</td>
<td>IS:2062</td>
<td>Structural Steel (Fusion / Welding Quality).</td>
</tr>
<tr>
<td>20</td>
<td>IS:325</td>
<td>Three Phase Induction Motor.</td>
</tr>
<tr>
<td>24</td>
<td>IS:2217</td>
<td>Recommendations for providing first aid fire fighting arrangements in public buildings.</td>
</tr>
<tr>
<td>26</td>
<td>IS:3589</td>
<td>Mild Steel Tubes (200mm and above).</td>
</tr>
</tbody>
</table>
8. **LAN SYSTEM:**

Local Area Networking connecting Servers and 620 nodes distributed over six floors in two building blocks has been proposed using a high speed data transport backbone. The system shall have Optical Fiber as backbone and gigabit Ethernet (CAT 6) copper cable connection to individual computers.

The system is designed keeping in mind the provisions for internet connectivity in future. There will be a Central Switch, referred as Layer 3 or Core Switch that will be physically located in the server room is capable of connecting to not only cluster of servers but also external connections (that of internet gateway, leased line or leased line) and Intelligent Storage Devices.

There will be secondary switches at each floor where the Optical Fiber coming out of Core switch will terminate and the network connection will be distributed through CAT-6 Universal Twisted Pair (UTP) cables capable of data transmission at a speed up to 1 gigabit/second. These secondary switches are known as Layer 2 or Edge switch.

All switches proposed, both Layer 2 & Layer 3, shall be of modular in nature and be fixed to Floor Mounted Racks (24U in size) specified. One number of Rack per Block per floor shall be used to fix Server and Floor Switches.

The Jack Panels are used for structured cabling and shall be used for each group of 24 users. They too are fixed to Racks at each floor. 1 metre long Patch Cords are used to connect the Jack Panels with the Switches. Individual User connections are made from the other end of the Jack Panels by means of CAT6 UTP Cable with RJ-45 Connectors at each Jack Panel end. These cables ultimately terminated at the individual I/O (Information Outlets) fixed near the user nodes. 2 metre long Patch Cords are used to connect individual Computers and Servers with the I/O Units.

**First Floor:**
One number each rack shall be mounted on floor at both Server Room and LAN Duct Room.

**Second to Fifth Floor:**
One number each rack assigned for North and East Block, shall be mounted on floor of LAN Duct room.

**Sixth Floor:**
One number each rack shall be mounted on floor at both Server Room and LAN Duct Room.

**THE ARCHITECTURE**

The proposed LAN shall have multi-layer architecture. At the core, the Core or Layer 3 Switch shall handle all external network traffic like internet, Campus Networking (if two or more separate buildings to be connected through Fiber Optic networks) as well as internal connections like Servers, Printers and Storage Devices. The modular design of the switch shall enable it to connect with Optical Fiber cables vis-à-vis Copper (UTP CAT 6) cables. Since Computers can not connect directly through Optical Fiber cable, a common platform like this switch is needed to interface between Fiber and Copper Cable network.

The module Switch Concept for Core and Edge Switches

24 Port CAT6 (Copper cable) module

Switch Chassis

All signals (data) gathers through the CAT 6 cable at the Core switch shall be transmitted through a very high bandwidth 6-core Optical Fiber cable to other floors. At each floor there are Edge or Layer 2 switches which are modular in design like the Core switch. At one end it will connect to the Fiber Optic backbone and on the other hand distribute the data through the Gigabit ports, which will eventually connected to individual computers through CAT6 cable.
Schematic Diagram of LAN
### 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><strong>CIVIL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cement</td>
<td>Ultra-Tech, ACC, Grasim, Lafarge</td>
</tr>
<tr>
<td>2</td>
<td>Reinforcement Bars</td>
<td>Fe500 grade of TATA, SAIL, RINL</td>
</tr>
<tr>
<td>3</td>
<td>White Cement</td>
<td>Birla, J.K</td>
</tr>
<tr>
<td>4</td>
<td>Ceramic Floor Tiles</td>
<td>Premium quality NITCO, JOHNSON, VERMORA</td>
</tr>
<tr>
<td>5</td>
<td>Ceramic Tiles for Dado</td>
<td>Premium NITCO, JOHNSON, VERMORA, Bell</td>
</tr>
<tr>
<td>6</td>
<td>Vitrified/ Rectified Tiles</td>
<td>Premium Quality NITCO, JOHNSON, VERMORA</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</td>
</tr>
<tr>
<td>9</td>
<td>Concrete Interlocking Pavement Tiles and Concrete Paver Block</td>
<td>Wondercrete, Eurocon, AP Galaxy, Ultra, Stylish Interlocking Pvt. Ltd.</td>
</tr>
<tr>
<td>10</td>
<td>Flush Door</td>
<td>Centurydoor, Greenply flush door, Truwood door, Duradoor, Sarda</td>
</tr>
<tr>
<td>11</td>
<td>Block Board/Prelaminated particle board/ Plywood/ decorative veneers</td>
<td>Kit ply, Sarda Ply, Greenply, Uro ply</td>
</tr>
<tr>
<td>12</td>
<td>FRP Doors</td>
<td>Dolphin Foam Industries or equivalent</td>
</tr>
<tr>
<td>13</td>
<td>Cylindrical locks/ locks</td>
<td>Godrej/ Aligarh lock store/ Ramson</td>
</tr>
<tr>
<td>14</td>
<td>Extruded Aluminium sections (unless otherwise specified in BOQ)</td>
<td>INDAL, JINDAL, HINDALCO</td>
</tr>
<tr>
<td>15</td>
<td>Aluminium Composite Panel</td>
<td>Alstrong, Aluco-bond, Aludecor, Durabuild</td>
</tr>
<tr>
<td>16</td>
<td>Al door, window, partition system</td>
<td>Domal, Shuko or equivalent</td>
</tr>
<tr>
<td>17</td>
<td>Structural glazing system</td>
<td>WICONA, Shuko or equivalent</td>
</tr>
<tr>
<td>18</td>
<td>Reflective Glass for glazing</td>
<td>AIS, Saint Gobian, Pilkington</td>
</tr>
<tr>
<td>19</td>
<td>Acoustic Panel</td>
<td>Techno-acoustic panel of Chanyaka Technologies India</td>
</tr>
<tr>
<td>No.</td>
<td>Item Description</td>
<td>Brand/Manufacturer</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>20</td>
<td>Minarel board false ceiling</td>
<td>Armstrong/ AMF / OWA</td>
</tr>
<tr>
<td>21</td>
<td>Gypsum false ceiling</td>
<td>Gypsum India Ltd.</td>
</tr>
<tr>
<td>22</td>
<td>E-grid classic false ceiling</td>
<td>Everest</td>
</tr>
<tr>
<td>23</td>
<td>Metal false ceiling system</td>
<td>Hunter Doglus or equivalent</td>
</tr>
<tr>
<td>24</td>
<td>E-glass</td>
<td>AIS, Pilkington, Sejal</td>
</tr>
<tr>
<td>25</td>
<td>Vertical Blinds</td>
<td>Classic/ Hunter Doglus</td>
</tr>
<tr>
<td>26</td>
<td>Automatic Sliding gate</td>
<td>Godrej (to be executed by authorized vendor of Godrej)</td>
</tr>
<tr>
<td>27</td>
<td>Laminated flooring system</td>
<td>Pergo or equivalent</td>
</tr>
<tr>
<td>28</td>
<td>High pressed Clay tiles</td>
<td>SBTC, confetti export</td>
</tr>
<tr>
<td>29</td>
<td>Wall coverings (interior)</td>
<td>Elimento lifestyle pvt. Ltd or equivalent.</td>
</tr>
<tr>
<td>30</td>
<td>UPVC rain water pipes with fittings</td>
<td>Oriplast, Supreme.</td>
</tr>
<tr>
<td>31</td>
<td>Polysulphide Sealant</td>
<td>Choksey, Sika Qualcrete, Degussa, Fosroc</td>
</tr>
<tr>
<td>32</td>
<td>Polycarbonate Sheet</td>
<td>GE Plastic or Equivalent</td>
</tr>
<tr>
<td>33</td>
<td>Exterior type acrylic based paint</td>
<td>Excel of Nerolac, Weathercoat of Berger, or equivalent of ICI, Apex</td>
</tr>
<tr>
<td>34</td>
<td>Distemper</td>
<td>Asian Paint, Berger, ICI, Nerolac</td>
</tr>
<tr>
<td>35</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>36</td>
<td>Synthetic Paint</td>
<td>Asian Paint, Berger, ICI, Nerolac</td>
</tr>
<tr>
<td>37</td>
<td>Zinc Chromate Primers</td>
<td>Shalimar, Asian Paint, Berger, ICI</td>
</tr>
<tr>
<td>38</td>
<td>Glass</td>
<td>Modi/ Saint Gobin/ Asani</td>
</tr>
<tr>
<td>39</td>
<td>Chemical / Mechanical Anchor Fastners</td>
<td>HILTI, FISCHER</td>
</tr>
<tr>
<td>40</td>
<td>Hydraulic door closer</td>
<td>Hardwyn make (Eddy) or equivalent</td>
</tr>
<tr>
<td>41</td>
<td>Floor spring for aluminium door</td>
<td>Hardwyn, Garnish</td>
</tr>
<tr>
<td>42</td>
<td>Fittings for Aluminium doors and windows.</td>
<td>Ebco, Doorline</td>
</tr>
<tr>
<td>43</td>
<td>Water Proofing Compound/ Admixtures</td>
<td>Choksey, Sika Qualcrete, Degussa, Fosroc</td>
</tr>
<tr>
<td>44</td>
<td>Epoxy Grout for tile fixing</td>
<td>Laticrete, Bal endula, Sika or equivalent.</td>
</tr>
<tr>
<td>45</td>
<td>Specialist vendor for spider glazing works, ACP works</td>
<td>Ajit (India) Pvt. Ltd., Aline Curtain Walls Pvt Ltd., Alunilite Pvt Ltd.</td>
</tr>
<tr>
<td>46</td>
<td>Modular Furnitures, Modular Partitions, Chairs etc.</td>
<td>Featherlite, Godrej, Blowplast</td>
</tr>
</tbody>
</table>

**SANITARY ITEMS**

Sanitary Fittings and Fixtures:

<table>
<thead>
<tr>
<th>No.</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Porcelain Goods (Vitreous China and Fire Clay Sanitaryware)</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>PVC Cistern (with all fittings and accessories):</td>
</tr>
<tr>
<td>3</td>
<td>Plastic Seat Covers with frame</td>
</tr>
<tr>
<td>4</td>
<td>CP on brass fittings and Accessories</td>
</tr>
<tr>
<td>5</td>
<td>Stainless-Steel Sinks (with or without drain-board and having integrated waste fittings)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil Pipes and Fittings:</td>
</tr>
<tr>
<td>6</td>
<td>Centrifugally Cast (spun) Iron Pipes &amp; fittings</td>
</tr>
<tr>
<td>7</td>
<td>Sand Cast (spun) Iron Pipes &amp; fittings (conforming to IS: 1729)</td>
</tr>
<tr>
<td>8</td>
<td>Pig Lead (for caulking of joints)</td>
</tr>
<tr>
<td>9</td>
<td>C.I. Manholes</td>
</tr>
<tr>
<td>10</td>
<td>C.I. Double Flanged non-return</td>
</tr>
<tr>
<td>11</td>
<td>PVC Tank</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Supply Pipes and Fittings:</td>
</tr>
<tr>
<td>12</td>
<td>G.I. Pipes</td>
</tr>
<tr>
<td>13</td>
<td>G.I. Fittings</td>
</tr>
<tr>
<td>14</td>
<td>Centrifugally Cast Iron Pressure Pipes (LA class) and Fittings with connection pieces for flanged connection where required.</td>
</tr>
<tr>
<td>15</td>
<td>UPVC pipes</td>
</tr>
<tr>
<td>16</td>
<td>Gunmetal Valves</td>
</tr>
<tr>
<td>17</td>
<td>Cast Iron Valves</td>
</tr>
<tr>
<td>18</td>
<td>Strainers</td>
</tr>
<tr>
<td>19</td>
<td>PVC Pipes and strainers for Tubewell (Medium casing pipe and matching thickness strainers conforming to IS: 12818)</td>
</tr>
<tr>
<td>20</td>
<td>MS Top nipple Pipe for Tubewell</td>
</tr>
<tr>
<td>21</td>
<td>Lift Pump set</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Submersible Pump set</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Instruments &amp; Elecricals</td>
</tr>
<tr>
<td>23</td>
<td>Pressure Gauge &amp; Pressure Switch</td>
</tr>
<tr>
<td>24</td>
<td>Water proof flat Cable</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Panel</td>
<td>Sewerage and drainage</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>25 Stoneware pipes and fittings</td>
<td>Hind Ceramic, Orind, Perfect, Burn</td>
</tr>
<tr>
<td>26 RCC Hume pipes and Collars</td>
<td>West Bengal Concrete Industries, Laxmi, Sood &amp; Sood, Jain &amp; Co or equivalent</td>
</tr>
<tr>
<td>27 C.I. Covers</td>
<td>D.N. Singha or equivalent</td>
</tr>
<tr>
<td>28 RCPC Cover/ RGT grating</td>
<td>West Bengal Concrete Industries, Frenco Cement Works Pvt. Ltd.</td>
</tr>
<tr>
<td>29 Mirror</td>
<td>Akoi, Atul, Silver, Fish, Jolly</td>
</tr>
<tr>
<td>30 STP</td>
<td>Thermax, Ionexchane</td>
</tr>
</tbody>
</table>

**ELECTRICALS**

<p>| 1 | H.T. Switch-Gear | Siemens, Crompton Greaves, BIECCO, AREVA, ABB, Andrewyle |
| 2 | Distribution Transformer | Crompton, Volt Amp, TRUVOLT, Universal Electric |
| 3 | Diesel Engine | CUMMINS, GREAVES, TIL, Kirlosker |
| 4 | A.C. Alternator | KRILOSKER, CROMPTON, STAMFORD |
| 5 | ACB, MCCB, SFU, CFS, HRC Fuse | Siemens, ABB, L&amp;T, Schneider, C&amp;S |
| 6 | Contactor | Siemens, ABB, L&amp;T, GE, Schneider, BCH |
| 7 | Relay | ALSTOM, Siemens, L&amp;T, Ashida |
| 8 | MCB DB, MCB, RCCB | MDS, Siemens, Hager, ABB, L &amp; T |
| 9 | Ammeter, Voltmeter, PF Meter | AE, IMP, L&amp;T |
| 10 | Ammeter/Voltmeter selector switch | Kaycee, L&amp;T, SWITRON |
| 11 | 11 KV XLPE (E) Aluminium Cable | Fort Gloster, NICCO, Havells, Asian Cables, Polycab |
| 12 | 1100 Volts grade PVC insulated steel armoured and over all PVC sheathed cable. | Fort Gloster, NICCO, Havells, Asian Cables, Polycab |
| 13 | 1100 V grade PVC insulated stranded/flexible copper conductor wire with size in sq.mm. embossed on cable surface. | Finolex, R.R. Kable, L&amp;T, Rajnanigandha, Meseab |
| 14 | Rigid PVC Conduit with ISI marked | PRECISION, BEC, Harse |</p>
<table>
<thead>
<tr>
<th></th>
<th>Product Description</th>
<th>Brands</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Galvanised Steel Pipe</td>
<td>Tata Iron &amp; Steel Co., Jindal, Bansal</td>
</tr>
<tr>
<td>16</td>
<td>Current Transformer</td>
<td>Crompton Greaves, L &amp; T, Kappa</td>
</tr>
<tr>
<td></td>
<td>TPN switch fuse unit / switch fuse unit with HRC fuses</td>
<td>Siemens, L &amp; T, GE, C&amp;S, Schneider, Crompton Greaves,</td>
</tr>
<tr>
<td>10</td>
<td>DP/SPN SFU/ SDFU with HRC fuse</td>
<td>LK, HPL, Havell’s, L&amp;T, Crompton Greaves, Siemens, C&amp;S</td>
</tr>
<tr>
<td>12</td>
<td>KWH Meter</td>
<td>Alstom, HPL-SOCOMEC, L&amp;T, Havell’s.</td>
</tr>
<tr>
<td>14</td>
<td>Motor Starter</td>
<td>Siemens, L &amp; T, Schneider (CG), GE, T &amp; C.</td>
</tr>
<tr>
<td>16</td>
<td>Changeover Switch</td>
<td>L &amp; T, ELECON/ Gerard, Havell’s, Clipsal</td>
</tr>
<tr>
<td>21</td>
<td>Rigid PVC Conduit</td>
<td>B.E.C., Plaza, Kalingha, AKG, Precision, Gerard</td>
</tr>
<tr>
<td>22</td>
<td>Black stove enamelled conduit and galvanised steel conduit with ISI marked embosed on conduit surface</td>
<td>B.E.C., NIC, AKG, Supreme</td>
</tr>
<tr>
<td>23</td>
<td>Decorative Electrical Switch Board cover with white top Lamination</td>
<td>Hylam or equivalent</td>
</tr>
<tr>
<td>24</td>
<td>Metal clad socket &amp; plug having scraping earth arrangement</td>
<td>Hager, Schneider (CG), MDS, L &amp; T, Gerard</td>
</tr>
<tr>
<td>25</td>
<td>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.</td>
</tr>
<tr>
<td>26</td>
<td>250 Volt 6 Amp. Ceiling rose, 250 Volt : 16 Amp 3 pin socket with switch combined</td>
<td>Anchor, CPL, Precision, SSK, Magic.</td>
</tr>
<tr>
<td>27</td>
<td>Modular type 6 A &amp; 16 A switch. 6 A &amp; 16 A socket, front plate, mounting box, Regulator/Dimmer</td>
<td>Wraparound of MK, Mosaic of Legrand, Ethena of Crabtree</td>
</tr>
<tr>
<td>28</td>
<td>Modular Electronic Regulator/Dimmer</td>
<td>Wraparound of MK, Mosaic of Legrand, Ethena of Crabtree</td>
</tr>
<tr>
<td>29</td>
<td>Clock switch/time switch</td>
<td>L &amp; T, MDS, Hager, GIC</td>
</tr>
<tr>
<td>30</td>
<td>'CLIP ON' Terminal assembly</td>
<td>Tosha, Elmex</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Brand(s)</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>32</td>
<td>ON/OFF Rotary Switch/ Selector Switch/ programme switch</td>
<td>ENERCON</td>
</tr>
<tr>
<td>33</td>
<td>Cable Glands</td>
<td>COMIC, Raychem</td>
</tr>
<tr>
<td>34</td>
<td>Cable Tray</td>
<td>Pilco, MEK</td>
</tr>
<tr>
<td>35</td>
<td>Battery</td>
<td>EXIDE, STANDARD</td>
</tr>
<tr>
<td>36</td>
<td>Fluorescent light fittings (All types) &amp; lamp.</td>
<td>Philips, Thorn, Bajaj</td>
</tr>
<tr>
<td>37</td>
<td>Decorative wall bracket/ ceiling mounted Luminaire for PL/incandescent lamp</td>
<td>Philips, Thorn, K-litr, Bajaj, Metal Coats</td>
</tr>
<tr>
<td>38</td>
<td>Fluorescent Street Light Luminaire &amp; lamp</td>
<td>Philips, Thorn, K-litr, Bajaj, Metal Coats</td>
</tr>
<tr>
<td>39</td>
<td>Halogen spot luminaire &amp; lamp.</td>
<td>Philips, Thorn, K-litr, Bajaj, Metal Coats</td>
</tr>
<tr>
<td>40</td>
<td>Metal halide luminaire &amp; lamp</td>
<td>Philips, Thorn, K-litr, Bajaj, Metal Coats</td>
</tr>
<tr>
<td>42</td>
<td>Exhaust Fan</td>
<td>G.E.C., Crompton, Polar, USHA</td>
</tr>
<tr>
<td>43</td>
<td>Ceiling Fan</td>
<td>Crompton, Orient, Polar, USHA</td>
</tr>
<tr>
<td>44</td>
<td>Busbar Trunking/Rising Main</td>
<td>Control &amp; Switchgear (C &amp; S), Zeta.</td>
</tr>
<tr>
<td>49</td>
<td>Decorative Street Light Poles</td>
<td>Metal Coats or equivalent</td>
</tr>
<tr>
<td>50</td>
<td>Sodium vapour, Murcury vapour MHL fittings and lamps</td>
<td>Philips, Crompton, Bajaj</td>
</tr>
<tr>
<td>52</td>
<td>CCTV system</td>
<td>Godrej or equivalent (work to be executed by authorized vender of godrej or equivalent)</td>
</tr>
</tbody>
</table>

**FIRE FIGHTING AND PREVENTION WORKS**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Brand(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MS pipes</td>
<td>Jindal / BANSAL / TATA</td>
</tr>
<tr>
<td>2</td>
<td>Sluice/NRV</td>
<td>Kalpana / H.Sarkar / Venus</td>
</tr>
<tr>
<td>3</td>
<td>Air Release Valve</td>
<td>Sukan / Leader</td>
</tr>
<tr>
<td>4</td>
<td>Fire Hydrant Valve</td>
<td>Newage/Ghosh Engg.</td>
</tr>
<tr>
<td>5</td>
<td>GM Coupling</td>
<td>Ghosh Engg. / ISI Marked</td>
</tr>
<tr>
<td>6</td>
<td>Pumps</td>
<td>Kirloskar / Mather &amp; Platt / KSB</td>
</tr>
<tr>
<td>7</td>
<td>Fire Extinguisher</td>
<td>D.Flame / Minimax / Cease Fire</td>
</tr>
<tr>
<td>8</td>
<td>Rubber tube for hose reel</td>
<td>Dunlop / Jyoti</td>
</tr>
<tr>
<td>9</td>
<td>Paint</td>
<td>Asian / J &amp; N / Berger</td>
</tr>
<tr>
<td>10</td>
<td>Hose Reel</td>
<td>Zenith / Ghosh Engg./ Equivalent</td>
</tr>
<tr>
<td>11</td>
<td>Anti vibration elements</td>
<td>Dunlop / Kanwal / Resitoflox</td>
</tr>
<tr>
<td>12</td>
<td>GM Sismese connection</td>
<td>Ghosh Engg. / Zenith</td>
</tr>
<tr>
<td>13</td>
<td>Pressure Switch</td>
<td>Indfoss / Switzer</td>
</tr>
<tr>
<td>14</td>
<td>Pressure guage</td>
<td>H.Guru / Feibig</td>
</tr>
<tr>
<td>15</td>
<td>Wire</td>
<td>Finolex / National</td>
</tr>
<tr>
<td>16</td>
<td>PVC Conduit</td>
<td>BEC / Steelcraft / Precision</td>
</tr>
<tr>
<td>17</td>
<td>Switch gear</td>
<td>L &amp; T / EE / Siemens</td>
</tr>
<tr>
<td>18</td>
<td>Foot Valve with Strainer</td>
<td>H.Sarkar / Venus</td>
</tr>
<tr>
<td>19</td>
<td>Electric Motors</td>
<td>Kirloskar / Crompton / Siemens</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Brand(s)</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>20</td>
<td>Cables</td>
<td>CCI/Universal/Fortgloster</td>
</tr>
<tr>
<td>21</td>
<td>Cable end termination</td>
<td>Dowell / Comet</td>
</tr>
<tr>
<td>22</td>
<td>Sprinkler</td>
<td>Grinnell / Best / Tyco</td>
</tr>
<tr>
<td>23</td>
<td>Manual Call Points &amp; speaker</td>
<td>Edward, Notifier, Honeywell, System Sensor</td>
</tr>
<tr>
<td>24</td>
<td>Detector Smoke</td>
<td>Edward, Notifier, Honeywell, System Sensor</td>
</tr>
<tr>
<td>25</td>
<td>Detector Heat</td>
<td>Edward, Notifier, Honeywell, System Sensor</td>
</tr>
<tr>
<td>26</td>
<td>HOOKER</td>
<td>Philips, Minimax, Agni</td>
</tr>
<tr>
<td>27</td>
<td>Panel for fire alarm system</td>
<td>Philips, Agni, Minimax, Edward, Notifier, Honeywell, System Sensor</td>
</tr>
<tr>
<td>28</td>
<td>Zonal Panel</td>
<td>Philips, Agni, Minimax</td>
</tr>
<tr>
<td>29</td>
<td>Fire Door</td>
<td>Pacific / Equivalent</td>
</tr>
<tr>
<td>31</td>
<td>Main panel with ACB’s – (Febricator)</td>
<td>L&amp;T, GE Power Control, Siemens, Madhu Electric</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>OTHER MISC. WORKS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>LAN SYSTEM</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Core Switch/ Layer 2 Switch and other switch</td>
<td>HP, CISCO</td>
</tr>
<tr>
<td>2</td>
<td>CAT 6/ Optical Fibre Cables/ Patch cords</td>
<td>Krone, CISCO, D-Link</td>
</tr>
<tr>
<td>3</td>
<td>Racks</td>
<td>HP, EPW, HCL</td>
</tr>
<tr>
<td></td>
<td><strong>SOUND AND PROJECTION SYSTEM</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>For Auditorium</td>
<td>OHM, JBL</td>
</tr>
<tr>
<td>2</td>
<td>Speaker / high power throw subwoofer, wall mounted speakers, Stage monitor</td>
<td>OHM, JBL, EV</td>
</tr>
<tr>
<td>3</td>
<td>Surround speaker</td>
<td>OHM, JBL, EV</td>
</tr>
<tr>
<td>4</td>
<td>Amplifiers</td>
<td>Crown, QSC</td>
</tr>
<tr>
<td>5</td>
<td>Dolby Digital system controller</td>
<td>OHM, dBX</td>
</tr>
<tr>
<td>6</td>
<td>Dolby Cenema processor</td>
<td>Denon, Lexicon</td>
</tr>
<tr>
<td>7</td>
<td>Automatic FeedbackSuppressor</td>
<td>dBX, Shure</td>
</tr>
<tr>
<td>8</td>
<td>20 channel professional audio mixing console</td>
<td>SoundKraft, Yamaha, Mackie</td>
</tr>
<tr>
<td>9</td>
<td>Microphones</td>
<td>AKG/ Shure</td>
</tr>
<tr>
<td>10</td>
<td>Industry standard boundary Mic PCC 160</td>
<td>Crown</td>
</tr>
<tr>
<td>11</td>
<td>Cables for sound system</td>
<td>Krystal, Finolex, Lapp</td>
</tr>
<tr>
<td>12</td>
<td>Euro metal Racks</td>
<td>Valrack, President</td>
</tr>
<tr>
<td>13</td>
<td>Servo Stabiliser with inbuilt spike guard</td>
<td>Quartron/ APC</td>
</tr>
<tr>
<td>14</td>
<td>PD F 30 Sx Professional Projector</td>
<td>Projection Design, Christie</td>
</tr>
<tr>
<td>15</td>
<td>UPS</td>
<td>APC</td>
</tr>
<tr>
<td>16</td>
<td>For Conference Halls</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Speakers</td>
<td>CSC, ADS, Byford</td>
</tr>
<tr>
<td>18</td>
<td>Amplifiers</td>
<td>Crown, QSC</td>
</tr>
<tr>
<td>19</td>
<td>Microphones</td>
<td>AKG/ Shure</td>
</tr>
<tr>
<td>20</td>
<td>DVD Player</td>
<td>Samsung, Philips, Moser Bayer</td>
</tr>
<tr>
<td></td>
<td>Item</td>
<td>Brand(s)</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>20</td>
<td>Projectors</td>
<td>Sharp, NEC, Infocus</td>
</tr>
<tr>
<td>21</td>
<td>Projector stand</td>
<td>Liberty, Adtus</td>
</tr>
<tr>
<td>22</td>
<td>Glass Beaded Higain screen</td>
<td>Braun, Liberty</td>
</tr>
<tr>
<td>23</td>
<td>Video Buffer Amplifier</td>
<td>Milestone/ Info</td>
</tr>
<tr>
<td>24</td>
<td>Cables</td>
<td>Krystal, Finolex, Lapp</td>
</tr>
</tbody>
</table>

**LIST OF TENDER DRAWINGS**

SK / EPI / ESIC / KOLKATA / 2008 / TENDER - 01 TO 05