RAJKOT MUNICIPAL CORPORATION
SOLID WASTE MANAGEMENT

CONSTRUCTION OF ELEVATED SEMICLOSED BODY REFUSE TRANSFER STATION AT MOTAMAVA RAJKOT

E- TENDER

TENDER NOTICE NO : RMC/SWM/2023-24/39

5th Attempt

VOLUME: III

TECHNICAL SPECIFICATION

TO BE SUBMITTED TO:

Environment Engineer,
RAJKOT MUNICIPAL CORPORATION,
Dr. Ambedkar Bhavan, Dhebar Road
Rajkot-360001
GUJARAT

GENERAL NOTE FOR ALL COMPONENTS:

ALL CONCRETING WORK OF GRADE M200 (CONTROLLED CONC.) OR HIGHER SHALL ONLY BE DONE AT SITE BY READY MIX CONCRETE WITHOUT FLY ASH CONTENT FOR MORE THAN 1 CUM QUANTITY, UNDER SUPERVISION OF RMC / PMC / TPI REPRESENTATIVE. MIX DESIGN OF CONCRETE SHALL BE GOT APPROVED WITH ENGINEER IN CHARGE / CONSULTANT / TPI.

FIRE HYDRANT SYSTEM

Motor driven fire pumps:
End suction type, horizontally mounted centrifugal pump (as per IS 1520), TAC approved each capable to deliver 10.80 cum/hour (180 lpm) of clear water at minimum 70 M TDH, coupled to a suitably electric motor mounted on a common base frame and ant vibration pads coupling, coupling guard and fixing bolts etc. Motor HP to be suitably selected to suit minimum discharge and residual head at the top most hydrants. The characteristic curve should have a large range of discharge points for different heads.
C I Sluice Valve
C I components of the sluice valve shall be of Grey cast iron conforming to IS 210. The valves shall be flanged having solid wedge gate valve, inside screw, hand wheel with open-close indications etc all conforming to IS 780 but of nominal pressure rating of PN 1.6 as per TAC norms.
Test Pressure at manufacturers works
Flange drillings shall normally be as per IS 1538. However, if the manufacturer drills the flanges to other standard specifications, the valves shall be supplied with a pair of matching flanges, nuts, bolts, washers; rubber insertion etc and such flanges shall have inside threads to suit pipes of same nominal size as that of the valve.
G M Valves
Gun metal components of the peets valves i.e. Gate Valves, Check Valves i.e. non-return valves, and Globe valves etc shall be of Gun Metal conforming to Grade 2 of IS 318. The valves shall be having flanged or screwed ends, hand wheel with open-close indications etc all conforming to Class-2 Valves of IS 778 (ISI marked) or imported as per ASTM.
C I non return valves
C I reflux valves, i.e. swing check type non-return valves, shall be conforming to IS 5312. Test pressures shall be same as per CI sluice valves.
M S Pipes and Fittings
All M S pipes shall be as per IS 1239 (heavy/medium quality as mentioned in the schedule of items upto 150 mm N B, as per IS 3589 (minimum 6 mm thick) above 150 mm N B, and the fittings shall be of all welded construction, butt weld type flanges shall conform to IS 6392 and gaskets of synthetic moulded rubber approved by Fire Standard. All pipes outside the building shall be laid underground at a depth of 1 mtr (approx) and laying shall be as per layout drawing, excavation, back filling of earth, cutting holes in existing structure where necessary, providing puddle collars/pipes as required & making good the damages including making the concerned portion of the structure water tight. Erection of over ground piping shall be complete with necessary pipe supports hangers with MS angles/plate/nut bolts/clamps etc with fabrication as required including providing MS puddle pipes/collars as required for punctures through walls/slabs etc. Erection of pipe lines shall also include chipping of wall; making holes inside RCC or brick walls, slabs and necessary civil works for restoration of the surface after completion of erection. The quoted tender rate shall include all the above works, as well as the cost of route markers for under ground pipe lines as per following specifications. Route marker with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) of size 60 cm x 60 cm at bottoms and 50 cm x 50 cm at the top with a thickness of 10 cm including inscription duly engraved as required (spacing approx 15 mtrs or as

directed at site). No extra payment will be made on this account.
Pressure Gauges
Pressure gauges with controlling cocks etc shall be of approved make having pressure range, bourdon material and dial size as specified in schedule of items.
Pressure Switches
Pressure switches with accessories shall be of approved make and design and shall actuate (`cut-off' and/or `make contact' as required) at pre-set pressures.
Landing Valves (Hydrant Valve)
Gun metal landing valve (internal/external Fire-Hydrants) with oblique type single outlet as per schedule of quantities complete with hose coupling adaptor of 63 mm size, instantaneous spring lock arrangement and blank cap with chain conforming to IS 5290. External Fire-Hydrants to be provided with stand posts as specified in schedule of quantities. Orifice plates may be provided where inlet pressure is required to be reduced as per WBFS requirement.
Branch Pipe
Gun metal, short type, instantaneous pattern branch pipe to suit fire hose delivery coupling of 63 mm size complete with G M nozzle of 20 mm nominal size conforming to IS 903.
Hose with Coupling
63 mm nominal internal dia hose, rubber lined woven - jacketed coupling with Type-II (Reinforced Rubber lined type) of IS 636, fire fighting delivery hose 15 M long each, fitted with gun metal coupling of 63 mm size with multi serrated tail and double instantaneous spring lock arrangement comprising of male half at one end and female half at other end complete with rubber cup washer and conforming to IS 903.
Hose Reel
Swinging hose reel conforming to IS 884 & comprising of 3 ply rubber hose of length specified in schedule of items, 20 mm (3/4") nominal bore (25 kg/cm2/350 psi bursting pressure), mild steel pressed reel with 170 degree swinging, nozzle of G M chromium plated, with non-jamming controlling handle which shall stay at the `ON' `OFF' position as set, wall brackets with `U' shaped reel carrier made of C I complete with 25 mm NB G M valve at the inlet, and orifice plates (if necessary for reducing pressure).
Air Vessel
Mild steel air vessel adequate size to take care of pressure surges during operation of the system and venting of entrapped air in the system shall be complete with air relief valve, pressure gauge, drain valve and shutt off valve at the inlet.
Valve Chamber
Valve chamber of adequate size to accommodate external valves shall be constructed as directed per site condition.
Fire-Brigade Connections
Fire-Brigade connections (inlets) to Riser and Under Ground Reservoir shall be with two numbers of 63 mm instantaneous inlets for each connection as per TAC norms. Other aspects of the connection shall be as per IS 904.
Painting
All external steel surfaces shall be thoroughly cleaned to remove rust, scale etc before applying the primer.
All underground piping shall be provided protective wrappings as per TAC norms.
All over ground piping/hose boxes/landing valves/hose reel, M S frames etc shall be painted with two (2) coats of RED LEAD primer or equivalent followed by two coats of Post Office Red coloured Synthetic enamel finish paint.
All other equipment shall be given a red oxide/zinc chromate primer and two (2) coats of synthetic enamel.

GENERAL SPECIFICATION FOR ELECTRICAL INSTALLATION WORK

Below list of items arelikely to be used in the project. However, final capacity/size/rating etc shall be decided during detailed engineering and they should be got approved from EIC.

This list should be considered as technical specifications .For any query or discrepancy follow the detail tender specifications or IS Rules decision of EIC shall be final and binding.

The list below are indicative, not exhaustive. Necessary items required to be added for satisfactory completion of the project should be considered as part of the scope of work.

1.0 INTERNAL WIRING

This section covers, definition of point wiring, system of wiring and supply, installation, connection, testing and commissioning of point wiring for light points, ceiling fan points, exhaust fan points, convenience socket outlet points, power socket outlet points etc. including fixing of light fixtures, ceiling fan, exhaust fan, wall fan etc.

1.1 STANDARDS

The following standards and rules shall be applicable:

STANDARD NO.	**PARTICULAR**
IS : 732	Code of practice for electrical wiring installation (System voltage not exceeding 650 V)
IS : 1646	Code of practice for fire safety of buildings (General) Electrical installation.
IS : 2509	Rigid non-metallic conduits for electrical wiring.
IS : 6946	Flexible (Pliable) non-metallic conduits for electrical installation.
IS : 1293	3 pin plugs and sockets.
IS : 8130	Specifications of conduits for electrical installation.
IS : 3854	Switches for domestic purpose.
IS : 3415	Fittings for rigid non-metallic conduits.
IS : 4648	Guide for electrical layout in residential building Indian electricity act and rules.

Regulations for the electrical equipment in buildings issued by the Bombay Regional Council of Insurance Association of India.

All standards and codes mean the latest.

1.2 POINT WIRING

A point shall consist of the branch wiring from the distribution board together with a switch as required, including the ceiling rose or pendant holder or swan holder, or ceiling fan box or socket or suitable termination. A point shall include, in addition, the earth continuity conductor / wire

from the distribution board to the earth pin / stud of the outlet / switch box and to the outlet points.

The point wiring shall be carried out in the under mentioned manner :

1.2.1 Supply, installation, fixing of conduits with necessary accessories, junction / pull / inspection / switch boxes and outlet boxes.

1.2.2 Supplying and drawing of wires of required size including earth continuity wire.

1.2.3 Supply, installation and connection of flush type switches, sockets, cover plates, switch plates, etc.

1.2.4 The point shall be complete with the branch wiring from the Switch board to the outlet point, Pre laid conduit with accessories, junction, pull, inspection boxes, control switch, socket, outlet boxes, ceiling roses, button / swan holder, connector etc.

1.3 POINT RATE

The rate per point shall include supply, installation, connection, testing and commissioning of point as described under “point wiring”. The measurements of the points will be enumerated.

Circuit Mains shall not be paid extra. Rate for the point shall consist of wiring from the outlet point to the switch board as required with a connector/ plate/ ceiling rose fan box with hook socket with switch. The point rate shall include in addition to phase and neutral wire a PVC insulated earth continuity wire from switch to outlet. The unit rate for the point shall consist of the circuit wiring form LDB to outlet point through switch and/or socket, switch board as required and including the outlet points with connector, fan hook box or sockets. A point shall include in addition to phase and neutral wire a PVC insulated Earth continuity wire from LDB to the final termination at outlet points. No extra rate shall be paid for circuit mains for looping switch board to switch board.

.

1.4 SYSTEM OF WIRING

Unless otherwise mentioned on the drawings, the system of point wiring shall be as follows:

The system of wiring shall consist of single core, PVC insulated, 650/1100 volt grade, copper conductor FRLS wires laid through concealed PVC conduits as directed.

1.5 GENERAL

The contractor shall submit for approval, the drawing of conduit layout indicating the route of the conduits, number and size of the conduits, location of junction / inspection / pull / outlet boxes, size and location of switch boxes, number and size of wires pulled through each conduit and all other necessary relevant details prior to laying of conduits. Only after the drawings are approved, the contractor shall proceed the work of conduit laying.

Prior to laying and fixing of conduits, the contractor shall carefully examine the working drawings prepared by him and approved by the Consultant indicating the layout, satisfy himself about the

sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details. Any discrepancy found in the drawings shall be brought to the notice of the Owner's site representative. Any modifications suggested by the contractor shall be gotten approved before the actual laying of conduits is commenced.

In laying of conduits it is important that not more than two right angle bends are provided for each circuit and as far as possible. No junction box shall be provided in the entire length of conduit run for drawing of wires. Only switch outlets, lighting fixture outlets, equipment power outlets and socket outlets shall be considered for drawing of wires.

1.6 MATERIAL

1.6.1 PVC CONDUITS :

All non-metallic PVC conduits shall conform to IS : 9537. The conduit shall be plan and type as specified in IS : 9537 and shall be used with the corresponding accessories (Refer IS : 3419 specification for fittings for rigid non PVC metallic conduits). PVC conduits shall be rigid unplasticised, medium gauge having 1.6 – 1.8 mm. wall thickness up to 20 mm. diameter conduit and 1.8 - 2 mm. wall thickness for all sizes above 20 mm. diameter.

1.6.2 BOXES :

All the boxes for switches, sockets and other receptacles, junction boxes, pull boxes and outlet boxes shall be fabricated from 2.0 mm. thick mild sheet painted with two coats of red-oxide and then two coats of enamel paints as called for. Colour of the paints shall be as approved by the client. The boxes shall have smooth external and internal finished surface. Boxes in contact with earth or exposed to the weather shall be of 2 mm. mild steel and hot dip galvanized after fabrication. Separate screwed earth terminal shall be provided in the box for earthing purpose. All boxes shall have adequate no. of knock out holes of required diameter for conduit entry. Switch boxes to receive switches, socket outlets, power outlets, telephone outlets, fan regulators, etc. shall be fabricated to the approved shape and size to accommodate all the devices without overcrowding. Outlet boxes to receive ceiling fan shall be fitted with adequately sized rod / hook to fix ceiling fan. The boxes shall be of minimum depth of 65 mm.

1.6.3 COVER PLATE:

The cover of the boxes to receive outlet points shall be of best anodized sheet cut to shape and size or plate of approved manufacturers of switches.

1.6.4 CABLES:

The cables shall conform to IS: 694. For all internal wiring FRLS wires of 650 / 1100 volts grade, single core shall be used.

The conductors shall be plain annealed copper conductors complying with IS : 1554.

The conductors shall be circular copper conductor.

The insulation shall be PVC complying with the requirements of IS : 694. It shall be applied by an extrusion process and shall form a compact homogenous body.

The thickness of PVC insulation shall be as set out in the relevant standards

The cores of all cables shall be identified by colours in accordance with the following sequence.

Single phase	-	Red
Three phase	-	Red, Yellow, Blue
Neutral	-	Black
Earth	-	Green or Green/Yellow

Means of identifying the manufacturer shall be provided throughout the length of cable.

Unless otherwise specified in the drawings the size of the cables used for internal wiring shall be as follows:

In case of circuit wiring for lights, exhaust fans, convenience socket outlet points (P+N+E) :
3 nos. of 1.5 mm.^{2} - From switch boards to outlet points

1.6.5 SWITCHES :

Switches shall conform to IS : 3854, IS : 1293 and IS : 4615. The switches shall be single pole, single or two way and shown on the drawings or as specified. They shall be of piano(tissino type) type rated for 250 volt, and of full 5 / 15 A capacity. They shall be provided with insulated dollies and covers.

The switches shall be rocker operated with a quite operating mechanism with bounce free snap action mechanism enclosed in an arc resistant chamber. The switches shall have pure silver and silver cadmium contacts. The switches shall be flush modular type The make of the switches shall be as indicated in the drawings or BOQ or make of material or as suggested and approved by the client. The switches installed in outdoor area shall be industrial, metal clad type, and shall be provided in weather proof enclosures, complete with weather proof gasketed covers.

1.6.6 SOCKETS :

The sockets shall conform to IS : 1293. Each socket shall be provided with control switch of appropriate rating. The sockets shall be piano(tissino type) type, rated for 250 volts, and either of full 5 A or 15 A capacity, as mentioned on the drawings.

Sockets shall be of three pin type, the third in being connected to earth continuity conductor. The socket shall be flush modular type. The sockets installed in machine room, plant room or wet / damp area shall be metal clad weather proof type. The finishing and make of all the sockets shall be same as light switch. The socket shall have fully sprung contacts and solid brass shrouded terminals to ensure positive electrical connections.

The sockets shall be provided with automatic shutters, which opens only when earth pit of the plug inserts in the socket.

The socket shall be provided with three pin plug top suitable to the socket and of the same make as socket.

1.7 DRAWING OF CONDUCTORS

The drawing and joining of copper conductor or wires shall be executed with due regard to the following precautions, while drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. There shall be no sharp bends.

Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or ringing.

PVC insulated copper conductor wire ends before connection shall be properly soldered (at least 15 mm length) with soldering flux / copper solder, for copper conductor. Strands of wires shall not be cut for connecting to the terminals. The connecting brass-screws shall have flat ends. All looped joints shall be soldered and connected through terminals block / connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. Conductors having nominal cross section are exceeding 4 sq. mm shall always be provided with crimping type cable sockets. At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used. Brass nuts and bolts shall be used for all connections.

Only certified wire man and cable jointers shall be employed to do joining work.

For all internal wiring PVC insulated wires of 650 / 1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in looping system and no joint shall be allowed in the length of the conductors. No wire shall be drawn in to any conduit, until all work of any nature that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduits the conduits shall be thoroughly cleaned of moisture, dust, and dirt or any other obstruction by forcing compressed air through the conduits.
Maximum permissible number of 1100 volt grade PVC insulated wires that may be drawn into rigid non metallic or PVC Conduits are given below :

Size of wires Nominal Cross section Area (Sq. mm.)	**Maximum number of wires within conduit size(mm)**				
	20	**25**	**32**	**40**	**50**
1.5	5	10	14	--	--
2.5	5	8	12	--	--
4	3	7	10	--	--
6	2	5	8	--	--
10	--	3	5	6	--
16	--	2	3	--	6
25	--	--	2	4	6
35	--	--	--	3	5

1.8 JOINTS

The wiring shall be by looping back system, and hence all joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. **No joints shall be made inside conduits and junction boxes**. Joints where unavoidable , due to any specified reasons, prior permission in writing shall be obtained from the client before making such connections. Joints by twisting conductors are prohibited.

1.9 LOAD BALANCING

Balancing of circuit in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

1.10 EARTHING

All earthing systems shall be in accordance with IS : 3043 - 1985 code of practice for earthing.

1.11 TESTING OF INSTALLATION

Before a completed installation is put into service, the following tests shall be complied with.

1.11.1 INSULATION RESISTANCE

The insulation resistance shall be measured by applying 500 volt megger with all fuses in places, circuit breaker and all switches closed.

The insulation resistance in giga ohms of an installation, measured shall not be less than 50 mega ohms divided by the number of points on the circuit.

The insulation resistance shall be measured between
EARTH TO PHASE
EARTH TO NEUTRAL
PHASE TO NEURAL
PHASE TO PHASE

1.11.2 EARTH CONTINUITY PATH :

The earth continuity conductors shall be tested for electrical continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit-breaker, measured from the connection, with the earth electrode to any point in the earth continuity conductor in the completed installation and shall not exceed one ohm.

1.11.3 POLARITY OF SINGLE POLE SWITCHES :

A test shall be made to verify that every no-linked, single pole switch is connected to one of the phase of the supply system.

1.11.4 COMPLETION CERTIFICATES :

All the above tests shall be carried out in presence of client and the results shall be recorded in a prescribed forms. Any default during the testing shall be immediately rectified and that section of the installation shall be re tested. The completed test result from shall be submitted to the client for approval.

On completion of an electric installation a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form as required by the local electric supply authority.

2.0 DISTRIBUTION BOARDS

DISTRIBUTION BOARDS (DB's)

Distribution Boards (DB's) shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, neutral grounded at transformer. The DB shall be minimum di-electric strength of 2.5 KV / Sec. All Distribution Boards shall manufactured by a manufacturer listed in Appendix-I.

DB's shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993.

2.1 CONSTRUCTION FEATURES

DB's shall be **IP 43**& made out of 1.6 mm thick high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of DB shall be folded and braced as necessary to provide a rigid support for all component. DB shall be suitable for indoor / outdoor installation, wall mounting free standing type, in double door construction. The Distribution Boards shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement. All removable/ hinged doors and covers shall be grounded by 4.0 sq mm tinned stranded copper connectors. Distribution Boards shall be suitable for the climatic conditions. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage up to and including 1100 V AC.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of DBs.

Three phase boards shall have phase barriers and a wire channel on three sides. Neutral bars shall be solid tinned copper insulated bars with tapped holes and chase headed screws. For 3

phase DB's, 3. Independent neutral insulated bars shall be provided. All DB's shall be internally pre-wired using copper insulated PVC wires brought to a terminal strip of appropriate rating for outgoing feeders.

Knockout holes of appropriate size and number shall be provided in the DB's in conformity with the location of cable/conduit connections. Detachable sheet steel gland plates shall be provided at the top / bottom to make holes for additional cable entry at site if required.

Distribution Boards shall comprises of the following:

1.1.1 A panel for mounting where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.

1.1.2 Installation accessories shall be part of the DB for fixing conductor and rails for mounting MCB's and RCCB's etc.. neutral bus bars & earthing bus bars required in the circuit. All busbars in the FDB shall be insulated type.

1.1.3 Service cable /interconnection shall be part of the Distribution Boards.

1.1.4 The board shall be installed at a height such that the operating is within reach of the normal human height i.e. 1.2 to 1.8 meters from finish floor level.

1.1.5 Degree of protection shall be IP-52 for indoor application, IP-54 for kitchen & laundry and IP-55 for outdoor application.

1.1.6 All three phase distribution boards shall have 4 rows and single phase distribution boards shall have single rows for housing of MCB's and RCCB's unless noted otherwise.

1.1.7 Phase segregation to be maintained in all three phase distribution boards.

1.1.8 Earthing shall be provided in each FDB's.

2.2 MINIATURE CIRCUIT BREAKER (MCB)& MCCB

MCB

Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B,C,D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the

external operating handle.

MCB should be having an integrated label holder with dual side din rail locking facility. Incoming & Outgoing should have facility for termination of Busbar & Cable separately.

Cable termination facility should be up to 35 sq. mm.

MCCB

The MCCB shall be thermal magnetic having features of indication and protection for overload, short circuit, earth fault. MCCB should be confirming to IS 13947 or IEC-947.

Important Parameters

Sr No	Parameters	Data
1.	Rated Operating Voltage	500 V
2.	Rated Insulation Voltage	1000 V
3.	Rated Impulse Withstand voltage	8 Kv
4.	Rated ultimate short ckt breaking capacity @ 415V	35 kA
5.	Rated Short time withstand current for 1sec	35kA
6.	Rated Short time withstand current for 3 Seconds	--
7.	Rated short circuit making capacity @ 440V ac	105kA
8.	Protection range for over load and short circuit	from 40% to 100%
9.	Utilization category	B
10.	Mechanical Life operations without Maintenance	4000
11.	Mechanical Life operations with Maintenance	4000
12.	Electrical Life operations @ 440V without maintenance	4000
13.	Number of poles	3 or 4 as applicable

The MCCB shall be with protections and having various setting range as below with 2NO+2NC auxiliary contacts.

Protection	**Current Adjustment**	**Time Adjustment**
Overload (Ir)	0.4 – 1 times In	Min.5 Setting

Short circuit	1.5 – 10 times Ir.	Min 4 Setting
Instantaneous	1.5 – 11 times In	Fixed
Earth fault	0.2 – 1 times In	Min. 4 Setting

Following constructional features are required:

- Trip free mechanism
- Total segregation between power and front shield so as to guarantee maximum operational safety.
- Operating lever should indicate true position of contacts.
- Provision for ROH with door interlock facility and pad lock facility. Adjustable shaft for ROH.

2.3 RESIDUAL CURRENT CIRCUIT BREAKER CURRENT OPERATED TYPE (RCCB)

I. System of Operation

Residual Current Circuit Breaker shall confirm to IEC 61008.RCCB shall work on the principle of core balance transformer. The incoming shall pass through the torroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB shall be current operated independent of the line voltage, current sensitivity shall be of 30 / 100 mA at 240/415 volts AC and shall have a minimum of 20,000 electrical operations.

It should provide full protection as envisaged by IE rules – 61-A, 71 – ee, 73 – ee, 1985 and also rule 50 of IE rule1956.

II. Mechanical Operation

The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing /opening of all the three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

III. Neutral Advance Feature

The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact First before the phases; and at the time of opening, the

neutral shall breaks last after allowing the phases to open first. This is an important safety feature which is also required by regulations.

MCB should be having an integrated label holder with dual side din rail locking facility. Incoming & Outgoing should have facility for termination of Busbar & Cable separately.

Cable termination facility should be up to 35 sq. mm.

IV. Testing Provision

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB / RCCB and the operating handle shall move to the "OFF" position.

2.4 **EARTHING**

Earthing shall be provided as per IS:3043-1987.

2.5 **PAINTING**

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivaiting (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be of Siemens gray paint shade no. RAL-7032 of IS Code No.5.

2.6 **LABELS**

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

2.7 **TESTING**

Testing of panels shall be as per following codes:

IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages upto and including 1000 VAC.

IS: 13947 : 1993 Degree of protection

2.8 **WIRING**

In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

3.0 MEDIUM VOLTAGE CABLES

3.1 SCOPE

This section shall cover supply of medium voltage cables.

3.2 STANDARDS

The following standards and rules shall be applicable :

IS : 1554	PVC insulated electric cables (heavy duty).
IS : 1753	Aluminium conductors for insulated cables.
IS : 3961	Recommended current ratings for cables.
IS : 8130	Aluminium conductors for insulated cables

Indian Electricity Act and Rules.

3.3 MEASUREMENTS

The cables will be measured in meters. The unit rate shall include cutting the cable into required lengths, packing , loading , unloading, insurance, transportation, delivery to stores/site as per work order, stocking in stores, testing of cables at stores etc. of medium voltage cable.

3.4 GENERAL

The medium voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian Standards specifications, manufacturer's instructions. The cables shall be delivered at site in original drums with manufacturer's name, size, and type, clearly written on the drums.

3.5 MATERIAL

The MV cables shall be cross linked polyethylene (XLPE) insulated PVC sheathed of 1100 volts grade aluminium or copper conductor, armoured and unarmoured heavy duty, conforming to IS : 7098 Part I IS : 1988 Part I. as asked for in the schedule of quantities.

3.5.1 All XLPE Aluminium/Copper Power cables shall be 1100 Volts grade, multi core constructed as per IS : 7098 Part-I of 1988 as follows :

a) Stranded Aluminium /Copper conductor of high conductivity upto 4 mm.^{2} size, the conductor shall be solid and above 4 mm.^{2}, conductors shall be concentrically stranded as per IEC : 328.

b) Cores laid up

c) The inner sheath should be bonded over with thermo-plastic material for protection against mechanical and electrical damage.

d) Armoring should be provided over the inner sheath to guard against mechanical damage. Armouring should be Galvanised steel wires or galvanisedsteel strips. (In single core cables used in A.C. system armouring should be non-magnetic hard aluminium Wires/Strips. Round steel wires should be used where diameter over the inner sheath does not exceed 13 mm; above 13 mm flat steel armour should be used. Round wire of different sizes should be provided against specific request.)

e) The outer sheath should be specially formulated heat resistant black PVC compound conforming to the requirement of type ST2 of IS : 5831-1984 extruded to form the outer sheath.

3.5.2 Conductor shall be of electrolytic Aluminium/Copper conforming to IS : 8130 and are compact circular or compact shaped.

3.5.3 Insulation shall be of XLPE type as per latest IS general purpose insulation for maximum rated conductor temperature 70 degree centigrade.

3.5.4 In Inner sheath laid up cores shall be bonded over with thermoplastic material for protection against mechanical and electrical damage.

3.5.5 Insulation, inner sheath and outer sheath shall be applied by extrusion and lapping up process only.

3.5.6 Armouring shall be of galvanised steel wire/flat.

Galvanised steel flat strip / round wires applied helicaly in single layers complete with covering the assembly of cores.

For cable size upto 25 Sq. mm. : Armour of 1.4 mm dia G.I. round wire

For cable size above 25 Sq. mm. : Armour of 4 mm wide 0.8 mm thick G.I. strip

3.5.7 Repaired cables shall not be used.

3.5.8 Current ratings of the cables shall be as per IS : 3961.

3.5.9 The XLPE insulated cables shall conform to latest revision IS read along with this specifications. The Conductor shall be stranded Aluminium/Copper circular/ sector shaped and compacted. In multi core cables the core shall be identified by red, yellow, blue and black coloring of insulation as following.

CORE IDENTIFICATION :

Two core	:	Red and Black
Three core	:	Red, Yellow and Blue
Four core	:	Red, Yellow, Blue and Black
Single core	:	Green, Yellow for earthing

Black shall always be used for neutral.

3.5.10 The XLPE insulated 1100 Volts grade power cables shall conform to latest IS and shall be suitable for a steady conductor temperature of 70 degree centigrade. The conductor shall be stranded Aluminium/Copper as called for in the Schedule of quantities. The outer sheath shall be as per the requirement of type ST-2 of IS:5831 of 1984.

3.5.11 The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.

3.5.12 Progressive automatic in line sequential marking of the length of cables in meters at every one meter shall be provided on the outer sheath of all cables.

3.5.13 Cables shall be supplied in non returnablewooden drums as per IS : 10418.

3.5.14 Both ends of the cables shall be properly sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation, storage and erection.

3.5.15 The product should be coded as per IS :- 7098 Part-I as follows :-

Aluminium Conductor A

XLPE Insulation 2X

Steel round wire armour W

Steel strip armour F

Steel Double round wire armour WW

Steel Double strip armour FF

Non-magnetic (Al.) round wire armourWa

Non-magnetic (Al.) strip armour Fa

PVC outer sheath Y

3.6 GENERAL

All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.

The cable shall be supplied in single length i.e. without any intermediate joint or cut unless specifically approved by the client.

The cable ends shall be suitably sealed against entry of moisture, dust, water etc. with cable compound as per standard practice.

3.7 TESTING

3.7.1 FINISHED CABLE TESTS AT MANUFACTURER'S WORKS :

The finished cables shall be tested at manufacturer's works. Following routine tests for each and every length of cable and copy of test results shall be furnished for each length of cable alongwith supply. If specified, the cables shall be tested in presence of clients representative.

(a) VOLTAGE TEST :

Each core of cable shall be tested at room temperature at 3 KV A.C. R.M.S. for a duration of 5 minutes.

(b) CONDUCTOR RESISTANCE TEST :

The D.C. Resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20° c. to check the compliance with the values specified in IS 8130 - 1976.

Prior to dispatching cables, and at the time of delivering the cables at stores, following tests shall be carried our :-

Insulation Resistance test between phases and phase to Neutral and phase to earth.

Continuity test of all the phases, neutral and earth continuity conductor.

Sheathing continuity test.

Earth resistance test of all the phases and neutral.

All tests shall be carried out in accordance with relevant Indian Standard Code of practice and Indian Electricity Rules. The Vendor shall provide necessary instruments, equipments and labour for conducting the above test and shall bear all expenses in connection with such tests. All tests shall be carried our in the presence of the client and results shall be recorded in the prescribed forms.

3.8 CABLE MARKING

EMBOSSING ON OUTER SHEATH :

The outer sheath shall be legibly embossed with following legend :

ELECTRIC CABLE : 1100 V, SIZE : 3.5 C x ----- mm ^{2}.

Manufacturer's Name & year of manufacturing.

3.9 SEALING, DRUMMING& PACKING

After tests at the manufacturer's works, both ends of the cable shall be sealed to prevent the ingress of moisture during transportation and storage.

Cable shall supplied in length of 500 ± 10% meters on packed non-returnable drums of sufficiently sturdy construction.

Cables of length more than 250 meters shall also be supplied on non-returnable drums.

The spindle hole shall be 110 mm minimum diameter.

Each drum shall bear on the outside flange, legibly and indelibly in the English literature, a distinguishing number, the manufacturer's name and particulars of the cable i.e. voltage grade, length, conductor size, cable type, insulation type and gross weight shall also be clearly visible. The direction for rolling shall be indicated by an arrow. The drum flange shall also be marked with manufacturer's name and year of manufacturing etc.

4.0 LIGHTING FIXTURES & ACCESSORIES

The light fixtures and fittings shall be assembled and installed in position complete and ready for service, in accordance with details, drawings, manufacturer's instructions and to the satisfaction of the Project Manager.

4.1 SCOPE :

Scope of work under this section shall include inspection at suppliers/manufacturer's premises at site, receiving at site, safe storage, transportation from point of storage to point of erection, erection and commissioning of light fittings, fixtures and accessories including all necessary supports, brackets, down rods and painting etc as required.

4.2 STANDARDS :

The lighting and their associated accessories such as lamps, reflectors, housings, ballasts etc., shall comply with the latest applicable standards, more specifically the following:

General and safety requirements for Luminaries :

Part-1 Tubular fluorescent lamps	-	IS – 1913 (Part-1)
Bi-pin lamp holders for tubular fluorescent lamps	-	IS - 3323
Electronic Ballasts for fluorescent lamps – General & Safety requirement	-	IS – 13021 (Part-1)
Electronic Ballasts for fluorescent lamps – Performance requirement	-	IS – 13021 (Part-2)
Tubular Fluorescent lamps	-	IS - 2418 (Part-1to4)
Luminaries – General requirement	-	IS – 10332 (Part-1)
Luminaries – Constructional requirement	-	IS – 10332 (Part-2)
Luminaries – Screw and Screwless termination	-	IS – 10332 (Part-3)
Luminaries – Methods of Tests	-	IS – 10332 (Part-4)
Particular requirement – General purpose Luminaries	-	IS–10332(Part-5 / Sec - 1)
Particular requirement – Recessed Luminaries	-	IS–10332 (Part-5 / Sec – 2)
Particular requirement – Luminaries for Road and Street lighting	-	IS–10332 (Part-5/Sec-3)

Particular requirement – Portable General purpose Luminaries - IS–10332 (Part-5/Sec-4)

4.3 LIGHT FITTINGS-GENERAL REQUIREMENTS :

a). Fittings shall be designed for continuous trouble free operation under atmospheric conditions without reduction in lamp life or without deterioration of materials and internal wiring. Degree of protection of enclosure shall be IP-65 for outdoor fittings except bulkhead fitting. Bulkhead fitting shall be provided with IP-54 protection.

b) Fittings shall be so designed as to facilitate easy maintenance including cleaning, replacement of lamps/ ballasts.

c). All fittings shall be supplied complete with lamps. All mercury vapour and sodium vapour lamp fittings shall be complete with accessories like ballasts, power factor improvement capacitors, starters, etc. Out door type fittings shall be provided with weather proof junction boxes (IP-55) and IP-54 Control gear boxes.

d) Each fitting shall have a terminal block suitable for loop-out connection by 1100 V PVC insulated copper conductor wires up to 4 sq.mm. the internal wiring should be completed by the manufacturer by means of standard copper wire and terminated on the terminal block.

e) All hardwares used in the fitting shall be suitably plated or anodized and passivated.

f) Earthing : Each lighting fitting shall be provided with an earthing terminal. All metal or metal enclosed parts of the housing shall be bonded and connected to the earthing terminal so as to ensure satisfactory earthing continuity throughout the fixture.

g) Painting/Finish : All surfaces of the fittings shall be thoroughly cleaned and degreased and the fittings shall be free from scale, rust, sharp-edges, and burns.

h) The housing shall be powder coated/stove-enameled or anodised as required. The surface shall be scratch resistant and shall show no sign of cracking or flaking when bent through 90 deg. over 12 mm dia mandrel.

i) Metal used in BODY of lighting fixtures shall be not less than 32 SWG or heavier if so required to comply with specification of standards. Sheet steel reflectors shall have a thickness of not less than 20 SWG. The metal parts of the fixtures shall be completely free from burns and tool marks. Solder shall not be used as mechanical fastening device on any part of the fixture.

4.4. LIGHT FITTINGS – SPECIAL REQUIREMENTS

Box Channel Type Industrial Fittings

Box type slim line channel must be in screw less construction manufactured from M.S. CRCA sheet steel powder coated with MS CRCA cover, powder coated white. Light reflection surface in Box/Channel type fittings shall be in a POLYESTER PRECOATED STEEL having a reflection factor of not less than 80%. SCREWLESS DESIGN & CONSTRUCTION Light fixtures shall be preferred due to their ease of maintenance, especially for box/channel for box/channel type fixtures.

Moisture Proof Industrial Fittings

Surface mounted totally enclosed moisture proof fixtures must be in polycarbonate body and diffuser with transparent prismatic interior and smooth exterior and frosted end. Fixture must be completely sealed with polyerethane double gasket to achieve IP 65 protection. Fixture is complete with CRCA steel white powder coated / enameled finish reflector.

18 W / 36 W Fluorescent and 36 W CFL Low Glare Light Fittings

Recessed mounted, modular fluorescent lighting fixture made of CRCA Sheet steel powder coated (white) housing, electro chemically brightened and anodised reflector, three dimensional cross louvers with concave contours, fresnel top at louver saddle to increase efficiency. The luminance of <200 cd/M^2 at 63 degree viewing angle in all directions so as to confirm Cat-2 classification of CIBSELG3

4.5 ACCESSORIES FOR LIGHT FITTINGS REFLECTORS

The reflectors shall be made of CRCA sheet steel/aluminium /Silvered glass/Chromium plated sheet copper as required. The thickness of reflectors shall be as per relevant standards. Reflectors made of steel shall have stove enameled/ vitreous enameled/epoxy coating finish. Aluminium used for reflectors shall be anodized/epoxy stove enameled /mirror polished. The finish for the reflector shall be as specified. The reflectors shall be free from scratches / blisters and shall have a smooth and glossy surface having optimum light reflecting coefficient. Reflectors shall be readily removable from the housing for cleaning and maintenance without use of tools.

4.6 LAMPS

4.6.1 TLD

Lamp shall be environment friendly low pressure mercury discharge lamp with mercury content less than or equal to 5 mg. The lamp shall have minimum lumen maintenance of 85 and CRI of 85. The lamp must comply to ROSH (Restriction of Hazardous substances) and covered by WEEE. Lamp should be fully re-cyclable. The lamp should be low on maintenance with life of 40 K hours in case of electromagnetic ballast and 65 K hours in case of HF ballast up to 10% failure. The discharge glass shall be lead free.

TLD Lamps shall be minimum tri-phosphor type and have bi-pin bases. Colour spectrum of light shall be equivalent to "PHILIPS color 84 or color 86 color 82 or "OSRAM color 21 or color 11 or color 41 (as required at site)".

The fluorescent Tubes (TLD) should have cool daylight colour designation. But Architects reserve the right to prescribe either Cool Daylight or Bright White or Incandescent Colour Designations for TLD. NO extra payment will be made over the quoted rate of bidder for this. The 36 W fluorescent tubes will have Nominal Luminous Flux of not less than 3350 lumens whether so mentioned in the Schedule of Quantities or not.

T 5 – HIGH EFFICIENCY ECO-FRIENDLY LAMPS

T-5 lamp shall be environment friendly low pressure mercury discharge lamp with mercury content less than or equal to 3 mg. lamp should have lowest CO2 emission compared to any other comparable light source (40% less than a TL-D standard lamp, 26% less than TL-D / 80). T-5 lamp shall be 100% lead free. T-5 lamp shall be designed for operation with electronic gear and well suited for dimming. Maximum lumen output to be reached at approx 35^{o}C in free burning position. T-5 lamp can be ignited from -15^{o}C to + 50^{o}C. Lamp should be fully recyclable and must comply to ROSH (Restriction of Hazardous substances) and shall be covered by WEEE. T-5 shall have 16 mm in diameter service life of TL-5 lamp should be 10% more than TL-D lamps. T-5 lamp shall have lumen efficacy of up to 104 Lux / W and shall have excellent colour rendering to En 12464 (Ra 80 to 89).

4.6.2 Compact fluorescent lamp shall have same luminous flux and power consumption as fluorescent tubes but less than half the length and more compact than U-shaped and circulator lamps. CFL shall be suitable for use with conventional control gear & standers and for HF electronic control gear. CFL lamp shall be non integral type of OSRAM / PHILIPS only.

4.7 HIGH FREQUENCY ELECTRONIC BALLAST

High frequency electronic ballast shall be used with fluorescent / Compact Fluorescent Lamps wherever specified in the schedule of quantities. High frequency electronic ballast shall comply to the following:

- IEC 927, IEC 928 for ≤10% total harmonic distortion.
- EMI / RFI – Confirming to FCC / VDE Class A/B.
- Line Transient as per IEEE C62.41.
- Ballast Crest Factor C1.7%.
- No Stroboscopic Effect
- Constant Wattage / Light output between 240 V ± 10%.
- Circuit protection for surge current and inrush current.
- Short circuits, open lamp protection
- PF > 70 for fluorescent / T5 lamp and CFL.

- Deactivated lamp protection
- Suitable for use with single and twin lamps
- RFI < 30 MHz EN 55015
- Total Harmonic Distortion (THD) ≤10%
- Immunity to interference EN 61547
- Safety EN 60928 / IEC 928 / IS 13021 (Part I)
- Performance EN 60929 / IEC 929 / IS 13021 (Part II)
- Vibrations & Bump tests IEC 68-2-6 FC

IEC 9001

- Quality Standard ISO 9001
- Environmental Standard ISO 14001
- DC Operation EN 60924
- Emergency Lighting Operation VDE 0108

Total System consumption (lamps + ballast) for
1 x 28 W T-5, shall not exceed 32 W

5. EARTHING

5.1 EARTHING

The system shall be TNS with four wire supply system (R,Y,B,N and 2 Nos. E) brought from the main L T Panel. All the non-current carrying metal parts of electrical installation and all metal conduits trunking, cable sheaths, switchgear, distribution panels, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All metal work such as pipe lines, ducts, cable trays, stair case railing etc shall be bonded to earth.

All earthing shall be in conformity with IS:3043 1987, and the basic system of earthing shall be TNS.

5.2 EARTHING CONDUCTORS

Earthing conductors shall be of copper / GI as mentioned in schedule of quantities and shall be protected against mechanical injury and corrosion.

5.3 SIZING OF EARTHING CONDUCTORS

The cross sectional area of earthing conductor shall not be smaller than half of the largest current carrying conductor subject to an upper limit of 80 Sq.mm. If the area of the largest current carrying conductor or bus bar exceeds 160 sq.mm then two or more earthing conductors shall be used in parallel, to provide at least half the cross sectional area of the

current carrying conductor or bus bars. All fixtures, outlet boxes, junction boxes and power circuits up to 15 amps shall be earthed with PVC insulated copper wire.

All 3 phase switches and distribution panels up to 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper / GI wires. All 3 phase switches and distribution panels up to 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia copper / GI wires. All switches, bus bar, ducts and distribution panels of rating 200 amps and above shall be earthed with minimum of 2 nos separate and independent 25 mm x 3 mm copper / GI tape.

5.4 CONNECTION OF EARTHING CONDUCTORS

Main earthing conductors shall be taken from the earth connections at the main L T panel to an earth electrode with which the connection is to be made. All joints in tapes shall be with four rivets and shall be brazed in case of copper and by welding bolting in case of GI, wires shall be connected with crimping lugs, all bolts shall have spring washers. Sub- mains earthing conductors shall run from the main distribution panel to the sub distribution panel. Final distribution panel earthing conductors shall run from sub-distribution panel.

Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor, or its distribution panel. Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to distribution panel at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, lighting fitting etc. which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of the earthing conductor for earthing purposes, even though the run of metallic conduit is earthed.

The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 2.5 M below finished ground level.

The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column.

The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.

19 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber.

Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe.

The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing.

The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.

Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS : 3043, Code of Practice for Earthing Installation.

The earth conductors (Strips / Wires copper / Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanised Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.

The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

EARTH LEADS AND CONNECTIONS :

Earth lead shall be bare copper or Galvanisedsteel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. G.I strips buried in the ground shall be protected with bitumen and hessian wrap or polythene faced hessian and bitumen coating. At road crossing necessary Hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface.

The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

5.5 **PROHIBITED CONNECTIONS**

Neutral conductor, sprinkler pipes, or pipes conveying gas, water or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lightning protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system. The electrical resistance measured between earth connection at the main L T panel and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate or circuit breakers, and shall not exceed 1 ohm. All switches carrying medium voltage shall be connected with earth by two separate and distinct connections. The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in G I pipe of adequate size. The overlapping in strips at joints where required shall be minimum 75 mm. The joints shall be riveted and brazed in case of copper and by welding / bolting in case of GI in an approved manner. Sweated lugs of adequate capacity and size shall be used for termination of all conductor wires above 6 sq.mm size. Lugs shall be bolted to the equipment body to be earthed

after the metal body is cleaned of paint and other oily substances and properly tinned. Equipotent bonding of all metallic structures shall be done.

5.6. EARTHING

The following must always be ensured in earthing system.

- All earths must be interconnected at the earth pits. This includes generator neutrals, transformer neutrals, transformer body, lightning protection system earths, UPS earths etc.

- Extraneous conductive parts such as gas pipes, other service pipes and ducting risers and pipes of fire protection equipment and exposed metallic parts of the building structure.

5.7 The Contractor shall get the soil resistivity test done at his own cost of the area where earthing pits are to be located before starting the installation.

5.8 RESISTANCE TO EARTH

The resistance of earthing system shall not exceed 1 ohm.

5.9 SPECIFICATION FOR HOT DIP GALVANIZING PROCESS FOR MILD STEEL USED FOR EARTHING FOR ELECTRICAL INSTALLATION

GENERAL REQUIREMENTS

I. Quality of Zinc

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS:209-1992.

II. Coating Requirement

Minimum weight of zinc coating for mild steel flats with thickness upto 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square metre shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs, rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing. Jointing of earthing tape shall be by welding. All joints and cut ends shall be properly painted with aluminium paint.

5.10 TEST :

The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS : 3043.

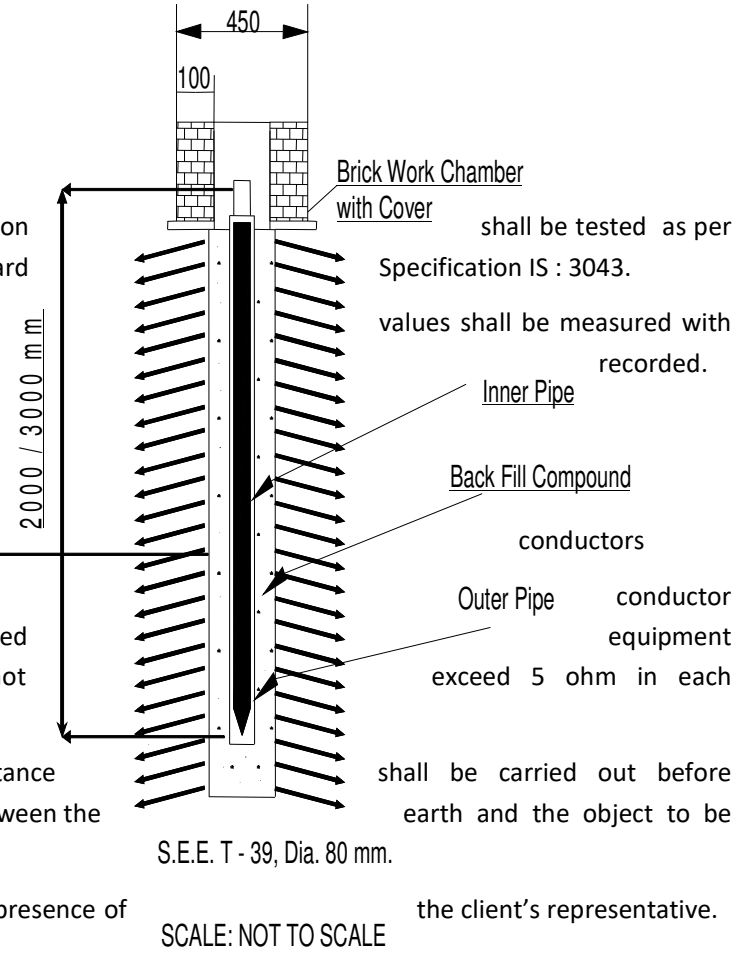
The following earth resistance values shall be measured with an approved earth megger and recorded.

1) Each earthing station
2) earthing system as a whole
3) Earth continuity conductors

Earth resistance for each earthed conductor shall be measured which shall not exceed 5 ohm in each case.

Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.

All tests shall be carried out in presence of the client's representative.



Conformity to IE Act, IE Rules, and Standards

All Electrical works shall be carried out in accordance with the provisions of Indian Electricity Act, 2003 and Indian Electricity Rules, 1956 amended up to date (Date of call of tender unless specified otherwise). List of Rules of particular importance to Electrical Installations under these General Specifications is given in Appendix C for reference.

(13) DIESEL GENERATING SETS

Item No. 01:

Supplying and erecting, commissioning and testing diesel generating set having continuous rating, 3 phase, 415 volts, 50 cycles A.C. supply comprising of a totally enclosed air/water cooled diesel engine with multi-cylinders developing suitable BHP not less than following capacity at 1500 RPM with 10% overload for one hour in 24 hours with standard accessories like fly wheel, lubricating oil cooler, "A" class governor, heavy duty fuel wheel and lubricating oil filter, oil bath air filler, lubricating oil pressure gauge, end exhaust manifold, standard set of tools with adjustable spanners, screw drivers, feeder gauge, cylinder head to cover, joint cylinder head to exhaust, element lube oil filter, 12/24 volts electric starting equipment complete with standard battery, dynamo, cut-outs, ammeter, necessary wiring, pressure gauge, starter etc and heavy duty Residential type exhaust silencer and vertical hot air duct both logged with asbestos rope, save oil trays, exhaust piping of required length, standard wall/floor mounted fuel with level indicator and piping and drip proof alternator, self excited, self regulated, screen protected, with

excitation system, capable of delivering the rated system output at 415 volts, 3 phase, 0.8 PF, 50 Hz, 4 wire, running at 1500 RPM, conforming to IS-4722- 1968 with voltage regulation +/- 5% of rated voltage from no load to full load. Both the engine and alternator fitted on a common fabricated steel base plate with antivibration mounting engine and alternator both connected to each other by flexible flange coupling and with floor/wall mounted control panel box comprising of voltmeter ammeter, selector switches, ACB / MCCB / MCB of adequate capacity, indicator lamps duly wired with HRC fuses. The alternator & control panel shall be connected with provided suitable capacity armoured cable and complete with Acoustic enclosure (canopy) made out of 18 SWG CRCA Sheet, sound absorbing material Rockwool of 64 density & 100 mm thick conforming to IS:8183 The resin bonded rockwool covered from inside the canopy by perforated sheet with 3/4 mm holes, sound level not more than 75 dB at a distance of 1 mtr, as per PVCT norms. Erection, commissioning and satisfactory testing as per requirement with first filling of fuel, oil, etc. with guarantee of complete system for One year. & with obtaining all necessary certificate from Electrical Inspector. The Capacity and Ratings of DG sets are as below.
(G) Continuous Rating of 50 KVA ,BHP not less than 65.8 BHP

Workmanship and measurement:
Item shall be executed as per item description, manufacturers specification and instruction of engineer in charge.
Rate shall be for one number**.**

Approved Make List for Civil Works

ITEM	Approved Brands/Quality
ORDINARY PORTLAND CEMENT (OPC 53)	UltraTech, Siddhi, Binani, Sanghi, Ambuja, Hathi, Jaypee, J K Lakshmi
WHITE CEMENT	Birla White, J K White, Nihon White
TMT FE-500 OR FE- 500 D RIBBED BARS	ASR, NATIONAL, GERMAN–TMX, JINDAL, SAIL, VIZAG, TATATISCON, ELECTROTHERM (ETTMT), UTKARSH, GALLANT
AUTOCLAVED AERATED CONCRETE BLOCKS	UltratechXtralite, J K Smart Blox, Aerocon, Ecogreen, Accurate, Wonder Block, Efcon
TEAK WOOD	Valsad, Ghana, Nigeria, Bulsar, C P Teak or as approved by director project. free from knots, cracks.
FLOAT/ TINTED GLASS	Modi Guard / Asahi / Saint Gobain
INTERLOCKING PAVER BLOCKS-MACHINE PRESSED	Locally available as approved shape and size, Rubber moulded, having crushing strength not less than as described in Item.
M.S. SECTIONS	Any I.S.I.
G.I. SHEET/SSR	Jindal, ASR,Essar
INSULATION	AEROLAM/ROCKWOOL
CONSTRUCTION CHEMICALS	
ANTITERMITE TREATMENT HEPTACHLOPR	Durmet by Cynamid India, NocilPyramid ,Lyntric by Bayer India
SPECIALISED CONSTRUCTION CHEMICALS	Fair-Mat, Fisher,Fosroc, Sikka, Pidilite, Global, BASF, Dr. Fixit
WATER PROOFING MATERIALS	Fair-Mat, Fosroc, Sikka, Pidilite, BASF, Dr. Fixit, Zycosil
TILES	
CERAMIC TILES	Somany, Kajaria, Jonson, Asian, Varmora, Sunheart, Simpolo,Zealtop, Swastik, Bell
GLAZED TILES	Somany, Kajaria, Jonson, Asian, Varmora, Sunheart, Simpolo, Zealtop, Swastik, Bell
VITRIFIED TILES	Somany, Kajaria, Jonson, Asian, Varmora, Sunheart, Simpolo, Zealtop, Swastik, Bell
PAINT	
ACRYLIC PAINT	ICI, Dulux,Asian,Nerolac, Burger, Jotun, Global
OIL BOUND DISTEMPER	ICI, Dulux, Asian, Nerolac, Burger, Jotun, Global
FIRST QUALITY ENAMEL PAINT	ICI, Dulux, Asian, Nerolac, Burger, Jotun, Global
PUTTY	ICI,Dulux, Asian, Birla White Wall Care, Global,JK
WEATHER PROOF EXTERIOR EMULSION PAINT	ICI, Dulux, Asian, Nerolac, Burger, Jotun, Global
WALL TEXTURE	Jotun, Heritage, Global, Asian
ALUMINIUM	
ALUMINIUM SHEETS AND ACCESSORIES	Jindal, Hindalco, Banko, National
ALUMINIUM EXTRUDED DOOR/ WINDOW SECTION	Jindal, Hindalco, Banko, National
ALUMINIUM HARDWARE	Everite, Garnish, Crown Classic, Glider
FURNITURE / WOOD WORK	
PLY/ BLOCK BOARD	KIT Ply, Anchor, Greenply, Uniply, Century, Archidply
ADHESIVE	Fevicol SH, Araldite, SR 998, Century SH.
WOOD PRESERVATIVE	STP- Pentaphene pale, Pest Control (India)

FLUSH DOOR – DECORATIVE / NON-DECORATIVE(IS Marked)	KIT Ply, Anchor, Greenply, Uniply, Century, Archidply
PVC DOOR	Rajshree, Vikas, Sintex
LAMINATE SHEET	Century, Formica, Greenlam, Alfa-ica, Decolam, Sundek,Merino, Aerolam, Bell
WOODEN ADHESIVES	Fevicol, Blue coat, Araldite.
DOOR HARDWARE	Kich, Dorma, Palladium, Magnum, Dorset, Godrej, Arch, Ozone
DOOR CLOSER, FLOOR SPRING	Kich, Dorma, Palladium, Magnum, Dorset, Godrej, Arch, Ozone
DEAD LOCKS/ MORTISE LOCKS	Kich, Dorma, Dorset, Godrej,Arch, OZONE
Gypsum ceiling	SaintGobainGyporc/ USG BORAL/ Asian Gypsum Industries Pvt. Ltd

Notes:

a) The contractor shall produce samples of the materials for approval of the Executive Engineer/PMC. The materials of the makes out of the above as approved by the EIC shall be used on the work. EIC member has not bide to give any reason for rejection of any brand from the above list and its decision will be consider as final.

b) In respect of materials for which approved makes are not specified above, these will be of makes to be decided by the PMC/Engineer in Charge.

Approved Make List for Sanitary and Plumbing Works

ITEM	Approved Brands/Quality
SANITARY AND PLUMBING	
SANITARY WARE	Cera,Hindware,Parryware, Johnson, Somany, Tita
P.V.C. PIPES AND FITTING (UPVC/CPVC)	Finolex, Supreme, Kisan,Ashirwad, Astral, Dutron, Prince, Precision, Ajay, Waterflow
CHROMIUM PLATED WATER SUPPLY FITTINGS	Hindware, Jaquar, Aquel, Kohler, Essco, Grohe, Plumber, Cera, Somany,DCI
C.I. MANHOLE COVER	ISI approved make
PLUMBING FIXTURES	Hindware, Jaquar, Aquel, Kohler, Essco, Grohe, Plumber, Cera, Somany, DCI
PVC WATER TANK (100% VIRGIN PVC)	Syntex, Aqua, Aris
S.S. SINKS	Nirali, Navkar, Parryware
SLUICE VALVE	Kirloskar, Kartar, Sir, Krisna
NON RETURN VALVE	Kirloskar, Kartar, Krisna

Notes:

a) The contractor shall produce samples of the materials for approval of the Executive Engineer/PMC. The materials of the makes out of the above as approved by the EIC shall be used on the work. EIC member has not bide to give any reason for rejection of any brand from the above list and its decision will be consider as final.

b) In respect of materials for which approved makes are not specified above, these will be of makes to be decided by the PMC/Engineer in Charge.

LIST OF MATERIALS OF APPROVED BRAND/ MANUFACTURER (ONLY FIRST QUALITY TO BE USED (ELECTRICAL WORKS)

MAKE LIST FOR ELECTRICAL WORKS		
SR.NO.	**ITEM**	**STANDARD MAKE**
1	DRY TYPE TRANSFORMER	SCHNEIDER / VOLTAMP / KIRLOSKAR / CROMPTON
2	H.T.VCB / PANEL	ABB / SIEMENS / SCHNEIDER ELECTRIC / L&T
3	PROTECTION RELAY FOR H.T PANEL	GE / ABB / L&T / SIEMENS / SCHNEIDER
4	H.T.XLPE CABLE	POLYCAB / FINOLEX / HAVELLS/ KEI
5	H.T.JOINT (HEAT SHRINKABLE)	RAYCHEM / 3-M
6	LT PANELS	CPRI / ERDA APPROVED PANEL BUILDER. 70KA SHORT CIRCUIT WITHSTANDS STRENGTH. ACCESSORIES AS PER MENTIONED IN MAKE LIST.SUBJECT TO CLIENT CONFIRMATION.
7	DISTRIBUTION BOARDS	LEGRAND / SCHNIEDER / HAGER / L&T / SIEMENS
8	MEDIUM VOLTAGE CABLE & WIRE	FINOLEX / POLYCAB / KEI / HAVELLS
9	CABLE TRAY (ALLTYPE)	PROFAB / PRECISION / UNIVERSAL / INDIANA
10	LT SWITCH GEAR (ALL RANGE)	AS PER SPECIFIED PANEL DESCRIPTION IN BOQ. MODEL AS PER SPECIFIED IN BOQ ABB/ SIEMENS/ L&T/ LEGRAND / SCHNIEDER, C & S,Ancnor
11	LT MCCB	SIEMENS / SCHNEIDER / LEGRAND / ABB / L&T
12	LT MCB, ELCB	LEGRAND / SIEMENS / SCHNEIDER / L&T / ABB
13	LTSFU	SIEMENS / SCHNEIDER ELECTRIC / L&T / ABB
14	LT CONTACTORS	SIEMENS / SCHNEIDER ELECTRIC / ABB / L&T / LEGRAND

15	AUTO CHANGE OVER SWITCH	SCHNEIDER / ABB / L&T / SIEMENS / LEGRAND
16	STARTER (STAR-DELTA /DOL)	SCHNEIDER / ABB / L&T / SIEMENS / LEGRAND
17	SUBMERCIBLE MOTOR / MONO BLOCK PUMP SET	CROMPTON / KBL / FALCON / LUBI
18	METERS (DIGITAL)	ENERCON / SCHNEIDER /L&T / SECURE / ABB
19	RELAYS- EARTH FAULT	SIEMENS / SCHNEIDER ELECTRIC / L&T / LEGRAND
20	INDICATING LAMP	SIEMENS / SCHNEIDER ELECTRIC / ABB / KAPPA / TEKNIC
21	ELECTRIC TIMER	SIEMENS / LEGRAND / L&T
22	ROTARY SWITCH	SIEMENS / SCHNEIDER ELECTRIC / KEYCEE / SALZER
23	PUSH BUTTON AND PUSH BUTTON SET	SIEMENS / SCHNEIDER ELECTRIC / L & T/ BCH / RAAS CONTROL
24	SELECTOR SWITCH	KEYCEE / SALZER / SCHNEIDER / SIEMENS
25	ANNUNCIATOR	PROTON / EAPL
26	LUGS	DOWELL'S / 3D / JAINSON / COMET / HMI
27	BIMETALLIC LUGS	ISMAL / HMI / DOWELLS
28	CABLE GLAND	JAINSON / 3D / COMET / HMI
29	PVC CONDUITS AND ACCESSORIES	PRECISION / NIHIR / POLYCAB / ASTRAL
30	CASING CAPING	PRECISION / NIHIR / POLYCAB
31	MODULAR SWITCHES, SOCKETS & OTHER ACCESSORIES	MK / LEGRAND / HAVELLS/ANCHOR
32	PVC TAPE	STEEL GRIP / ANCHOR
33	WIRES FOR INTERNAL WIRING	FINOLEX / HAVELLS / POLYCAB /RR
34	CO AXIAL TV CABLE	DELTON /NATIONAL /HAVELLS / FINOLEX
35	CONNECTORS (COLOURS AS PER PHASE & NEUTRAL)	SALZER / ELEMEX / L&T / CONNECT WELL / PHOENIX

36	LED LIGHT FIXTURES / POST TOP LENTRAN LIGHT	PHILIPS SIGNIFY / HAVELLS / WIPRO / CROMPTON / BAJAJ AS PER MODEL SPECIFIED IN BOQ
37	LIGHTING CONTROLLER	DYNALITTE / ATCO / ANCHOR / LEGRAND / C&S
38	CEILING FAN/ EXHAUSTFAN	CROMPTON / USHA / HAVELLS / ORIENT AS PER MODEL SPECIFIED IN BOQ
39	SENSORS	MK / CRESTON / LUTRON / LEGRAND
40	COMPUTER	HP/ DELL/ LENOVO/ IBM
41	CAT6 / RJ45 / CAT6 JACK PANEL	TYCO / SYSTIMAX / SCHNEIDER –DIGI LINK / LE GRAND
42	UNDER FLOOR METAL TRUNKING / CABLE MANAGEMENT SYSTEM ONWALL	MK / LEGRAND / SCHNEIDER
43	UPS	EMERSON /NUMERIC/EATON
44	LIGHTNING PROTECTION	ASHLOK / LPI / ALSTORM
45	DG SET	CUMMINS / CROMPTON GREAVES / KOEL / VOLVO
46	DG SET AMF PANEL	AS PER THE DG SET SUPPLIER. (SWITCH GEAR AS PER MAKE LIST.)
47	TV MONITOR	HP/DELL
48	DIGITAL MULTI FUNCTION METER	SECURE/AE/ CONZERV/ENERCON
49	LT CABLE LUGS	DOWELS/3M/COMET
50	CHEMICAL EARTHING (BORE TYPE)	ASHLOK / LPI
51	CCTV SYSTEM (CAMERA, DIGITAL VIDEO RECORDER)	HONEYWELL/ SONY/ SCHNEIDER (PELCO) / PANASONIC
52	LIFT (ELEVATOR)	OTIS, MITSUBISHI, SCHINDLER, JOHNSON, Express Lift, Omega
53	SPLIT AC	HITACH/BLUE STAR/DAIKIN/MITSUBISHI/O-GENERAL/CARRIER/TOSHIBA

54	U-PVC WATER PIPE	PRINCE / SUPREME / ASTRAL / FINOLEX
55	STREET LIGHT POLE AND BRACKET	BAJAJ, TRANSRAIL, VALMONT.
56	AUDIO-VIDEO SYSTEM	BOSE, YAMAHA, SONY, EPSON, PURE LINK (AS PER BOQ SPECIFICATION)
57	RO SYSTEM	AQUA GUARD, KENT, AQUA ULTRA UV, AO SMITH.
58	WATER COOLER	USHA, CELLO, BLUESTAR.

Special Note: -

1	Client has all right to check the challans of supplier.
2	The MCB and MCB DBs must be of same make.
3	Contractor has to take Prior approval for all the make of material from Client/Consultant/PMC before execution.
4	The Client/Consultant/PMC reserves the right to select the manufacture or approved make from the above list.
5	Any make not mentioned in the above lists must be approved from Client/Consultant before execution.
6	All the material should be ISI and as per standards mentioned in specifications and BOQ.
7	In case of shortage of material or un-time delivery or change in model take prior approval from client/consultant