
Electrical Works

Section I Specification and
List of Make

Section II Item Specification

Section II Item Specifications

Section II: Electrical Works - Item Specifications

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E 1 Mv Switch Gear & Power Panels

1.1.1 Supplying, unloading at site, shifting to site, assembling, leveling, grouting, erecting, Testing, & Commissioning main L.T. panel board, fabricated from M.S. sheet & folded channel totally enclosed cubical type compartmentalized.

1 Material

Should Conform to Section-I, E – 9

2 Workmanship :

- 1) Main busbar should be electrolytic tin copper type.
- 2) All internal wiring and all connection shall be with copper wires and strips as required. Use copper flexible wire for below 100 Amps and copper strips for over 100 Amps.
- 3) All component, frame etc shall be earthed. A common internal earth bar with two separate earthing leads to be provided.
- 4) Powder coating to be done on all sheet metal works as required.
- 5) Panel should have MS base frame for floor mounting unless otherwise specified.
- 6) The board should be front operated and extensible type.
- 7) Compression type brass glands and crimping lugs for incomer and outgoing ends.
- 8) All ammeters to be provided with C.T.'s and selector switch and voltmeter with selector switch and control fuses.
- 9) Panel components shall be as specified
- 10) The design and location of all panels to be approved by the architect/consultant before fabrication and installment.
- 11) All panels should be dust and vermin proof.
- 12) All panels should be fabricated out of 14 gauge sheet The door should be made from 14 gauge (2 mm) and the other parts should be made from 14 gauge sheet metal.
- 13) All meters should be digital type only unless and otherwise specified.
- 14) The metering on main panels shall be LOAD MANAGER type unless and otherwise specified.
- 15) The board should meet with the requirement of IS2147/1962. Internal wiring, busbar making etc. shall conform to IS 375/1963.
- 16) All the Switches used should be capable of withstanding the AC23 duty for motor operation. The Switches should have quick make quick break. The contacts should be silver plated double break type. The switch should conform to IEC 947-III.
- 17) Main LT Panel, Emergency Panel, Bus coupler and APFCR panel should be fabricated in the approximate length of 1 meter and depth of 1 meter compartment.
- 18) The board should withstand the system prospective fault current
- 19) The switches shall conform to IS : 4047. the fuses shall conform to IS : 220. the fuses shall be of HRC type.

- 20) Engraved plastic labels shall be provided indicating the feeder details, capacity, cable size, load in KW and danger signs.
- 21) The entire panel board should be with adequate height width & depth as per relevant prevailing I.S. code and Installation include foundation bolts of suitable size as per requirement.
- 22) All compartment doors should be concealed hinged type & handles of feeders to be interlocked mechanically with the doors such that door cannot be opened when the switch is in 'ON' position & switch cannot be 'ON' when the door is in open position.

(a) ERECTION :

Electrical panels his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading / unloading during transportation. The contractor shall be responsible for final assembly and interconnection of busbars / wiring. Foundation channel shall be delivered in convenient shipping section by the manufacturer. The contractor shall make shall be grouted in the flooring by the contractor. Switchgear shall be aligned and levelled on their base channels and bolted to them as per the instructions of the client / consultant. The earth bus shall be made continuous throughout the length. Loosely supplied relays and instruments shall be mounted and connected on the switchgear. The contacts of the drawout circuit breaker shall be checked for proper alignment and inter changeability.

After erection, the switchboard shall be inspected for dust and vermin proof. Any hole which might allow dust or vermin etc. to enter the panel shall be plugged suitably at no extra cost. If the instrument transformers are supplied separately, they shall be erected as per the direction of the client / consultant. The contractor shall fix the cable glands after drilling the bottom / top plates of all switchboards with suitable holes at no extra cost.

Range of overload relays / timers etc. shall be checked with requirement of motor actually to be connected at site and if the same is undersized / oversized, it shall be brought to the notice of the client / consultant, who shall arrange procurement of corrected components. However, the contractor shall not charge anything extra for labour for such replacements.

(b) TESTING :

Before electrical panel is energised, the insulation resistance of each bus shall be measured from phase to ground. Measurement shall be repeated with circuit breakers in operating positions and contacts open.

Before switchgear is energised, the insulation resistance of all control circuits shall be measured from line to ground.

The following tests shall be performed on all circuit breakers during erection.

- Contact alignment and wipe shall be checked and adjustment where necessary in accordance with the breaker manufacturer's instructions.
 - Each circuit breaker shall be drawn out of its cubicles, closed manually and its insulation resistance measured from phase to phase and phase to ground.
 - All adjustable direct acting trip devices shall be set using values given by the consultant/ manufacturer.
 - The dielectric strength of insulating oil wherever applicable, shall be checked.
- Before switchgear is energised, the following tests shall be performed on each circuit breaker in its test position.

- Close and trip the circuit breaker from its local control switch push button or operating handle. Switchgear control bus may be energised to permit test operation of circuit breaker with A.C. closing with prior permission of the client / consultant.
- Test tripping of the electrically operated circuit breaker by operating mechanical trip device.
- Test proper operation of circuit breakers latch, check carriage limit switch if provided. Test proper operation of lockout device in the closing circuit. Wherever provided by simulating conditions which would cause a lockout to occur.
- Trip breaker either manually or by applying current or voltage to each of its associated protective release.
- Before switchgear is energised, the tests covered above shall be repeated with each breaker in its normal operating position.
- Capacitor banks shall be tested as per manufacturer's instructions. In addition, test for output and/or capacitance, insulation resistance test and test for efficiency of discharge device shall be carried out.
- All electrical equipment alarms shall be tested for proper operation by causing alarms to sound under simulated abnormal conditions.

(c) PROFORMA FOR PCC, MCC, DB, CONTROL PANEL TEST :

- Circuit breaker or contactor module designation / bus no.
- Insulation resistance test (contacts open, breaker racked in position)
 - a) between each phase of bus : Mega ohm
 - b) between each phase and earth : Mega ohm
 - c) DC and AC control and auxiliary circuits : Mega ohm
 - d) between each phase of CT / PT and between CT & PT circuit if any : Mega ohm
- CT checks :
 - a) CT ratio
 - b) CT secondary resistance
 - c) CT polarity check
 - Check for contact alignment and wipe.
 - Check / test all releases / relays.
 - Check mechanical interlocks.
 - Check electrical interlocks.
 - Check switchgear / control panel wiring.
 - Check breaker / contactor circuit for :
 - a) Closing - local & remote (wherever applicable)
 - b) Tripping - local & remote (wherever applicable)
 - Opening time of breaker / contactor.
 - Closing time of breaker / contactor.

[This proforma shall be jointly signed by the CLIENT / CONSULTANT and the contractor in duplicate].

3 Mode of measurement :

The rate shall be for one unit of panel.

E 2 M C B

1.1.2 to 1.1.10 M.C.B. :

Supplying, Assembling, levelling, connecting & testing MCBs/ELCBs/ELMCBs/Isolators of various rating in boards as specified 297 to 304.

1 Material

Should Conform to Section - I, E-2

2 Workmanship

Should mount all the MCBs/ELCBs/ELMCBs/Isolators and other accessories in the D.B. as per the MCB chart furnished by consultant and also do the necessary connections. Should check for any faulty connections and reconnect the same. Also check for the loading once complete installation of fixtures and other equipments is completed.

3 Mode of measurement

As per item 2.1 but for MCBs/ELCBs/ELMCBs/Isolators and accessories.

E 3 Cable Trench

Not Applicable

E 4 C a b l e s

3.1.1 to 3.1.2 Supply, Installation, Testing, Laying, Commissining of following 1100 volt grade XLPE insulated PVC sheathed aluminium / Copper conductor armoured cables as per specification in trenches, cable trays, ducts, over bed of sand, clamped to wall with suitable clamps including, saddles fixing bolts, connecting testing and commissioning with identification tags at every 10 mtr. & Both ends. with All the fixing accessories, excavation Back filling & Cable protection with Bricks as per the drawing (If required)..

1 Material

Should conform to SectionI, E – 3

2 Workmanship

Installation

A) Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the contractor shall mark it out on the drawings and also on the site and obtain the approval of the Architect/Consultant before laying the cable. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only.

B) Cables, running indoors shall be laid on walls, ceiling, inside shafts or trenches. Single cables laid shall be laid in GI/PVC pipe and not to fix on wall slab directly or drawn through GI / PVC pipes fixed on wall or ceiling and supported at not more than 500 mm. Where number of cables are run, necessary perforated cable trays shall be provided wherever shown. Perforated trays shall be mild steel or Aluminum as specified in the schedule of work and supported on mild steel frame work as shown on drawings or as approved. Cables laid in built-up trenches shall be on steel supports. Plastic / Aluminum identification tags shall be provided at every 30 m. All cables laid shall be properly dressed and atleast 50 mm space shall be kept between the cables.

C) Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or in accordance with the manufacturer's recommendations whichever is higher.

D) In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion. Cables shall be protected with brick or cement tiles on all the three sides as shown on drawings. Width of excavated trenches shall be as per drawings. Back fill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall be provided with cables markers at every 20 meters and at all loop points.

E) The general arrangement of cable laying is shown on drawings. All cables shall be full runs from panel to panel without any joints or splices. Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid. cable termination for conductors upto 4 sq.mm. may be insertion type and all higher sizes shall have tinned copper compression lugs. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armoring shall be earthed at both ends.

F) In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall be laid in slant position. So, that no rain water may enter the building. After the cables are

tested. The pipes shall be sealed with M. seal & then tarpaulin, shall be wrapped around the cable for making the entry of water light.

G) All cables shall be provided with stainless steel/Aluminum cable identification tags at a maximum distance of 10 m.

H) All cables to be laid should be properly dress and atleast 50 mm space should be kept between the calbes.

INSTALLATION OF CABLE NETWORK :

Cable network shall include power, control and lighting cables which shall be laid in underground trenches, cable trays, G.I. pipes, or on building structures as detailed in the relevant drawings, cable schedules or as per the client / consultant's instructions. Supply & installation of cable trays, G.I. pipes / conduits, cable glands and sockets of both end isolators, junction boxes, remote push button stations, etc. shall be under the scope of the contractor.

(a) General requirements for handling cables :

Before laying cables, this shall be tested for physical damage, continuity, absence of cross phasing, insulation resistance to earth and between conductors. Insulation resistance tests shall be carried out with 500 / 1000 V megger.

The cables shall be supplied at site, wound on wooden drums as far as possible. For smaller length and sizes, cables in properly coiled form can be accepted. The cables shall be laid by mounting the drum of the cable on drum carriage. Where the carriage is not available, the drum shall be mounted on a properly supported axle, and the cable laid out from the top of the drum. In no case the cable will be rolled on as it produces kinks which may damage the conductor.

Sharp bending of cable shall be avoided. The bending radius for PVC insulated and sheathed, armoured cable shall not be less than 10 D, where "D" is overall diameter of the cable.

While drawing cables through G.I. pipes, conduits, RCC pipes, ensure that size of pipe is such that, after drawing cables, 40% area is free. After drawing cables, the end of pipe shall be sealed with cotton / bituminous compound.

High voltage (11 kV and above), medium voltage (240 V and above) and other control cables shall be separated from each other by adequate spacing or running through independent pipes / trays.

Armoured cables shall never be concealed in walls / floors / roads without G.I. pipes, conduits or RCC pipes.

Joints in the cable throughout its length of laying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed, proper straight through epoxy resin tight joint shall be made, without any additional cost.

A minimum loop of 3 mtr. shall be provided on both ends of the cable, and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying.

Cable shall be neatly arranged in the trenches / trays in such manner so that criss-crossing is avoided and final take off to the motor / switchgear is facilitated. Arrangement of cable within the trenches / trays shall be the responsibility of the contractor.

All cable routes shall be carefully measured and cable cut to the required lengths and undue wastage of cables to be avoided. The routes indicated in the drawings is indicative only and the same may be rechecked with the client / consultant before cutting of cables. While selecting cable routes interference with structures, foundations, pipelines, future expansion of buildings etc. should be avoided.

All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all PVC insulated cables shall be taped with an approved PVC or rubber insulating tapes. Use of friction type or other fabric type tape is not permitted. Lead sheathed cables shall be plumbed with lead alloy.

Wherever cable rises from underground / concrete / masonry trenches to motors / switchgears / push buttons, these shall be taken in G.I. pipes of suitable size, for mechanical protection upto 300 mm. distance of concerned cable gland or as instructed by the client / consultant.

The cable pass through foundation / walls of other underground structures, the necessary ducts for opening will be provided in advance for the same. However, should it become necessary to cut holes in existing foundation of structures the electrical contractor shall determine the location and obtain approval of the client / consultant before cutting is done.

(b) LAYING OF CABLES (UNDERGROUND SYSTEM)

- Cables shall be so laid in trench that this will not interfere with other underground structure. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded / diverted as directed by the owner / consultant.
- Cable shall be laid at minimum depth of 750 mm. in case of L.T. and 1200 mm. in case of H.T. from ground level. Excavation will be generally in ordinary soil. The width of trench shall be sufficient for laying of required no. of cables.
- Sand bedding 75 mm. thick shall be made below and above the cables. Layer of bricks (full size) shall be laid above sand bedding on the sides and above the cables to cover cables completely. More than one cable can be laid in the same trench. However, the relative location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction of the client / consultant.
- For all underground cables, route markers should be used :
 - a) Separate route markers should be used for LT, HT and telephone cables.
 - b) Route markers should be grounded in ground with 1:2:4 cement concrete pedestal size 230 x 230 x 300 mm..
 - c) Cable markers should be installed at an interval not exceeding 30 mtr. along the straight routes of cables at a distance of 0.5 mtr. away from centre of cable with the arrow marked on the cable marker plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.

- RCC Hume pipe for crossing road in cable laying shall be provided by employer. No deduction shall be made for cable laying in Hume pipe for not providing bricks, sand and excavation. RCC hump pipe at the ends shall be sealed by bituminous compound after laying and testing of cables by electrical contractor without any extra charge.

(c) LAYING OF CABLE IN MASONRY TRENCHES

Masonry / concrete trenches for laying of cables shall be provided by employer. However, steel members such as M.S. angles / flats etc. shall be provided and grouted by electrical contractor to support the cables without any extra charge. Cables shall be clamped to these supports with minimum saddles / clamps. More than one tier of cables can be provided in the same trench if the no. of cables are more.

Entry of cables in trenches shall be sealed with bituminous MASTIC compound to stop entry of water in trenches.

(d) LAYING OF CABLES IN CABLE TRAYS

Cable trays and steel members such as M.S. angle / channel / flats etc. shall be provided and fixed by the contractor.

Cable shall be fixed in cable trays in single tier formation and cables shall be clamped with flat clamps and galvanised bolts / nuts.

Earthing flat / wire can also be laid in cable tray alongwith cables.

After laying of cables, minimum 20% area shall be spare.

(e) TESTING OF CABLES :

- i. Before energising, the insulation resistance of every circuit shall be measured from phase to ground. This requires 3 measurements if one side is grounded and 6 measurements for 3 phase circuits.
- ii. Where splices or terminations are required in circuits rated above 650 volts, measure insulation resistance of each length of cable before splicing and/or terminating. Repeat measurements after splices and/or terminations are complete.
- iii. DC high voltage test shall be made after installation on the following :
 - a) All 1100 volts grade cables in which straight through joints have been made.
 - b) All cables above 1100 V grade.

For record purpose test data shall include the measured values of leakage current versus time.

The DC high voltage test shall be performed as detailed below :

Cables shall be installed in final position with all the straight through joints complete. Terminations shall be kept unfinished so that motors, switchgear, transformer etc. are not subjected to test voltage.

The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution.

iv. PROFORMA FOR TESTING CABLES :

DATE OF TEST

a)	Drum No. from which cable taken.	
b)	Cable from	to
c)	Length of run of this cable meter	
d)		
e)	Insulation resistance test	
i)	between core-1 to earth	mega-ohm
ii)	between core-2 to earth	mega-ohm
iii)	between core-3 to earth	mega-ohm
iv)	between core-1 to core-2	mega-ohm
v)	between core-2 to core-3	mega-ohm
vi)	between core-3 to core-1	mega-ohm
vii)	duration used : 1 kV	
e)	High voltage test	
	Voltage	Duration
i)	between core an earth.	
ii)	between individual cores	

[This proforma shall be jointly signed by the CLIENT / CONSULTANT and the contractor in duplicate].

All test readings shall be recorded and shall form part of the completion documentation.

3 Mode of measurement

The cable shall be measured in per mt. Basis and the rates shall include ;

- 1) Cables and clamps
- 2) Installation, Commissioning and testing
- 3) Cable marking and all the accessories for the cable if at all to be installed on walls.

Cable length shall be certified by engineer in charge from Clients side.

E 5 Cable Termination

4.1.1 to 4.1.5 Supplying & fixing heavy gauge compression type Brass glands & making joint with necessary crimping socket of long neck type connecting the same to various equipment like section pillar, switch, starter, motor etc. sizes of cables specified in BOQ CUPAL washers shall be provided for copper busbars to aluminum connection:

1 Workmanship

Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool.

TERMINATION AND JOINTING OF CABLES :

- i. a) For HT cables suitable size of push on type termination kit shall be used.
- b) Use of glands :

All PVC cables upto 1.1 kV grade, armoured or Unarmoured shall be terminated at the equipment / junction box / isolators / push buttons / control accessories, etc. by means of suitable size single compression type cable glands. Armour of cable shall be connected to earth point. The contractor shall drill holes for fixing glands wherever necessary. Wherever threaded cable gland is to be screwed into threaded opening of different size, suitable galvanised threaded reducing bushing shall be used of approved type.

In case of termination of cables at the bottom of the panel over a cable trench having no access from the bottom, a close fit holes should be drilled in the bottom plate for all the cables in one line, then bottom plate should be split in two parts along the centre line of holes. After installation of bottom plate and cables with glands, it shall be sealed with cold sealing compound.

ii. USE OF LUGS / SOCKETS :

All cable leads shall be terminated at the equipment terminals, by means of crimped type solderless connectors unless the terminals at the equipment ends are suitable for direct jointing without lugs / sockets.

The following is the recommended procedure for crimped joints and the same shall be followed :

- a) Strip off the insulation of the cable and with every precaution, not in severe or damage any strand. All insulation's to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.
- b) The cable should be kept clean as far as possible before assembling it with the terminal / socket. For preventing the ingress of moisture and possibility of re-oxidation after crimping of the aluminium conductors, the socket should be filled with corrosion inhibiting compound. This compound should also be applied over the stripped portion of the conductor and the palm surface of socket.
- c) Correct size and type of socket / ferrule / lug should be selected depending on size of conductor, and type of connection to be made.
- d) Make the crimped joint by suitable crimping tool.

- e) If after crimping the conductor in socket / lug, some portion of the conductor remains without insulation the same should be covered sufficiently with PVC tape.
- f) For HT cable the manufacturer's recommendation should be followed.

iii) DRESSING OF CABLE INSIDE THE EQUIPMENT :

After fixing of cable glands, the individual cores of cable shall be dressed and taken along the cable ways (if provided) or shall be fixed to the panels with polyethylene straps. Cable shall be dressed in such a manner that small loop of each core is available inside the panel.

For motors of 20 HP and above, terminal box if found not suitable for proper dressing of aluminium cables, the erector shall modify the same without any additional cost.

Cables inside the equipment shall be measured and paid for on lug to lug basis.

iv) IDENTIFICATION OF CABLES / WIRES / CORES :

Power cables shall be identified with red, yellow and blue PVC tapes. For trip circuits identification, additional red ferrules shall be used only in the particular cores of control cable at the termination points in the switchgear / control panels and control switches.

In case of control cables all cores shall be identified at both ends by their wire numbers by mean of PVC ferrules or self sticking cable markers, wire numbers shall be as per schematic / connection drawing. For power circuit also, wire numbers shall be provided if required as per the drawings of switchgear manufacturer / supplier.

2 Mode of measurement

Rate shall be considered for 1 nos of joint.

E 6 Street Lighting Poles

6.1.1 to 6.1.5 Supplying and erecting approved make Octagonal pole made from HR sheet steel. The pole should be made as per IS. and shall be coated with hot dip galvanizing as per IS 2629/2633/4759, suitable suspend local wind speed with integral Junction box consist of terminal plate of min 6mm Hylam sheet, standard profile 35mmX7.5mm Din-Rail for MCB Mounting, stud type terminal and arrangement for cable termination to be erected on suitable foundation (included).

(G) 8 Mtr. Long 70 mm Top X 155 mm bottom dia, 3 mm thickness with 260mmX260mmX16mm base plate, 4-M20 Bolts and 600mm long J-Bolt..

- 1. 8 way connector and 6A MCB**
- 2. 50 mm diameter DWC pipe for each cable entry. Pipe length is up to 1.5 mtr. Per cable**
- 3. Wiring up to the light fixture from the junction box using 3nos x 1.5 sq.mm. flexible copper wires Fixture of specified make.**
- 4. Concrete coping with foundation bolt EN Grade FB bolt M16*600 mm boltwith base plate with stiffener. Sprial/Coil Type Earthing from the 8 swg Cu. Wire of 2.5 mtr. With the suitable size pipe with clamps and painting.**
- 5. Radium stip of two colour at suitable height**
- 6. Excavation & back filling for erection of poles. Debris to be removed from the site to suitable location as per the instruction of the engineer incharge**

1 Material

Shall conform, Section-1, E – 8

2 Workmanship

The pole shall be installed as shown in the drawing and shall be checked for proper earthing. Wiring sequence shall as per the design given by the consultant.

3 Mode of measurement

The rate shall be for one pole with installation of light fixture .

E7 Light Fixtures & Fans

6.1 Supply, Installing, Testing , commissioning of Light fixtures of various types and of specified make:

1 Material

Should conform to Section-I, E – 5

2 Workmanship

The fixture shall be installed on wall / ceiling as directed and as per manufacturer's instruction, with necessary accessories for surface, concealed, suspended from ceiling, bracket mounting etc. The job also includes connection of fixture with respective outlet point with heat resistant wires through heat resistance sleeve and PVC connector. The exhaust fan shall be installed complete with M.S. angle iron mounting frame/ ring, G.I. louvers, wire mesh and plug at the end of the cord including wiring & earthing etc. Proper earthing shall be provided to the fixtures

INSTALLATION OF LIGHTING FIXTURES / FANS :

i) INSTALLATION OF LIGHTING FIXTURES :

Scope of work under this item shall start from light point, with 3 nos. 1.5 mm.² PVC insulated wires from connector to the connector inside the lighting fixture, connections, fixing of lighting fixture complete with all accessories, lamps on wall / roof / steel truss etc. testing the lighting fixture and commissioning. If wire length of light point is enough to reach connector of light fitting, connector in light point can be deleted.

iii) INSTALLATION OF EXTERNAL LIGHT FIXTURES :

Street lighting installation shall be carried out as per details shown in the drawing.

The poles shall be erected in perfect plumb with concrete foundation at a location shown in the drawing. The foundation shall be designed to withstand the static load as well as wind velocity and bending moment of the pole and shall be approved by the client prior to execution.

The junction box shall then be clamped to the erected pole as per details shown in the drawing. The luminaires shall also be installed on the pole and be electrically wired to the respective junction box. The cable lay out shall follow the tentative route as shown in the drawing. In case of any constraint on the cable route the same shall be brought to notice of the client. The cable lay out shall be carried out in an underground manner and the said installation complete with electric connections.

Earthing installation shall follow the details for the same shown in the drawing.

The earthing station (coil type) and the earthing grid installation shall be carried out as per the specification for the said works given in section under title "Earthing" of this tender document.

On completion of the installation, the street light poles shall be painted with two coats of metal primer (Red Oxide) followed by two coats of Synthetic enamel of the shade as approved by the Engineer-in-charge.

The brackets shall be made of 38 mm. NB MS class "B" pipe approx. 1.8 mtr. long bent at the centre at an angle 120° C. with necessary holding brackets, hold fasts etc. with special

reducer at the end to accommodate type of street light fitting to be fixed. Bracket shall have 1 coat of anti-corrosion paint before despatch to site and 2 coats of approved make and shade of aluminium paint. This bracket shall also be provided with one M.S. water tight box complete with the connector, neutral link, rewirable fuse etc.. See enclosed drawings of street light poles.

Installation of poles shall be done as per enclosed drawings of street light poles. The depth of pole to be buried in ground shall be $\frac{1}{5}$ th of the total pole length or as specified in drawing, whichever is more. Special care shall be taken in erecting poles so that these are not strained or damaged during erection and are firmly stayed till the foundation are secured. The pole shall be grouted inside ground pit (cross-section 600 x 600 mm.) with cement concrete 1:2:4. Before the placement of concrete around pole in the pit, necessary conduit pipes (not less than 25 mm. dia.) shall be placed for facilitating drawing of cables. Separate conduit shall be provided for incoming and outgoing cables. The cement concrete shall be protected from premature drying by curing for atleast 7 days after pouring. All concrete surface from 150 mm. below ground level to top shall be finished smooth with cement mortar 1:4.

This includes fixing of street light fittings complete with accessories and lamps at the end of the pole / bracket, connecting it with 3 x 2.5 mm.² aluminium conductor, PVC insulated cable from water tight M.S. box, testing, commissioning. Third core shall be connected with earthing point of light fitting at one end and earthing point of marshalling box at the other end.

3 Mode of measurement

The unit rate shall be considered for Supplying and fixing one fixture. The rate shall include following

- a) All fixing accessories, mounting bracket, ballast condensers and control gear wherever applicable.
- b) Supplying and fixing Ball and socket joints wherever required.
- c) Earthing of fittings.
- d) Electrical connections to fittings/fans from the junction box/ceiling rose.
- e) Installation and interconnection of Electronic regulators for ceiling fans.

Per Unit for Supplying, assembling, installing, connecting ,testing and commissioning of fluorescent/ incandescent luminaries fixture, ceiling fan, exhaust fan etc.

Refer General Instruction for Electrical work – Basic Rates for Light Fixtures also.

E 8 Earthing

7.1 Providing earthing stations for equipment earthing as shown and specified in IS:3043 and drawing for equipment complete with :

600 x 600 x 3.15 mm tinned cu. plate.

Chemical Earthing

1 Material

Shall be as per Section-I, E - 6

2 Workmanship

Following activities shall be carried out for the earthing station

- a) Excavation in hard murrum.
- b) laying Watering pipe.
- c) brick masonry with hinged covers.
- d) Charcoal and Salt fill.
- e) Earth station should be 1 mt. away from building.
- f) Keep minimum 2 mt. distance between two earth pits.
- g) The pit should be minimum 4 mt. deep.
- h) The earth resistance should not exceed 1 ohm.
- i) All earth pits of same category shall be interlinked with strip.

Following points shall be followed strictly.

- A) 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.
- B) 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.
- C) The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.
- D) 20 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.
- E) Top of the pipe shall be provided with G.I. funnel and screen for watering the earth \ ground through the pipe.
- F) 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.
- G) 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.

- H) 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.
- I) The earth conductors (Strips / Wires copper/ Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanized 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.
- J) 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.
- K) Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.
- L) The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.
- M) The connection between strip and plate shall be through stainless steel bolts and washers.

Following tests shall be carried out :

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

- A) The following earth resistance values shall be measured with an approved earth meager and recorded.
 - 1) Each earthing station
 - 2) Earthing system as a whole
 - 3) Earth continuity conductor
- B) Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 3 Ohm in each case.
- C) Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.
- D) All tests shall be carried out in presence of the Site Engineer.

3 Mode of measurement

Rate shall be considered for one unit of pit.

Earth wire/strips :

Supply and laying cu. earthing strips for interconnecting the earthing stations, panels, DB's etc. in built-up trenches, on walls/ceiling, buried in ground generally as specified and shown on drawings complete with :

- a) **Fixing accessories.**
- b) **Corrosion protection of buried conductors with bituminous coating and covered with PVC tapes.**

No.8 to 16 Gauge bare GI earth wire or strip.

25 x 3 mm tinned cu. strips.

No.8 Gauge bare cu earth wire.

1 Material

Copper strips of sizes specified in the item shall be had. The strips shall not be corroded.

2 Workmanship

Copper strips shall be laid along with the cables and mains as instructed by the consultant and along the path of the cable. The strips shall be terminated at both the ends properly via brezing / SS nut and bolts with double washer screws and nuts as instructed by the consultant. Strips shall not be bend to and extent that they go brittle.

3 Mode of measurement

The rate shall be considered on meter basis and the quantity shall be certified by the engineer in charge from Clients side.

Juction Box :

Water Tight Junction Box of Hensel make Cat. No. KG9003IN or equivalent. With necessary clamp for mounting of the J.B. (All the cable / wire connections to the JB shall be with the Water tight Glands only).

1 Material

Should conform to Section-I, E – 1

2 Workmanship

As per item no 2.10 above .

3 Mode of measurement

The rate shall be for one unit of Junction Box.