

SCOPE OF WORK FOR ELECTRICAL WORKS

1.0 GENERAL

The scope of works covers Design, manufacture, factory testing, supply, delivery to site, unloading, handling and storage at site, complete installation including cement concrete foundation and supporting steel structure wherever necessary, final checkup, painting, performance testing and commissioning of pumping machinery and related electrical equipments, Instrumentation system and other required accessories to be supplied under these specifications on turnkey basis. Scope also include first filling of consumables and satisfactory performance of all equipments provided in price Schedule, Vol-III.

All piping works includes suction, delivery bypass, header pipes, rising main, pipe manifold system including specials, eccentric reducers, concentric reducers, Y connections, tees, bends, puddle flanges, thrust blocks, chambers, required civil works, spectacle blinds, gaskets, nuts bolts, washers, etc complete. Scope also includes connections to GRP delivery pipelines with MS/HDPE pipes in all respect at his own cost.

The contractor shall be fully responsible for the electrical, mechanical, instrumentation equipments & other installations for storage, theft, fire natural calamity etc. till the entire work covered by this contract is satisfactorily completed by his and handed over to the Co Developer.

If any discrepancy is noticed between conditions of contract, specifications, Schedule – B and Drawings, the most stringent of the above shall apply.

All electrical & mechanical installations shall be of high quality, safe durable, complete and fully operational including all necessary items, spares and accessories whether or not specified in detail. All electrical & mechanical work shall be completed in accordance with the regulations and standards to the satisfaction of the Co Developers.

Any item of work, either supply and / or erection of material/ machinery which have not been specifically mentioned in this specification and drawing but are at most necessary to complete the work for trouble free, efficient operation and guaranteed performance of the entire plant offered shall be deemed as included within the scope of this specification and shall be provided by contractor without any extra cost to the Co Developer.

The contractor will have to submit data sheets and constructional drawings after award of contract of work and before manufacture of equipments. The same shall be got approved from the Co Developer.

Equipment and accessories shall be manufactures as per the regulations, relevant standards, and specifications. The material of construction of pumps, valves and pipe work shall be non corrosive and tested in laboratory. Equipments shall be selected and procured from the approved vendors only.

The contractor will have to arrange factory inspection and testing of equipments as per the Indian Standard Specification or equivalent standards at his own cost. During inspection tenderer shall provide traceable certificates (of authorized bodies) of test and calibration instruments/ equipments that are used for testing of instruments. Following Test Certificates shall be provided.

- Certificates of calibration with its accuracy and uncertainty.
- Certificates of standards and classification.
- MOC certificates of instruments and its parts.

The equipments shall be installed as per the instructions of the respective manufacturer of equipments and verification of various process parameters including behavior of equipment in abnormal conditions.

The contractor will have to submit a completion certificate for installation of electrical equipments for inspection of installation by Electrical Inspector and approved for release of power by GEB. The contractor should also submit capacitor testing certificate & test report for electrical installation to GEB as per the requirement for the release of GEB power connection.

The contractor shall submit required copies of instructions and maintenance manuals of all equipments in English on operation, preventive and regular maintenance and repair.

On completion of work, the contractor will have to submit as built drawings indicating the complete mechanical and electrical system.

The tenderer shall provide technical catalogues & any reference for standards along with his tender documents. The tenderer shall also mention detail model No. of instrument or software with its types and sub types along with its accessories, if any. The separate sheet shall be provided of all instruments for each service.

Latest Standards, software versions and classifications to be ensured as per the specifications wherever applicable and mentioned. The tenderer shall indicate any deviation to given specifications shall be indicated in tender performa.

Each instrument shall be supplied with riveted and easily visible (after installations) SS complete. The nameplate shall be as manufacturer standard with following details.

- Model No.
- Tag No.
- Range with its engineering unit.
- Approval of any standards, if any
- Serial No.

The tenderer shall provide test certificates for instruments and its material wherever applicable and calibration certificates within specified accuracy level. The tenderer shall provide certificates, which ensures standards, classifications, etc. from recognized manufacturer by government authorities.

Packing & towardsing: Each instrument shall be suitably protected with suitable packing material and shall be marked its project identification in BLUE colour for easy scrutiny.

2.0 Rating

Rating of all items shall be appropriate for the condition on the particular site on which the items will be used.

The rating of all electrical equipment / components shall be for three phase 415V, 50Hz AC supply with the following variations:

- 1.0 Voltage variation $\pm 10\%$
- 2.0 Frequency variation $\pm 3\%$
- 3.0 Combined variation $\pm 10\%$

The source of power supply to this scheme will be through 11kV overhead lines from nearest 66 KV substation of power supply authority.

The power transformer of 11kV/0.433 kV for operation of plant, lighting load and auxiliary load.

Power factor correction capacitors shall be provided and their capacity shall be adequate to correct the power factor above 0.99 to unity at full / part plant load.

The ratings of all equipments shall be as per manufacturer's printed literatures and drawings.

3.0 Regulations and Standards

All material and equipment shall conform to the relevant Indian Standards and shall be of the approved make and design. The material of construction of all components, which are in direct with liquid, shall be non – corrosive. The contractor shall be responsible for the safe custody of all the materials and shall insure them against theft, damage by fire, earthquake etc. Any item, which is proposed as a substitute, shall be accompanied by all technical detail giving sizes, particulars of materials and the manufacturer's name and shall be submitted along with the bid offer. At the time of the submission of proposed substitute the contractor shall state the credit, if any due to the Co Developer's. In the event, the substitution is approval all changes and substitutions shall be requested in writing and approvals obtained in writing from the Co Developer. Decision of Co Developer in the matter shall be final.

All materials of the same kind of service shall be identical and made by the same manufactures. Any deviation to this rule shall be approved by the Co Developer. Top priority shall be given to the products that have a permanent agent providing spare parts and maintenance facilities in the same city where the project is situated.

The installation shall conform in all respects to Indian Standard Code of Practice for pumping machinery and electrical equipment installations. It shall also be in conformity with the current Indian Electricity rules, Indian Electricity Act, National Electrical code and regulations of the local Electrical Supply Authority in so far as these become applicable to the installation. Wherever these specifications call for a higher standard of material and / or workmanship than those required by act of the above regulations, then these specifications shall take precedence over the said regulations and standard. In general, the material, equipment and workmanship not covered by the above shall conform to the relevant Indian Standards.

The electrical installation work shall be executed by licensed electrical contractor and shall follow codes, Indian standard specifications and Rules (within the best meaning of the same) under this contract.

4.0 Operation Methodology

Operation methodology shall be by instrumentation and remote control. The intending tenderer shall quote rates with full justification for other items that are required in his opinion over and above the items provided in the price schedule.

5.0 Inspection and Testing

Co Developer reserves the right to inspect and test at manufacturer's works at all reasonable times during manufacture of items included in this contract. Tests on site of completed works shall demonstrate among other things.

- 5.1 That the equipment installed complete with specifications in all particulars and is of the correct rating for the duty and site conditions.
- 5.2 That all items operate efficiently and quietly to meet the specified requirements.
- 5.3 That all circuits are correctly fused and protected and that all protective devices are properly coordinated.
- 5.4 That all non-current carrying metal work is properly and safely grounded in accordance with the specifications.
- 5.5 While testing any machineries / equipments at manufacturer's / contractor's place the Co Developer shall reserve the right to check / calibrate all the measuring devices.

The contractor shall provide all necessary instruments and labour for testing and shall make adequate records of test procedures and readings and shall repeat any tests requested by the Co Developer and shall provide test certificates signed by a properly authorized person. Such test certificates shall cover all works.

If tests fail to demonstrate the satisfactory nature of the installation or any part thereof then no claims for the extra cost of modifications, replacements or retesting will be considered. The Co Developer decision as to what constitutes a satisfactory test shall be final.

The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

- 5.6 All materials, components and equipments covered in this specification shall be procured, manufactured, erected, commissioned and tested at all the stage as per comprehensive quality assurance programme drawn in with ISO-9000A.

This is however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Co Developer. The detailed quality plans for manufacture and field activities should be drawn up by the tenderers separately in the prescribed format and will be submitted to Co Developer for his approval.

- 5.7 Manufacturing quality plan will detail out for all components and equipments, various test/inspection be carried out as per the requirements of specification and standard mentioned there in quality practices and procedures followed. Contractor's quality control organization, the relevant reference documents and standards, acceptance norms, inspection documents raised etc. during all stages of material procurement manufacture, assembly and final testing / performance testing.

5.8 Field quality plans will detailed out for all the equipments the quality practices and procedure etc to be followed by contractor's site quality control organization, during various stages of site activities from receipt of materials / equipments at site.

5.9 The tenderer shall also furnish along with the quality plan copies of the reference documents/ plant standards/ acceptance norms/test and inspection procedure etc as referred in them. These quality plans and reference documents/standards etc will be subject to Co Developer approval, without which manufacture shall not proceed. These approved documents shall form apart of the contract. In these approved quality plans Co Developer shall identify customer hold points (CHP) test/checks which shall be carried out in presence of the .Co Developer which work will not proceed without Co Developer in writing.

All deviations to this specifications, approved quality plan and applicable standards must be documented and referred to Co Developer representative along with technical justification for approval.

5.10 No materials/equipments in required quantity shall be dispatched from the manufacturer's works until & unless the same is either accepted subsequent to pre dispatch final inspection (including verification records of all previous test/inspection) by Co Developer representative or such pre dispatch final inspection is waived by the Co Developer.

All material used or supplied shall be backed up by valid material certificate and test reports. These certificates and reports shall indicate the hit number or other such acceptable identification number of the material they purport to certify. The material certified should also have the identification details stamped on it.

5.11 All material used for equipment construction including casting and forging etc shall be of tested quality as per relevant codes/standards. Details of results of the test conducted to determine the main properties, chemical analysis and details of treatment procedure recommended and actually it shall be recorded on certificates. Tests shall be carried out as per applicable materials standard agreed details.

5.12 No welding shall be carried out on iron component for repair or whatsoever purposes.

All the sub vendors proposed by the contractor for procurement of major bought out items including castings, forging, semi finished and finished components/equipment (list of which shall be drawn by the contractor, submitted to and finalize by the Co Developer) shall be subject to Co Developer approval.

5.13 The contractor shall undertake an inspection, testing program during manufacture in his work that of his sub contractor's to ensure the mechanical accuracy of components, compliance with drawing conformance to functional and performance requirements acceptability of all materials, parts and equipments correlation of its identity with test certificate shall carry out all test/ inspection required establish that the items/equipments conform requirements of this specification and the relay codes/standards specified in this specification addition to carrying out tests as per the approval.

6.0 Painting

Equipments shall first be cleaned and given two coats of Zinc base primer and then it shall be coated with three coats of approved shade of paints. The coating shall be uniform and smooth and shall adhere to the entire surface.

7.0 Packing and Preservation

7.1 Each spares shall be clearly marked or labelled on the out side of the packing with its description. When, more than one spare part is packed in a single case, a general description of the contents shall be shown on the out side of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

7.2 All cases, containers or packages are liable to be opened for such examination as may be found reasonable by the engineer.

7.3 In case of equipment supplied with grease/lubricants from imported origin, the supplier shall clearly indicate the indigenous equivalent of the grease/lubricant and source of supply so as to enable to Co Developer to procure these items for indigenous sources. Necessary initial filling of lubricating oil, grease etc. shall be arranged by the contractor with no extra cost of Co Developer.

8.0 Spare Parts

The tenderer shall indicate and include, in the supply all the necessary commissioning spares and recommended spares (of OEM) as described below in the schedule of spare parts. The Co Developer reserves the right to finalize the exact quantities of the spare parts. The spare ordered by / Co Developer shall be delivered at the site at agreed delivery schedule.

8.1 Commissioning Spares

8.2 It will be the responsibility of the Contractor to draw and furnish a list of all commissioning spares required for successful commissioning of the equipment covered under the contract. Such list shall be furnished by the contractor within four months of the date of LOI / work order, separately for each equipment and shall be reviewed by Co Developer and discussed for mutual agreement. The commissioning spares will be so identified as to allow the trial operation to suffer for want of commissioning spares. The identification of commissioning spare will not in any way relieve the vendor any of its responsibilities of satisfactory performance under the provisions of other condition of contract. All the commissioning spares shall be deemed to include in scope of the contractor as a part of the respective equipment package at no extra cost to Co Developer.

8.3 All such identified spares shall be supplied by contractor at least two months before the schedule date of commencement of trial operation of the respective package. Such spare shall be received and stored. Erection contractor at the project site and utilized when required.

8.2 Recommended Spares

8.2.1 In addition to the spares mentioned above, the tenderer shall also indicate in the schedule of recommended list of spare parts, his recommended list of spares with unit price for two year of normal operation of the plant. The / Co Developer reserves the right to buy any or all of the recommended spare parts.

8.2.2 The tenderer shall also indicate the services expectancy period for the spare parts under normal operating conditions before the replacement is necessary.

8.2.3 In case some of the spare parts become inapplicable due to change in design / engineering agreed by the / Co Developer, the / Co Developer reserves the right to procure some other spares whose prices are already available in the initial offer in lieu of such not applicable spares subject to the condition that the total amount of the initial order remains the same.

9.0 Completion Certificate

On completion of the electrical and mechanical installation (or and extension to an installation) a certificate shall be furnished by the contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority. The contractor shall be responsible for getting the installation inspected and approved by the local concerned authorities. Contractor have to co – ordinate and co-operate to the concerned official of GIDC/GEB and Electrical Inspector for timely released of power supply and for initial inspection and annual inspection of all electrical equipments and installations.

The indicative scope of work to be carried out by the selected contractor, inter alia include the following, but are not limited to :

3.2 Identification of Underground utilities/ Shifting of utilities shall be required.

Apart from carrying out improvement and maintenance works, the Contractor shall be, inter- alias, responsible for the following activities:

(i) Procurement of required clearances (other than those specified as GIDC's obligations) for commencing and completing the works.

- (ii) Surveying and setting out of Works and other pre-construction stage activities as required by GIDC and prudent utility practices;
- (iii) Completion of works according to the scope of works, specifications and drawings within stipulated time frame, with adequate equipment and plant support;
- (iv) Safety management during implementation of Works.
- (v) Preparation and implementation of Total Quality Management Program;

INSTRUCTION TO BIDDER

“Bidders are required to take note of the important instruction laid down under and quote their rates accordingly. In case of discrepancy between instruction laid here in under and technical specification or instruction in Technical Bid. Instruction here in under shall prevails over technical specification, methodology of execution of items specified in technical specification or the technical Bid of tender document”.

1. The Bill of Quantities shall be read in conjunction with Tender documents, Specifications, Drawings and addendum.
2. The quantities given in the Bill of Quantities are estimated and provision is given to provide a common base for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the contractor and verified by the Engineer and valued at the rate and priced bided in the price Bill of Quantities where applicable.
3. General Directions and description of work and material are not necessarily repeated or summarized in the Bill of Quantities. Reference to the relevant sections of contract documentation shall be made before entering rates or prices against each item in Bills of Quantities.
4. The rates and prices quoted under Bill of Quantities (except in so far as it is otherwise provided under the contract) include all constructional plant, labour, supervision, materials, all temporary works (including temporary diversion of traffic, traffic management) and false works erection, maintenance, establishment and overhead charges, profit, taxation and levies and other charges together with all general risks, liabilities and obligations set out or implied in the contract and including remedy of defects during the Defect Liability Period till performance & maintenance guarantee period.
5. Combined flakiness and elongation index for machine crushed aggregate shall not be more than 30% as per MORTH publication 2001 – 4th edition and the instruction contained under vernacular circular of Gujarat under No. SOR/102006/104/S-1 dated 25.01.2007 of Govt. of Gujarat shall be followed.
6. The units of measurement described in the Bill of Quantities are metric units. Abbreviations used in Bill of Quantities are as follows:

Cu. Met	-	M ³
Sq. Met	-	M ²
Meter	-	M
Met. Tones	-	MT
Kilogram	-	Kg.
Gram	-	gm.
Cubic Centimeter	-	C C.
Kilogram per Sq.cm	-	Kg/cm ²
Millimeter	-	mm
Numbers	-	No.
Quintal	-	Qtl.

Item No.1

1. Power Control Centre

1.0 Scope

This scope shall cover design, manufacture, check test, and supply of lighting control panel, MCCB distribution boards etc. as described in this specification, as per drawings and schedule of quantities.

2.0 General Specifications

All the Panels shall be metal clad, totally enclosed, rigid, floor mounting, air insulated, cubicle type suitable for operation on three phase / single phase, 415 V / 240 V, 50 Hz., neutral effectively grounded at transformer and short circuit level as mentioned in the drawings.

All the outdoor panel shall be double door type with IP54 protection class construction.

All the indoor panel shall have IP51 protection class construction.

The painting of all the metal part shall be as per the painting specification defined in the datasheet.

The Panels shall be designed to withstand an heaviest condition at site, with maximum expected ambient temperature of 45° c., 90% humidity and salty, dusty weather.

3.0 Standards and Codes

The Panels shall comply with the latest edition of relevant Indian Standards and Indian Electricity Rules and Regulations. The following Indian standards shall be complied with :

IS : 4237	General requirements for switchgear and control gear for voltages not exceeding 1000 V a.c or 1200 V d.c.
IS : 375	Switchgear bus bars, main connection and auxiliary wiring, marking and arrangement.
IS : 13947	Low voltage switchgear and control gear.
IS : 8197	Terminal marking for electrical measuring instrument and their accessories.
IS : 2551	Danger notice plates
IS : 10118	Code of Practice for selection, installation and maintenance of switchgear and control gear.
IS : 8623	Specification for factory built assemblies of switchgear and control gear for voltage upto and including 1000 V A.C. and 1200 V D.C.
IS : 8828	Miniature circuit breakers.
IS : 9224	Low voltage fuses
IS : 2705	Current transformers
IS : 3156	Voltage transformer
IS : 3231	Electrical relay for protection
IS : 1248	Indicating instruments
IS : 722	Integrating instruments
IS : 6875	Control switches and push buttons

Indian Electricity Act and Rules (as amended up to date) and approval of FIA of India.

The Panels also require approval of the Engineer / consultant at various stage of their manufacture such as design, selection, construction, testing, shipping etc.

4.0 Construction

4.1 Cubical Type Panels

4.1.1 Structure

The Panels shall be metal clad enclosed and be fabricated out of high quality CRCA sheet, suitable for indoor installation having dead front operated and floor mounting type.

All CRCA sheet steel used in the construction of Panels shall be 2 mm. thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet steel shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal.

The Panels shall be totally enclosed, completely dust and vermin proof and degree of protection being not less than IP : 51. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be fully gasketed with foam rubber and /or rubber strips and shall be lockable.

All panels and covers shall be properly fitted and secured with the frame and holds in the panel correctly positioned. Fixing screws shall enter into holes, taped into an adequate thickness of metal or provided with bolts and nuts. Self threading screws shall not be used in the construction of Panels.

A base channel of 75 mm. x 50 mm. x 6 mm. thick shall be provided at the bottom. A clearance of 300 mm. between the floor of the Panels and the bottom of the lower most unit shall be provided.

Panels shall be preferably arranged in multi-tier formation. The Panels shall be of adequate size with a provision of 20% spare space to accommodate possible future additional switchgear. The size of the Panels shall be designed in such a way that the internal space is sufficient for hot air movement and the electrical component does not attain temperature more than 45°C. All the electrical component shall be derated for 45°C. The ratings indicated in the drawing are derated for 45°C.

Knock out holes of appropriate size and number shall be provided in the Panels in conformity with the number, and the size of incoming and outgoing conduits / cables.

Alternately, the Panels shall be provided with removable sheet steel plates at top and bottom to drill holes for cable / conduit entry at site.

The Panels shall be designed to facilitate easy inspection, maintenance and repair.

The Panels shall be sufficiently rigid to support the equipment without distortion under normal and under short circuit condition. They shall be suitably braced for short circuit duty.

4.1.2 Protection Class

All the indoor Panels shall have protection class of IP : 51 for indoor installation and IP 52 for outdoor installation.

4.1.3 Painting

The painting shall be seven tank process with powder coating.

4.1.4 Circuit Compartments

Each circuit breaker and switch fuse unit shall be housed in separate compartments and shall be enclosed on all sides. Sheet steel hinged lockable door shall be duly interlocked with the breaker / switch fuse unit in 'ON' and 'OFF' position. Safety interlocks shall be provided for air circuit breaker to prevent the breaker from being drawn out when the breaker is in 'ON' position.

The door shall not form an integral part of drawout position of the circuit breaker. All instruments and indicating lamp shall be mounted on the compartment door. Sheet steel barriers shall be provided between the tiers in a vertical section.

4.1.5 Instrument Compartments

Separate adequate compartment shall be provided for accommodating instruments, indicating lamps, control contactors / relays and control fuses etc. These components shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker / switch fuse unit, bus bar and connections.

4.1.6 Bus bars

The bus bar shall be air insulated and made of high quality, high conductivity, high strength Copper.

The bus bar shall be of 3 phases and neutral system with separate neutral and earth bar. The bus bar and interconnection between bus bars and various components shall be of high conductivity Copper. The bus bar shall be of rectangular cross-section designed to withstand full load current for phase bus bars and half rated current for neutral bus bars in case of MCC panels only and shall be extensible on either side. The bus bar size shall be as per drawing. The bus bar shall have uniform cross-section throughout the length.

The bus bars and interconnections shall be insulated with heat shrinkable PVC sleeve and be colour coded in red, yellow, blue and black to identify the 3 phases and neutral of the system if specified in datasheet. The bus bar shall be supported on unbreakable, non-hydroscopic SMC / DMC insulated supports at sufficiently close intervals to prevent bus bars sag and shall effectively withstand electromagnetic stresses in the event of short circuit capacity of 50 KA RMS symmetrical for 1 sec. and a peak short circuit withstand of 105 KA minimum.

The bus bar shall be housed in a separate compartment. The bus bar shall be isolated with 3 mm. thick bakelite sheet to avoid any accidental contact. The bus bar shall be arranged such that minimum clearance between the bus bar are maintained as below :

Between phases	: 25 mm. minimum
Between phases and neutral	: 25 mm.
Between phases and earth	: 25 mm.
Between neutral and earth	: 20 mm. minimum

All bus bar connections shall be done by drilling holes in bus bars and connecting by chromium plated or tinned plated brass bolts and nuts. Additional cross-section of bus bar shall be provided in all Panels to cover up the holes drilled in the bus bar. Spring and flat washers shall be used for tightening the bolts.

All connections between bus bars and circuit breakers / switches and cable terminals shall be through copper strips of proper size to carry full rated current. These strips shall be insulated with insulating tapes.

4.1.7 Electrical Power and Control Wiring Connection

Terminal for both incoming and outgoing cable connections shall be suitable for 415 V grade, copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solderless sockets for the cable size as indicated on the appended drawings for the Panels.

Power connections for incoming feeders of the main Panels shall be suitable for 415 V grade copper conductor (AYFY) cables.

Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.

Both control and power terminals shall be properly shrouded.

10% spare terminals shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block, so that not more than one outgoing wire is connected per terminal.

Terminal strips for power and control shall preferably be separated from each other by suitable barriers of enclosures.

Wiring inside the modules for power, control, protection and instruments etc. shall be done with use of 660 / 1100 V grade, PVC insulated copper conductor cables conforming to IS : 694 and IS : 8130. Power wiring inside the starter module shall be rated for full current rating of respective contactor, but not less than 4.0 sq.mm. cross-section area. For current transformer circuits, 2.5 sq.mm. copper conductor wire shall be used. Other control wiring shall be done with 1.5 sq.mm. copper conductor wires. Wires for connections to the door shall be flexible. All conductors shall be crimped with solderless sockets at the ends before connections are made to the terminals.

Control power for the Motor starter module shall be taken from the respective module switchgear outgoing. Control power wiring shall have control fuses, (HRC fuse type) for circuit protection. All indicating lamps shall be protected by HRC fuses.

Particular care shall be taken to ensure that the layout of wiring is neat and orderly. Identification ferrules shall be fitted to all the wire termination for ease of identification and to facilitate checking and testing.

Spring type washers shall be used for all copper and aluminium connections.

Final wiring diagram of the Panels power and control circuit with ferrules numbers shall be submitted alongwith the Panels as one of the documents against the contract.

4.1.8 Terminals

The outgoing terminals and neutral link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformers for instruments metering shall be mounted on the disconnecting type terminal blocks. No direct connection of incoming or outgoing cables to internal components of the distribution board is permitted, only one conductor may be connected in one terminal.

4.1.9 Wireways

A horizontal PVC wire way with screwed covers shall be provided at the top to take interconnecting control wiring between different vertical sections.

4.1.10 Cable Compartments

Cable compartments of adequate size shall be provided in the Panels for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate supports shall be provided in the cable compartments to support cables. All outgoing and incoming feeder terminals shall be brought out to terminal blocks in the cable compartment.

4.1.11 Earthing

G.I. earth bars of 25mm x 3 mm shall be provided in the Panels for the entire length of the panel. The frame work of the Panels shall be connected to this earth bar. Provisions shall be made for connection from this earth bar on both side of the panels to the main earthing bar coming from the earth pit. Door earthing shall be provided for all the compartments.

The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar. The armour shall be properly connected with earthing clamp, and the clamp shall be made for connection from this earth pit on both side of the Panels.

The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar. The armour shall be properly connected with earthing clamp, and the clamp shall be ultimately bonded with the earth bar.

4.1.12 Labels

Engraved metal labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.

4.1.13 Name Plate

A name plate with the Panel's designation in bold letters shall be fixed at top of the central panel. A separate name plate giving feeder details shall be provided for each feeder module door.

Inside the feeder compartments, the electrical components, equipments, accessories like switchgear, control gear, lamps, relays etc. shall suitably be identified by providing stickers.

Engraved name plates shall preferably be of 3 ply, (Red-White-Red or Black-White-Black) lamicold sheet. However, black engraved perspex sheet name plates shall also be acceptable. Engraving shall be done with square groove cutters.

Name plate shall be fastened by counter sund screws and not by adhesives.

4.1.14 Danger Notice Plates

The danger notice plate shall be affixed in a permanent manner on operating side of the Panels.

The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.

The danger notice plate, in general, meet the requirements of local inspecting authorities.

Overall dimensions of the danger notice plate shall be 200 mm. wide x 150 mm. high.

The danger notice plate shall be made from minimum 1.6 mm. thick mild steel sheet and after due pre-treatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.

The letters, the figures, the conventional skull and bones etc. shall be positioned on plate as per recommendation of IS : 2551-1982.

The said letters, the figures and the sign of skull and bones shall be painted in signal red colour as per IS : 5-1978.

The danger plate shall have rounded corners. Location of fixing holes for the plate shall be decided to suit design of the Panels.

The danger notice plate, if possible, be of ISI certification mark.

4.1.15 Internal Components

The Panels shall be equipped complete with all types of required number of auto transformer starters, switch fuse units, contactors, relays, fuses, meters, instruments, indicating lamps, push buttons, equipment, fittings, busbars, cable boxes, cable glands etc. and all the necessary internal connections / wiring as required and as indicated on relevant drawings. Components necessary for the proper and complete functioning of the Panels but not indicated on the drawings shall be supplied and installed in the Panels.

All parts of the Panels carrying current including the components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the acceptable values of the relevant specifications at the part of the Panels.

All units of the same rating and specifications shall be fully interchangeable.

5.0 Components

5.1 General

The type, size and rating of the components shall be as indicated on the relevant drawings.

While selection of the capacity of the components resulting from the prevailing conditions like ambient temperature shall be allowed for. The thermal and magnetic trip rating shall be compensated for the ambient temperature.

The rating indicated on the drawing are ratings anticipated at prevailing site conditions.

5.2 Fuse Switch Units

- All SDFs shall comply with IEC 60947 – 3 – 1998 and IS 13947- 3 – 1993. Test certificates from independent testing authorities should be submitted.
- All Fuses shall comply with IEC 269 – 2 – and IS 13703- 2 – 1993. Test certificates from independent testing authorities should be submitted.
- All SDFs and fuses should be from the same manufacturer.
- All SDFs from 32A to 800A should be rated for AC-23A utilisation category.
- SDFs should have adequate terminal width to ensure proper contact surface area when terminated with appropriate aluminium cables with lugs
- Rated fused short circuit capacity of SDF should be equal to rated breaking capacity of associated HRC fuse.
- SDF should have quad break mechanism.
- SDF should be fitted with enhanced safety features like terminal shroud at incoming & outgoing, phase barriers, fuse covers.
- Fuse covers should be fitted on individual phase for ratings above and should provide IP 20 protection.
- SDF should have adjustable shaft length for all ratings.
- Neutral for all ratings should be covered.
- SDFs should have DIN rail mounting upto 100A
- It should be possible to inspect and replace contacts in installed condition (without removing the cables)
- It should have large/adequate ground clearance from terminals to facilitate connection of multiple cables.
- It should be possible to fit aux.contact block in the SDFs.
- All insulating material of SDFs should meet requirements of glow wire test as per IEC 60947 / IEC 60695
- Power loss of HRC fuses should be lower than the power loss limit specified in IS-13703 Part-2
- It should be possible to achieve same quadrant of operation for SDF irrespective of orientation of terminals (mounting of SDF).
- The SDFs & fuses shall be of the same make.

5.3 Miniature Circuit Breakers

Miniature Circuit breakers shall be current limiting type conformed with British standard BS : 3871 (Part I) 1965 and IS : 8826. The housing of MCBs shall be heat resistant and having a high impact strength. The fault current of MCBs shall not be less than 6000 A at 240 V. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical 'ON' and 'OFF' indications.

The circuit breaker dollies shall be of the trip free pattern to prevent closing the breaker on a faulty circuit.

The MCB contacts shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCBs shall be provided with magnetic fluid plunger release for over current and short circuit protection. The overload or short circuit device shall have a common trip bar in the case of DP and TPN miniature circuit breakers. All the MCBs shall be tested and certified as per Indian Standards, prior to installation.

5.4 Fuse

Fuses shall be of high rupturing capacity (HRC) fuse links and shall be in accordance with IS : 9224 -1979 and having high rupturing capacity of not less than 35 MVA at 415 V. The back-up fuse rating for each motor / equipment shall be so chosen that the fuse does not operate on starting of motors / equipment. HRC fuses shall be of the make as specified in Make of Material. The fuse and SFU make shall be same make.

5.5 Contactors

The contactors shall meet with the requirements of IS : 13947 and BS : 775.

The contactors shall have minimum making and breaking capacity in accordance with utilization category AC3 and shall be suitable for minimum Class II intermittent duty.

If the contactor forms part of a distribution board then a separate enclosure is not required, but the installation of the contactor shall be such that it is not possible to make an accidental contact with live parts. The coil and contacts shall be easily replaceable without taking out / removal of contactor from the panel. The contact system shall be suitable for inspection.

5.6 Moulded case circuit breakers

1.Standard Feature-

- The MCCBs should be extra current limiting type with trip time of less than 10 m.sec. under short circuit conditions. The current limiting action should be achieved with repulsion principle.
- The MCCBs should preferably have an anti - reclosing feature.
- All MCCBs shall be 4 Pole Microprocessor type and with in-built earth fault feature.

2.Standards & Certification-

- The MCCBs shall comply with the requirements of the IEC & IS Standards i.e- IEC 60947-2/ ISI3947 – Part 2.
- The MCCBs should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA /ASTA.
- The MCCBs shall be CE Marked.

3.Breaking Capacity-

- The MCCBs should have a Service short circuit breaking capacity (Ics) as well as Ultimate breaking capacities (Icu) as 35 KA at 415 Volts 50 Hz AC or required kA.

4. Protection Releases- .

- Adjustable Overload protection adjustable from 40% to 100% of In.
- Adjustable short circuit protection 6 to 9 times Ir upto 400 A MCCB & 3 to 6 times Ir for above 400 A MCCB.
- Adjustable Ground Fault protection with pick up settings from 20% to 50% of In and delay settings from 100 m.secs or 200 m.secs.
- In-built thermal memory.
- True RMS sensing.

5. Accessories

- **Internal Accessories -** The MCCB should have user friendly clip-fit type site fittable. Internal accessories like shunt / Under voltage / Trip alarm contacts / auxiliary contacts etc. **shall be provided wherever required.**
- Internal accessories should have double insulation & No side bias.
- **External Accessories –**
- **ROM –** All MCCBs should be fitted with the Extended type Rotary Operating Mechanism (ROM).
The ROM should be suitable for direct mounting on MCCB or Panel door.
The ROM should be with door interlock (with defeat feature) & padlock facility.

Terminal Shrouding – The MCCB Terminations/ Spreader links should be shrouded & touch proof.

6. Other Features

- The MCCB should be suitable for contact inspection.
- The MCCB shall be suitable for both Cu and Al termination.

The MCCB shall have spreader links and phase barriers as standard feature.

5.6 Voltmeter

Voltmeter shall comply with BS : 90. The dial of the meter shall be square in shape of 96 x 96 mm. or 144 x 144 mm. size. The voltmeter shall be moving iron type, flush pattern, with dust and moisture proof enclosure.

The voltmeter selector switch shall be arranged to provide line to line voltage reading and line neutral voltage.

5.7 Ammeter

Ammeter shall comply with BS : 89. The dial of the ammeter shall be square in 96 x 96 mm. or 144 x 144 mm. size. The ammeter shall be moving iron type, flush pattern with dust and moisture proof enclosure. The range of the ammeter shall be in accordance 1 to 1.5 times the feeder full load current. Separate current transformer shall be provided for all ammeters.

5.8 Current Transformer

Where ammeters are called for C.T.s shall be provided for current measuring. Each phase shall be provided with separate current transformer of accuracy Class I and suitable VA burden for operation of associated metering and controls. Current transformer shall be in accordance with IS : 2705 - 1992 as amended upto date.

5.9 Push Buttons

The push button unit shall comprise of the contact element, a fixing holder, and a push button actuator. The push button shall be momentary contact type. The contacts shall be of silver alloy and rated at 10 Amps. continuous current rating. The actuator shall of standard type and colour as per its usage for ON, OFF and TRIP.

5.10 Indicating Lamps

Indicating lamps shall be transformer operated low voltage rated and shall be supplied complete with translucent covers to diffuse the lamp light.

Colour shade for the indicating lamps shall be as below :

ON indicating lamp	: Red
OFF indicating lamp	: Green
TRIP indicating lamp	: Amber
PHASE indicating lamp	: Red, Yellow, Blue

6.0 Shop Drawings

Prior to fabrication of the Panels the supplier / contractor shall submit for consultant's approval the shop / vendor drawing consisting of G.A. drawing, sectional elevation, single line diagram, bill of material etc. and design calculations indicating type, size, short circuiting rating of all the electrical components used, bus bar size, internal wiring size, Panels dimension, colour, mounting details etc.. The contractor shall submit manufacturer's catalogues of the electrical components installed in the Panels .

7.0 Inspection

At all reasonable times during production and prior to transport of the Panels to site, the supplier / contractor shall arrange and provide all the facilities at their plant for inspection.

8.0 Test Certificates

Testing of Panels shall be carried out at factory and at site as specified in Indian standards in the presence of consultant. The test results shall be recorded on a prescribed form. The test certificate for the test carried out at factory and at site shall be submitted in duplicate to the consultant for approval.

Item No.2

Supply, Installation, testing and commissioning of Lighting/ Power Receptacles / Air conditioner power distribution panels(MCBDCs), flush mounting, double door type dust and vermin proof, powder coated enclosure and provided with four pole MCB as in comer in dust tight, powder coated enclosure and provided with four pole MCB as a feeders. The panels shall be provided with the R,Y,B indicating lamps on the front door and shall be with complete wiring and all materials as per drawings, specifications and directions of Engineer - In - Charge. 18 Ways SPN (Total 12 Nos 1 pahse O/G circuit), Incomer 63 A Four pole MCB- 10 kA. Out going circuits : 18 Nos 6/10/20 Amp SP MCBs 10 kA.

Item No. 3

Providing and erecting XLPE(IS:7098)(II)-88 ISI marked Armoured cable multi staranded Copper conductor for 1.1 KV to be laid on wall with necessary clamps or in existing cable trench / pipe at road crossing or floor of following size of cables.A) 4 core 2.5 sq.mm 2XWY FOR HPSV Fitting fighter parking
4 core x 4 sq.mm 2XWY for Out door street light.

Item No.4

Supply and Installation of Approved make Four Pole LT Heavy Duty Switch Disconnecter Fuse Unit Cubical type for panel mounting complete with operating mechanism suitable to operate on 415V A.C. With HRC fuses of suitable load confirming to IS. 13947 (Part I & III). of following capacities with weather proof, dust & vermin proof, wall / pole mounted front operated Outdoor type box having IP-64 protection made from 14 SWG thick CRC M.S. sheet for outer body & doors, 16 SWG thick CRC M.S.sheet for internal partitions with necessary supporting angles, flats including cutting, bending, drilling, welding, riveting with internal partitions & cable alley as per requirements & instruction of engineer-in-charge with erection . This switch shall be installed at power supply connection from power supply authority if required and insist by power supply authority.

Item No.5

Providing and erecting XLPE(IS:7098)(II)-88 ISI marked Armoured cable multi staranded Aluminium conductor for 1.1 KV to be laid on wall with necessary clamps or in existing cable trench / pipe at road crossing or floor of following size of cables.A) 3.5 core 120 Sq.mm (70 sq.mm 1/2 core A2XFY main incomer from DGVCL meter to LT panel.

Item No.6

6a

Providing & laying of **50 MM** Nominal OD **Doubled Walled Corrugated Pipes** (DWC) of polyethylene (conforming to IS 14930 - II) with necessary connecting accessories like coupler, Tee, L - Bow, etc. of same material at required depth (90 cms) including excavation for laying of cable below ground/ road surface for enclosing cable and back filling the same to make ground as per original & as per instruction of Engineer Incharge - for Streelight Cable of 1 x 4 core x 16 Sq. MM and Service cable of 1 x 4 core x 16 Sq. MM - Make : Dura guard/ Carlon/ Emtell / telorex

6b

Providing & laying of **120 MM** Nominal OD **Doubled Walled Corrugated Pipes** (DWC) of polyethylene (conforming to IS 14930 - II) with necessary connecting accessories like coupler, Tee, L - Bow, etc. of same material at required depth (90 cms) including excavation for laying of cable below ground/ road surface for enclosing cable and back filling the same to make ground as per original & as per instruction of Engineer Incharge - for Streelight Cable of 1 x 4 core x 16 Sq. MM and Service cable of 1 x 4 core x 16 Sq. MM - Make : Dura guard/ Carlon/ Emtell / telorex

6c

Supplying following size of Light duty "A" Class G.I. Pipe & erecting as directed by Engineer-in-charge. (a) 50 mm dia. For outdoor fittings installation

Item No.7 and 8

The cable end termination is carried out by the contractor as per the schedule B.

Item No.9

Lighting Luminaries.

- 9a Supply, Installation, connection , testing and commissionin of following lighting fixtures with lamps sources with the junction box provided for the point wiring, with suitable control gear box if any , including supply of all hardware required for installation, labour and materials as per specification s, drawing and directions of Enginner - In - Charge. 2X 36 W FTL 3250 LUMENS SURFACE MOUNTED LIGHT FIXTURE WITH DECORATIVE MIRROR OPTICS REFLECTOR AND LOUVERS. X TEND TCS 398.2 OR EQV.
- 9b Providing & erecting white stove enamelled Box type fluorescent fitting complete with Electronic Ballast assembly, tube, holders erected with lead wires & connection with one tube 36/40 watt.120 cms and adapter if required.Cat-III
- 9c Providing and erecting approved make decorative recess / surface mounting type mirror optics luminaire complete with non retrofit tubes, electronic ballast, high circuit P.F. & rust free fitting components mounted in powder coated CRCA / Al. housing with holder clear / opal diffuser complete erected with lead wire.
- 9d Supplying and erecting **industrial high bay luminaire** , installation with ballast, ignitar, holder, integral type. (A) With 150 watt SON lamp/metal haild lamp Cat- III
- 9e Approved make **street light luminaire** with one no suitable for- HPSV / MH lamp complete with control gear and accessories , **Single piece Deep drawn Aluminium housing** with two compartments duly stove enamelled painted side reflector protective acrylic cover, synthetic felt gasket, necessary hardware. The fitting should be suitable for side entry having suitable socket bore for clamping complete erected. (B) With 150 watt SVL. /Metal Halide lamp Cat - III

Item No. 10 to 16

Lighting System (Internal Wiring)

1. Scope

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, bell outlet points etc. including fixing of light fixtures, ceiling fan, exhaust fan, wall fan, bell etc. **Concealed wiring shall be carried out in this tender.**

2. Standards

The following standards and rules shall be applicable :

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 : 9537 (PART 2)	Rigid steel conduits for electrical wiring.
IS : 2667	Fittings for rigid steel conduits for electrical wiring.

IS : 3480	Flexible steel conduits for Electrical wiring.
IS : 3837	Accessories for rigid steel conduit for electrical wiring.
IS : 694	PVC insulated cables.
IS : 9537 (PART 3)	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 : 3854	Switches for domestic purpose.
IS : 3419	Fittings for rigid non-metallic conduits.
IS : 4648	Guide for electrical layout in residential buildings.

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.

3. 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 :

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

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

Supply, installation and connection of flush type switches, sockets, cover plates, switch plates, and fixing fan regulator etc.

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

4. 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.

5. 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 wires / cables laid through exposed (surface mounted) PVC conduits as directed. Conduits shall be surface mounted on walls.

6. General

Prior to laying of conduits, the contractor shall submit for approval, the shop drawing for 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. Only after the drawings are approved, the contractor shall proceed with the work of laying of conduits.

7. Material

7.1 PVC Conduits

All non-metallic PVC conduits shall conform to IS : 9537 (Part 3). The conduit shall be plane and of 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, heavy gauge having 2.0 mm. wall thickness upto 20 mm. diameter conduit and 2.5 mm. wall thickness for all sizes above 20 mm. diameter.

7.2 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.

7.3 Cables

The cables shall conform to IS : 694. For all internal wiring PVC insulated cables 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 compound 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, ceiling fans, bell, convenience socket outlet points (P+N+E) :

1.5 sq.mm.	-	From D.B. to switch boards.
1.5 sq.mm.	-	From switch boards to outlet points

In case of power socket outlet circuit having not more than two 15 A power outlet (P+N+E) :

4.0 sq.mm.	-	From D.B. to first floor outlet
2.5 sq.mm.	-	From first power outlet to second power outlet

In case of power socket outlet circuit having single 15 A power outlet (like water heater) (P+N+E) :

sq.mm.	-	From D.B. to power outlet.
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In case of 15 A. power outlet for window Air conditioner or other likewise appliances (P+N+E) :

sq.mm.	-	From D.B. to power outlet.
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The earth continuity conductor shall be similar to circuit cables and shall be drawn through conduit alongwith other circuit cables. The size of the earth continuity conductor shall be as follows :

MINIMUM SIZE OF EARTH CONTINUITY CONDUCTOR NOT FORMING PART OF THE SAME CABLE AS THE ASSOCIATE CIRCUIT CONDUCTOR.

Nominal cross-section area of largest associated copper circuit conductor in sq.mm.	Nominal cross-sectional area of earth continuity conductor in sq.mm.
1.5	1.5
2.5	1.5
4.0	2.5
6.0	2.5
10.0	6.0
16.0	6.0
25.0	16.0
35.0	16.0
50.0	16.0

Separate circuit shall run for each water heater, kitchen equipment, window air conditioner, and similar outlets at location as shown on drawings.

8. Conduit Joints

Conduits shall be joined by means of plain couplers vinyl and / or solvent cement. Where there are long runs of straight conduit, inspection type couplers shall be provided at intervals , as approved by the Engineer. The conduits shall be thoroughly cleaned before making the joints. In case of plain coupler joints, proper jointing material like a vinyl solvent cement (gray in color) or any material as recommended by the manufacturer shall be used.

9. Bends in Conduit

Wherever necessary, bends or diversions may be achieved by bending the conduits or by employing normal bends. No bends shall have radius less than 2.5 times outside dia. of the conduit. Heat may be used to soften the PVC conduit for bending, but while applying heat to conduit, the conduit shall be filled with sand to avoid any damage to the conduit.

10. Outlets

All the outlets for fittings, switches etc. shall be boxes of substantial construction. In order to minimize condensation or sweating inside the conduits, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects , etc. Fixing between conduit and boxes, outlet boxes, switch boxes and the like must be provided with entry spouts and smooth PVC bushes. Joints between conduit and any type of boxes shall be effected by means of conduit couplers in each of which shall be coupled smooth PVC bush from inside the box. In any case all the joints shall be fully water tight.

11. Bunching of Cables

Cables of AC supply of different phase shall be bunched in separate conduits. The number of insulated wires/ cables that may be drawn into the conduits shall be as per the following table. In this table, the space factor does not exceed 40%. However, in any case conduits having lesser than 19 mm dia. shall not be used.

MAXIMUM PERMISSIBLE NUMBER OF 650 VOLT GRADE SINGLE CORE CABLES THAT MAY BE DRAWN IN TO RIGID PVC CONDUITS.

CABLE SIZE	SIZE OF CONDUITS (MM) (MAX. NO. OF CABLES)
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IN MM2

	19 / 20	25	32	38 / 40	51 / 50
1.5	4	8	15	-	-
2.5	4	6	10	-	-
4.0	2	4	8	12	-
6.0	1	4	6	8	-
10.0	1	3	5	10	-
16.0	-	2	4	5	12

Wires carrying current shall be so bunched in the conduit that the outgoing and return wires are drawn in the same conduit. Wires originating from two different phases shall not be run in the same conduit.

12. Fixing of Conduits

Conduit pipes shall be fixed by heavy gauge spacer bar saddles. The saddles shall be of 3 mm x 19 mm galvanized mild steel flat, properly treated and securely fixed to support by means of nuts and bolts raw bolts, brass machine screws, as mentioned, at an interval of not more than one meter but on either side of couplers, or bends, or junction / pull / outlet boxes or similar fittings, saddles shall be fixed at a distance of 30 cm from the centre of such fittings.

Draw boxes shall be located at convenient location for easy drawing of wires.

Every mains and sub mains shall run in independent conduits with an independent earth wire of specified capacity along the entire length of conduit.

The conduits to be installed shall be of ample cross section area to facilitate the drawing of wires. The diameter of the conduit shall be selected as per table specified in this specifications. But in no case it shall be less than 25 mm diameter.

Entire conduit layout shall be done such as to avoid additional junction boxes other than for outlet points. Conduits shall be free from sharp edge and burrs. Conduits shall be laid in a neat and organized manner as directed and approved by the Engineer. Conduit runs shall be planned so as not to conflict with any other services pipe, lines / duct.

If required, connection between PVC and steel conduits shall be through a junction box. Direct connection between PVC and steel conduits are not allowed.

Where exposed conduits are suspended from the structure, they shall be clamped firmly and rigidly to hangers of design to be approved by Engineer. Where hangers are to be anchored to reinforced concrete, appropriate inserts and necessary devices for their fixing shall be left in position at the time of concreting, making holes and opening in the concrete will generally not be allowed. In case, it is unavoidable, prior permission of the Engineer shall be obtained.

13. Protection Against Dampness

In order to minimize condensation or sweating inside the conduit, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects, as far as possible.

14. 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. All strands of wires shall be soldered at the terminals. All strands of wires shall be soldered at the end before connection. 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.

15. 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. Contractors shall be continuous from outlet to outlet. Joints where unavoidable, due to any specified reasons, prior permission in writing shall be obtained from the Engineer before making such connections. Joints by twisting conductors are prohibited.

16. Load Balancing

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

17. Earthing

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

18. Testing Of Installation

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

18.1 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 megohms of an installation, measured shall not be less than 50 megohms divided by the number of points on the circuit.

The insulation resistance shall be measured between

EARTH TO PHASE
EARTH TO NEUTRAL
PHASE TO NEUTRAL
PHASE TO PHASE

18.2 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.

18.3 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.

18.4 Completion Certificates

All the above tests shall be carried out in presence of Engineer 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 Engineer 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.

Modular type point wiring is carried by the contractor in the tender.

- 10a Point wiring for Light / Bell with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in/ on surface on wall/ceiling complete with 6A Modular type switch / bell push & accessories and earth continuity of following type, erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected, with necessary Lamp holder/ceiling rose / H.D.Connector as directed.(a) with medium class Rigid PVC pipe and accessories Cat-II
- 10b Point wiring for FAN with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (Green) both are of .ISI marked 1.1 KV Grade FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in / flushed on wall/ceiling complete with 6A Modular type switch and hum free EME four or more step type electronic fan regulator with separately mounted and accessories with earth continuity of following type erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected. with necessary ceiling rose / H.D.Connector as directed.(a) with medium class Rigid PVC pipe and accessories Cat- II
- 10c Point wiring for Looped Plug with 6A Modular type switch & 5 pin socket erected on PVC / Metallic box, single mounting base frame covered with textured / metallic front plate modules erected on / in wall / ceiling with following type accessories Cat – II
- 10d Point wiring for Two Way Controlled Light Point with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (green) both are of .ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of pipe to be erected concealed in / flushed on wall/ceiling ,complete with 6A Modular type switches and following type of accessories erected on PVC / Metallic box, single mounting base frame covered with textured / metallic front plate modules erected on / in wall / ceiling as per pipe erected. with necessary batten/angle holder or ceiling rose or H.D.Connector as directed. (a) with medium class Rigid PVC pipe and accessories Cat-II.
- 10e Point wiring for Individual Plug with & earthwire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of to be erected concealed in / on surface of wall / ceiling complete with Modular type switch & 5 pin Plug erected on PVC / Metallic box covered with appropriate front plate modules erected on / in wall / ceiling as per pipe erected with following type of accessories.[II] For 16A Plug with 2-2.5 sq.mm Cu. Wire (a) with medium class Rigid PVC pipe and accessories Cat-II

- 10f Point wiring for Individual Plug with & earthwire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of to be erected concealed in / on surface of wall / ceiling complete with Modular type switch & 5 pin Plug erected on PVC / Metallic box covered with appropriate front plate modules erected on / in wall / ceiling as per pipe erected with following type of accessories.[II] For 16A Plug with 2-4 sq.mm Cu. Wire (a) with medium class Rigid PVC pipe and accessories Cat-II
- 10h1 Providing following type of Modular Type Accessories mounted with pvc / metallic box, single mounting base frame covered with textured / metallic front plate , modules erected with necessary connection. As desired by Engineer In charge Two Pin/ RJ-11 Telephone Socket with Top Cat - II
- 10h2 (2) Two nos. 6A SP switch or One No SP Switch and One No 6A 5 Pin Plug or Two Nos 6Amp. 5 Pin plug
- 10h3 Two Pin/ RJ-11 Telephone Socket with Top
- 10h4 TV Co-axial Socket outlet
- 10h5 Blank Plate Single
- 10h6 Modem Jack for Computer Open RJ-45 Cat-II
- 10h7 6/16Amp. Universal socket
- 11 Providing and erecting 1.5 mm thick FIA approved and ISI mark (embossed) RIGID PVC PIPES of following size complete erected with necessary PVC fittings & Junction boxes fixed with adhesive solution & Clamps with following type of erection. for open execution with clamps erecting on wall /ceiling of following sizes of Diameter..25 mm
- 12a Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected concealed in /flushed on wall/ceiling, with 1.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size (a) with medium class Rigid PVC pipe and accessories (a) 2 wire 1.5 sq. mm Cat - II
- 12b do but 2 wire 2.5 sq. mm
- 12c Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected in / on wall / ceiling with 2.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size (a) with medium class Rigid PVC pipe and accessories (a) 2 wire 4 sq. mm Cat- II
- 13 Providing & Erecting following size of TV Co-axial flexible cable comprising inner conductor of solid bare copper insulated with Foam PE & Secondary conductor made of poly - Aluminium film bonded Al. Braids @ coverage of 65%, overall sheathed with black PVC insulation RG-6.
- 14a Supplying & erecting Delton or approved make Telephone Cable electrolytic grade annealed copper conductor insulated with PE insulation twisted in to pairs with colour combination bunched together in concentric layers so as to minimies cross-talk & wrapped with FRPVC tape and sheathed with FR PVC or HFFR outer jacket suitable for indoor telephone wiring and confirming to C- DOT S/ WS - 113 / IEC 60189-2, UL-1581 SECTION 1080 V W -1 erected in existing pipe of following size of conductor and nos of pairs with necessary connections. 0.6 mm Un armoured Two pair.
- 14b Do but Armoured Ten pair
- 14c Supply, laying horizontally and vertically of CAT 5E computer data cables from Ethernet switch at control room to individual computer in PC pipes. The rates shall be included all labour and materials as per specifications, drawings and directions of Engineer - In Charge.
- 15a Supplying & erecting M.S. Box having 16 Gauge painted with red oxide or Heavy duty PVC box erected flushed on wall or concealed in wall with necessary plastering & finishing as directed of following size.100 mm x 100 mm x 75 mm (d).
- 15b Providing & Erecting 3mm thick laminated sheet with grooving as directed

- 15c Supplying & erecting M.S. Box having 16 Gauge painted with red oxide or Heavy duty PVC box erected flushed on wall or concealed in wall with necessary plastering & finishing as directed of following size.175 mm x 100 mm x 75 mm (d).
- 16 Supplying & erecting Approved make call bell indicator with buzzing sound and Red light indicating lamp with Red light button to attend the call suitable for 240 v 50 cys supply to be erected on polished wooden board with 3mm thick laminated sheet with connections per way.

Item No.17

EARTHING & EARTHING MATERIALS

Supplying & erecting funnel type earthing having earth plate of following size buried in specifically prepared earth pit 3 mtr. below ground with 40 kg. charcoal and salt with alternate layers of charcoal & salt, 20mm.dia. G.I. pipe with Funnel with a wire mesh for watering & bricks masonry block, C.I. Cover complete as per para 7.3 of IS 3043 with necessary length of double Galvanised Iron / copper earth wire No 6 SWG bolted with lug to the plate and covered in 12 mm dia. G.I. pipe 2.5 mtr long complete connected to the nearest switch gear with end socket as per direction & duly tested by earth tester confirming to IS (As per drawing) with following specification (C) with 60 x 60x 0.315 cms. Copper earth Plate

EARTHING & EARTHING MATERIALS

1.0 General

All the non-current carrying metal parts of the electrical installation and mechanical equipments shall be earthed properly. The metal conduits, cables armour and sheath, electric panels boards, lighting fixtures, and all other parts made of metal shall be bonded together and connected by means of specified earthing system. An earth continuity conductor shall be installed with all the feeders and circuits and shall be connected from the earth bar of the panel boards to the conduit system, earth stud of the switch box, lighting fixture, earth pin of the socket outlets and to any metallic wall plates used. All the enclosures of motors shall be also connected to the earthing system.

2.0 Scope of Work

The scope of work shall cover supply, laying, installation, connecting, testing and commissioning of :

- 2.1 Earthing station.
- 2.2 G.I strips from earthing station to equipotential bar.
- 2.3 G.I strips / wires from equipotential bar to connect power panels, DBs, switchboards etc.

Bonding of Non-current carrying parts, and metallic parts of the electrical installation.

3.0 Standards

3.1 The following standards and rules shall be applicable:

- 1) IS: 3043 - Code of practice for Earthing with latest revision
- 2) Indian Electricity Act and Rules

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the British Standard Codes of Practice in absence of Indian standard.

4.0 Type of Earthing Station

4.1 Pipe Electrode Earth Station

- 4.1.1 The earth station shall be as shown on the drawing and shall be used for equipment earth grid and/or street light pole earthing.
- 4.1.2 The earth electrode shall be 3.0 M long 38 mm dia class "A", Galvanised steel pipe.
- 4.1.3 The earth resistance shall be maintained with a suitable soil treatment as shown on the drawing.
- 4.1.4 The resistance of each earth station should not exceed 1 ohms.
- 4.1.5 The earth lead shall be fixed to the pipe with a nut and safety set screws. The clamp shall be permanently accessible.
- 4.1.6 The earthing grid and the earthing conductor shall be hot dip Galvanised iron strips of the size as shown in the drawing.
- 4.1.7 G.I. pipe with funnel of approved quality shall be used for watering the earth electrode \ station.
- 4.1.8 The block masonry chamber with Cast Iron hinged cover shall be provided for housing the above referred funnel and pipe.
- 4.1.9 The hardware and other consumables for earthing in_ stallation shall be hot dip Galvanised iron material as shown on the drawing.

5.0 Installation and Connection

- 5.1 The pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 3.0 M below finished ground level.
- 5.2 The 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.
- 5.3 The pipe electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Char_ coal dust and Salt mixture.
- 5.4 20 mm. dia. G.I. pipe for watering, shall run from top edge of the pipe electrode to the mid level of block masonry chamber.
- 5.5 Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe.
- 5.6 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.
- 5.7 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.
- 5.8 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.
- 5.9 The earth conductors (G.I Strips / Wires.) inside the building shall properly be clamped / supported on the wall with Galvanised Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conduc_tors outside the building shall be laid atleast 600 mm. below the finished ground level.
- 5.10 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 equip_ ment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

- 5.11 Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.
- 5.12 The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

6.0 Earth Leads and Connections

- 6.1 Earth lead shall be bare G.I as specified with sizes shown on drawings. 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 atleast 8 mm away from the wall surface.
- 6.2 The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

7.0 Equipment Earthing

All apparatus and equipment transmitting or utilising power shall be earthed in the following manner. G.I. earth strips/wires shall be used unless other-wise indicated in the Schedule B.

8.0 Power Transmission Apparatus

- 8.1 Metallic conduit shall not be accepted as an earth continuity conductor. A separate insulated / bare earth continuity conductor of size 50% of the phase conductor subject to the minimum shall be provided.

NOMINAL CROSS-SECTIONAL AREA OF LARGEST ASSOCIATED COPPER CIRCUIT ONDUCTOR SQ. MM.	NOMINAL CROSS-SECTIONAL AREA OF EARTH-CONTINUTY CONDUCTOR SQ. MM.
1.0	1.0
1.5	1.5
2.5	1.5
4	2.5
6	2.5

The earth continuity conductor be drawn inside the conduit shall be insulated.

Non metallic conduit shall have an insulated earth continuity conductor of the same size for metallic conduit. All metal junction and switch boxes shall have an inside earth stud to which the earth conductor shall be connected. The earth conductor shall be distinctly coloured (Green or Green / Yellow) for easy identification.

Armoured cable shall be earthed by two distinct earth connections to the armouring at both the ends and the size of connection being as for the metallic conduit.

In the case of unarmoured cable, an earth continuity conductor shall either be run outside along with the cable or should form a separate insulated core of the cable.

Three phase power panel and distribution boards shall have two distinct earth connections of the size correlated to the incoming cable size. In case of single phase DB's a single earth connection is adequate.

9.0 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.

Each earthing station

Earthing system as a whole

Earth continuity conductors

Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 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 ENGINEER

10.0 Method of Measurement

10.1 Provision of earthing station complete with excavation, electrode, watering pipe, soil treatment, masonry chamber with cast iron cover etc. shall be treated as one unit of measurement.

10.2 The following items of work shall be measured and paid per unit length covering the cost of the earth wires / strips, clamps, labour etc.

- a) Main equipment earthing grid and connection to the earthing station.
- b) Connection to the switch board, power panels, DB etc.

10.3 The cost of earthing the following items shall become part of the cost of the item itself and no separate payment for earthing shall be made.

- a) Motors - earthing forming part of the cabling / wiring for the motors.
- b) Isolating switches and starters should form part of mounting frame, switch starter etc.
- c) Light fittings - form part of installation of the light fittings.

Conduit wiring, cabling - should form part of the wiring or cabling.

Item No.18.

Providing and erecting required size HOT deep Galvanised strip for earthing for LT pannel board, DBs etc. along the cable trenches/ table trays / on the wall or structure / burried in ground min 500 mm deptch including excavation and backfilling, installation shall include the welding at joints and providing anti corrosive paint(black bitumen) at the welded portion and clamping using GI clamps and necessary hardware and material as per standard drawings, specifications and directions of Engineer In charge 50 mm x 6 mm GI strips .

Item No.19

- 19a Approved make Power Saving 50 Watt Ceiling Fan with Condenser 230 volt A.C. 50 Cys. 1200 mm sweep complete having 3blades with aluminium blades with , canopy & 30 cms. down rod erected with 24/ 0.2 flat 3 core flexible wire with earthing.(Havells, Ori
- 19b Supplying & erecting Fan Hook of 10 mm M.S. Roundbar grouted in RCC slab with Making the site as original.
- 19c Supplying & erecting fan hook box of 10 mm M.S. round bar bounded to the RCC bars up to 50mm length each side and pierced through a 16 Gauge M.S. box / Heavy Duty PVC box having depth of 75mm complete erected concealed in Ceiling with necessary finishing
- 19d Providing 2.5 mm thick laminated sheet to cover the fan hook of fan box.

Item No.20 and 21.

Item No. 1 STREET LIGHT POLE: (09 Mtr pole).

The street light pole having over all length of 09.00 Mtr. shall be tubular swaged type and manufactured as per I.S.: 2713 / 1980. The poles shall be fabricated from the M.S. Medium Class ERW pipes as per IS 1239 Part - I 2004 of TATA/ SURYA / JINDAL / ASIAN make in three stepped sections as specified in the attached drawing. Swaging process only shall be used for reducing the section of street light pole for swaged / stepped design. The bracket shall be fabricated as per drawing enclosed. Suitable arrangement shall be provided at the top of the street light pole for fixing of street light fixtures. The 300 x 300 x 6 mm thick MS plat to be welded at the bottom of the pole and the necessary earthing termination bolt and the cable entry for the Luminaries etc shall be provided as per the distance given for fixing of junction box in the drawing.

Length of section - Out side dia. x Wall thickness. Bottom : 5.00 mtrs. - 114.30 mm x 4.50 mm. Middle : 2.00 mtrs. - 88.90 mm x 4.05 mm. Top : 2.00 mtrs. - 76.10 mm x 3.25 mm. (e) Approximate Weight of Pole : 92 Kg

The street light pole is having over all length of 09.0 Mtr. The effective length of section shall be:

Bottom	5.00 mtr. having outside dia. 114.30 mm and wall thickness 4.5 mm.
Middle	2.00 mtr. having outside dia. 88.90 mm and wall thickness 4.05 mm.
Top	2.00 mtrs. having outside dia. 76.10 mm and wall thickness 3.25 mm.
Planting Depth	: 1.5 Mtr.
Approximate weight of pole	: 92.0 Kg. (Without Bracket)

Minimum Size of Pipe in Swaged Joint	Length of Swaged in mm as per IS
114.30.mm O.D.	300mm
88.90 mm O.D.	230mm

The installation of street light pole shall be done as per direction of engineer In charge.. The planting depth shall be 1.50 Mtr. Special care shall be taken while erection of poles so that these are not strained or damaged during erection and are firmly stayed till the foundation are secured. The poles shall be grouted in side the ground pit (Cross section 600 mm dia) with cement concrete 1:2:4. Before the placement of pole in the pit . 100 mm thick, 600 mm dia 1:2:4 cement concrete bed shall be prepared and only after drying, poles shall be put in the pit. One (as a item b) **cement concrete foundation** (including excavation) for the pole with **60 X 60 X 150 cms** deep in 1:3:6 cement concrete (20 to 25mm stone metal) with 45 cms x 45 cms (or 45 cms dia) x 45 cms high cement concrete plinth with necessary curing and finishing in approved manner as per instruction of Engineer- in-charge and as per drawing Before placement of concrete around pole in the pit, necessary conduit pipe (not less than 38/40 mm dia (Item c)) shall be placed for facilitating drawing of cables. The protection at conduit pipe's end should be provided to avoid damage to cable during the replacement. The cement concrete shall be protected from premature drying by curing for at least seven days after pouring / casting. All concrete surfaces from 150 mm below ground level to top shall be finished with cement mortar 1: 4. After complete drying, three coat of white wash shall be applied to the finished concrete surface. All the materials for civil and electrical works shall be arranged and provided by the contractor.

- b) Providing M-20 / 1:2:4 of cement concrete foundation & 70% PCC from bottom including excavation for the pole of size 60x60x150cms. Deep in below ground level with plinth of 45 cms x 45 cms including excavation for steel tubular pole with 60 cm x 60 cm (or 60 cm dia) x 150 cm deep in 1:3:6 cement concrete, (20 mm to 25 mm stone metal) with 45 cm x 45 cm (or 45 cm dia) x 45 cm x 45 cms) high upper ground level with necessary curing and finishing in approved manne orn as per the instruction of incharge Engineer. - **(1 No. Per St. Lght Pole)**
- c) Providing of Medium - ' B ' Class Galvanised Iron Pipe 38/ 40 mm dia. having smooth finished bore of the pipe on both ends, erected on the face of pole with clamps, nuts and bolts for laying of cable along the pole & well shaping (135°) the pipe as per site requirement to ease cable entry. (2.0 Mtr. long pipe per cable entry) - **(2 Nos. - Pipes for two Cable Entry Per St. Light Pole)**

- d) P & F of Heavy Duty Flange type brass Cable Gland with rubber ring suitable for 1 x 4.0 Core x 16 Sq. MM PVC Insulated Alu. Armoured cable complete with outgoing tails, insulating taps etc. - **(2 Nos. Glands Per Sintex Box on St. Light Pole)**
- e) P & F of Solderless Crimping Type Aluminium Lugs (4 Nos. per termination) conforming to IS suitable for 1 x 4.0 Core x 16 Sq. MM PVC Insulated Aluminium Armoured cable with high pressure tool & complete erected with insulating materials for each termination. - **(2 Nos. Termination Per St. Light Pole)**
- f) Supplying & erecting of 300 mm x 200 mm x 100 mm (deep) size, Sintex or approved make, composite FRP (plastic) loop - in - loop out box approx. 2.00 mm thk. box complete with bakelite connector strip 4 way - 2 nos./ 8 ways - 1 no. (incoming & out going cable), single pole 6 A to 32 A, MCB (Cat-III) with ISI marked suitable to operate on 240 V, A. C. supply and having overload & short circuit tripping element and breaking capacity 10 kA conforming to IS: 8828/ 1996 & hinged doors having locking arrangement with mounting clamp with nuts, bolts & washers suitable for erection on pole with cable clamps & earth bolt. - **(1 No. Per St. Light Pole)**
- g) SITC of funnel type pipe earthing having 150 cms Long and 2.5 cms dia. Medium Class Galvanised iron pipe with coupling and buried in specially prepared earth pit with salt & charcoal complete with necessary double 8 SWG Copper earth wire - 0.8 Kg (2 x 3.5 Mtr. = 7Mtr.) laid upto bolt fitted in pole for earthing. (Earthing at each poles) as per drawing - **(1 Job Per St. Light Pole)**

Pipe Electrode Earthing:

Earthing electrode shall consist of a GI (Class -C) Amebica / GST / Tata / Jindal / Prakash / Indian Tube Company make 25mm dia and 1.5 meters long GI pipe electrode shall be buried vertically in the ground as far as practicable below permanent moisture level with its top not less than 150mm x 300 mm below ground level. The electrode shall be in one piece and no joints shall be allowed in the electrode. Wherever possible earth electrodes shall be located as near water tap, water drain or a down take pipes. Earth electrode shall not be located in proximity to a metal fence. It shall be kept clear of the pump house/substation foundations and in no case shall be nearer than 2 meters from the outer face of the wall. The pipe earth electrode shall be kept vertically and surrounded with 150mm thick layer of charcoal dust and salt mixture up to a height of 1.50 meters x 300 mm from the bottom as per drawing. At the top of the electrode and funnel over the GI pipe. (As per drawing).

Item No. 2.

a. Single Arm Brackets :

Providing & fixing **Single Arm Bracket** comprising main Light Class M.S. pipe of 4.2 cms duly hot dip galvanized. Outside dia. complete with suitable M. S. sleeve tubing of approx. 30 cms. length and suitable for 76.5 mm/ 80 mm or required size of pole top having 5 nos. fasteners for fixing the bracket and having suitable rise as per site condition as directed and spread of 2 Mtrs. With suitable welded stiffener, reducer and nipple with check nuts, complete painted with one coat of red oxide and two coat of aluminium paint, as per drawing. After completion of the all fabrication work, whole bracket section shall be processed for hot dip galvanizing by single dip method having 86 microns for uniform thickness, better aesthetic appearance, as per IS: 4759 :1996 (Reaffirmed 2006) Edition 4.1 (2002-05).

b. STREET LIGHT LUMINARE WITH 150 WATT HPSV :

Providing & erecting approved make, Outdoor Step POT Optic Streetlight Luminaire with Sodium Vapour Lamp - (Cat - III) - NAV T complete with control gear & accessories operating on 200 - 240 V, A. C. Power Supply of single piece construction. It comprises of die cast housing with new generation staircase precision optics (Step POT) reflector sealed with toughened glass mounted on a die cast frame with IP 65 lamp compartment and IP 54 control gear compartment protection dip drawn aluminum housing with built in Step pot optic reflector with necessary hardwires. The luminaries should be for side entry having suitable for socket bore clamping complete & having IP - 65 protection with lead wires & connections (Cat - III) - (1 No. St. Light Luminaire per Arm x 1 Arm = 1 No. St. Light Fitting)

The installation of fitting compete with accessories and lamps at the end of the pole bracket connecting it with 2 wire 2.5 sq.mm main with 1.1 KV grade FRPVC insulated ISI marked Standard Copper conductor wire in existing pipe erected with 1.5 sq.mm copper conductor FRPVC insulated standard wire of green colour for earth continuity of fixtures from earthing point of the pole to the fixture.

All the fittings required for fixing the luminaries , such as reducer, coupler, gasket and all type of hardwares shall be provided by the contractor at his cost. All tools and tackles required for the entire work shall also be arranged by the contractor . In any case GIDC will not provide any such facility , whatsoever

Item No. c.

Providing & laying mains with 1.1 kV grade **FR PVC** insulated ISI Marked Stranded **Copper** Conductor **2 Wire 2.5 Sq. MM.** in existing pipe/ in street light pole erected with **1.5 Sq. MM. copper conductor FR PVC** insulated stranded wire of green colour for earth continuity. - **(11 Mtr. per St. Light Fitting x 1 Nos. St. Light Fitting = Total 11 Mtr.)**

Item No.22

Supplying, erecting, commissioning and testing EPABX CMOS microprocessor based system having common features With remote programming & remote dialling having following other common features. (Accord Matrix or equivalent approved make)- Auto Call Disconnecter- (Incoming - Local- STD) with programmable timing- External Call forward with DOSA- Walk in Class of service & trunk reservation- Boss ring & call back on No Reply last caller recall CLI- Hot Line with Delay & with No.- Unsupervised Conference- Serial DISA (DISA with option to dial another No. if Extn. is No Reply)- Programming Flexibility of all features related to timer(41 Timer)-10 Different group of out going call restriction like 95, 97, 98 etc.Having following capacity. (E) 4 incoming junction line & 12 extensions.

Item No.23

Supplying, installing, testing & commissioning of digital pure sine wave **INVERTOR** of approved make single phase 230v complete with overload relay & necessary protection with following size of batteries, erected with battery terminal wire, copper lead wire to be connected to load with 10 Amp., 10 kA MCB. [F] 2000 VA with battery 12V, 150 AH load up to 1250 W . The installation and wiring shall be carried out as directed by Engineer In charge.