

7.17 ELECTRICAL INSTALLATION**7.17.1 General**

This specification covers Erection, Testing and Commissioning of the electrical equipment.

Should the bidder wish to deviate from this specification in any way, he shall draw specific attention to such deviation by listing the deviations in the deviation schedule without which his offer will be considered in conformity with the specification in all respects.

7.17.2 Scope of Work

The scope of work shall include but not limited to the following:

Installation and testing & commissioning of Generator, Transformers, Switchgears, Buducts, Motors, Control and Relay Panels, Battery and Chargers, Cables, Push button stations, Cable trays and accessories, DG Set, UPS system, Communication system, Illumination system, Earthing and lightning protection system, Switchyard equipment, and all other electrical items forming part of this project.

7.17.3 Installation Requirements**7.17.3.1 General**

All electrical installation work are to be carried out in accordance with this tender document and in conformity with the requirement of Indian Electricity Act, 1910 and Indian Electricity Rules as amended upto date and relevant standards. Manufacturers recommendation are also to be followed. The installation shall be carried out by a licensed and approved electrical contractor. The electrical installation must be got approved by the Electrical inspector of Tripura state.

7.17.3.2 Switchgears and Control Gears

Switchgears and Control gears shall be installed as per IS 101114/ relevant IEC.

The foundations shall be designed to carry the dead weight of panels and additional impact loads imposed. The equipment shall be installed correctly and leveled properly. The floor level in front of the equipment shall be such as to facilitate easy drawout of breakers.

For storage batteries the floor shall be chemically resistant type and walls shall have chemically resistant tiles upto a suitable height. Alternatively chemical resistant paints are also acceptable.

All openings shall be closed to avoid entry of foreign particles.

Should the Switchgear or part of it be having a low IR value, the entire switchgear shall be dried up, with special care, to avoid direct local heating of surrounding insulation.

7.17.3.3 Transformers

Transformer installation shall be carried out as per IS 100214/ relevant IEC.

The level of the transformer base should be higher than the highest flood and storm water level of that area.

High rating transformer shall be placed after grouting channels or rails over concrete foundations, leveled, aligned & checked for free movement on the rails. Other

transformers shall be placed directly on concrete beds. Stoppers to wheels shall be clamped immediately to prevent any movement.

Adequate clearance shall be maintained on sides and over the highest point of transformers.

Fire barrier walls shall be provided as per requirements.

Oil soak pit/drain pit of adequate capacity with necessary drain pipes shall be provided for draining of oil, away from the transformer.

Fire protection with sprinkler system shall be provided for higher rating of transformers as required.

Samples of oil shall be taken from the bottom of the tank and tested for proper dielectric strength and acidity. It should be ensured that the oil is free from dust and moisture during filling-in operation.

Drying out of the transformer shall be carried out to attain the required insulation levels as required.

7.17.3.4 Busducts

The insulators in busducts shall be inspected for any possible damage during transit and the defective ones shall be replaced. Contact surface of busbars, busbar bolts and nuts shall be thoroughly cleaned. The busduct run shall be properly aligned and leveled and shall be suitably supported.

The opening in the wall where the busduct enters OUTSIDE TO INSIDE room shall be completely sealed off so that entry of rain water and foreign materials are prevented. Expansion joints, flexible connectors inspection on openings, shall be checked for proper tightness.

The Generator busduct enclosure shall be checked for earth continuity and then properly earthed.

7.17.3.5 Illumination Systems

Wiring installations shall be carried out as per IS 732/ relevant IEC.

The location of the lighting panels shall be such that the same shall be operated easily.

The location of the light fittings, receptacles, switches, etc. shall be such as to avoid interference with piping or other equipment and to avoid objectionable shadows and glare.

Lighting panels shall be suitable for wall / column mounting. Outdoor lighting panel may be floor mounted. Fixtures shall be firmly supported from structures. Clamps may be bolted or welded to the steelworks. In case of concrete structures, fixtures may be fixed with the help of anchor fasteners. In false ceiling areas fixtures shall be supported from the true ceiling.

All hardware shall be galvanised or zinc passivated. Wherever 90° bending on conduit routes are involved inspection elbows or smooth bends shall be used. All wires in conduit shall be colour coded. Each circuit shall have independent phase and neutral wire. Earth wire shall run in all conduits. Conduit size shall be chosen considering 40% maximum fill.

For street lighting, fixtures shall be mounted on steel poles. Each pole shall be grounded by connecting it to the plant ground grid or by using individual 3 m length ground rod.

In false ceiling areas the switchboards and the conduits shall be recess mounted below the false ceiling.

7.17.3.6 Cables / Conduits

Cable shall be laid above ground in overhead cable trays or shall be laid in cable trays in cable trenches. For interplant cabling separate cable rack/cable trench or combined pipe cum cable rack shall be used.

Cable spreader room shall be provided below switchgear rooms and it shall be provided with easy access for inspection and maintenance.

Proper slope shall be ensured in the cable trenches for draining of water. Cable entry to the building from cable trench shall preferably be overhead (above plinth level) to avoid water entry into the building. Depth of cable trenches shall be adequate to provide the required bending of the largest sized cable at the terminating ends.

The cable from power plant to river water pump house alone may be buried directly in ground. Method and depth of burying shall be as given in I.S. 1255. Route markers shall be provided at an interval of 30 m and at each change of route direction.

Where a cable route crosses a permanent road/railway line cables shall be drawn through hume pipes or G.I. pipes. Such Pipes shall be laid in a straight configuration preferably perpendicular to the road / railway line. Filling criteria in any pipe shall not be more than 40%.

The cable layout shall be so designed that a fire in one route affecting certain equipment shall have minimum effect on other equipment.

Separate cable trays/ conduits/ pipes shall be used for the following

- HT Power
- LT Power
- Control
- Instrumentation/communication cables
- Fire survival cables

HT power cables shall be laid with adequate spacing between each cable. For LT Power Cables also spacing between the cables shall be preferably provided. In any case LT Power Cables shall not be laid in more than one layer. Control and Instrumentation cables shall not be laid in more than two layers.

The Contractor shall provide necessary embedded steel inserts in wall/floor/ceiling surfaces for supporting cable trays. The cable racks shall be secured to the rack/tray supports by welding to those inserts or other available building steel surfaces. In case of non-availability of embedded steel inserts in certain tray routes, the contractor shall have to secure the supports on wall/floor/ceiling surfaces by providing suitable anchoring system/ steel inserts having adequate load bearing capability.

Sufficient spacing not less than 250 mm shall be provided between different tiers of trays to permit adequate access, for installing and maintaining the cables.

The cable risers or vertical raceways shall be covered by 2.5 mm thick sheet steel, hot dip galvanized cable tray covers with suitable stiffeners upto 2.5 metres from respective floor for mechanical protection. The sheet cover shall be of removable type.

In transformer yard and switchyard cables shall be laid in cable trays in RCC concrete trenches with RCC covers.,

The size of the conduit shall be selected on the basis of maximum 40% fill criteria..

Conduits shall be used for routing of cables (power / control) from cable trays to equipment/ junction boxes. Pipe sleeves (Hume/GI) shall be used for routing of cables between floors, road crossing, entry/exit from outside of building etc. All conduits/pipe shall have their ends closed by caps till the cables are pulled. After the cables are pulled, the ends shall be sealed by suitable sealing compound having fire withstand capability.

Cable laid on trays and risers shall be neatly dressed and clamped at an interval of 1500 mm. and 900 mm. for horizontal and vertical cable runs respectively.

All power cables shall be clamped individually & control cables may be clamped in groups of three or four cables.

All single core power cables shall be laid in trefoil formation and suitably clamped with nylon/ FRP trefoil clamps or with other approved means. The nylon/FRP trefoil clamps shall have very high mechanical strength, fire retardant and self extinguishing characteristics. These clamps shall be with necessary fixing hardwares like bolts, nuts, washers etc. which are hot dip galvanized.

For direct buried arrangement before the cables are placed, the excavated portion shall be filled with a layer of sand. This sand layer shall be leveled and the cables laid over it. The cables shall then be covered with 150 mm sand on top of the largest diameter cable and sand shall be lightly pressed. A protective covering with 70 mm thick bricks shall then be provided on top. The remaining portion of the excavated trench shall then be back filled with soil, rammed and leveled.

Each cable and cable tray shall be tagged with numbers. Cables and conduits shall be tagged at their entrance, at every 30 m and exit from any equipment, junction box. The tags shall be of aluminium or other approved means with the number punched on it and securely attached to the cable. The location of cable joints, if any, shall be clearly indicated with cable marker with an additional inscriptions "Cable-Joint" and "Cable Number".

The contractor shall put ferrules on all control cable cores in all junction boxes and at all terminations. The ferrules shall carry terminal numbers as per drawings. All ferrules shall be coloured, plastic & interlocked type.

All cable entry points shall be properly sealed and made vermin and dust proof. Unused opening, if any, shall be effectively closed. Sealing work shall be carried out with approved fire sealing compound.

Cables shall be installed without joints except for river water pump house. Jointing kits shall be suitable for the type of cable and for the particular type of installation. The contractor shall provide jointing kits complete with insulating materials, stress grading/relieving materials, plastic mould, resin, earthing materials and all other accessories. A suitable loop shall be provided near all joints. Suitable loop shall also be provided for all power cables of 6.6 kV and all LT Power Cables of bigger size at the switchgear ends.

Communication cables shall run on instrument trays/ducts. Wherever these are not available, cables shall be taken sufficiently away from power cables. Communication cables shall cross power cables at right angles.

Top trays with exposure to elevated walkways shall be provided with covers for mechanical protection.

7.17.3.7 Earthing System

Earthing installation shall be carried out as per IS 3043.

All conduits, trays, cable armour and cable end box, electrical equipment such as motors, switchboards, panels, cabinets, hand rails, rails, fence & fence gates, columns, junction boxes, lockout switches, fittings, fixtures, etc. shall be effectively grounded. The grounding of equipment shall be done by Galvanised steel / copper flat connected to the risers of main ground mat.

For prefabricated cable trays, a separate ground conductor shall run along the entire length of each row of cable tray and suitably clamped on the cable tray.

All ground conductor connections shall be made by electric arc welding/brazing and all equipment earth connections shall be made by bolting with the earthing pads. Ground connections shall be made from nearest available station ground grid risers.

Equipment shall be generally be furnished with two separate ground pads with tapped holes, bolts, nuts and spring washers etc. Equipment ground connections, after being checked and tested shall be coated with anti-corrosive paint. Atleast two earth connections shall be provided for all electrical equipment as per IE rules. Longer run of cable trays etc. shall be periodically earthed.

Earthing conductors along their run on walls and columns shall be supported by cleating with approved materials/welding at intervals of 750 mm. For system earthing, earthmat consisting of interconnected mesh of mild steel rods buried in the ground under the main plant area and all off site areas, interconnected together by minimum two numbers of parallel conductors.

Each earthing lead from the neutral of the Transformers shall be directly connected to two electrodes in treated earth pits which in turn shall be connected to station earthing grid.

Earthing for Electronic equipment shall be carried out separately through insulated copper cable & shall be grounded with separate earth electrode. All the earth pits of electronic equipment shall be interconnected. The combined earth resistance shall be less than 0.5 ohm

Earthing terminal of each lightning arresters and capacitor voltage transformer shall be directly connected to earth electrode which in turn shall be connected to station earthing grid.

Earthing mat of 1500 mm x 1500 mm size of closely spaced 300 x 300 x 300 mm deep conductors shall be provided below the operating handles of the isolators. Operating handle shall be directly connected to the earth mat.

7.17.3.8 Lightning protection system

Lightning protection installation shall be carried out as per IS 2309.

All areas of the power plant shall be provided with lightning protection as per IEC/IS. The lightning protection system for buildings shall consist of Horizontal/Vertical /Galvanised Steel/Copper air terminations, down conductors, test link and earth electrodes. The installation shall include laying clamping/cleating anchoring/welding of the down conductors on walls/columns etc. and connection to the earth electrode through a test link.

Every down conductor shall be provided with a test joint at about 1500 mm. above ground level and connected to an individual earth electrode. The earth electrode shall in turn be

connected to the main plant earthing grid. All joints in the down conductors shall be of welded type only.

The lightning protection system shall not come in direct contact with other equipment/systems such as cables, conduits, electrical equipment, underground metallic ducts etc. All metallic structures within 200 mm. vicinity shall be bonded to the lightning protection system.

All down conductors shall be cleated/welded/brazed to the wall/columns at an interval 1500 mm. All welded/brazed joints shall be coated with anti-corrosive paint for rust protection. The horizontal roof conductors at the top of building/ structures shall be cleated at an interval of 1500 mm. by providing necessary cement mortar sand blocks.

Direct Stroke Lightning Protection System (DSLPP) shall be provided in the switchyard by shield wires and spikes as applicable.

7.17.3.9 Safety Devices

The contractor shall supply and install all danger plates as per IS:2551. The danger plates shall be written in local language and English and shall be provided for the electrical equipment as per regulation.

Rubber mats of chequered profile shall be laid before each switchboard. They shall be of suitable voltage grade and of black colour. In the switchgear room and inside plant area, first aid boxes shall be provided as per the requirements of Indian Electricity Rules & Regulations.

7.17.3.10 Painting

The Contractor shall paint steel fabrications at site with two (2) coats of red oxide based primer followed by two (2) final coats of synthetic enamel paint. All damaged painted surfaces shall be cleaned and coated with two (2) coats primer followed by a finishing coat of paint. All damaged galvanized surfaces shall be coated with cold galvanizing paint. All equipment after erection shall be touched-up where required with coats of finishing paint.