

IITB/Dean IPS/DC/HOSTEL 3/10

Proposed renovation of TV & Dance room, Hostel 3 for Indian Institute of Technology Bombay within IITB campus Powai. Mumbai –400 076”

NIT NO: IITB/DEAN IPS/DC/HOSTEL 3/10/2025 DATED: 08-07-2025

TENDER BID DOCUMENTS

FOR

ELECTRICAL WORKS

TECHNICAL SPECIFICATIONS

1.0 SCOPE

The Scope of work shall be followed as mentioned below.

2.0 LIST OF APPLICABLE STANDARDS

Electrical installation work and supply of electrical equipment and accessories shall conform to the relevant, latest Indian Standards (IS) specifications and shall also comply with the requirements of the regulation or acts in force in the Loner together with other relevant specifications with particular reference to the following.

- a) National Electrical Code Act.
- b) Regulation of local authority such as Electrical Inspector.
- c) Fire Insurance Regulation.
- d) Indian Explosive Act.
- e) Factory Act.

3.0 STATUTORY APPROVAL

Entire electrical installation, testing and commissioning shall be carried out in accordance with the general specification and shall comply with the requirements of currently applicable statutory regulations or acts in force including but not limited to the following

3.1.1 Indian Electricity Rules 1956.

3.1.2 Indian Electricity Act, 1910.

3.1.3 Indian Factories Act, 1948

3.1.4 Indian Standard Specifications with particular reference to the following:

1. IS-732 : Code of Practice for Electrical Wiring Installations
2. IS-3043 : Code of practice for earthing
3. IS-10028 : Code of practice for Installation & Maintenance of (Part II & III) Transformers.
4. IS-10018 : Code of Practice for Installation and maintenance (Part I to IV) of Switchgear.
5. IS-5216 : Guide for safety procedures and practices in Electrical work.
6. IS-1255 : Code of practice for Installation and maintenance of Power Cables up to and including 11KV ratings
7. IS – 1554 Part – I : Code of Practice PVC Cables
8. IS – 694 : Unarmored PVDC Cables.
9. IS – 7098 Part – I : XLPE Cables Low Voltages
10. IS – 7098 Part – II : XLPE Cables High Voltages?

3.1.5 B.S. - 162 : Switchgear

3.1.6 CBIP : Sub-station Manual.

3.2 Nothing in this specification, and attached drawings shall be construed to relieve the contractor of his responsibility to make the installation comply with the requirements of the above. It shall be the responsibility of the contractor to obtain approval of competent Govt. authorities and satisfy them regarding the compliance with relevant regulations, for his scope of work. Any inspection required to get the electrical installation cleared by relevant authorities shall be to contractor's account.

3.3 Test certificates for the installation shall be prepared in the form required by The Electrical Inspector / Electricity Board. Any rework necessitated on Account of remarks by Electrical Inspector / Electricity Board shall have to be carried out by the contractor at no extra cost.

4.0 SCOPE OF SUPPLY AND INSTALLATION

- 4.1 Equipment supplied and installed by the Contractor
- a) The contractor shall be responsible for the supply, delivery, Unloading and transportation to site, installation, testing and commissioning of all Electrical equipments / materials as indicated in schedule of quantities, and all papers of documents to be filled and all relevant certificates / TC etc.
 - b) The equipments/ materials to be supplied by the Contractor shall be subject to inspection by the owner's engineer at site & consultants Engineer's approval. This inspection shall not however absolve the Contractor of his obligation under the terms of contract.
 - c) The Contractor shall be responsible for the satisfactory operations of the equipment supplied by him for the period of 12 months from the date of commissioning or 18 months from the date of delivery whichever is earlier.
 - d) In case of custom-built items, Contractor shall obtain the approval of general arrangement drawings from the engineer in charge at site.
 - e) The Contractor shall make available all the machines, tools, tackles, testing equipment, etc, required for the period of installation work,

5.0 SERVICES TO BE PROVIDED BY THE CONTRACTOR

- 5.1 All installation materials covered under the 'Schedule of Quantities and Rates' including necessary hardware such as clamps cleats nuts and bolts, brick, sand, coke and salt, solders, fluxes & all accessories etc. including all consumables like electrodes, gases etc. shall be supplied by the Contractor.
- 5.2 The Contractor shall not avail himself of any unintentional errors or omissions in the descriptions gives in this specification and attached drawings.
- 5.3 Contractor shall also keep a check on the deliveries of the equipment / material covered in his scope or erection and shall advise owner well in advance regarding possible holdups in his work due to expected delays in delivery of equipment to enable owner to expedite the deliveries.
- 5.4 All packing/ plates/ shims required for the alignment/ leveling of equipment should have to be arranged by the contractor as per instructions of the owner or his representative, free of change.
- 5.5 Final touch up of electrical equipment, if required shall be carried out by the contractor. Paint will be arranged by the contractor. Brushes shall be arranged by the Contractor.
- 5.6 Single line welding shall not be accepted. All joints shall be made by lap welding and all jointing lines will be welded by qualified welder (ITI)

6.0 SWITCHGEARS & PANELS / DB's

- 6.1 All switchgears shall be handled with care and use of crane / fork lift and trailer shall be made for Unloading / handling as well as for the purpose of installation.

- 6.2 All equipment and panels to be installed shall be transported from the storage are to the location of installation by the Contractor. The panels shall preferably be kept inside the packing cases till the foundations are ready. This packing shall be opened only at the place where it is required to be installed.
- 6.3 Installation of switchgear also includes assembling the panels, aligning the same and fixing on the foundation as per the manufacture's / supplier's instruction. All the components shall be checked for tightness as well as for any visual damages. Visual damages shall be brought to the notice of the owner. Busbars should be tightened to 35 KN-m to 50 KN-m by torque wrench.
- 6.4 In the event of switchgear giving the low I.R. value, switchgear shall be dried-up/ treated with air drying as per the manufacture's recommendations to improve the I.R. value to the safe value for commissioning.
- 6.5 Earthing of the switchgear shall be done using the proper size of conductors as per the relevant engineering documents.(IS – given in front page No. 2)
- 6.6 Main bus bars, bus risers shall be connected to fixed and outgoing terminals and bus systems shall be totally enclosed by individually taping with not less than five half-layer insulating tapes on all busbars. All joints shall be padded with plastic compound prior to taping. Control wiring, AC & DC control supply connections shall be interconnected between different shipping sections of the switchgear cubicles.
- 6.7 All switchgear shall be tested at site as per the manufacture's recommendations and shall include the minimum following tests.
- a) Visual inspection for dimensional check-up, completeness of the equipments as per the manufacturer's documents, furnishing the list of missing components, if any, tightness of all the terminals/ equipments, etc.
 - b) Measuring I.R. Value.
 - c) High voltage test.
 - d) Testing of protective relays with primary and secondary injection test, wherever applicable.
 - e) Stimulation test for all the interlocks, annunciations and for the correct operations of the switchgear.
 - f) Testing of oil for Di-electric strength, wherever applicable.
 - g) Any other tests as recommended by Site Engineers / Site-in-Charge.
- 6.8 All the switchgears shall be cleaned with vacuum cleaners before commissioning.
- 6.9 Plugging / sealing of all the unused cut outs for the cable glands in the equipment.
- 7.0 MAIN PCC/ DG PCC, CAPACITOR BANKING/ CAPACITOR PANEL & POWER & MOTOR CONTROL CENTER
All testing & Commissioning shall be done by the contractor in presence of manufacturers Engineer/ site engineer, before Testing SOP to be made.
- 7.1 Capacitor banks with PFIC panel shall be installed and commissioned after checking all connections as per the Manufacturer's detailed technical manuals.
- 7.2 UPS panel shall only be installed and UPS supplier shall carry out commissioning.
- 8.0 WALL MOUNTING PANELS (DB) / LOCAL STARTERS/ P.B. STATIONS, POWER AND LIGHTING RECEPTABLES / LSB /etc.

- 8.1 Normally wall mounting panels including light distribution boards, power distribution boards, push button stations, local starters, power and lighting receptacles are mounted on fabricated steel mounting frames which are either grouted into the building walls using Anchor bolts of 10mm & 75 mm long or welded to building structural members or welded to separate mounting channels on the floor.
- 8.2 The locations of items referred in the clause above and as shown in the drawings are approximate. The electrical contractor shall check actual location of these devices in the field with the Engineer-in-charge so that the locations are convenient from the operational point of view and do not interfere with removal and maintenance of any equipment.
- 8.3 The mounting height of the wall mounting panels, P.B. Stations, local starters, switches and receptacles shall be generally 1.2 m above ground level or mutually decided as per site conditions.
- 8.4 The Contractor shall fabricate necessary frames, brackets, mounting channels, canopy if located outdoor etc. for installation of these equipment from the structural steel. The installation of this equipment shall include fabrication of necessary frames/ brackets, grouting of these frames in RCC / Masonry walls using 10 mm & 75 mm long Anchor bolts, grouting of mounting channels where applicable in the floors using 10 mm & 75mm long Anchor bolts, welding of mounting frames / brackets to building structural columns or mounting channels. Necessary civil works for the above shall be carried out by the electrical contractor. Painting: after applying derusting primer, the two coats of Synthetic enamel paint to be applied.

9.0 CABLES

9.1 SCOPE:

This specification covers the requirements of Power Cables Upto 1.1KV, and Lighting Cables with general purpose insulation and sheaths. Requirement of special sheaths with Fire Survival (FS) and flame retardant low smoke (FRLS) characteristics are also covered in this specification.

CONTRACTOR'S SCOPE FOR CABLE SUPPLY, LAYING, INSTALLATION, TESTING & COMMISSIONING INCLUDED FOLLOWING:

- a. Transporting the cables from the store to various locations of installations in such a manner to achieve maximum utilizations and avoiding cable jointing.
- b. Drums under the Contractor's custody shall be arranged properly in drum-yards and cable shall be cut after measuring the exact length at site with respect to cable schedule / after taking dimensions at the locations. The cut lengths of cables shall be properly sealed to prevent ingress of moisture. And empty wooden drums to be shifted to scrap yard.
- c. Before laying, the cables shall be tested for continuity and insulation value after it is cut.
- d. Cables shall be laid in trenches, trays on walls, columns, structural steel as per requirements shown in respective engineering documents.
- e. All cables shall be dressed properly in aesthetically acceptable manner as approved by Engineer-in-charge. Extra length in form of Loop shall be provided near termination for all cables, wherever possible.
- f. Individual cables at wall or on column / beams shall be clamped at an interval of 300mm using individual G.I. spacers and saddles.

- g. Cable termination shall be carried out using appropriate size of single/ double compression weatherproof cable glands and suitable size of crimping type tinned copper cable lugs for copper cables and aluminum cables. All glands shall be nickel plated brass. With de-oxidizing one cable joint milli-volt loss to be logged for HT paste main cables.
- h. Cable gland shall be of 'COMET' made and cable lugs shall be 'DOWELL's make (Brass)
- i. Cable identification tags shall be provided on either end of the cable as well as at bends and at an interval of 30 meters. The tags shall be made of 2 mm thick aluminum strip or 22 SWG SS strip 20mm wide and embossed with cable number as per respective cable schedule. The tags shall be fastened to cables by brass wires. Alternative new material / method to be evaluated during execution.
- j. All wall openings shall be effectively sealed after installation of cables.
- k. All cables after terminations shall be provided with ferrules to identify the terminal number as per the vendor/ engineering documents.
- l. Cables installed in places where mechanical damages are likely to occur shall be protected by G.I conduits / pipes Upto 2000 mm from the ground / floor level. If cable travels vertically.
- m. Chasing in wall for embedding cable / conduits shall be done using electrically operated Cutters. Contractor should engaged skilled labour to give satisfactory finish as acceptable to client.

9.2 CODE AND STANDARDS :

The design, construction, manufacture and performance of cables shall comply with all currently applicable statues, regulations and safety codes in the locality where cables will be installed. Nothing in this specification shall be construed to relieve the VENDOR of this responsibility.

9.3 SPECIFICATIONS :

The following aspects are applicable for all the types of cables covered in this specification.

- a) Construction and Performance of the Cable shall conform to the Standards indicated herein.
- b) **Conductor :**
 - i) Aluminum conductor, stranded, Grade H4, Class 2 as per IS 8130 (conductors for insulated electric cables and flexible cords) and designated by alphabet A.
 - ii) Annealed, stranded Copper Conductor, Class 2 as per IS 8130. Conductor shall be tinned when indicated under notes in relevant Data sheet.
- c) **Test and Test Equipment**

Insulation for cables shall be as per requirement indicated herein and shall conform to the properties covered in the following applicable standards.

 - i) IS 5831 - PVC insulation and sheath for electric cables
 - ii) IS 6380 – Elastomer insulation and sheath for electric Cables
 - iii) IS 6474 – Polyethylene insulation and sheath for electric

cables

d) Core Identification

Colour coding shall be acceptable for all cables upto 5 cores. Cables with more than 5 cores shall have printed numerals on each core.

e) Inner sheath

Inner sheath when specified shall be extruded type and shall be compatible with the insulation provided for the cables.

f) Armour

Armoring for the cables shall comprise galvanized steel or hard drawn aluminium, in the form of round wires or strips. These are designated as below in Data Sheet.

- W - Galvanized single steel wire
- F - Galvanized single steel strip
- AW - Hard drawn single aluminium wire
- AS - Hard drawn single aluminium strip

Any other special requirement of armour shall be as per section – C of the specification or as indicated under notes in Data Sheet.

g) Outer Sheath

The outer sheath shall be of an extruded layer of suitable synthetic material compatible with the specified ambient and operating temperature of the cables. The sheath shall be resistant to water, ultra violet radiation, fungus, termite and rodent attacks. The colour of the outer sheath shall be black otherwise specified In Section – C or under notes in Data Sheet. Elastomer and PE sheath shall meet the requirements of standards covered under 3.1.c above.

h) Tests and Test Equipment

Cables shall be subjected to routine and acceptance tests in accordance with standards specified. Test methods shall conform to IS 10810 (Methods of Test for Cables). Type tests and optional tests according to applicable standards shall be conducted on cables when specified in Section – C or under notes in data sheet. BIDDER shall ensure use of calibrated test equipment having valid calibration test certificates from standard laboratories traceable to National standards.

i) Cable Drums

Cables shall be supplied in non – returnable wooden drums. The wood used for construction of the drum shall be properly seasoned and free from defects and wood preservative shall be applied to the entire drum. All ferrous parts shall be treated with a suitable rust preventive coating to avoid rusting during transit or storage. Cables drums shall confirm to IS 10418 (Specification for drums of electric cables).

The BIDDER shall indicate in the offer, the maximum length for each size of cable, which can be supplied on one drum. The actual length supplied on each drum shall be within tolerance limit of $\pm 5\%$ with an overall ceiling of $\pm 5\%$ on total ordered quantity of each size of cable unless otherwise indicated in Section – C/Data sheet. However, before winding the cables on drums, VENDOR shall obtain PURCHASER's approval for the drum lengths. Cable ends shall be sealed by non-hygroscopic sealing caps.

Cable lengths specified in Data sheet are approximate only. Actual requirements will be advised to the successful BIDDER at the time of placing the order.

Incremental cable lengths in meters shall be embossed on the outer sheath of every 1 meter interval when specified in Section – C or under notes in Data sheet.

9.4 Telecommunication Cables:

The Cables shall meet the following requirements:

- a) Conductor : Solid, tinned, annealed copper
- b) Insulation : PVC insulation type –A as per IS 5831
- c) Twisting : The insulated conductors shall be twisted together to form twisted pairs or quads, these shall be stranded in concentric layers to form the cable core. The cable thus formed shall be tightly lapped with outer wrapping tapes. The interstices of insulate cable core shall be completely filled with viscose compound.
- d) Overall Width 0.05 mm aluminum tap or 0.013 mm Melinex screening tape, overlap not less than 30%.
- e) Other details: A suitable non – magnetic rip cord shall be laid details longitudinally under the sheath. The armoring shall be of galvanized steel wires or galvanized single steel strip. The inner PVC sheath shall be of type – A. The outer PVC sheath shall be of Type ST-1.
- f) Voltage tests for: Dielectric withstand between conductors – 500 V for 1 minute (rms) and between conductor and sheath – 2000 V rms/3000 VDC.

The following abbreviations are used to these cables

C	-	Copper Conductor, Solid, tinned, class 2 as per IS 8130
F	-	Galvanized single steel strip
W	-	Galvanized single steel wire
✓	-	Items required
X	-	Items not required

The construction, performance and testing of the cable shall comply generally with the following standards:

- i) IEC 189-1 (Low frequency cables wires with PVC insulation and sheath General tests and measuring methods.
- ii) IEC 189 -2 (-do-cables in pairs, quadruples and quintuples).

10.0 CABLE TRAYS:

- a. All cable trays shall be Perforated / ladder type, prefabricated fire retardant plutunded section of various colors, light weight easy installation to be used. Galvanized MS or of perforated G.I. Or type as specified in schedule of quantities / rates & shall comply with specifications of National Electrical code. All bolts, nuts washers shall also be hot dip galvanized and shall confirm to latest I.S. All bends in cable trays shall be smooth and curvature for bend shall be suitable for the largest diameter of cable running in tray (Minimum bending radius for cables 12-15D) The width of the cable tray shall be decided on the No. of cables to be laid in such a manner that minimum distance between two cables shall not be less than one cable diameter. The straight sections of cable trays shall be supplied in 2.5 M length. The side angles have

three 10mm diameter holes at each end of the straight sections, elbows, crosses, tees etc. for fixing the side couplers. All elbows, ts junction bend, shall be fabricated to suit site requirements. To prevent entry of water through wall openings the cable trays shall be offset at the building entry point that is the elevation inside the building shall be higher than the outside. And opening to be closed with special material.

- b. Perforated trays shall be of channel type of 50mm height & width as specified in drawings. Ladder type shall be made of 40 x 20 slotted for the rungs & 100mm x 30mm channel for side rails. The thickness of sheet steel for various types of trays is 2mm Upto & including 300mm width
- c. Cables in horizontal trays shall be tied using nylon tie wrap of suitable size at an interval of one meter. Horizontal trays shall be clamped with the supports/ structure/ racks at an interval of 500mm.
- d. Cables in vertical trays shall be clamped at an interval of 50mm using strip fastener suitable non-metallic material. (Vendor to specify)
- e. Generally along with each cable routes separate two Nos. of bare earth wires/ strips shall run in cable trays.
- f. Cable trays shall be supplied with all accessories like 90 deg. Bends, coupler plates, Tees, reducers, 4 way cross, Anchor fasteners for installation etc.

11.0 ALL CABLES SHALL BE TESTED AS UNDER BEFORE ENERGISING THE SAME:

- a. Megger test using 1000 volt Megger for all L.T. cables. With calibration certificate
- b. Checking of correct terminations on either side as per the engineering documents.
- c. Continuity checking with necessary instruments – by consultant/client.

12.0 EARTHING & LIGHTNING PROTECTION:

- 12.1 All equipment shall be earthed using appropriate size of hot dip galvanized (galvanizing thickness not less than 100 microns) G.I. / COPPER Flats / G.I. wire as shown in respective engineering documents/ drawings. ALCOMETER checking of Thickness of 100 microns to be shown to consultant / client.
- 12.2 The resistance of the total earthing system shall be less than one ohm to ensure satisfactory operating of protective devices.
- 12.3 The earth pit shall be plate type & as per the engineering standard documents to comply with I.S. 3043 / other relevant specification / documents.
- 12.4 All main earthing grid shall be joined by full welding having over-lapped joints and shall be protected with bitumen compound. Connections to the equipment shall be of hot dip galvanized materials. Terminal joints shall be bolted type & total.
- 12.5 Earth pit installation and laying of main earthing grid shall include excavation, re-filling hammering and leveling with soft soil of the earth and leveling the ground. Main earthing grid shall be buried at minimum depth of 800mm below finished ground level. Plate electrode shall be G.I & of dimension as specified in the drawing. The plate shall be buried vertically in ground at a depth not less than 3 meters with its face vertical. Earth leads to the electrode shall be connected to the plate with bolts, nuts, & washers. A.G. I. pipe for watering as specified in drawings shall be clamped with bolts vertically to the plate & terminated to a wire mesh funnel which shall be enclosed in a fine masonry chamber (RCC with 1:3:6 ratio). The

masonry chamber shall be provided with G.I frame & C.I. inspection cover with proper painting & marking.

- 12.6 Wherever entry of water due to rains or any other reason is likely to occur during excavation, Contractor shall make available necessary dewatering pumps
- 12.7 All earthing materials shall be hot dip galvanized as per I.S.
- 12.8 Earthing system shall be tested for individual resistance of earth pit as well as for the total earthing grip.
- 12.9 The lightning arrestors roof & down coming conductors shall be connected to the earthing system through separate earth pits.
- 12.10 Earth wire shall run throughout the conduits/ pipes/ trays. All clamping shall be done using clamps.

13.0 LIGHTING SYSTEM:

- 13.1 The lighting fittings shall be installed on the ceiling / column/ wall or ceiling cutout as shown in appropriate engineering documents. The supporting arrangements shall be approved by the Engineer-in-charge. Location of lighting fittings, switches etc. shall be generally as shown on the drawing.
- 13.2 All structural support/ lighting poles, wherever provided, shall be duly painted with 2 coats of zinc phosphate/ zinc chromate primer and 2 coats of enamel paint after the installation of fittings. (Vendor to quote for polyurethane coating for structures & poles, alternatively) Heat resistance
- 13.3 All cables shall be 1100 Volts grade, PVC insulated, copper/ Aluminum Conductor, as per IS with appropriate colors
- 13.4 Coding for phases, neutral and earth connections.
- 13.5 Lighting switches and panels shall be installed on walls/ column at a height of 1.2 Mtrs above ground using suitable structural steel wall bracket / stand to ensure that the same are lifted from the wall to the extent of 40mm. Thickness of the switchboard shall be 16 SWG.
- 13.6 Lighting panels /DB's shall have cable entries from top by providing suitable gland plate/ knock-out plates. Lighting panels/ DB's shall be fabricated only after obtaining the approval of general arrangement drawings from the concerned site engineer. The lighting panels shall have terminals for all incoming and outgoing cables.
- 13.7 Lighting fittings wherever applicable shall be provided with capacitors to improve power factor. Installation of lighting fittings shall also include providing lamps and energizing the same.
- 13.8 Flameproof fixtures shall be wired using armoured, copper cables & flameproof double compression cable glands without junction boxes. All fittings shall be earthed by G.I wire and tinned copper lugs for connections to fittings.
- 13.9 All lighting fittings shall be earthed using 8 SWG G.I wire and special lugs for connections to fittings.
- 13.10 Installation of lighting fittings shall also include providing lamps and energizing the same.

13.11 Lighting poles shall be as per the relevant drawings & shall be of specified section with swaged joints. The street lighting / floodlighting poles are normally supplied with one coat of primer. The electrical contractor shall apply a coat of bituminous paint to the bottom portion of each pole which is being embedded in the concrete foundation and an additional coat of primer to the rest of the pole. The installation of the lighting pole shall include excavation of the earth for the foundation and casting of the RCC concrete foundation as shown in the drawing. G.I. pipe shall be embedded in the R.C.C concrete foundation as shown in the drawing to route the supply cables to the control box on the lighting pole. After the installation, the lighting pole shall be given two coats of epoxy paint of approved shade. (vendor to quote alternatively for polyurethane coating)

14.0 MOTORS:

14.1 The motors will be installed and aligned by contractors.

14.2 The Contractor shall check the cable entry provided on the motor cable box for fixing the gland and inform the owner/ owner's representative of requirement of reducers, if any sufficiently in advance or procure necessary reducers.

14.3 Larger rated Motors/ Alternator etc., may require modification of cable box for cable termination. The Contractor shall carry out the same as per requirement of site Engineer.

14.4 The motor shall be earthed at two different points. The earthing strip/ wire shall be neatly laid and clamped. If earthing is of wire then, the said wire to be terminated through lugs, paint to be scrapped where earthing is connected & continuity to be checked for motor.

14.5 In case of cable from trench/ ground, lower floor etc. G.I. pipes shall be provided to bring the cable and the opening of the pipes shall be sealed with compound after commissioning the motor

14.6 The motors shall be run on no-load for four hours, after checking the condition of grease and bearings. Temp to be marked for future maintenance

14.7 The motors shall be tested for insulation value before commissioning. The insulation value of individual motors shall be recorded properly and handed over to owner/ owner's representative. If required, the windings shall be dried with space heaters. A motor inspection chart to be prepared in which insulation, No load current voltage, RPM etc. to be noted.

14.8 Decoupling and coupling of motors for checking the direction of rotation is part of contractor's scope. History card to be filled with all data like HP.--, RPM--, Frame size, -- etc. Format will be given by consultant.

15.0 STRUCTURAL STEEL

15.1 Structural steel required for the cable tray, equipment foundation, equipment supports etc. shall be treated as separate item & accordingly payment shall be made as per rate quoted in schedule of work. The rates quoted for installation work of various equipment shall not include any major steel work. However minor steel material such as cable clamps etc. shall be included in relevant item. Material take-off of structural steel for this purpose shall be prepared by contractor & furnished in advance enabling client/consultant to decide for scope of supply of steel. However fabrication and installation shall be carried out by contractor. Quantities indicated in specification are approximate.

15.2 Installation are of structural steel shall include fabrication work also. All fabricated portions of steel shall be painted with after de rusting, 2 coats of zinc phosphate/ zinc chromate primer and 2 coats of enamel paint of approved shade to be decided by the site Engineer.

16.0 TESTING PROCEDURE

- 16.1 All equipment shall be tested in presence of Site Engineer as per the relevant IS/ as specified in this specification/ as directed by the Engineers-in-charge and proforma test reports shall be prepared for all the equipment and signature to be obtained on test report.
- 16.2 Installation rates as quoted in schedule of quantities/ rates shall include installation of equipment, testing and commissioning of the same.
- 16.3 Contractor shall be required to provide their own, calibrated with calibration certificate with valid date, for testing equipment and the same shall be available at site throughout the execution of the work.
- 16.4 A brief schedule of the tests to be carried out on each type of electrical equipment is given below.

16.4.3 POWER AND CONTROL CABLES

All cores of cables shall be tested individually for continuity and Insulation Resistance before connecting to the equipments.

16.4.6 TESTS FOR EARTHING SYSTEM

- a. The resistance of each earth pit shall be measured & recorded.
- b. The resistance of the complete earthing system shall be less than 1.0 ohm or values specified by the local Electrical Inspector whichever is less.
- c. Earthing continuity tests shall be carried out for all the equipment.

17.0 POINT WIRING (Office areas & Stores Area):

Point wiring shall consist of all the materials right from distribution board together with a switchboard, control switches with front plate & box of same make as switch, fan regulator, plug sockets, industrial plug sockets as required including providing conduits & accessories, the ceiling rose, lamp holders, connector, pendant holder or a swan holder, fan hook boxes, junction boxes etc. with proper termination.

- 17.1 All lighting fixtures & ceiling fans, wiring shall be carried out using 3nos. 2.5 Sq. mm PVC insulated FRLS stranded copper conductor 660/1100 V grade PVC insulated wires in 16 SWG black enameled MS conduit / PVC conduit . Wiring from D.B. to the switches & switch to switch shall be done using 2.5 Sq. mm stranded copper wires. Separate wire shall be used for earthing of all points. Individual junction/ Inspection boxes shall be provided for each lighting fitting for the purpose of looping from fitting to fitting. The boxes shall be round / square with Knockout holes suitable to terminate the conduits. The boxes shall have concealed screwed sockets to fix the ceiling rose. Boxes shall be minimum 50 mm deep. Looping shall be done in lighting fittings. Installations of ceiling fans shall be inclusive of embedding / grouting of necessary suspension hooks in building RCC work and installation of fan regulator on the building wall. The installation of exhaust fans shall include fabrication of necessary steel framework, making the opening in the masonry wall and grouting of the steel frame work in the opening. After installation of the frame work, the masonry work shall be made good to original condition by the contractor.
- 17.2 All single phase plug sockets (Upto 16A) wiring shall be carried out using 3 core 3nos. 2.5 Sq. mm PVC insulated FRLS stranded copper conductor 660/1100 V grade.
- 17.3 Point wiring shall include all necessary conduits with G.I pull wire, conduit fittings, conduit accessories like saddles, spacers, bends, couplings, collars etc., junction/ pull/ inspection

boxes, wire, conduit supports, bushings, lamp holders, ceiling rose, flexible conduit/inspection L bends, fan hooks wherever required & terminations using tinned copper lugs of crimping type. A point wiring shall include in addition the earth continuity conductor / wire from the D.B. to the earth pin / stud of the outlet/ switchbox & to the outlet point. In addition point wiring shall include provision of PVC sheathed flexible three core extension chords including flexible conduit from light/outlet points to the light outlets.

- 17.4 The system of wiring will be as specified in the drawings. In case of lighting point wiring, wiring from D.B. or Switch to common switch controlling more points will be measured considering first point (From D.B. or switch to switch till First point) as full point and subsequent point as half points. Maximum number of points in one circuit shall be limited to 7/8 or 1000 watts. Neutral wire size shall be same as the phase wire. All terminations shall be done using copper lugs.
- 17.5 In case of power point wiring, maximum two power plugs shall be looped from one circuit. A/C Industrial power plug point shall be fed from one circuit. They shall not be looped. Neutral wire size shall be same as the phase wire. All terminations shall be done using tinned copper lugs.
- 17.6 All switches and plugs sockets shall be enclosed in 16 SWG sheet steel enclosures with top plate both of same make as of switches/ sockets. Switchbox shall be concealed/ Flush mounting/ surface type depending upon type of wiring.
- 17.7 The total load of lighting and power points have to be balanced after commissioning.
- 17.8 Point wiring for all areas shall be concealed in walls ceiling & under floors. Where ever false ceiling is present point wiring shall be above false ceiling.
- 17.9 Telephone points shall be laid using 2 Pair 0.5 / 0.7 Sq. mm copper unarmored cable in 25mm conduits from the junction box / EPABX to the socket outlet. The sockets shall be RJ11 type (Anchor Roma /CPL/Equiv.)

17.10 **SPECIFIC REQUIREMENT FOR WIRING:**

Prior to laying & fixing of conduits, contractor shall carefully examine the layout drawing given & prepare a detailed drawing showing conduit routing with sizes, No. of conduits per phase (Min conduit size shall be 25mm.), no. of wires running in each Conduit Considering 25% Spare space for future pulling, control switch location. The contractor shall take the approval of all the drawings by the consultant prior to the installation of conduits.

For each lot of wire supply, contractor shall supply a certificate issued by the manufacturer stating its Make (i.e. Finolex/Polycab, Date of manufacturer, insulation class & standards to which it comply.)

Wiring shall be totally colour coded as per I.S. (Single phase- Red; Three phases-Red, Yellow, Blue; Neutral- Black; Earth-Green.

18.0 **LDB, & PDB**

List of applicable standards:

- IS 375- 1964 : Switchgear busbars, main connections and auxiliary wiring, making and arrangement.
- IS 2147 : Degrees of protection provided by enclosures for low voltage switchgear and control gear.
- IS 4237 : General requirements for switchgear and control gear for voltages not exceeding 1000 V.
- IS 8623 : Factory-built assemblies of switchgear and control gear for voltages upto including 1000 V AC and 1200 V DC.

- 18.1 The DB's shall be Pre fabricated, with 14 SWG CRCA sheet steel after 7 tanks pretreatment. The frame of individual vertical panels shall be fabricated using pressed and shaped CRCA sheet steel 14 SWG thickness or by using suitable mild steel structural sections. All load bearing sections shall be of 14 SWG sheets. Doors shall be double door type of 14 SWG. Only inside partitions shall be 16 SWG.
- 18.2 All hardware shall be corrosion resistant. All joints and connections of the panel members shall be made by galvanized, zinc passivated or cadmium plated high quality steel bolts, nuts and washers, secured against loosening.
- 18.3 DB's shall be of front access type. All openings, covers & doors shall be provided with neoprene gaskets round the perimeters to make the DB dust and vermin proof.
- 18.4 The cable entry shall be from top. DB's shall be suitable for wall mounting. The degree of protection shall be IP 52.
- 18.5 The DB's shall be provided with 3 phase, 4 wire, and busbar system. Main busbars including vertical droppers or risers of DB's shall be electrical grade aluminum conforming to IS-5082. The horizontal and vertical busbars in the switchgear shall be insulated with heat shrinkable PVC Sleeves, Colour coded red, yellow, blue and black. The busbars in switchgear shall be supported on SMC insulators. All hardware used in busbar connections shall be zinc passivated. All busbar connections shall be provided with spring washers. Busbars should be tightened to 35 KN/m² to 50 KN / m² by torque range.
- 18.6 For D.B's with single & three phases outgoing there shall be separate Neutral links for all the three phases.
- 18.7 In the event of switchgear giving the low I.R. value, switchgear shall be dried-up/ treated with air drying as per the manufacturer's recommendations to improve the I.R. value to the safe value for commissioning. Earthing of the switchgear shall be done using the proper size of conductors as per the relevant engineer's documents.
- 18.8 Main busbars, bus risers shall be connected to fixed and outgoing terminals and bus systems shall be totally enclosed by individually taping with not be less than five half-layer insulating tapes on all busbars. The incomer, bus bar, O/G ways shall be completely segregated from each other.
- 18.9 The DB's shall be powder coated inside and outside. The shade shall be decided later. Total thickness of painting shall be atleast 90-100 microns. The finished panels shall be dried in staving ovens in dust free atmosphere. Panel finish shall be free of imperfections like pinholes, orange peels, run off paint etc. All the side plates, front doors, internal plates shall be powder coated.
- 18.10 Inside the DB, the wiring for power, control, signaling, protection and instrument circuits shall be done with PVC insulated copper conductors. The insulation grade for these wires shall be

650/1100 volts. All control wiring shall be enclosed in plastic channels with the wires neatly bunched together.

- 18.11 The LDB/ PDB incomers shall be with ELCB of rating & 100mamp sensitivity as mentioned in BOQ. All O/G shall comprise ELCB for all the phases MCB's shall be of 10 KA breaking capacity with 'G' type characteristics. The MCB's shall be TPN/ SPN, snap mounted on to the DIN rail channel.
- 18.12 It shall be possible to replace any single MCB without disturbing the other MCB's. There shall be atleast 3 to 4 vacant spaces with DIN rail channel in the DB for mounting MCB's in the future. The rating & quantity of O/G ways shall be as specified in DB load schedule.
- 18.13 Name plate with necessary designation shall be fixed at the center of the DB. Engraved nameplates giving feeder details shall be provided for each compartment. Nameplate shall be of acrylic with white letters on black background.
- 18.14 All openings, covers & doors shall be provided with neoprene gaskets around the perimeters to make the DB dust and vermin proof.
- 18.15 Tests shall be carried out on various equipment/ components mounted on the LDB/ PDB as per relevant Indian Standard Specifications.
- a) Verification of wiring (continuity test) as per approved wiring diagrams.
 - b) Mechanical operation test.
 - c) Insulation test on busbars, power& control circuits with 1000V Megger.
 - d) Measurement of sheet steel and pointing thicknesses.

19.0 MAKE & TYPE OF EQUIPMENT:

19.1	Switchgear component	:	L&T,/Schneider / Siemens
19.2	PVC Insulted wires (660/1100 V grade, color coded	:	Finolex / Polycab /Ravin Cables
19.3	Industrial Plug sockets	:	MDS/ BCH/ Legrand
19.4	Switches / Plug sockets/ Plates/ boxes	:	North West /Anchor Roma
19.5	Cable Glands	:	Comet.
19.6	Cable Lugs	:	Dowell' S

19.7	Capacitors (APP Type)	:	L&T / Malde/Epcos
19.8	MCB / ELCB	:	L&T/MDS/HAGGER (10kA Sc. Level)
19.9	Cable	:	Finolex/ Polycab/Ravin Cables
19.10	Industrial Fitting. & Lamp	:	OSRAM / Philips / Wipro/Oasis
19.11	M.S. Conduits & Accessories	:	BHARAT/ BEC
19.12	PVC Conduits & Accessories	:	Precision./Asian
19.13	Ceiling Fan	:	Crompton / Orient
19.14	Electronic dimmers for fans	:	North West / Anchor Roma
19.15	Exhaust fan	:	Newtec / GEC/Crompton/Bajaj
19.16	Lamps for fittings	:	OSRAM / Philips/ Wipro
19.17	D.B's (Double door type)	:	Legrand (MDS) / Schneider /Hagger
19.18	Clean Room Light Fixtures	:	WIPRO/BAJAJ/ PHILIPS
19.19	Dimmable Ballast	:	Tridonic Atco

21.0 DEVIATIONS

Deviations from the specifications must be stated separately in writing at the quotation stage. In the absence of such statement it will be assumed that the requirements of the specification are met without exception.

22. SUPPLY OF MATERIALS BY THE CONTRACTOR

All materials supplied by the Contractor shall be new and of approved quality manufactured by approved vendors, conforming to Indian standards or to standards mentioned in the bill of quantities. The materials shall have approved quality unless other wise approved by Consultants/ Engineer in charge prior to procurement and use. The Contractor shall furnish manufacturer's certificates for the materials supplied when asked for and shall get the materials tested, if asked for, by the Engineer-in-charge. The cost of all tests and test certificates shall be borne by the Contractor. No separate payment shall be made for testing.

24. FOR FINAL PAYMENT

All the liabilities of the contractor in terms of his payments of taxes, duties, salaries, wages etc. Shall be contractors responsibility and contractors shall provide an affidavit, before final payment is made to contractor,

25. MEASUREMENTS

Rates and measurements shall conform to the bill of quantities based on the detailed specifications. Mode of measurements to be as specified under detailed specifications.

All measurements shall be computerized & of which soft & hard copy to be submitted to Client and Consultants for each running bill. All bills will be accompanied by necessary attachments and reconciliation statements. The bills, if not accompanied by necessary attachments may be liable for rejection.

Actual measured quantity will considered for final payment.

26. All statutory clearances like obtaining labor license, ESIC, P&F & Insurance are the sole responsibility of Electrical contractor. All statutory approvals – photocopy to be submitted along with 1st running bill. In absence of these documents 1st running bill will not be cleared.
27. All material in contractor's scope of supply will be inspected approved by Client / Consultant before dispatch.
28. Contractors should quote for all items including rate only item. Some of these Rate only items may be executed. The implication of cost of such items will be done by Consultants in techno – commercial evaluation of bids. The discount to be passed on rate only items also at the time of submission of price break up.
29. All bought out items will be covered under one year guarantee. We require guarantee certificate from original manufacture as back-to-back arrangement. All defective parts will be replaced free of cost within warranty period.
30. Contractor to arrange the scaffolding arrangement to erect the Electrical Fixtures up to 5.5 to 6.5 meter height. The scaffolding arrangement to have movable lockable wheel.
31. Good House keeping procedure has to be followed at site. All scrap & debris generated by contractor to be cleaned regularly. If not done than the Penalty will be imposed by client.
32. Electrical Contractor to submit the As Built Drawing after the hand over the job. Final Bill will be cleared after handing over **AS BUILT** Drawings.
33. The Cable wastage should not exceed 2.5%. Any short fall in cable issued to contractor & cable Installed by contractor at site, after reconciliation of cable & other free issued items the excess qty of wastage will be charged as per purchase rates of the Item & amount will be deducted from the Contractors final Bill.

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