

TECHNICAL SPECIFICATIONS ELECTRICAL WORK

TECHNICAL SPECIFICATIONS

1 SCOPE:

The specifications given below pertain to the entire electrical installation work to be carried out in the Dormitory area, SY Canteen at Mazagon Dock shipbuilders limited.

Environmental Conditions:

- Maximum Temperature: 35° C
- Minimum Temperature: 18° C
- Humidity: 60%
- Height: MSL

1.0 Codes and Standards:

The design, manufacture and performance of equipment shall be as per all current statutory regulations and safety codes in the locality where the equipment will be installed. Nothing in these specifications shall be construed to relieve the vendor of this responsibility.

1.1 (A):- GENERAL SPECIFICATION OF THE EQUIPMENT:-

The scope of work comprises of Designing, Obtaining Approval of MDL and Fabricating as per approved Drawings, Testing at Works, Packing and Forwarding, Supplying, at Site, Checking at site, Touching Up all Damaged portions, and assessing the Electrical Contractor while commissioning of the Panels at site. Further Touching up of damaged powder coated painting shall be carried at site after the installation of all panels is completed by the contractor.

The Main L.T. Panel, Power Control Centers, distribution boards shall be metal clad, totally enclosed, rigid, floor mounting, air-insulated, cubicle type for use on 415 volts, 3 phase 50 cycles system.

The equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions. Means shall be provided to facilitate ease of inspection, cleaning and repairs in the installations where continuity of operation is of prime importance.

1.2 (B):-CONSTRUCTION:-

The Main LT Panel, Power Control Centers, Distribution boards shall be :-

- a) Of the metal enclosed, indoor, floor mounted, free standing type.
- b) Be made up of the minimum 14 Gauge White CRCA Sheets vertical sections, which, when coupled together shall form continuous front operated dead back type switchboards except for Main L.T Panel which shall have back access

| Sr. No. | Item | Relevant IS | Relevant IEC |
|----------------|---|--------------------|---------------------|
| 1 | General requirements for switchgear and control gear for voltages not exceeding 1000 V AC or 1200 V DC | IS: 4237 | |
| 2 | Switchgear bus bars, main connection and auxiliary wiring, marking and arrangement. | IS: 375 | |
| 3 | Degree of protection provided by enclosures for Low voltage switch gear and control gear. | IS: 2147 | |
| 4 | Terminal marking for electrical measuring instrument and their accessories. | IS: 8197 | |
| 5 | Danger notice plates | IS: 2551 | |
| 6 | Code of Practice for selection, installation and maintenance of switchgear and control gear. | IS: 10118 | |
| 7 | Specification for factory built assemblies of switchgear and control gear for voltage up to and including 1000 V AC and 1200 V D.C. | IS: 8623 | |
| 8 | Miniature circuit breakers. | IS: 8828 | |
| 9 | Current transformers | IS: 2705 | |
| 10 | Voltage transformer | IS: 3155 | |
| 11 | Electrical relay for protection | IS: 3231 | |
| 12 | Indicating instruments | IS: 1248 | |
| 13 | Integrating instruments | IS: 722 | |
| 14 | Control switches and push buttons | IS: 6875 | |

c) Provide dust and vermin proof design. All the Panels should be designed in such a manner that the in Panel Temperature should not rise more than 30 degree Centigrade over an ambient of 45 degree Centigrade. The Vendors has to provide the temp sensors. If the temp of the cubicle increase more than 15 degree over an ambient the Exhaust Fan should be started and even after that the temp of the Bus Bars reaches to 85 degree the Alarm should be stared and should the command to the Main Breaker to Trip. All this provision has be done by the bidder without any extra cost. The Small Exhaust fans with the louvers should be provided for the Main Bus Bar chambers and all the cable alleys. All the fans should have the provision to start and stop by way of MCB. All the fans should be suitable for continuous duty. All panels cable alleys should have dust proof ventilators with the provision to mount impedance compensated fans

d) The Main L.T Panel, Power Control Centres and Distribution Boards shall be constructed only of materials capable of withstanding the mechanical,

electrical and thermal stresses, as well as the effects of humidity, which are likely to be encountered in normal service.

1.3 TECHNICAL SPECIFICATIONS FOR LT PANEL

1.3.1 SCOPE OF WORK

This scope shall cover design, manufacture, check test, and supply of medium and low voltage motor/power control Panel boards, MCB distribution boards etc. as described in this specification, as per drawings and schedule of quantities.

1.3.2 CODES & STANDARDS

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:

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

1.3.3 DESIGN BASIS & SITE CONDITIONS

| | |
|---------------------|--|
| Ambient Temperature | : Max. / Min. = 50° C. /6° C. |
| Design temperature | : 50 Degree C. |
| Relative humidity | : 95% max. |
| Altitude | : 20 M above MSL |
| Location | : Mumbai |
| Voltage | : 415+/- 10%, TPN |
| Frequency | : 50 Hz. + 3% to -6% |
| Neutral | : Solidly / earthed neutral. |
| Fault level | : 24 MVA, Symmetrical at 415V solidly earthed. |

1.3.4 TECHNICAL REQUIREMENTS:-

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.

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 heaviest condition at site, with maximum expected ambient temperature of 45°C, 90% humidity and salty, dusty weather.

1.3.5 **CUBICAL TYPE PANELS:**

1.3.5.1 STRUCTURE

- a 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.
- b 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.
- c The Panels shall be totally enclosed, completely dust and vermin proof and degree of protection being not less than IP: 65. 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.
- d 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, tapped into an adequate thickness of metal or provided with bolts and nuts. Self-threading screws shall not be used in the construction of Panels.
- e A base channel of 100 mm. x 50 mm. shall be provided at the bottom. A clearance of 300 mm. between the floor of the Panels and the bottom of the lower most units shall be provided.
- f 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. The entire electrical component shall be derated for 50°C. The ratings indicated in the drawing are de-rated for 50°C
- g 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.
- h Alternately, the Panels shall be provided with removable sheet steel plates at top and bottom to drill holes for cable/conduit entry at site.
- i The Panels shall be designed to facilitate easy inspection, maintenance and repair.

j 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.

1.3.5.2 PAINTING:

a The painting shall be with 2 coats of epoxy primer along with two coats of PU paint [Anti-corrosive paint]. Paint shade shall be confirmed with the client.

1.3.5.3 CIRCUIT COMPARTMENTS:

a 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.

b The door shall not form an integral part of draw out 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.

1.3.5.4 INSTRUMENT COMPARTMENTS:

a 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, busbar and connections.

1.3.5.5 BUS-BARS:

a The busbar shall be air insulated and made of high quality, high conductivity, high strength Copper.

b The busbar 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 busbar shall be of rectangular cross-section designed to withstand full load current for phase bus bars and half rated current for neutral bus bars and shall be extensible on either side. The busbar size shall be as per drawing. The busbar shall have uniform cross-section throughout the length.

c 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 busbar

shall be supported on unbreakable, non-hygroscopic 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 15 KA RMS symmetrical for 1 sec. and a peak short circuit withstand of 31.5 KA minimum.

- d 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 bars to be 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 |

- e 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.

- f 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.

1.3.5.6 ELECTRICAL POWER AND CONTROL WIRING CONNECTION:

- a Terminal for both incoming and outgoing cable connections shall be suitable for 1100 V grade, aluminum/copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solder-less sockets for the cable size as indicated on the appended drawings for the Panels.
- b Power connections for incoming feeders of the main Panels shall be suitable for 1100 V grade aluminum conductor (LT XLPE) cables.
- c Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.
- d Both control and power terminals shall be properly shrouded.
- e 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.
- f Terminal strips for power and control shall preferably be separated from each other by suitable barriers of enclosures.

- g 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.
- h 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.
- i 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.
- j Spring type washers shall be used for all copper and aluminium connections.
- k Final wiring diagram of the Panels power and control circuit with ferrules numbers shall be submitted along with the Panels as one of the documents against the contract.

1.3.5.7 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.

1.3.5.8 WIRE-WAYS:

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

1.3.5.9 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.

1.3.5.10 EARTHING:

- a Copper earth bus of suitable size 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 sides of the panels to the main earthing bar coming from the earth pit. Door earthing shall be provided for all the compartments.
- b 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 sides of the Panels.
- c 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.

1.3.5.11 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.

1.3.5.12 NAME PLATE:

- a 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.
- b Inside the feeder compartments, the electrical components, equipments, accessories like switchgear, control gear, lamps, relays etc. shall suitably be identified by providing stickers.
- c 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.
- d Name plate shall be fastened by counter sunk screws and not by adhesives.

1.3.5.13 DANGER NOTICE PLATES:

- a The danger notice plate shall be affixed in a permanent manner on operating side of the Panels.
- b The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.

- c The danger notice plates, in general, meet the requirements of local inspecting authorities.
- d Overall dimensions of the danger notice plate shall be 200 mm. wide x 150 mm. high.
- e 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.
- f The said letters, the figures and the sign of skull and bones shall be painted in signal red colour as per IS: 5-1978.
- g The danger plate shall have rounded corners. Location of fixing holes for the plate shall be decided to suit design of the Panels.
- h The danger notice plate, if possible, be of ISI certification mark. Suitable Voltage rated rubber mates to be provided.

1.3.6 INTERNAL COMPONENTS:

1.3.6.1 MINIATURE CIRCUIT BREAKERS (MCB):

- a Miniature Circuit breakers shall be current limiting type conformed with British standard BS: 3871 (Part I) 1965 and IS: 8825. The housing of MCBs shall be heat resistant and having high impact strength. The fault current of MCBs shall not be less than 9000 A at 230 V. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical 'ON' and 'OFF' indications.
- b The circuit breaker dollies shall be of the trip free pattern to prevent closing the breaker on a faulty circuit.
- c 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.

1.3.6.2 MOULDED CASE CIRCUIT BREAKER (MCCB):

- a The MCCB's shall conform to the latest applicable standards (IS: 13947)
- b MCCBs in AC circuits shall be of TP/TPN/FP construction arranged for simultaneous manual closing and opening. Operating mechanism shall be quick-make, quick-break and trip-free type. The ON, OFF and TRIP positions of the MCCB shall be clearly indicated and visible to the operator.

Operating handle for operating MCCBs from door of board shall be provided.

The instantaneous short circuit release shall be so chosen by the Contractor as to operate at a current in excess of the peak motor inrush current and a range of settings shall be provided for the Employer 'S / Engineer's selection.

MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.

MCCB's shall incorporate time delay devices to ensure that it will tolerate harmless transient overload unless this is well in excess of 25% of its rated value for a sustained period.

The MCCBs shall be provided with the following features:

- a) Inverse-time-current tripping characteristics under sustained overload.
- b) Instantaneous tripping on short circuit.
- c) MCCBs shall be of current limiting type only.
- d) MCCBs must have its rated service breaking capacity (Ics) equal to or greater than its specified fault level.
- e) Variable Thermal setting shall be provided in all MCCB s with thermal Magnetic releases.

1.3.6.3 CONTACTORS:

- a The contractors shall meet with the requirements of IS: 2959 and BS: 775.
- b The contractors shall have minimum making and breaking capacity in accordance with utilisation category AC3 and shall be suitable for minimum Class II intermittent duty.
- c If the contractor forms part of a distribution board then a separate enclosure is not required, but the installation of the contractor shall be such that it is not possible to make an accidental contact with live parts.

1.3.6.3 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 - 1964 as amended upto date.

1.3.6.4 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.

1.3.6.5 INDICATING LAMPS:

a 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 – the LED shall be 22.5 mm and self-coloured:

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

b DIGITAL Ammeter & Voltmeter

1.3.4 DRAWING & INFORMATION

Prior to fabrication of the Panels the supplier/contractor shall submit for MDL 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, busbar 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.

1.3.5 INSPECTION & TESTING

a 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.

b 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 approvals.

1.3.6 METHOD OF MEASUREMENT

All the items will be measured as mentioned in Bill of quantity.

1.3.7 GUARANTEE & WARRENTY

The Bidder shall stand guarantee for the performance of entire equipment and components for twelve (12) months from the date of commissioning or eighteen (18) months from the date of dispatch, whichever is earlier.

1.3.8 DRAWINGS AND DATA

As part of the technical bid, tenderer shall furnish the following data:

1.3.9 DATA SHEET FOR LT PANEL:-

- a. Incomer: 200A, 415 V, 3P MCCB, 25kA, with built in over-current short circuit and earth fault releases.
- b. Metering Section: Digital Ammeter & Voltmeter .
- c. CT Ratio:-3 Nos. of 200/5 Amps having 15 VA burden and Class-1 accuracy for metering purpose.
- d. Busbar: 250A, FP, CU., 25kA for 1 sec.
- e. Indicator : LED type RYB phase indicators, MCB type
- f. Outgoings :

32A,FP, MCB,10kA - 02 Nos.

63A,FP, MCB,10kA - 03 Nos.

1.4. DISTRIBUTION BOARDS

1.4.1 Scope

The scope of work shall cover the supply, installation, testing and commissioning of lighting and power distribution boards including cable sleeves, anchor fasteners etc. Associated minor civil works required for the erection of the DB's such as opening in wall etc. are also included in the scope of this contract.

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

| Sr. | Item | Relevant IS | Relevant IEC |
|-----|--|-------------|--------------|
| 1 | General requirements for switchgear and control gear for voltages not exceeding 1000 V AC or 1200 V DC | IS: 4237 | |

| | | | |
|---|---|----------|--|
| 2 | Switchgear bus bars, main connection and auxiliary wiring, marking and arrangement. | IS: 375 | |
| 3 | Terminal marking for electrical measuring instrument and their accessories. | IS: 8197 | |
| 4 | Miniature circuit breakers. | IS: 8828 | |

1.4.3 Distribution Boards

Distributions boards along with the controlling MCB's or Isolator as shown shall be fixed in a mild steel Box with hinged lockable door suitable for recessed mounting in wall. Distribution boards shall be made of 18 SWG sheet steel with hinged lockable spring loaded cover duly rust inhibited through a process of degreasing, acid pickling, phosphating and powder coated to an approved colour over a red oxide primer. The enclosure shall meet IP 43 rating. All components shall be mounted on DIN rails and covered totally with a sheet steel cover rendering it finger-safe. Access to the internal connections shall be only through removing the cover sheet.

Three phase boards shall have phase to phase barriers and a wire channel for internal wiring. All DB's shall be internally prewired using copper insulated high temperature PVC wires brought to a terminal strip of appropriate rating for outgoing feeders. Conduit knockouts shall be provided as required/shown on drawings and the entire board shall be rendered dust and vermin proof with necessary sealing gaskets.

The distribution board shall have one main neutral and 3 separate sub - neutral links, one for each phase of adequate capacity as per number of outgoing per phase. The DB shall have earth bar(s) of adequate capacity as per total numbers of outgoing of DBs. Two numbers separate earth terminals, (one on each side) shall be provided on the outer body of DB for its body earthing.

The DB shall be supplied complete with cable ties, circuit identification labels and few spare blanking plates.

1.2.4 DB TECHNICAL SPECIFICATION:

| | | |
|--|---|--------------------------|
| No. of Ways | : | 4, 6, 8 & 12 ways |
| Type of Installation | : | Surface & Flush mounting |
| Colour / Finish | : | RAL Grey (Semi Glossy) |
| Door Options | : | Reversible |
| Door Locking Options | : | Sliding Lock |
| Removable Gland Plates | : | Top & Bottom |
| Protection Level of Distribution Board | : | Advanced |
| Distribution Technique | : | Insulated Bus bar |
| Bus Bar Rating | : | up to 125A |

| | | |
|---|---|--|
| Provision for Incomer slots | : | 8 Slots |
| Voltage Rating | : | 240/415V-3 Phase/4 Wire |
| Incoming Options | : | Three Phase MCCB, MCB or RCCB |
| Outgoing Options | : | SP or TP or Both MCB |
| Neutral Bar Terminal Capacity | : | 25 mm ² , Split on both sides |
| Earthing Bar Terminal Capacity | : | 25 mm ² , Split on both sides |
| Ingress Protection (IP) | : | IP43 |
| Insulation Voltage (Ui) | : | 690V |
| Frequency | : | 50Hz |
| Dielectric Strength | : | 2.5KV |
| Ambient Temperature | : | -5 °C to 40 °C |
| Distribution Board- Reference Standards | : | IS 8623; IS 13032 |

1.4.4 DRAWING & INFORMATION

The following drawings shall be submitted along with the bid:

General arrangement drawing showing overall dimensions, weight, internal arrangement and mounting details.

Terminal chamber, showing bus-bar arrangement with all dimensions. Power wiring diagram

1.4.4 METHOD OF MEASUREMENT

Supply of the DB including transport to site, loading and unloading etc. as specified will be treated as one unit for measurement and payment.

The quotes values of parameters shall be within given tolerance for given period of service life.

1.4.5. TECHNICAL SPECIFICATIONS FOR INTERNAL WIRING

SCOPE OF WORK

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

CODE & STANDARDS

The following standards and rules shall be applicable:

| Sr. No. | Item | Relevant IS | Relevant IEC |
|---------|--|---------------------|--------------|
| 1 | Code of practice for electrical wiring installation (System voltage not exceeding 650 V) | IS: 732 | |
| 2 | Code of practice for fire safety of buildings (General) Electrical installation. | IS: 1646 | |
| 3 | Rigid steel conduits for electrical wiring. | IS: 9537 (Part - 2) | |
| 4 | Fittings for rigid steel conduits for electrical wiring. | IS: 2667 | |
| 5 | Flexible steel conduits for Electrical wiring. | IS: 3480 | |
| 6 | Accessories for rigid steel conduit for electrical wiring. | IS: 3837 | |
| 7 | PVC insulated cables. | IS: 694 | |
| 8 | Rigid non-metallic conduits for electrical wiring. | IS: 9537 (Part - 3) | |
| 9 | Flexible (Pliable) non-metallic conduits for electrical installation. | IS: 6946 | |
| 10 | 3 pin plugs and sockets. | IS: 1293 | |
| 11 | Specifications of conduits for electrical installation. | IS: 8130 | |
| 12 | Switches for domestic purpose. | IS: 3854 | |
| 13 | Fittings for rigid non-metallic conduits. | IS: 3419 | |
| 14 | Guide for electrical layout in residential buildings Indian electricity act and rules. | IS: 4648 | |

DESIGN BASIS & SITE CONDITIONS

All the equipment and components provided in the Wiring and accessories shall be suitably designed for installation and satisfactory operation as specified below.

| |
|-----------------|
| Site conditions |
|-----------------|

| | | | |
|--|--|-----------------------|--|
| Location Mumbai, Maharashtra | Site altitude 560M-800M above mean sea level | | |
| Ambient temperature | Relative humidity | | |
| Maximum 410 C | Maximum 85 % | | |
| Minimum 050 C | Minimum 35 % | | |
| Design 450 C | Design 90 % at 50 0 C | | |
| Seismic factor Zone IV as per IS:1893 | Rainfall 722 mm/year | | |
| Environmental Tropical/Wet/Dry climate | Location of Equipment Indoor | | |
| Wind speed Annual avg. 4.35 | | | |
| Electrical system data: | | | |
| Power supply for Equipment | | | |
| Voltage 415 V \pm 5 % | Frequency 50 Hz \pm 3 % | | |
| Permissible combined voltage & frequency variation \pm 6 % | System design faults level (Symmetrical) | 10 kA for 1 sec. max. | |
| System earthing LV side neutral solidly earthed | Wiring 3 phase, 4 wire on 415V system | | |

1.5 BUSBARS

1.5.1 Switch gear shall be provided with three phase and neutral bus bar. Bus bar shall be of uniform cross section throughout their length and up to the incoming terminals of the incoming feeder circuit breaker.

1.5.2 Bus bars shall be made of high conductivity tinned Aluminum/copper. (As shall be stated in the respective item of the bill of quantities) and shall be provided with at-least the minimum clearances in air as per applicable standards for a 500 V, 3 phase system.

1.5.3 All bus bar and bus-taps shall be insulated with close fitting sleeve of hard, smooth, dust and dirt free plastic insulation of high dielectric strength (450 V/mil) to provide a permanent high dielectric non-aging and non-tracking protection; impervious to water, tropical conditions and fungi. The insulation shall be non-inflammable and self-extinguishing and in fast colours to indicate phases. The joints shall be insulated in such a way as to provide for accessibility of contact bolts for maintenance. The di-electric strength and properties shall hold good for the temperature up to 900 C. If the insulating sleeve should be coloured, bus bar shall be color-coded throughout the length and not with coloured bands.

1.5.4 Bus bar shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Bus bar supports shall be made of Hylam sheets, glass reinforced moulded plastic material, Permali wood or cast resin.

1.5.5 Separate supports shall be provided for each phase of the bus bars. If a common support is provided for all three phases, ant tracking barriers shall be incorporated.

1.5.6 Bus bar joints shall be complete with high tensile steel bolts and Belleville washers and nuts. Bus bars shall be thoroughly cleaned at the joint locations and a suitable contact grease shall be applied just before making a joint.

1.5.7 The Bus bars shall have uniform cross section with 30°C rise above ambient and with color coded PVC sleeves. The maximum current density for copper bus bar shall be 1.6amp/mm² in case of all Panels. The maximum current density for aluminum bus bar shall be 0.8amp/mm² in case of all Panels. The Branch bus bars shall have 75% of aggregate capacity of feeder connected. The Neutral and Earthing Bars shall have cross-sectional areas not less than 50% of Phase Bus bar. In case bus bars are mentioned as 4 pole then the neutral bus bar shall have same cross section as that of phase bus bar.

1.6 MCCB's

The MCCB's shall conform to the latest applicable standards (IS: 13947) MCCBs in AC circuits shall be of TP/TPN/FP construction arranged for simultaneous manual closing and opening. Operating mechanism shall be quick-make, quick-break and trip-free type. The ON, OFF and TRIP positions of the MCCB shall be clearly indicated and visible to the operator. Operating handle for operating MCCBs from door of board shall be provided. The instantaneous short circuit release shall be so chosen by the Contractor as to operate at a current in excess of the peak motor inrush current and a range of settings shall be provided for the Employer 'S / Engineer's selection. MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.

MCCB's shall incorporate time delay devices to ensure that it will tolerate harmless transient overload unless this is well in excess of 25% of its rated value for a sustained period.

1.4.1 The MCCBs shall be provided with the following features:

- a) Inverse-time-current tripping characteristics under sustained overload.
- b) Instantaneous tripping on short circuit.
- c) MCCBs shall be of current limiting type only.
- d) MCCBs must have its rated service breaking capacity (Ics) equal to or greater than its specified fault level.
- e) Variable Thermal setting shall be provided in all MCCB s with thermal Magnetic releases.

1.7 Miniature Circuit Breaker (MCBs)

Miniature Circuit Breaker shall comply with relevant IS / IEC standard i.e. IS- 8828-1996 & IEC – 60898 and ISI marked on each MCB. MCBs shall be quick make and

quick break type, suitable for 230 / 415V AC 50 Hz, breaking capacity should be 10kA and marked on MCB. MCB shall be classified as B, C, D curve type suitable marked on MCB. MCB's for Lighting & power sockets shall be C-curve, all MCBs used on UPS circuit shall be D-Curve only. MCB's shall have quick make can break non welding self-wiping silver alloy contacts.

The housing shall be made from heat resistant thermoplastic material and shall have high impact strength. All 2P, 3P and 4P miniature circuit breakers shall have a common trip bar independent to the external.

1.8 RESIDUAL CURRENT CIRCUIT BREAKER (300mA): -

Characteristics: -

- Phase (line) and Neutral both wires connected through RCD.
- It trips the circuit when there is earth fault current.
- The amount of current flows through the phase (line) should return through neutral.
- It detects by RCD any mismatch between two currents flowing through phase and neutral detect by -RCD and trip the circuit within 30 Miliseconds.
- If a house has an earth system connected to an earth rod and not the main incoming cable, then it must have all circuits protected by an RCD (because you might not be able to get enough fault current to trip a MCB)
- RCDs are an extremely effective form of shock protection.
- Protection of installations against the risk of fire (300 mA).

1.9 INDICATING INSTRUMENTS AND METERS

Electrical indicating instruments (Digital type) shall be of minimum 96 mm square size and with a class of accuracy of 1.0 and shall have provision for zero adjustment outside the cover. Digital meters should have red colored readout. The size of the meters to be provided on outgoing feeders and in wall mounted panels shall be 96mm x 48mm.

1.10 CABLE TERMINATIONS

Suitable double compression type, brass cable glands with check nuts, rubber sealing ring and brass washers mounted on a removable gland plate shall be provided to support all cables entering the switchgear. Cable Termination will be measured under separate item in the schedule of quantities.

1.11 INTERNAL WIRING

Wiring inside the switchgear shall be carried out with 1100 V grade, single core, PVC insulated, stranded copper conductor wires made to IS:694. Minimum size of conductor for power circuits is 4 mm². Not more than two connections shall be made on incoming side. The outgoing side of connector shall have only a single connection. Spare connectors to be provided for BMS & other uses

1.12 TERMINAL BLOCKS

1.12.1 Terminal blocks shall comprise finely threaded pairs of brass studs of at least 6 mm diameter, links between each pair of studs, washers, nuts and locknuts. The studs shall be securely locked within the mounting base to prevent their turning. Insulated barriers shall be provided between adjacent terminals.

1.12.2 Terminals shall be shrouded. Terminal blocks shall be adequately rated to carry the current of the associated circuit. Minimum rating of the terminal block shall be 10 A.

1.13 LABELS:

All labels shall comprise white letters on a black background and shall be made of non-rusting metal or 3-ply lamicaid or engraved PVC. Size of lettering shall be 6.0 mm.

1.14 EARTHING

1.14.1 Earth bus bars shall be supported at suitable intervals. Positive connection between all the frames of equipment mounted in the switchboard and earth bus bar shall be provided by using insulated copper wires/bare bus bars of cross section equal to that of the bus bar or equal to half the size of circuit load current carrying conductor, whichever is smaller.

1.14.2 All instrument cases shall be connected to the earth bus bar using 1100 V grade, single core 2.5 mm² stranded, copper earthing conductor.

1.14.3 All non-current carrying metal and hinged doors shall be earthed to the earth bar.

1.15 TESTS

Switchgear shall be subjected to following tests as per relevant standards along with following tests:

- a) Mechanical operation test.
- b) H. V. test for 1 minute.
- c) Insulation resistance at 1000 V D.C. before & after 1 minute H.V. test.

2. General Conditions:

- a. The quantities given in the schedule are indicative and contractor shall arrange for the actual requirement.
- b. The manufacturer should have in house testing facilities as per IS as well as special tests pertaining to PVC (FRLS) cables like 'Oxygen and Temperature Index Test', 'Smoke Generation test to measure and record smoke density over fixed time interval', HCl gas 'Emission Test' and 'Flammability Tests as per IEC, IEEE and Swedish Standards'.

2.1 Inspection:

All cables shall be inspected by the contractor upon receipt at site and checked for any damage during transit.

2.2 Joint in Cables:

The Contractor shall take care to see all the cables received at site are apportioned to various location in such a manner as to ensure maximum utilization and avoidance of jointing cables. This apportioning shall be got approved by the Owner before the cables are cut to lengths. Straight joints are prohibited. It is the contractor's responsibility to arrange the cable lengths to suit site requirements. Neither the owner nor their representative are responsible for approving the length for cable.

2.3 Excavation and Backfill

All excavation and backfill including timbering, shoring and pumping required for the installation of the cables shall be carried out by the contractor in accordance with the drawings and requirements laid down elsewhere. Trenches shall be dug true to line and grades. Backfill for trenches shall be filled in layer not exceeding 150mm. Each layer shall be properly rammed and consolidated before laying the next layer. The Contractor shall restore all surface, roadways, sidewalks, curbs, walls or other works out by excavation to their original condition, satisfactory to the Architects. Back filling shall be done with soft earth only.

2.4 Cable Termination of Cables and Joints:

(a) For termination of cables of size 16 sq.mm. and above, suitable copper cable sockets of appropriate size and capacity shall be provided at terminal ends. This condition is applicable to single PVC insulated wires of 16 sq.mm. and above also.

(b) Generally, Tubular sockets shall be used where grub screw/ clamp type fixing arrangement is available at the terminating end. Reducer / spade type sockets shall be used where bolt and nut arrangement is available at terminating end.

(c) The cable socket shall generally be fixed to the cable cores by crimping process.

(d) Irrespective of the size of the cable and the method of termination, the core end shall be cleaned and immediately covered with an oxide inhibiting/ corrosion inhibiting compound before termination.

(e) The tail end wires shall be finished in an appropriate colour by using PVC insulating sleeve.

3.0 POINT WIRING:

3.1 SCOPE:

The scope of this part comprises the supply, delivery, storing, erection, testing and commissioning of electrical wiring installation.

3.2 CONDUIT:

a) The conduit shall be Rigid PVC and black enameled screwed mild steel (as specified in the scheduled of quantity), manufactured to IS:9537 Part III including latest amendments, if any, and in accordance with the requirement set out in the schedule of quantities.

- b) The conduit accessories should be compatible to the conduit installed. PVC in case of PVC conduit and Black enameled steel in case of Black enamelled conduit
- c) Conduits shall be provided with couplers for straight joints.

3.3 CONDUIT CAPACITY:

The maximum capacity of a conduit for drawing in PVC insulated copper conductor wires shall be in accordance with the following table.No conduit shall be used having its diameter less than 20 mm. Not more than two circuits shall be bunched in one conduit.

Size of Wire (Made to IS:694)

Capacity of Conduit

| Size of Wire (Made to IS:694) | Capacity of Conduit | |
|-------------------------------|---------------------|-------------|
| | 20 mm. dia. | 25 mm. dia. |
| 1.5 Sq. mm. | 5 | 10 |
| 2.5 Sq. mm. | 5 | 8 |
| 4 Sq. mm. | 3 | 6 |
| 6 Sq. mm. | 2 | 5 |
| 10 Sq. mm. | - | 4 |

3.4 POINT WIRING (FOR LIGHT POINTS, SOCKETS, ETC.):

The wiring shall be of the looping in system as different from the tree system. Connectors should not be used without specific prior approval. Loop in on the phase side shall be at the switches and that on the neutral side shall be at the connector inside the lighting fitting or ceiling roses. All ceiling roses shall be 3- plate type. Every fan point and socket point shall have individual control switch unless stated otherwise. Light points may be group controlled by one switch as shown on drawings or as directed at site by the Architects/Consultants. Such a group will be called a set and will consist of one to up to six light points e.g. a set of three light points controlled by one switch.

Earthing shall be provided for all points according to the specification of the tender. The number of points in any circuit shall not exceed 9 in any case (unless otherwise stated) with load not exceeding 1000watts.

- a) The point wiring in conduit consists of wiring from the distribution board in conduit with Earthing and its ancillary work such as bends, couplers, junction boxes, PVC insulated wires up to the fixed terminals of ceiling roses, connectors of fixtures, etc. via switch whenever called for. The bidder should carefully study all the tender drawings to arrive at estimated length of circuit and point conduit length.

Circuit wiring cost is to be included in the point wiring rates and no separate payment will be made for circuit wiring.

b) For easy identification, wires with different colours shall be used (e.g. Red, Yellow, Blue - for Phases, Black for neutral), Green for running Earth.

3.4.1 Cable

The cables shall conform to IS: 697. For all internal wiring FRLS 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 FRLS compound complying with the requirements of IS: 697. It shall be applied by an extrusion process and shall form a compact homogenous body.

The thickness of FRLS 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, convenience socket outlet points (P+N+E):

| | |
|-----------|-------------------------------------|
| 2.5sq.mm. | From D.B. to switch boards. |
| 1.5sq.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):

| | |
|-----------|--|
| 2.5sq.mm. | From D.B. to first power outlet |
| 1.5sq.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):

| | |
|-----------|----------------------------|
| 4.0sq.mm. | From D.B. to power outlet. |
|-----------|----------------------------|

In case of 15 A. power outlet for window/Split Air conditioner or other likewise appliances (P+N+E):

| | |
|-----------|----------------------------|
| 4.0sq.mm. | From D.B. to power outlet. |
|-----------|----------------------------|

The earth continuity conductor shall be similar to circuit cables and shall be drawn through conduit along with 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 | 2.5 |
| 4.0 | 4.0 |

3.5 SWITCHES

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

The switches shall be rocker operated with a quiet operating mechanism with bounce free snap action mechanism enclosed in an arc resistant chamber.

The switches shall have pure silver and silver cadmium contacts.

The switches shall be flush modular type.

The make of the switches shall be as indicated in the drawings or BOQ or make of material or as suggested and approved by the client.

3.6 SOCKET

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

Sockets shall be of three pin type, the third in being connected to earth continuity conductor.

The socket shall be flush modular type.

The finishing and make of all the sockets shall be same as light switch.

The socket shall have fully sprung contacts and solid brass shrouded.

Terminals to ensure positive electrical connections.

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

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

4.0 LIGHTING FIXTURES

4.1 General requirements:

4.1.1 All Lighting Fittings shall be complete with Accessories and Fixtures necessary for installation whether so detailed under item description or not.

4.1.2 Fixture housing, frame or canopy shall provide a suitable cover for the fixture outlet box or fixture opening.

4.1.3 Fixtures shall be installed at mounting heights as detailed on the drawings or as instructed on site by the Architect/Consultants.

4.1.4 Fixtures and/or fixture outlet boxes shall be provided with hangers to adequately support the complete weight of the fixture. Design of the hangers and method of fastening other than shown on the drawings or herein specified shall be submitted to the Architects for approval prior to execution at site.

4.1.5 Pendant fixtures within the same room area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation as per instructions of Architects.

4.1.6 Flush mounted recessed fixtures shall be installed so as to completely eliminate leakage of light between the fixture and adjacent finished surface.

4.1.7 Fixture mounted on outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Extension pieces shall be installed where required to facilitate proper installation.

4.1.8 Fixture shall be completely wired and constructed to comply with the "regulations" and "Standards" for Electric Lighting fixtures, unless otherwise specified. Fixtures shall bear manufacturer's name and factory inspection label unless otherwise approved.

4.1.9 Wiring within the fixture and for connection to the branch circuit wiring shall be not less than 1.5 sq. mm. copper for 250 Volt applications. Wire insulation shall suit the temperature conditions inside the fixture

4.1.10 Metal used in lighting fixtures shall be not less than 22 swg. or heavier if so required to comply with specification of standards. Sheet steel reflectors shall have a thickness of not less than 20 swg. The metal parts of the fixtures shall be completely free from burns and tool marks. Solder shall not be used as mechanical fastening device on any part of the fixture

4.1.11 Ferrous metal shall be bonderized and given a corrosion resistance phosphate treatment or other approved rust inhibiting prime coat to provide a rust-proof base before application of finish.

4.1.12 Non-reflecting surfaces such as fixture frames and trim shall be finished in a baked enamel paint.

4.1.13 Finish shall be capable of withstanding 72 hours' exposure to an ultraviolet sun lamp placed 10 cm. from the surface without discoloration factor after exposure. Test results shall be furnished for each lot of fixtures.

4.1.14 Fixture with visible frames shall have concealed hinges and catches. Pendant fixtures and lamp holders shall be provided with ball type aligners or similar approved means. Recessed fixtures shall be constructed as to fit into an acoustic tile ceiling or plaster ceiling. Plaster rings shall be provided for plastered ceiling. Fixtures with hinged diffuser doors shall be provided with spring clips or other retaining devices to prevent the diffuser from moving.

4.1.15 Detailed catalogue for all fixtures or, if so required by the Architects, sample fixtures shall be submitted for approval to the Architect before orders for the fixtures are placed. Shop drawings for non-standard fixture types shall be submitted for approval to the Architects.

4.1.16 Recessed fixtures shall be constructed so that all components are replaceable without removing housing from the ceiling.

Lamps shall be supplied and installed in all lighting fixtures furnished under this contract.

Lamps used for temporary lighting service shall not be used in the final lamping of fixture units.

Lamps shall be of wattage and type as shown on the drawings. Where not shown, the details shall be ascertained from MDL before procurement.

Lamps for permanent installation shall not be placed in the fixtures until so directed by the Architect and this shall be accomplished directly before the building portions are ready for occupation.

4.2 LED Lamps:

lamp is a light-emitting diode (LED) product which is assembled into a lamp (or light bulb) for use in lighting fixtures. LED lamps have a lifespan and electrical efficiency which are several times longer than incandescent lamps, and significantly more efficient than most fluorescent lamps. LEDs come to full brightness without need for a warm-up time; the life of fluorescent lighting is also reduced by frequent switching on and off.

LEDs are “directional” light sources, which means they emit light in a specific direction, unlike incandescent and compact fluorescent bulbs, which emit light and heat in all directions.

The chart below shows the amount of brightness in lumen you can expect from different wattage light bulbs. The LED bulbs require much less wattage than the CFL or Incandescent light bulbs.

5.0 EARTHING AND LIGHTNING PROTECTION:

Supply of Earthing and Lightning Protection System:

5.1 Scope:

- (a) Earthing System to be provided shall comprise of earth electrode in earth pits, earth bus/ grid of copper/GI flats and bare copper/GI wires as earth continuity conductor.
- (b) Lightning Protection System shall comprise of early streamer emission type air terminal system, earth electrode of G.I. plate in earth pits, earth bus of down conductors of G.I. flats.
- (c) Entire earth system shall conform to the Code of Practice as per IS with its latest amendments.

5.2 General Requirements:

- (a) Enclosures and frame work of all current carrying equipment and accessories, structural steel/ columns shall be adequately earthed to a single earthing system, unless separate earthing systems are specifically stipulated. All three phase electrical equipment shall be earthed at two distinct points.
- (b) Earth leads and risers shall follow as directed and as short a path as possible. Suitable risers shall be provided as directed if equipment is not available when earthing is installed.
- (c) Terminations at equipment like motors shall have flexibility for movement of equipment.

5.3 Earth Bus and Earth Continuity Conductor:

- (a) Earth bus is a Copper/ G.I. strip or flat of specified size interconnecting all earth electrodes. This will be laid throughout the length of electrical shaft.
- (b) Fused DBs, MCB DBs and motors up to 30 kW rating shall be earthed by a G.I continuity conductor, as specified. Minimum size of continuity conductor shall be 8 SWG bare G.I., soft drawn. All power panels shall be earthed by G.I. Strip. Dedicated copper earthing for UPS & Server room.

5.4 Lightning Protection System:

- (a) The air terminal shall be early streamer emission type, which shall be equipped with a lower series of energy collecting electrodes and an upper series of spark generating electrodes.
- (b) Earth electrodes for lightning protection system shall be G.I. plate installed in earth pits as per I.S.

(c) The down conductors from air terminals shall be galvanized iron flat strips, hot dipped of size 32mm.x 6mm. as required. The down conductor shall follow a direct path to the earth electrode without any sharp bend, turn or kinks. These down conductors shall not be connected to earthing conductors above ground level but the metallic parts in the vicinity of lightning protection conductors such as ladders, pipes etc. shall be effectively connected and bonded.

(d) A test joint as per IS shall be provided for every down conductor within 1500mm. above ground level.

(e) Hardware and clamps shall be similar as used for the Earthing systems.

5.5 Artificial Treatment of Soil:

If the earth resistance is too high and the multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding sodium chloride, sodium carbonate, copper sulfate, salt and soft coke or charcoal in suitable proportions.

5.6 Resistance to Earth:

The resistance to each earthing system shall not exceed 1.0 ohm.

5.7 TESTING, MANUFACTURER'S TESTS, PRE-COMMISSIONING TESTS AND COMPLETE COMMISSIONING

The General intent of this specification is to mention the relevant tests to be done and furnished to the Employer by the Contractor. These are guidelines. However, the Contractor shall carry out all such tests and complete all formalities as per relevant Indian Standard Specifications, Tariff Advisory Committee's rules and Fire Insurance Requirements and/or Electricity Rules and Regulations as per Government Gazette and Publications.

5.8 Testing of Equipment:

All equipment before installing on the site work shall be tested and all such results produced to the Employer. Nothing shall absolve the Contractor from reperforming any tests that the Contractor may be called upon specifically by the Architects/PMC/Employer or supply company or electrical inspector. All equipment shall be tested jointly with the MDL as required by various sections of the specifications and test data shall be furnished as required.

5.9 Pre-commissioning Tests:

All rules, regulations and requirements of Electrical, Government or Local Authorities and of Indian Standard Specifications and/or Rules and Regulations stated in Indian Electricity Act shall be strictly complied. On completion of erection the contractor shall clean all the equipment thoroughly and inspect the entire installation for correctness and shall furnish a report of completion to the MDL. Pre-commissioning tests shall commence only on approval of this report by the MDL.

All tests and the certification thereof shall only be carried out by those authorized, skilled, experienced and certified permit holders of the Supervisor Category of State Government's Industries and Labour Department. No unauthorized personnel shall ever carry out any such tests as stated herein under.

- i) Phantom load tests for Protective Relays.
- ii) Insulation tests at the following points by 1000 Volts and/or 500 Volts megger.
Between phase and phase and neutral and phase and earth at Bus bars, all outgoing, cables, distribution Boards, Sub-Distribution Boards etc. Capacitor terminals between phases.
- iii) Mechanical Operational tests for all movable parts of switchgears, breakers tripping devices etc.
- iv) Phase sequence tests at all the relevant points for connecting correct R, Y and B as per the supply authority's positions.
- v) All Panels to be tested for interlocks, control tripping and breakers to be tested for sequential trippings.
- vi) Capacitors banks shall be tested for all residual voltages on the terminal of the units and it should not exceed 50 V after one minute.
- vii) For point wiring insulation resistance tests for all wiring, with switchgear in closed positions and loads connected.
- viii) Continuity tests shall be done for noting any short circuits and/or earthing of phases.
- ix) Earthing tests for continuity of Earth by earth megger, on L.V. side the reading shall not exceed 5 ohm and Computer dedicated earth reading shall not exceed 1 ohm.

5.10 Commissioning:

- a) Prior to commencement of installation work the Contractor shall obtain the approval of the sub-station drawings, if any, and electrical layouts prepared by him from the Electrical Inspector (or any other statutory authority including Supply Company). The time involved in this is included in the overall completion period of the contract.
- b) The Contractor shall obtain the written permission and sanction of commissioning the equipment and sub-station (if applicable) from Electrical Inspector and from Consultants/ PMC.
- c) All costs, incidental to obtaining such sanctions shall be to the Contractors' account.
- d) Contractor shall furnish all the necessary tests and test-reports to the Electrical Supply Authorities and complete all formalities required to comply as per the Rules and Regulations laid down for release of Electric Supply. If called on, the Contractor shall carry out all such tests and prove the results to the entire satisfaction of the local and Electric Supply Authorities. All costs and expenses incidental to the release of Electric Supply shall be to the Contractor's account and no demand whatsoever shall be to the Employer, except for any Security Deposits that the Supply Authorities would deem necessary for charging of the line, except as may be provided for in the schedule of quantities. All such documents forwarded and / or letters and/or correspondence exchanged in this regard shall be made available for inspection and the Contractor shall furnish 3 sets of such documents and drawings for the

Employer's records. After release of Electric Supply to Employer's premises, the Contractor shall furnish six sets of all tests declared to the Supply Co. Authorities and shall furnish all such documents, officially exchanged between the Contractor and Supply Co. Authorities for the record of employers.

Contractor shall also obtain and furnish the relevant completion certificate from the Electrical Inspector, Fire Officer and/or any other Authority thereof whichever may be applicable.

The scope of the contractor under commissioning also includes for doing relay settings so as to achieve proper discrimination and an installation free of nuisance trippings.

6.0 TECHNICAL SPECIFICATIONS FOR DATA & NETWORKING SYSTEM

6.1 SCOPE:-

The work described in this section shall apply to the supply, installation, testing and commissioning of Data & Networking system with relevant equipment and instruments.

The Network switch offers a power-efficient Gigabit Ethernet (GbE) network-access switching solution with integrated 10GbE uplinks. With high-performance capabilities and wire-speed performance, utilizing a non-blocking architecture to easily handle unexpected traffic loads, the switches offer simple management and scalability via an 40Gbps (full-duplex) high availability stacking architecture that allows management of up to four switches from a single IP address. An integrated 80PLUS-certified power supply and features such as Energy-Efficient Ethernet and short cable detection provide energy efficiency to help decrease power and cooling costs.

7.0 TECHNICAL SPECIFICATIONS FOR MDF BOX / TELEPHONE SYSTEM

SCOPE OF WORK

The work described in this section shall apply to the supply, installation, testing and commissioning of MDF Box with relevant equipment and instruments. The work shall also include testing, connecting and commissioning of telephone wiring system installed by others.

This installation is intended to provide an adequate system which shall encompass the service requirements as described hereunder.

Work under this section shall incorporate the supply, installation, testing and setting to work of the following:

7.2 TECHNICAL REQUIREMENTS

General

The following specification outlines the technical and operational requirements of MDF consisting of simple functional units enabling adaptations without interfering with the basic structure of the exchange.

Equipment shall be of modular design and housed in dust-proof cabinets.

Equipment shelves shall be of the modular type, with slide-in PC boards.

The equipment shall be designed in such a way that the heat dissipation does not require built-in forced ventilation or separate air conditioning provisions.

SYSTEM PHILOSOPHY

The system must be provided with all the modern MDF facilities and it must be possible to handle voice, text, data and safety devices communications.

The system shall be 100% non-blocking.

The system should support ISDN (PRI/BRI) technology.

The MDF should be suited to work on an ac mains supply of 230V with a tolerance of +10V and -15V.

The system should be ventilated by conventional airflow. No cooling fans should be used in any part of the MDF.

MDF should be suitable for up to 5 digit extension numbering scheme. This numbering scheme should be flexible. System should also allow mixed numbering scheme.

The features mentioned below should be available from extensions.

Call forwarding

Do not disturb

Override do not disturb

Speed dialing: system numbers

Speed dialing: individual numbers

Barge in

Call back

Paging, both external and internal

Call parking

Blind Transfer

In the night mode when the operator is not present at the console, the direct lines will have to be routed to different extensions for incoming calls. Once the call lands in the department it should be possible to answer it from any station.

It should also be possible to have a different class of service during the day and during the night. The system should support automatic changeover of class of services.

8.0 DOCUMENTS, CERTIFICATES, DRAWINGS AND SPARE REQUIREMENTS:

The intent of this specification is to give a guideline to the Contractor to furnish in reproducible all sets of relevant papers and lists of spares for the continuous performance of the electrical installation. Nothing shall absolve the Contractor from furnishing any information document and/or papers that have not been specifically stated herein.

8.1 Documents:

All relevant maintenance and operation manuals and dates of all Electrical Equipment supplied and erected by the Contractor on the site shall be bound and furnished to the Employer

8.2 Certificate:

All relevant test certificates etc. and as more specifically stated in clause, shall be furnished. Contractor shall also furnish all such certificates issued by the original manufacture towards guarantee of performance of all equipment supplied.

8.3 Drawings:

All working and erection drawings of the final erected plan of all electrical installation work in reproducible of equipment such as Breakers, L.T. Panels, Distribution Boards, Cable routing, sizing, connection diagrams, circuits, wiring diagrams and conductor sizes, lengths, termination details, operational charts, recorded readings, conduit, light fittings, socket outlet layout drawings etc. shall be furnished to the Employer. The employer reserves the right to the mode of submission of such details being furnished by the Contractor. All colored drawing shall be providing by contractor in A2 Print.

8.4 Spare Requirements:

The Contractor shall, notwithstanding anything stated otherwise, furnish lists of recommended maintenance tools, spares, fuses, sets, codes, catalogues, appropriate pricing, original equipment manufacturers' addresses, etc. to the Employer. Prior to such furnishing Contractor shall make a proper assessment of all such requirements and then proceed to make lists. The Contractor shall also be deemed to have understood the requirements, in such a way that it ensures a continuous operation and functioning of the Electrical Equipment under the stated ratings conditions and specifications.

9.0 CODES AND STANDARDS APPLICABLE

7.1 Codes & Standards

The entire electrical system shall comply with the latest versions of IS. Codes and IEC guidelines as detailed under various Equipment's, Items & Systems, above that it shall also comply with:

- Code of Practice of Electrical Wiring : IS 732
- Code of Practice for fire safety of buildings (General) Electrical Installation: IS 1646
- Specification of conduits for electrical installation : IS 8130
- Danger Notice Boards : IS 2557 / IS 5-1978 /IS 2551-1982

- Earthing : IS 3043
- Installation of switch gear : IS 3072
- Ingress Protection of Enclosures : IS 2147
- Meters : IS 1248
- General requirement for switchgear and control gear for voltage not exceeding 1000V: IS 4237
- Marking and arrangement for switchgear busbars, main connection, and aux. Wiring: IS 375
- Code of Practice for installation and maintenance of switch gear: IS 10118
- Specifications for factory built assemblies of Switchgear: IS 8623
- Indian Electricity Act and Rules Regulations for Electrical equipment and buildings issued by Bombay Regional Council of Fire Insurance Association of India.

10.0 PREMABLE TO BILL OF QUANTITIES

10.1 The Bill of Quantities must be read with the scope of work, Conditions of Contract, Drawings and the Specifications and the Contractor shall be deemed to have examined the Scope of Work, Drawings, Specifications, Conditions of Contract and to have visited the Site and acquainted himself with the Works to be done and the way in which they are to be carried out and all factors affecting the execution of the Works and the Costs thereof including temporary works if required to complete the works.

10.2 All work shall be measured net as it is finished and/or fixed in the Works and no allowance shall be made for wastage notwithstanding any general or local custom. Any items of work not covered in the Preamble shall be measured as per specifications for works methods laid down in relevant Indian Standards or as decided by the MDL Engineer.

10.3 The quantities set down against the items in this Bill of Quantities are an approximate estimate of the quantity of each kind of work included in the Contract and are given for the convenience of forming a common basis for tendering. They are not to be taken as a guarantee that the quantities scheduled will be carried out or required or that they will not be exceeded. The MDL reserves the right to delete any item indicated in the bill of quantities at any time.

10.4 The quantities shall therefore not be considered as representing the final measurements, it being the intention of the Contract (except where otherwise specifically stated) that the actual quantities of work ordered and carried out shall be jointly measured on completion by the MDL Engineer or his authorized representative and the Contractor and valued and paid for at such prices and rates entered by the Contractor in the Bill of Quantities.

10.5 The rates and prices set down against the items are to be the full inclusive value of the finished work shown on the Drawing and/or described in the Specifications or which can reasonably be inferred there from and to cover the cost of every description of Temporary Works executed or used in connection therewith (except those items in respect of which specific provision has been separately made in this Bill of

Quantities) and all the Contractor's obligations under the Contract including testing, giving samples and all matters and things necessary for the proper execution, completion and maintenance of the Works. No claim for additional payment shall be allowed for any error or misunderstanding by the Contractor of the work involved.

10.6 The Specifications and the various Sections in the Bill of Quantities are intended to cover the supply of all the materials and the execution of all works necessary to complete the Works. Should there be any details of Materials or Construction which have not been referred to in the scope of work, specifications, Bill of Quantities or the Tender Drawings, but the necessity for which may reasonably be implied or inferred there from, or which are usual, or essential to the completion of all works in all trades, the same shall be deemed to be included in the rates and prices within in the Bill of Quantities. The rates and prices shall cover the items as described in the scope of work, Bill of Quantities, tender drawings and other terms and conditions of the contract.

10.7 The Contractor's unit rates and prices in the BOQ shall include all equipment, apparatus, material, indicated in the BOQ, Scope of Work, Drawings, Specifications in connection with the item in question and also associated labour as well as all additional equipment, apparatus, material, consumables usually necessary to complete the system even though not specifically shown, described or otherwise referred to and also associated labour.

It also includes delivering the material, item to the specified storage area at Site. Installation of the same in the specified location as per Drawing & as specified, testing and commissioning as per Specification and direction of the Engineer' at Site. The unit price shall be deemed to include everything necessary to complete the work covered by this item in accordance with the scope of work, BOQ description, Specifications and Drawings.

The sum total of all the individual item prices shall represent the total price of the installation ready to be handed over. Use of any tools, equipment, machinery, lifting tackle, ladders consumables etc. required by the Contractor to carry out his work.

All the necessary measures to prevent the transmission of vibration. Storage and insurance of all plant and equipment, apparatus and materials.

11.0 GUARANTEE & WARRANTY

The Bidder shall stand guarantee for the performance of entire equipment and components for twelve (12) months from the date of commissioning or eighteen (18) months from the date of dispatch, whichever is earlier, as agreed up on and as reproduced in the purchase order within the tolerance specified or as permitted by the relevant standards for the equipment in his scope of supply. The Purchaser also reserves the right to use the rejected equipment or part thereof until the new equipment meeting the guaranteed performance is supplied by the Bidder.

12.0 LIST OF APPROVED MAKES

The schedule of quantities may specify for some items the make of materials to be quoted for. The list of makes given below is for materials other than those mentioned in the schedule of quantities. In case, for any material, different makes are listed below from that mentioned in the schedule of quantities then the make mentioned in the schedule of quantities will only prevail and the contractor will have to supply only that make mentioned in schedule of quantities

| Sr. No | Item Description | Makes/Brand |
|--------|--|---|
| 1 | Transceiver | DLINK/ CISCO/ HP switches |
| 2 | Light fitting | Crompton/ Philips/ Havells/ Bajaj |
| 3 | HPMV lamp | Crompton/ Philips/Havells /Bajaj |
| 4 | Fans | Almonard/ Crompton/ Bajaj |
| 5 | Water heater (geyser) | Almonard, Crompton, Racold,Bajaj |
| 6 | UV Mosquito Lamp | Balaji/Super trap |
| 7 | Flexible Cables | Polycab/ RR Cable/ Havells/ Finolex, |
| 8 | FRLS cables | Rallison/ Finolex/ Polycab |
| 9 | G.I. Cable tray | Bravo Trays / SV Metal |
| 10 | MCCB/MCB Vari-depth handle (Rotary handle) | Legrand/ Havells/ Schneider/ L&T/ Indo Asian |
| 11 | MCB Terminals | Elemex/ Connectwell /KEW/ Bentec |
| 12 | MCCB spreaders link | Legrand/ Havells/ Schneider/ L&T/ Indo Asian |
| 13 | Indication LED | Teknic// L&T |
| 14 | Flameproof/Weatherproof Tube light fitting | Crompton Greaves/ Sudhir switchgear/ Bajaj/ Baliga/ FCG |
| 15 | Flameproof/Weatherproof Junction Box | Connectwell/ Phoenix/ Sudhir switchgear/ Bajaj/ Baliga/ FCG |
| 16 | Flameproof/Weatherproof Single Phase Exhaust fan | FCG/ Sudhir/ Crompton Greaves/ Bajaj/ Baliga |
| 17 | Flameproof/Weatherproof MCB PLUG AND SOCKET COMBINED | FCG/ Sudhir/ Crompton Greaves/ Bajaj/ Baliga |
| 18 | L.T. Switchgear | |
| | A) Enclosed in sheet steel with H.R.C. fuses for 63A and above | L&T/ Siemens/Schneider |
| | B) Cast Iron with rewirable fuses | KEW/ CPL/ Kalki |
| | C) Circuit Breakers (Moulded Case) | Legrand/ Havell's/ Schneider/Indoasian |
| | D) Miniature Circuit Breakers | Legrand/ Havell's/ Schneider/ Indoasian |

| | | | |
|----|------|--|--|
| | E) | Cubical Panel Switchgear Accessories | |
| | I) | TPN / DP Switches / Isolators | Legrand/ Havell's/ Schneider/ L&T |
| | II) | Rotary CAM type, Selector Switch | Siemens / AEI/ Kaycee |
| | III) | Start / Stop push Button stations | L&T/ Siemens/ Havell's |
| | IV) | Contactors | L&T/Siemens/ABB/Schneider |
| | V) | Indicating Lamp | Siemens/ Vaishno/Teknic |
| | VI) | Earth Leakage Circuit Breakers | Legrand/Havell's/Schneider/L&T |
| | VII) | HRC Fuse | Siemens/ L&T/ GE |
| 19 | | Distribution Boards with MCB's | Legrand/ Havell's/ MDS/ L&T |
| 20 | | Cables | Polycab/ Havell's/Finolex/RR Cable |
| 21 | | Socket / Lugs | Dowells/Jainson/ Braco |
| 22 | | PVC wires | Polycab/ Havell's/Finolex |
| 23 | | Conduit | |
| | A) | M.S. Black and G.I. Conduit | Precision/ Diamond/ BEC |
| | B) | Rigid PVC Conduit and accessories | Precision/ Asian/ Diamond/ BEC |
| 24 | | PVC casing-n-capping and PVC casing-n-capping accessories | Precision/ Modi's/ Presto-plast |
| 25 | | Screws | Precision Fastners |
| 26 | | Piano switches flush mounting (5 to 15 A) / wall sockets & plugs (surface mounting), Modular switches (5 to 15 A) holder pendant / batten / angle, three plate ceiling rose (for 3 core twisted flexible wire), 30 A D.P. Ticino type switch fuse with indicating lamp, bell push surface mounting, flush mounting | Legrand/ Roma/ Anchor/ Indoasian |
| 27 | | Wall Socket and plug Metal clad (ray roll type) | Legrand/ Crompton Greaves/ Havell's/ Indoasian |
| 28 | | PVC Boards | Presto-Plast ISI marked |
| 29 | | Special Accessories concealed / decorative (plate switches) | Roma/ Precision/CPL/ Anchor |
| 30 | | Two / Three core flexible wires | Polycab/ Havells/ Finolex |
| 31 | | Storage Heater with thermostatic control | Almonard/Crompton/ Racold/Bajaj |
| 32 | | Lamps | |
| | A) | Fluorescent, HPMV, HP/LP-SV, Halogen / MLL | Crompton/ Philips/ Havells/Bajaj |

| | | | |
|----|----|---|---|
| | B) | Halogen / MLL& Metal Halide | Philips/ Crompton/GEC |
| | C) | CFL 8 to 24 W upto 36W, Groove type, pin type | Philips/Crompton/ Anchor/ Wipro, GE/Bajaj |
| | D) | LED | Philips/ Bajaj/ Havells/SYSKA |
| 33 | | Fittings for fluorescent HPMV lamps and LP / HPSV lamps with copper wound chokes and condensers. Bulkhead fittings, Duoflux / dispersive reflectors, flood light fittings. Recessed mounted CFL 36W & low watt. Fittings which use energy saving light source like CFL, TL-5 and LED. | Crompton/ Philips/Havells/ Bajaj/ Halonix |
| 34 | | Bell | |
| | A) | Call Bell / buzzer | Anchor/ Rider/ Cona |
| | B) | Wireless Call Bell system | Fobix Semicon/ Gold Metal/Honeywell |
| 35 | | Exhaust Fans / Pedestal Fans/air circulators | Crompton/ Almonard/ Bajaj |
| 36 | A) | Ceiling Fans with double ball bearings | Crompton/ Almonard/ Bajaj |
| | B) | Table Fans wall mounting Fans / cabin fans | Crompton/ Usha/Bajaj |
| 37 | | Terminal Block | Elmex/ Everest/ Jyoti |
| 38 | | Meters: Ammeter & Voltmeter (Analog) | Automatic Electric/ Mecor |
| 39 | | G.I. Pipes | Zenith/ Diamond |
| 40 | | Electronic Ballast | Philips/ Asian |
| 41 | | Fan's Electronic Regulator | Rider/ Anchor/ Cona |
| 42 | | Fluorescent Tube 28W T5 (4 ft or 3 ft or 2 ft) | Philips/ GE/Osram/ SYSKA |
| 43 | | Modular Switches, Sockets & Other Accessories | MK-Honeywell/Legrand/Scheinder/ Indoasian |
| 44 | | Metal Clad Socket with MCB | MDS/SIEMENS/ Legrand/ Indoasian |
| 45 | | PVC Junction Box | Sintex/Clipsal/Spelsberg |
| 46 | | Telephone Cable | Delton/Polycab/Finolex |
| 47 | | CAT 6 | Enercon/LAPP India/Molex |
| 48 | | Modular type USB charger socket | MK-Honeywell/Legrand/Scheinder |
| 49 | | Network Switch | Cisco/Siemens/Netgear |
| 50 | | Network Rack | Penduit/Rital/President |
| 51 | | Network accessories | Penduit/D-Link/Molex |
| 52 | | Patch Panel | Molex Premium/Penduit/D-Link |

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|----|---------------------------------|---|
| 53 | Connectors | Salzer/Elemex/Conectwell |
| 54 | Medium Voltage Cable | RRCABLE/Finolex/Polycab |
| 55 | LT PANEL | APJ ELECTRICAL / ABAK ENGG / ZENITH ENGG. |
| 56 | METERS (DIGITAL) | ENERCON / L&T / TRINITY |
| 57 | HDMI CABLE | POLYCAB / FINOLEX / D-LINK |
| 58 | LED TV/monitor | Samsung/Sony/LG |
| 59 | Cable Trays and its accessories | Legrands/ Asian Anciliary Corporation |