SECTION - 3
L.T PANEL & MAIN DISTRIBUTION BOARD

1.0 General/ Scope

1.1 The work includes supply, installation, connection, testing and commissioning of all material and services of the complete L.T. Panel and Main Distribution Boards (MDB) as specified herein and/or shown on the Tender Drawings and given in the Bill of Quantities.

1.2 The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and position of L.T. Panel and Main Distribution board.

1.2 The L.T. Panel and Main Distribution board shall comply with the local and international codes and with other relevant provisions of the Tender Documents.

1.4 The L.T. Panel and Main Distribution board shall be sheet steel fabricated, floor/ wall mounting type, totally enclosed, dust tight and vermin proof and shall have protection class as mentioned in for indoor installations. It shall be complete in all respect with material and accessories, factory assembled, tested and finished all according to the specifications and to the normal requirements.

1.5 The L.T. Panel and Main Distribution board with all components and accessories shall be suitable for front operation only and shall:

1.6 It shall be should rated for 400 / 230 V, 3-phase, 4 wire, 50 Hz system and shall have breaker rupturing capacity of ICS = 22 kA @ 415 V, unless other wise stated or shown on drawing/ BOQ.

1.7 Shall be provided with adequate clearance from live parts so that flashovers cannot be caused by switching, vermin, pests, etc.

1.8 Shall have all components rated for insulation class of 600-volt minimum.

1.9 All incoming and outgoing connection shall be from the top or bottom as required.

1.10 Have the components mounted so as to facilitate ease of maintenance from the front.

1.11 Wiring diagram shall be provided in the pocket on the inside of each door of the panel.

1.10 Shall be suitable for 415 volts AC, 3 phases 4 wire and 50 Hz system.

1.12 Shall be labeled with stainless steel nameplate on the front side of door for each incoming and outgoing circuit.

1.13 Doors shall be properly grounded by flexible copper cable/strip.

1.13 Shall have arrangements for extension of panel in future.

1.14 The switch gears shall be provided with components as shown in drawing

1.16 L.T. Panel shall be fabricated with 14 SWG MS sheet and shall have angle iron frame structure with sheet metal enclosure suitably bolted complying to standards and suitable to stand the static and dynamic stress caused due to prospective short circuit current.

2.0 Material

2.1 Sheet Metal Work

2.1.1 The main distribution board shall be fabricated, welded, grinded, finished with angle iron framework and cladded with 14 SWG MS sheet. It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories.

2.1.2 The L.T. Panel and Main Distribution board shall be supplied complete with foundation bolts/ screws and other installation materials as recommended by the manufacturer. Proper size cable clamping channels with galvanized steel clamps and brass cable glands respectively for unarmored and armored cables shall be provided. All holes, cutout shall be tool or jib manufactured and free from burrs and rough edges. An earth bar of appropriate cross section shall be provided and connected to the body of the distribution board. The doors shall be earthed by means of flexible copper strip**.** Means shall be provided to limit the opening angle of doors to about 100^0.

2.1.3 The cabling inside the L.T. Panel and Main Distribution board shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, selecting and control equipment shall be suitably arranged and clearly labeled by means of flame proof material using indelible ink/marking indicating the rating of fuse, switches, etc. The nameplates provided on the front of panel shall be of flame retardant material preferably stainless steel. Use of plastic or any inflammable material shall not be permitted for nameplates.

2.1.4 All metalwork shall be cleaned down to bare shining metal phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of color RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 100 microns.

3.0 Components

The L.T. Panel and Main Distribution boards shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the distribution board and of the electrical system. Typical specifications of the components are given hereunder.

3.1 Bus Bars

3.1.1 The bus bar shall be minimum of 1.55 Amps per sq.mm cross-sectional area. It shall be made of 99.9% pure electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. Neutral bus bar shall be of the same cross section as phase bus bars. Earth bus bar shall be of half cross section area as phase bus bars. The earth strip shall be run along full length of distribution board,

3.1.2 The phase identification of bus bars shall be by providing colored sleeves on bus bars ends and these shall be red, yellow and blue for phase and black for neutral. The earth bus bar shall be green.

3.1.3 The bus bars shall be triple pole, neutral & earth and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45 degree centigrade at rated current.

3.2 Circuit Breakers

3.2.1 ACB

3.2.1.1 The incoming circuit breakers of L.T. Panel and Main Distribution board (normal and emergency) shall be air circuit breakers whereas outgoing circuit breakers shall be moulded case type, unless stated otherwise on the drawings.

3.2.1.2 The circuit breaker shall be rated for 600 V triple pole, front mounted type manually operated with front operating grip handle. ON-TRIP-OFF indication shall be provided on circuit breakers. All circuit breakers in the distribution board shall be from the same manufacturer. The circuit breaker shall have the following protections and setting range unless otherwise shown on the drawing: -

a) Adjustable three pole, manual reset thermal overload release having range from 50 to 100 % of rated current. Magnetic trip shall also be adjustable.

b) After tripping through thermal / short circuit release the circuit breaker shall be reset manually.

c) The ACB shall comply with the standard IEC 947-2.

3.2.2 Molded Case Circuit Breaker (MCCB)

3.2.2.1 The MCCBs shall be moudlded case triple pole 440 Volts or single pole 250 Volts of current ratings as shown on the drawings.

3.2.2.2 The single and triple pole MCCBs shall have short circuit rupturing capacity suitable for the distribution system as approved by the Engineer or as shown on the drawings. The MCCBs shall be suitable for working on lighting and power circuits. The C.B shall be triple pole / signal pole manual reset type, with temperature compensated thermal overload release and instantaneous magnetic short circuit release. The rated service breaking capacity ICS shall be equal to 100% of ultimate breaking ICU. MCCB up to 250 A shall be adjustable 80 to 100% and higher rating have 50 to 100% setting.

3.2.2.3 The MCCBs shall be installed such that their switching levers are accessible through the front plate for operation.

3.2.3 MCB

3.2.3.1 The single pole and triple pole MCB's shall be of specified rating & specified kA rating, having Type C characteristic in general or else specified. The TP MCB's shall have factory fitted common inter-link for simultaneous ON/OFF Tripping operations.

3.3 Ammeter and voltmeter

3.3.1 All meters shall be flush mounting, moving iron, and spring controlled. The front dimensions shall be 96 x 96 mm. The meters shall have accuracy class 1.5. The ammeter shall be suitable for connection to 5 Amp secondary of current transformers. The ammeters and voltmeter shall have measuring range as indicated on the drawings.

3.3.2 The meters shall be of accuracy class 1.5 according to BS-89 and 90. The ammeter shall be suitable for connection to 5 Amps secondary of current transformers or directly through shunt as shown on drawings. The ammeters and voltmeters shall have measuring range as indicated on the drawings.

3.4 Current Transformers

3.4.1 Air cooled, ring type current transformers (CT) shall be provided having transformation ratio as indicated on the drawings. CT's shall be of accuracy class 1.0.

3.5 Selector Switches

3.5.1 Ammeter and voltmeter selector switches shall be complete with front plate and grip handle. R-Y-B and OFF position for ammeters and RY-YB-BR-RN-YN-BN and OFF position for voltmeters and shall be marked on the respective selector switches.

3.5.2 The selector switches for controls shall be rotary cam type, having required number of positions. It shall be provided complete with knob and front plate showing all positions as required.

3.6 Air Break Contactors

3.6.1 The contactors shall be air break, triple pole 400 VAC type and suitable for the type of duty to be performed. The main contacts shall be silver tipped, butt type with double break per pole. Each contactor shall be provided with single phase 230 VAC operating coil and minimum one spare normally open and one normally closed auxiliary contact. The number of working auxiliary contacts shall be provided according to the system requirements.

3.7 Push Buttons

3.7.1 The push buttons shall be momentary make/break contact type (normally open/normally close) and suitable for flush mounting. The push button for on and off switching shall be red and green respectively.

3.8 Indication Lamps

3.8.1 Indication lamps and selector switches shall be suitable for flush mounting complete with bases, 230 volt incandescent lamps and shall have rosettes of red color for on condition.

3.9 Line up Terminals

3.9.1 Line up terminals wherever provided for control or power circuits shall be suitable for voltage and size of conductors as indicated on drawing.

3.9.2 The line-up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

3.10 Labels

3.10.1 Panel and DB wiring required with numbered ferrules. All DB's to have circuit labels etc. & identification name tags) All breakers in L.T. Panel shall engraved labels fixed with screws or riveted to the panel doors. Size of the letter shall be 6 mm in capital letter on plastic laminated plate of black color with white color lettering. The labels for each compartment shall give name of the equipment, and also for meters, selector switches and lamps. These shall also indicate their application and status. In case the meters, selector switches and lamps are provided with integral labels no separate labeling will be required. Labeling of meters shall not be done when mounted

4.0 Installation

4.1 The LT panel and main distribution boards shall be installed at location shown on the drawing. The concrete pedestal shall be constructed as per relevant specifications of civil works. The Contractor shall be responsible to ensure co-ordination with the civil works for providing any openings, holes, etc., to avoid any breakage to completed works. In case the provisions in civil works for installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of Engineer.

4.2 The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

4.3 All installation materials for physically erecting the LT panel and main distribution boards, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. LT panel and main distribution boards shall be installed upright and in level and shall be firmly and rigidly bolted to the floor / wall and concrete supports.

4.4 The LT panel and main distribution boards shall be completely erected/ installed on wall as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking of meter, relays, etc., provided by the manufacturer for safe transport shall be released only after the panel is erected in position and the MDB is installed at its location. The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armor shall be connected effectively to ground.

4.5.1 The LT panel and main distribution boards shall be connected to earth as per standard and applicable codes and shall be tested and commissioned in the presence of the Engineer.

5. Inspection and tests.

5.1 All equipment shall be subject to inspection and witness tests by the engineer at supplier’s work prior to delivery at site. This shall include inspection of compliance specification.

- Over voltage and insulation test.
- Operational test.
- Any other test necessary for the purpose.

6. Drawings

6.1 Four copies of general arrangement drawing and circuit diagrams shall be supplied to Consultants for approval before manufacturer commences work.

SECTION - 4
LT DISTRIBUTION BOARDS

1.0 General/ Scope

1.1 The work includes manufacturing, fabricating, supplying, installing, testing, and commissioning of all material and services of the complete Low Tension (LT) Distribution Boards as specified herein, shown on the Tender Drawings and stated in the Bill of Quantities.

1.2 The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact location and position of the each L.T. Distribution Board.

1.3 The Low Tension Distribution Board with accessories shall comply with local and international codes and with other relevant provisions of the Tender Document.

2.0 Material

2.1 Sheet Metal Work

2.1.1 The Low Tension Distribution Board (DB) shall be fabricated with 16 SWG sheet steel recess / surface mounting as approved by the Engineer. All the components shall be installed on a common component mounting plate inside the enclosure and protected from the front with screwed sheet steel front plate. The enclosure shall be provided with rubber gasketing and a lockable hinged door with cam fastener.

2.1.2 The distribution board shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the DB. All holes, cut-out etc. shall be tool manufactured and free from burrs and rough edges.

2.1.3 The cabling inside the DB shall be suitably harnessed by means of straps or cords. An earth bar shall be provided for connection of incoming and outgoing earth conductors. The earth bar shall be permanently connected to the body of DB at two points. Flexible copper strip shall be provided for earthing of the door of DB.

2.1.4 Circuit numbers/ designation on all circuits shall be conspicuously marked to facilitate connection and maintenance.

2.1.5 All metal work of the DB shall be cleaned down to bare shining metal phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of color RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 100 microns.

3.0 Components

The Low Tension Distribution Boards (DB) shall be provided with components as specified, as shown on the Tender Drawings and required for the satisfactory operation of the distribution board and of the electrical system.
Typical component specifications are given below:

3.1 Bus Bars

3.1.1 The Bus bars shall be made of 99.9% pure high conductivity electrolytic copper and shall be completely isolated and mechanically braced for the specified fault level. The

identification of bus bars shall be by providing colors sleeves on bus bar ends and these shall be red, yellow and blue for phases and black for neutral. The earth bus bar shall be green.

3.1.2 The bus bars shall be for three phase, neutral and earth and shall be of appropriate size to meet the electrical and mechanical requirements of the system. The temperature rise shall not exceed 45°C at rated current.

3.2 Moulded Case Circuit Breaker (MCCB)

3.2.1 The MCCBs shall be moulded case triple pole 440 Volts or single pole 250 Volts of current ratings as shown on the drawings. These shall have fixed magnetic short circuit and adjustable/fixed thermal overload protection.

3.2.2 The MCCBs shall be installed such that their switching levers are accessible through the front plate for operation.

3.2.3 The single and triple pole MCCBs shall have short circuit rupturing capacity suitable for the distribution system as approved by the Engineer or as shown on the drawings. The MCCBs shall be suitable for working on lighting and power circuits.

3.3 Ammeters and Voltmeters

3.3.1 All meters shall be flush mounting, moving iron, spring controlled. The front dimensions shall be 96 x 96 mm for meters.

3.3.2 The meters shall be of accuracy class 1.5 according to BS-89 and 90. The ammeter shall be suitable for connection to 5 Amps secondary of current transformers or directly through shunt as shown on drawings. The ammeters and voltmeters shall have measuring range as indicated on the drawings.

3.4 Current Transformers

Air cooled, ring type current transformers shall be provided having transformation ratio as indicated on the drawings. The current transformers shall be of suitable burden having accuracy class 1.0 according to BS 3938. The current transformers shall have 5 amps secondary.

3.5 Selector Switch

The ammeter and voltmeter selector switch shall be complete with front plate, grip handle R-Y-B and OFF position for ammeters, and RY-YB-BR-RN-YN-BN and OFF position for voltmeters shall be marked on the respective selector switches.

3.6 **Air Break Contactors**

The contactor shall be air break, triple pole, 400 Volts. Each contactor shall be provided with a 230 Volt operating coil, one 6 Watt, 230 Volt red colored signaling lamp, control fuse and two normally open and two normally closed type auxiliary contacts wired unto terminals for electrical interlocking.

3.7 Push Buttons

Push Button shall be momentary contact type and suitable for flush mounting on the door of panel and on remote area. The push button for ON and OFF switching shall be spring-loaded.

3.8 Indicating Lamps

Indicating lamps shall be suitable for flush mounting, complete with base and 230

Volts incandescent lamp. It shall have rosettes of suitable colors as approved by the Engineer.

4.0 Installation

4.1 The locations of L.T. Distribution Boards (DB) are shown diagrammatically on the drawings. The actual location shall be determined at site, keeping in view the site conditions and in co-ordination with other equipment, as approved by the Engineer.

4.2 L. T. Distribution Boards for recessed mounting in wall shall be installed such that the door shall finish flush with the surface of wall. The recess mounted distribution board shall be installed before the plastering of walls. The DB shall be protected to avoid any damage due to the civil work. Any cuttings, dismantling of the existing wall required for fixing the DB shall be coordinated at site with the approval of Engineer. Any damage done to civil structure shall be made good by the Contractor. The outdoor distribution board shall be installed on pedestal at location as directed by the Engineer.

4.3 All loose parts dispatched separately with the DB shall be installed as per manufacturer instructions and all adjustments or setting shall be made as required. All screws, nuts and bolts used for fixing the distribution board shall be galvanized.

4.4 The distribution board installation shall include connecting all incoming and outgoing cables. The cable entry in the boards shall be provided from top or bottom as required.

4.5 The distribution boards shall be tested as per manufacturer's recommendations and as per instructions at site.

5. Inspection and tests.

5.1 All equipment shall be subject to inspection and witness tests by the engineer at supplier's work prior to delivery at site. This shall include inspection of compliance specification.

- Over voltage and insulation test.
- Operational test.
- Any other test necessary for the purpose.

6. Drawings

6.1 Four copies of general arrangement drawing and circuit diagrams shall be supplied to Consultants for approval before manufacturer commences work.