



TECHNICAL SPECIFICATION		SPECIFICATION NO. PROJ-ELEC/C&I-TS-MSSS-0007
		REVNO:00
PRODUCT	11KV/433V MOBILE-SKID MOUNTED SUBSTATION	DATE:24/04/2008
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### 11KV/433V-MOBILE SKID MOUNTED SUBSTATION

#### GENERAL:

The Skid mounted substation shall be of modular construction housed in a single enclosure consisting of HT control Panel with Two numbers Load break switch one incomer and one outgoing for the part of ring main supply system (Loop in & Loop out system), one number VCB and all other metering and protection, one No 11kV/415V Dry type Transformer and LT distribution Board etc. as detailed in the enclosed specification with all protections like over current, earth fault and under voltage etc.

The Substation should be suitable for outdoor application, compact and easily transportable and installation. The Substation shall have minimum maintenance requirement with no accidental access to live parts and fully complied with all statutory requirements.

The Skid mounted substation shall be fully compartmentalized. The Skid mounted substation shall be suitable for bottom cable entry.

The Skid mounted substation shall be Metal clad housing fabricated out of CRCA sheet steel of min. 3mm thick for outer enclosure and 2mm for the rest. Substation shall have suitable mechanical strength for lifting.

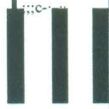
All sheet Metal components shall undergo rigorous seven tank process (degreasing, de-rusting, phosphating and sealing). Painting shall be of epoxy powder coating to shade RAL 7032 (Siemens Grey).

Selection of HT / LT Board and Transformer components rating shall be as per enclosed specifications.

#### System Requirements:

1. System HT : 11kV, 3phase, 3wire, 50Hz. 350MVA.
2. System LT : 433V, 3phase. 4wire. 50Hz. 35MVA.
3. Installation : Outdoor.
4. Transformer : 500 KVA rating
5. Busbar : Epoxy encapsulated copper busbar shall be provided. Epoxy

Seal off bushings shall be used between compartments.



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## DETAILS OF EQUIPMENTS:

### I. HT SWITCHGEAR

#### 1.0 General

- i) The switch gear shall be part of compact substation and which in turn is part of ring main supply system of 11kV, 3phase, 50HZ solidly' earthed neutral system. Highest system voltage will be 12kv.
- ii) The switch gear section shall have provision for one incomer and one outgoing to be part of ring main.
- ii) Specification and other particulars of the switch gear are broadly categorized under the following heads.
  - a) Cubicle with busbars, relay, instruments, earthing device etc.
  - b) Vacuum Circuit breaker.
  - c) Load break switch (TWO Nos)
  - d) Instrument transformer (PTs, CTs)
  - e) Panel lighting

#### 2.0

##### Cubicle

#### 2.1

##### Construction

- i) The switch gear along with the load break switch shall be one section of the compact substation and all the components of the switch gear section shall be accessible for easy maintenance.
- ii) Sheet steel shall be of minimum 2mm thickness for partition between sections and 3mm for hinged front and bolted rear doors.
- iii) Electrical continuity between all metal parts not alive and the earth terminals of the unit shall be ensured.
- iv) Insulated partition shall be provided for Busbars. CTs. PTs. outgoing cables & circuit breaker and relay and controls. Tinned copper busbars with suitable heat shrink sleeves shall be provided. Wire mesh shall be

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provided wherever necessary to prevent inadvertent touching of busbars.

- v) Hinged doors shall be provided for accessing the switchgear section. Three point locking arrangement with single operating handle shall be provided for all hinged doors. Hinge locks, lock covers etc., shall be fabricated from anti-corrosive material. The hinges shall be sturdy and robust. The doors shall be provided with additional members for strengthening to avoid any warping (or) bending.
- vi) Cubicles will be exposed to high winds, dust and rain. Neoprene gaskets of high quality shall be used. The top cover of kiosk shall have necessary slope to avoid stagnation of rain water.
- vii) Base frame shall be of sufficient thickness and tar painted to give corrosion resistance even if water accumulation is there.
- viii) All mechanical indications of breaker / LBS position, operation shall be visible from outside. Suitable transparent cover shall be provided on the front door of compact unit.
- ix) Emergency push button shall be accessible from outside.
- x) Safety shutters to cover live part to prevent accidental contact, and explosion vents to release the gases during fault occurrences shall be provided.
- xi) Lifting lugs, base frame of adequate thickness, foundation bolts of min. 19mm dia with suitable washers shall be provided. Lifting guides shall be provided at the top to prevent touching of wire ropes with body of unit while lifting the compact substation.

**2.2 Cable termination:**

- i) Both incoming and outgoing cables of the compact Substation are with bottom entry. Cable terminations shall be made with the sealing kits of specified type.
- ii) Blank G.I. plates gasketed and bolted to the cubicle for glanding and terminating control and power cables shall be provided.
- iii) Double compression type brass cable glands shall be used. Tinned heavy duty copper lugs shall be supplied for all cables. Adequate space shall be provided for splicing and termination of cable. The

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cable shall be secured properly in the compact Substation with suitable support.

### 2.3 Relays

- i) All relays specified shall be flush mounted in dust proof cases and shall match the appearance of the instruments mounted on the same panel. Each relay shall be identified with relay number indicated in the approved control scheme.
- ii) Protective relays shall be of easy with drawable type. Trip circuits shall be automatically broken and current transformer secondary circuits shorted, when a relay is withdrawn from its case. A marking strip shall be provided in front of each terminal block and diagram plate at the back of each case to identify connections.
- iii) Relay contacts shall withstand repeated operation and shall make or break the maximum currents in their circuit without deteriorating. All spare contacts shall also be wired upto the external terminals.
- iv) Relay coils shall carry their normal currents indefinitely and such currents as can occur under fault conditions. Relay mechanism shall not be affected by vibration or external magnetic fields, which may occur in normal operation.
- v) All relays in tripping circuits shall have mechanically operated flag indicators. Indicators, mechanical or electrical, shall also be provided on other relays to identify type of fault that may have occurred. Indicators shall be capable of being reset without opening the relay case. It shall not be possible to operate the relay by hand or to alter its setting, without opening the case. All relays shall operate satisfactorily from 70 to 110% of rated voltage.

### 2.4 Indicating Instruments

- i) All indicating instruments shall conform to IS 1248 and integrating meters to IS 722.
- ii) Indicating instruments shall be of size 96 x 96 mm and shall conform to 1.0 accuracy class. Meters shall be suitable to PT secondary of 110V (line) and CT secondary of 5A. Scales shall be suitably provided depending on the ratio of instrument transformer. All indicating instruments shall have non-reflecting bezels, clearly divided and legibly marked scales and sharply outline pointers. They shall be provided



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with zero adjusting devices for external operation. Indicating instruments shall be taut band type.

- iii) One no. static type, class 0.5 accuracy energy meters shall be provided (as shown in the single line Diagram).

### 2.5 Control Circuits

- i) Control switches shall be suitable for use in AC circuits upto 440V and rating of 5A.
- ii) All incoming control and power circuits shall be fed through isolating ON/OFF rotary switch and HRC fuses with insulating base and holder. Closing circuit, tripping and control circuit, lamp circuit shall be segregated and protected by independent fuses.

### 2.6 Control wiring and ferrules

- i) All wiring shall be carried out with 1100 volts grade core wires having multistrand copper conductor. All control circuit shall be with copper conductor having a minimum cross-sectional area of 1.5 sq.mm per core and CT circuit shall be 2.5 sq.mm copper conductors. The wire shall be insulated with PVC.
- ii) All control wiring shall be terminated using eye type tinned copper lugs on to the stud type terminals. More than two wires shall not be terminated onto a single terminal.
- iii) All holes or tubes for wiring runs shall be bushed and shall have room for reasonable future additions. All cable runs shall clear injurious gases and heat emitted by control gear operation or shall be adequately protected from them.
- iv) Control cables when laid in HT busbar chamber, cable shall be taken through conduits. No joints or tees shall be made in wires between terminals. The wire shall be identified by numbered ferrules at each end, all in accordance with the connection diagram, equipotential terminals shall have the same ferrule numbers.
- v) All ferrules shall be made of non-deteriorating materials. They shall be white except in case of warning ferrules, which shall be red. Ring type ferrules shall have the character engraved on it. The ferrules shall be firmly located in each wire so that they cannot move freely on the wire. Wiring across hinges shall be by flexible wires.

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- vi) The colour code for control wiring shall be as enumerated below:
- a) Metering circuits – Black
  - b) Closing, tripping, protection relays and main power supply circuits – Red.
  - c) Annunciation and indication circuits – White.

**2.7 Inscription**

- i) Each unit and each component shall be clearly labeled to indicate its purpose.
- ii) Owner's nameplates at front and back of each cubicle shall be engraved on white back ground with black lettering of 10mm size
- iii) Each component label shall include the component symbol shown on the connection or schematic diagram.
- iv) All components mounted inside the cubicle shall be provided with screwed inscription plate.
- v) The characters to be engraved on the cubicle labels shall be furnished at later stage.

**2.8 Earthing**

An earth bar adequate cross section shall be fixed preferably at the back of the switchboard. The earth bar shall be electrically continuous and shall run the full extent of each board. The earth bar shall be of same material as the busbars and shall have a minimum cross section of 300 sq.mm. Each unit shall be constructed to ensure satisfactory electrical continuity between all metal parts not intended to be alive and the earth terminals of the unit. Double earthing shall be provided from each equipment to the earth bus by suitable size of wire (or) flat.

**2.9 Paintings**

The switch gear unit cubicle shall be furnished with colour code to be indicated at the time of drawing approval conforming to IS 5-1961 latest. The sheet metal parts shall be subjected to following pre-treatment before final painting.

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- a) Degreasing
- b) Pickling for complete rust removal
- c) Phosphating
- d) Corrosion resistant primer painting. Two final coats spray painting shall be given.
- e) The cubicle shall be painted with colours as follows:-  
Internal – Glossy white

**2.10 Space heater**

Space heater with isolating switch fuse unit shall be provided for each cubicle.

**2.11 Testing & commissioning**

Routine tests as per relevant IS standards to be conducted at works & site and test certificates shall be furnished. Type test certificates for identical equipment shall be provided.

**2.12 Drawing**

The following drawings shall be submitted for approval. Copies of approved drawings along with reproducible and soft copies in CDs shall be furnished at the time of supply of equipment. As built drawings incorporating site modifications along with reproducible and soft copies in CDs shall be furnished.

- a) Dimensional GA drawing of switchgear indicating foundation details, cable gland plate location for each cable plan and elevation of switchboard.
- b) Cross sectional drawing of cubicle busbars CTs, cable breaker LV chambers and indicating all electrical clearances between busbars and earth.
- c) Front view of the switchboard indicating arrangement of relays, controls operating heights.
- d) Control schemes of each feeder / breaker with components specification.
- e) Terminal plan and internal wiring drawings of all the cubicles

f) Inter panel wiring drawings.

### 3.0 Circuit Breaker

- i) The circuit breaker shall be three pole vacuum circuit breaker with spring charged operating mechanism. Plug in isolating contacts and 4 NO+4NC auxiliary contacts all mounted on a withdrawable carriage.
- ii) The air clearance between phases and between phase to earth at the breaker incoming and outgoing terminals shall not be less than those indicated in the IS/IEC/British standards, corresponding to the basic insulation level of the circuit breaker as indicated in the criteria.
- iii) The temperature rise of the breaker contacts / terminals while carrying the rated continuously or the rated short circuit current of rated duration shall not exceed 40 deg C. Over ambient of 50 deg C. Further to minimize burning and pitting of contacts all parts exposed to the arc created by current interruption shall be protected by special arc resistance material.
- iv) The circuit breaker shall be designed such that the peak short circuit current (i.e. 2.5 times the RMS short circuit current) specified can be interrupted without causing appreciable damage to main contacts.
- v) The arc extinguishing chambers and the contact assembly shall be enclosed in an insulating tube made of FRP/tough glass/ ceramic or other suitable arc resistant material with sufficient strength to withstand the internal pressure / forces developed while clearing rated short circuit current.
- vi) Surge Arrestor shall be provided wherever necessary.
- vii) 110V DC for operation of the Circuit Breaker and protection relays shall be taken from power pack (110V DC). This is to ensure te operation of breaker in case of power supply failure. (2 open and 2 close operations).

### 3.1. Operating Mechanism

- i) Circuit breakers shall be provided with spring charged, manual & electrical independent closing and shunt trip and series trip for opening.



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- i) Trip coil shall operate satisfactory between 70% and 110% of rated voltage.
- ii) The closing and tripping circuits shall be self opening on completion of their respective functions irrespective of position of the breaker ON/OFF switch.
- iii) A readily identifiable mechanical emergency trip device as well as provision for manual charging of springs through the cubicle door shall be provided for each breaker.
- iv) In case of circuit breakers with more than one operating spring, they shall be so interlocked such that the springs are charged to the same extent and the breaker can be closed only if all the springs are charged to the required values. Further in case of multiple pole / phase breakers equal current sharing between poles shall be ensured by means of current balance schemes.
- v) In order to ensure the reliability and long operating life for the mechanism, the mechanism shall be light, with a high mechanical strength and abrasion resistance to avoid high rate of wear and tear and with few components. The number of components in the breaker and operating mechanism shall be kept to a minimum and they shall be designed to be free of undue stresses during normal or short circuit operations. Further they shall ensure a high frequency of operations indicated in technical particulars. All the moving parts of the mechanism requiring inspection, maintenance and lubrication shall be easily accessible.
- vi) Operation counter shall be provided on the breaker for recording number of ON/OFF operations.
- vii) A visual ON/OFF indication and SPRING CHARGED indication shall be provided positively coupled to the operating mechanism and visible from front with the cubicle door closed. Indications shall be provided for limit switches for spring charged and discharged condition. The Mechanism shall be TRIP FREE as per IEC.
- viii) The life of the operating mechanism shall not be less than 30,000 operations.
- ix) It shall not be possible to open the doors without opening the Circuit Breaker.

### 3.2 Auxiliary Contacts

- i) Each circuit breaker shall have 4NO+4NC of auxiliary contacts to control circuit changes for indication, protection, interlocking. Supervision. Metering and others.
- ii) Breaker auxiliary contacts available in test and service position and those available in service position only shall be clearly indicated.
- iii) Normally open and normally closed contacts shall be interchangeable at site.
- iv) All auxiliary contacts shall be positively operated by the main apparatus and all contacts shall be adequate to make, carry and interrupt the currents in their circuits.

3.3 Emergency push button to trip the VCB shall be provided inside a weather proof box on the outer side wall of the compact Substation. An Auxiliary terminal box shall house the terminal blocks to receive the following external inputs from

- a) Winding temperature indicator / alarm
- b) 240V. single phase, 50Hz supply for panel and SIS illumination.
- c) Separate terminal blocks shall be provided for control and power.

The auxiliary terminal box shall have IP55 protection on the outside wall of compact Substation.

### 4.0 11kV Load Break Switch

#### 4.1 General

HT load break switches are intended to connect / disconnect from the 11kV ring main system.

#### 4.2 Rating

The load break switch shall be fault make, load break type. The load break switch shall have rated current, fault making capacity, short time thermal rating, dynamic through fault withstand capability as specified in the design criteria without HRC fuses in the circuit.



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**4.3 Type of Load Break Switch**

Load break switch shall be air break type in fixed design.

**4.4 Operating Mechanism**

The load switch shall have quick make, quick break independent manual operating mechanism with mechanical ON/OFF indication.

**4.5 Interlocks**

It shall not be possible to open the door with load break switch on.

**4.6 Auxiliary Contacts**

4 NO + 4 NC auxiliary contacts rated to make and break 5A at 110V AC shall be provided.

**5.0 Instrument Transformer**


**5.1 Current Transformer (CT)**

- (i) Separate cores shall be used for metering and protection.
- (ii) All current transformers shall be designed to have over current factors to withstand the fault currents of the associated system as applicable to the switchboard.
- (ii) Current transformer used for protection shall an accuracy limit factor not less than 15. Those used for metering shall have a saturation factor of 2.

All current transformers shall have 5 Amp. Secondaries and shall be of resin cast with bar primary.  
Polarity of primary and secondaries of all the CTs shall be clearly marked.

**5.2 Voltage Transformer (PT)**

- (ii) Voltage transformer shall be built up of CRGO electrical steel. The voltage transformers shall be resin cast dry type. The PTs shall be 3 nos. of single – phase type of suitable ratio and burden.

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- (iii) HT side and LT side of PTs shall be protected by HRC fuses. LT terminals shall be terminated on separate power terminal block located in the same panel.
- (iv) Control supply 110V AC shall be derived from 11KV Bus PT for the following purpose:
- a) ON,OFF & Auto trip LED Indications for 11 KV VCB.
  - b) ON,OFF & Auto trip LED Indications for 0.4 KV ACB.
  - c) Working supply for 4 element relay meant for Transformer protection.
  - d) Input source for 110V DC Power pack. 110V DC for operation of the Circuit Breaker and protection relays shall be taken from power pack (110V DC). This is to ensure te operation of breaker in case of power supply failure. (2 open and 2 close operations).
  - e) PT signal to the static Energy meter (only in the case of 11 KV entry point kiosks) 11KV Bus PT burden shall be suitably designed to cater the above needs also.

#### 6.0 Selector Switches:

- i) The rating and other features of the switches shall be suitable for the application. The number of positions and the number of contacts required for each switch shall be as indicated in the schemes enclosed.
- ii) Selector switches shall be stay put type, provided with properly designated escutcheon plates clearly marked to show operating position.
- iii) Terminals carrying potential above 120V shall be shrouded to prevent accidental contact with personnel.
- iv) Ammeter selector switches shall have make before break contacts.
- v) The switches shall be suitable for semi-flush mounting with the front plate and operating handle projecting out. All connections to the switches shall be from the back.

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- vi) The arrangement for front mounting of these devices shall be such as to make them reasonably dust free so as not to interfere with normal operation.

#### 7.0 Indicating Lamps:

- i) Indication lamps shall be complete with lens covers and holders.
- ii) Each lamp shall be fitted with a durable resistance integrally wired in series within the lamp. Alternatively, lamps with built in transformers are acceptable.
- iii) The lamp cover (lens) shall be translucent of red colour.
- iv) Bulbs and covers shall be interchangeable, easily replaceable from the front without the need for any special means.
- v) Terminals having potential above 120V shall be shrouded to prevent contact with personnel.

#### 8.0 Terminals:

- i) Terminals shall be stud type of copper material.
- ii) Terminals shall be provided with transparent cover(s).
- iii) Separate terminals shall be available for each termination of loop-in and loop-out power connections.
- iv) Terminals shall be suitable for ring type copper cable lugs of size depending upon the circuit rating.

#### 9.0 Labelling:

- i) Labels to identify all the main assemblies, sub-assemblies and components of the Kiosk shall be provided.
- ii) Name and rating plate/markings shall be provided as required by relevant standard applicable to each component/assembly to be identified
- iii) Labels shall be of two colour, three layer plastic material with matt or semi matt finish or of the anodized Aluminium sheet.
- iv) All labels other than "danger" or "warning" labels shall have black lettering on a white background. Danger label shall be as per applicable standard and shall not be fixed on to removable parts.



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- v) All labels shall be securely fixed on to the equipment by means of self-tapping screws or other approved means.
- vi) Stick-on type labels of good quality and permanent mounting shall be acceptable for internally mounted components only.

### 10.0 Surface Treatment:

- i) All metal parts and the surfaces (exterior & interior) of equipment, unless stated otherwise in case of reflectors, shall be degreased by dipping in hot alkaline solution and rubbed with wire brush to remove oil & scale from them & then rinsed in water. Alternatively, they may be shot/sand blasted.
- ii) Parts shall be pickled by dipping in hydrochloric acid tank to remove the rust from the surfaces formed during storage of sheets & then rinsed to remove traces of the acid. The cleaning and pre treatment of all metal parts shall be as per applicable standards.
- iii) All parts shall then be subjected to a coat of red oxide primer paint.
- iv) All inside and outside surfaces of panel shall be spray painted with synthetic enamel of the shade.
- v) The surfaces to be painted shall then be prepared by phosphatizing to protect them from further rusting & to create a good bond with the paint. The pretreatment shall conform to the applicable standard.
- vi) Paint thickness shall be as per applicable standard.
- vii) Electrostatic or powder painting shall be acceptable subject to purchaser's approval.
- viii) Wherever possible, finished parts shall be coated with peelable compound by spraying method to protect the finished product from scratches, grease, dirty and oily spots during handling and transportation.

### 11.0 Additional Requirements:

1. 1 No emergency trip push button (mechanical).
2. **Mimic:** A single line diagram showing the direction of power flow shall be drawn on the front of load break switch. The mechanical operation of switch shall



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automatically indicate ON/OFF status of both main switch as well as the earth switch in the mimic diagram.

3. 1 set of epoxy encapsulated copper busbar interconnection arrangement for transformer.
4. Fluorescent lamps for sufficient illumination shall be provided and for that power supply shall be provided from LT side of Substation.
5. DC Fluorescent lamps for emergency lighting shall be provided.

### **12.0 TECHNICAL REQUIREMENTS:**

#### **1.0 11 KV SWITCHGEAR SECTION**

- i) Thickness of sheet steel :
  - a) Partitions between panels : 2mm sheet steel
  - b) Front and rear hinged doors and top covers sides and bottom : 3mm sheet steel
- ii) Rated voltage : 3 Phase, 12 KV, 50 Hz
- iii) Continuous rated current at 50 deg C : 1000 A
- iv) Short circuit withstand Capability to switchboard Including busbars :
  - a) Short time rating : 18.4 KA (RMS) for 3 secs.
  - b) Dynamic rating : 47 KA peak
- v) Busbars :
  - a) Materials of busbars & rating : Copper, 1000 A for phase, Size of dropper Shall be same as main bus bars.
  - b) Temperature rise of busbars at rated current over 50 deg C ambient : 40 deg C



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- c) Busbar chamber partition : Cast resin bushings to be provided
- d) Busbar joints :
  - 1. Cadmium plated bolts and tinned surfaces.
  - 2. Flexible connection if required
- e) Insulation : 1.1 KV PVC sleeved
- f) Phase identification : Colour tapes
- g) Support insulators : Non-hygroscopic, non-tracking, resin cast insulators.
- vi) Insulation level
- a) Impulse withstand value : 75 KV (P)
- b) 1 min. PF withstand value : 28 KV (RMS)
- vii) Auxiliary connections : Silver plated, 16A plug and socket
- viii) Safety shutters : Automatically operated shutters
- ix) Accessories with each cubicle
- a) HT section illumination lamp with Switch : To be provided
- b) Space heater : 230V, AC, 50 Hz heater with control switch
- c) 3 Pin power socket with switch : to be provided
- d) Base channel : Base channel of minimum 100 x 50 mm with cross bracings and 19mm foundation bolts.
- e) Name plates, inscription plates for components, switches feeder identification : As specified



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- f) Flexible copper connections between hinged doors and cubicle for earthing : To be provided
- g) Breaker accessories visible and accessible from outside : Mechanical breaker position
- Breaker ON / OFF
  - Mechanical trip push Button accessible from Outside with panel door close.
  - Mechanical close push button
- h) Removable welded wire mesh behind the panel : To be provided wherever necessary.
- i) Danger notice boards and instruction plates : To be provided
- j) Operation counter : To be provided
- k) i) Components to be mounted on the front door of cubicle : Push buttons, control and selector switches (operating height shall not exceed 1800mm) lamps, meters, relays (all as per approved layout)
- ii) Components to be mounted on the outer door of Kioks : Nil
- l) Termination type at incomer : 3 phase, cable termination for 1 No. (3 x 95sq. mm) XLPE cable cable entry from bottom
- m) Cable terminations for outgoing feeders : 3 phase, cable termination for 1 No. (3 x 95sq. mm) XLPE cable
- Cable : Bottom cable entry at the rear Side of cubicle
- Control cable : Bottom cable entry at the rear Side of cubicle with necessary Shielding.

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- x) Safety clearances in air between phases and phase & earth : 127mm (Minimum)
- xi) Control schemes : As per specification
- 1.1 Breaker**
- i) System : 11 KV, 50Hz, 3Phase system neutral earthed
- ii) Highest system voltage : 12 KV
- iii) Design ambient : 50 deg C
- iv) Rated current in IP55 enclosure at 50 deg C ambient : 630A
- v) Symmetrical breaking capacity at 12 KV or less : 18.4 KA (RMS)
- vi) Making capacity and dynamic stability rating : 47 KA peak
- vii) Short time current rating : 18.4 KA for 3 sec
- viii) Operating duty : 0-3 min- co-3 min – co
- ix) Total break time : Less than 4 cycles
- x) Critical current : Shall be restrike free
- xi) Arc extinction medium : Vacuum
- xii) First pole to clear factor : 1.5
- xiii) Operating Mechanism
  - a) Type of closing : Spring charged stored energy manual independent closing
  - b) Method of closing : Manual and electrical
  - c) Rated voltage of shunt trip : 110 V DC



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- d) Operating range : 70 – 110% of rated voltage
- xiv) No. of poles / Phase : One
- xv) No. of breaks / pole : One
- xvi) Auxiliary contacts : 4 No + 4NC (Silver plated contacts)
- xvii) Rating of auxiliary contacts : 5A at 110 V AC
- xviii) Wiring of auxiliary contacts : All auxiliary contacts wired to terminal block, external to draw out truck.
- xix) Material of fixed and moving contacts : Silver plated copper contacts with contacts self. Aligning feature having contact pressures
- xx) Interlock : Door interlock with breaker
- xxi) Breaker fully type tested as per : IEC – 56 and IS 2516
- xxii) There should be provision for shunt trip and series trip. Shunt coil should be rated for 110 V DC.

### 1.2 Current Transformer

- i) Type : Resin cast, bar primary
- ii) Ratio, burden accuracy class, cores : a) 50 / 25 / 5 / 5A, 15VA, class 1.0 for metering, 5P15 for protection for transformer feeder.
- iii) Short time rating : 18.4 KA for 3 sec.
- iv) Dynamic stability current : 47 KA peak
- v) Insulation level
  - a) Impulse withstand voltage : 75 KV peak
  - b) PF withstand voltage : 28 KV (RMS)



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- vi) Thermal overload capacity : 120% continuous
- vii) Applicable standard : IS 2705

**1.3 Potential transformers**

- i) Type : Resin cast, natural air cooled
- ii) Ratio :  $\frac{11KV}{3} / \frac{110 V}{3}$
- iii) Connection : Three single phase PT with suitable power pack for DC shunt trip
- iv) Rated burden : 20VA / Phase, class 1.0
- v) Voltage factor : 1.1 continuous, 1.5 for 30sec
- vi) Neutrals : Neutrals to be brought out for earthing on HV and LV side
- vii) **Insulation level** :
  - a) Impulse withstand voltage : 75 KV (P)
  - b) PF withstand voltage : 28 KV RMS
- viii) **Protection**
  - a) HV side : 2 Amp. HT HRC fuse for each phase
  - b) LV side : Link type HRC fuse
- ix) Mounting of PT : Fixed type
- x) Applicable standard : IS 3156

**1.4 Indicating meters**

- i) Type of meters : Ammeters, voltmeters
- ii) Type of movement : Taut band

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- iii) Size : 96 x 96 mm
- iv) Dial finish : White painted dial with pointer type needle
- v) Mounting : Flush mounting
- vi) Accuracy Class : 1.0
- vii) Voltage / current : 110 V PT, 5A CT sec current
- viii) Range : As specified
- ix) Applicable standard : IS 1248

**1.5 Auxiliary equipment**

- (i) Protection relays : Drawout type aux. Voltage 110 V DC
- (ii) Control switches : 16A, 440V AC quick make quick break, flush mounted stayput / spring return, IS4064
- (iii) Push buttons : 10A, 440V, 1NO +1 NC flush mounted, IS 1336
- (iv) Indicating lamps : 110V AC, Clustered LED type.
- (iv) Control circuit protection Fuses : Link type HRC fuse with Insulating base with holder
- (vi) Control schemes : As per specification

**1.6 11KV Load break switch**

- (i) Type of Load break switch (fixed /drawout) : Fixed
- (ii) Service (indoor / outdoor) : Outdoor
- (iii) Design ambient : 50 deg C
- (iv) Application standard : IS 4710



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- (v) Installation : Integral part of the ring main switch board
- (vi) Rated voltage : 11 kV
- (vii) Rated frequency : 50 Hz
- (viii) Max. continuous voltage upto which load break switch can be used : 12 kV
- (ix) Rated current inside cubicle based at specified ambient temperature : 400A quick make and quick break
- ix) **Operating mechanism**
  - a) Type of arc quenching : Air break
  - b) Contact material : Silver plated copper
  - c) Provision of stored energy spring charged mechanism : To be provided
  - d) Mechanical trip push button : To be provided
- x) **Switching rating at rated voltage**
  - a) Breaking capacity : 630 Amps, 0.7 PF
  - b) Breaking capacity of magnetizing current of transformer : 15 Amps
  - c) Capacitor switching capacity : 60 Amp, 12 kV
  - d) Making Capacity : 47 kA (Peak)
  - e) Electrodynamic withstand capability (without HRC fuses) : 47 kA (Peak)
  - f) Short time rating : 18.4 kA for 1 sec

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xii)	<b><u>Insulation level</u></b>	:	Impulse with PF withstand stand voltage kV (1.2 / 50) kV (RMS)
a)	Across the isolating distance	:	85            45
b)	To earth & between poles	:	75            35
xiii)	<b><u>Min. clearance in air in min</u></b>		
a)	Between phases	:	127
b)	To earth & between poles	:	127

**II DRY TYPE RESIN CAST TRANSFORMER:**

**1.0 General**

The transformer shall be 500 KVA, 11/0.433 KV, 3Ø, two winding, AN, Dyn 11 Transformer suitable for indoor installation with ± 5% off circuit tap changer in steps of 2.5% as per Technical Specification and IS 2026 with all fittings and accessories enclosed . The transformer is fed from HT switchgear. On the LT side, it is connected to LT switchboard through busbar.

**1.1 Transformer Rating and Over loading**

- (i) Transformers shall be capable of delivering the rated current at a voltage equal to 105 percent of the rated voltage without exceeding the temperature limits.
- (ii) Transformer shall operate satisfactorily without injurious heating at rated kVA, at any voltage within ± 10% of the rated voltage of the particular tap.
- (iii) Transformers shall be designed for 50 Hz. +3%, - 5%, unless otherwise specified in data sheet.
- (iv) Transformers for two or more limits of voltage or frequency or both shall operate satisfactorily at its rated kVA without injurious heating under all the rated conditions of voltage or frequency or both, provided increase in voltage is not accompanied by decrease in frequency.



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- (v) Transformers shall be suitable for over loading as per IS 6600, unless specified otherwise. Off circuit tap switch, terminal bushings, other auxiliary components / equipment shall be designed for maximum permissible overloading. Short time over loading to the extent of 50% shall be considered for this purpose, for all transformers unless specified otherwise.

### 1.2 Short Circuit withstand capability

- i) Transformers shall be capable of withstanding thermal and mechanical stresses during 3 phase, line to line, double line to earth and line to ground dead short circuits at the transformer terminals, for a period specified, without any injury. Temperature of the windings prior to the short circuit to be considered for this shall be that corresponding to the maximum permissible value applicable to the overloading cycle specified.
- ii) For this purpose, infinite supply system and solidly earthed systems shall be considered.

### 1.3 Flux Density

- i) The maximum flux density in any part of the core and yokes at normal voltage and frequency, shall be such that the flux density under over voltage condition as per clause 4.1.2 shall not exceed the maximum permissible values for the type of laminations used and core construction adopted.
- iii) In case of transformers with variable flux, the voltage variation, which would affect flux density at every tap, shall be kept in view while designing the transformer.
- iv) Transformers shall be designed to withstand the following overfluxing conditions:

110% of maximum density : Continuous for all transformers corresponding to rated voltage.

### 1.4 Magnetic circuit

- (i) The cores shall be constructed from high grade, low loss, high permeability cold rolled non-ageing grain oriented silicon steel laminations.

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- (ii) Thickness of laminations shall be 0.3 mm or less surface insulation of laminations shall be rust resistant and have high interlaminar resistance. Insulation shall withstand annealing temperature as high as 850 deg.C. The insulation shall be resistant to the action of hot cooling medium.
- (iii) The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 2000V AC for one minute.
- (iv) Wherever the CRGO sheets are punched or sheared into laminations, laminations shall be annealed in a non-oxidising atmosphere to relieve stresses and restore the original magnetic properties of CRGO sheets. The laminations shall be free of all burrs and sharp projections.
- (v) The design of magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and production of flux components at right angles to the plane of the laminations which may cause local heating.
- (vi) Ducts shall be provided where necessary to ensure adequate cooling. The winding structure and major insulation shall not obstruct the free flow of cooling medium through such ducts.
- (vii) All steel sections used for supporting the core shall be shot or sand blasted after fabrication.
- (viii) The finally assembled core and coil assembly shall be rigidly fixed to the tank to avoid shifting during transport, handling and short circuits. Adequate provision shall be made for lifting the complete core and coil assembly.
- (ix) The supporting frame work of the cores shall be so designed as to avoid the presence of pockets which would prevent complete emptying of the tank through the drain valve, or cause trapping of air during filling.

**1.5 Windings**

- (i) Transformers shall be suitable for solidly earthed neutral system.
- (ii) The coil clamping arrangement and the finished dimensions of any ducts shall be such as to not impede the free circulation of cooling media through the ducts.



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- (iii) The windings / and connection of transformer shall be braced to withstand shocks, which may occur during transport or due to short circuits, repeated peak loads and other transient conditions during service.
- (iv) Windings shall be subjected to a shrinkage treatment before final assembly, so that no further shrinkage occurs during service. Adjustable device shall be provided for taking up any possible shrinkage of coils in service if required.
- (v) The conductors shall be transposed at sufficient intervals in order to minimize eddy currents and equalize the distribution of currents and temperature along the windings.
- (vi) Coil clamping rings shall be of steel or of a suitable insulating material. Axially laminated material other than bakelite paper shall not be used.
- (vii) Completed core and winding assembly shall be dried in full vacuum to eliminate presence of moisture. After drying process, the full assembly shall be impregnated immediately.
- (viii) No strip conductor, wound on edge shall have a width exceeding six times its thickness.
- (ix) The winding material shall be copper
- (x) Windings shall not have sharp bends, which might damage insulation and / or produce high dielectric stresses.
- (xi) Coils shall be supported using dried and high – pressure compressed wedge type insulation spacers at frequent intervals.
- (xii) All threaded connections shall be locked. Leads from the winding to the terminal board and bushings shall be rigidly supported to prevent injury during short circuits / vibration.
- (xiii) Permanent current carrying joints in the windings and leads shall be welded or brazed.
- (xiv) Clamping bolts for current carrying parts inside the transformer shall be compatible with liquid under all service conditions.



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### 1.6 Tappings

- (i) Tapping as specified shall be provided on the higher voltage winding of each transformer and shall be arranged so as to maintain as far as possible the electromagnetic of the windings.
- (ii) The Taps shall be changed by links.

### 1.7 Temperature Measurement

- i) Winding temperature shall be monitored with RTD's. The RTD leads shall be brought out and connected to temperature scanner.
- ii) Each scanner shall have potential free Normally Open Contacts for alarm and trip contacts. Temperature setting of each contact shall be independently adjustable at site. A manual reset type maximum temperature indicator shall be provided for each scanner.
- iii) All contacts shall be rated to make 0.5 A (min) and break 0.2 A (min) at 110 V AC. All contacts shall be wired to marshalling box.

### 1.8 Internal earthing arrangements

All metal parts of the transformer with the exception of individual core laminations core bolts and associated individual clamping plates shall be earthed internally

### 1.9 Tests

All the transformers shall be subjected to the following routine tests and one transformer shall be type tested at the manufacturer's works Test procedure as per IS-2026 shall be adopted.

- i) Routine Tests
  - 1 Transformer shall be fully assembled with all fittings and accessories including wheels to ascertain that all the parts fit correctly
  - 2 Resistance of each winding of each phase at principal tap and at all other taps

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3. Voltage ratio at all taps.
4. Checking of voltage vector relationship.
5. Impedance voltage at rated frequency and principal tap, lowest and highest taps.
6. Load loss at rated current.
7. Zero sequence impedance at principal tap, rated frequency.
8. No load loss and no load current at rated frequency and 100%, 110% of rated voltage on HV side. Test shall be repeated with 415V, 3 Phase supply connected to LV side (if the LV side rated voltage is more than 415V). No Load & Load Losses shall be as per CBIP / IS with tolerance.
9. One minute power frequency withstand voltage test.
10. Induced over voltage withstand test.
11. Polarity check, ratio check, measurement of secondary winding resistance, excitation, characteristic curve, insulation resistance of all bushing CTs.
12. Calibration of winding temperature indicators,

ii) Type test

13. Temperature rise test.
14. The Contractor shall submit Type Test certificates for similar capacity Transformer supplied by him elsewhere for (i) Short time withstand capability Test and (ii) Impulse Voltage withstand Test. In case Type Test certificates for similar equipment are not available the same will be conducted in the presence of the Purchaser or his Representative if Purchaser so desires without any financial implications to the purchaser.

**2.0 Additional Requirements:**

1. Fluorescent lamps for sufficient illumination shall be provided and for that power supply shall be provided from LT side of Substation.

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2. DC Fluorescent lamps for emergency lighting shall be provided.

**3.0 TECHNICAL PARTICULARS OF 11 / 0.433 kV Transformer**

1. Power supply system in which transformer is to be used.
  - a) Primary side (HV) max. voltage : 12 kV
  - b) System earthing
    - Primary side (HV) : Solidly earthed
    - Secondary side (LV) : Solidly earthed
2. Max. and min. 3 phase and ground Fault levels
  - Primary side (HV) : 350 MVA
3. Direction of power flow : Bi-directional
4. Transformer application : industrial distribution
5. Transformer type
  - a) indoor / outdoor : Indoor
  - b) Dry type / oil filled : Resin cast, Dry type
  - c) Core type / shell type : Core type
6. Auto wound / Two winding / three Winding : two winding
7. Number of phases : Three
8. Rated frequency : 50Hz
9. Rated no load voltage :
  - HV winding : 11kV
  - LV winding : 0.415 kV

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- |    |                                                                                        |                                               |
|----|----------------------------------------------------------------------------------------|-----------------------------------------------|
| 10 | Cooling                                                                                |                                               |
|    | a) Cooling medium                                                                      | Air                                           |
|    | b) Method of cooling                                                                   | AN                                            |
| 11 | Rated kVA at no load voltage and Principle tap                                         | 500 kVA                                       |
| 12 | overloading as per IS 6600                                                             | Required                                      |
| 13 | Max. temp. rise at rated kVA and Principle tap                                         |                                               |
|    | a) Top oil by thermometer method Over design ambient temp of 50 Deg C                  | 50 deg C                                      |
|    | b) Any winding (HV & LV ) by resistance method over design ambient temp. of 50 deg C   | 55 deg C                                      |
| 14 | <u>Permissible Variations</u>                                                          |                                               |
|    | a) Percentage impedance voltage at rated current frequency, principle tap tap 75 deg C | 4.5 %                                         |
|    | b) Frequency variation                                                                 | +3%, -5% of 50 Hz                             |
|    | c) Voltage variation voltage                                                           | +/- 10% of rated                              |
| 15 | <u>Tappings</u>                                                                        |                                               |
|    | a) Off-Circuit / ON load                                                               | Off Circuit                                   |
|    | b) Manual / Automatic                                                                  | Manual, by changing links, by isolating Power |



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- c) No. of Steps : +5%, +2.5%, +0 -  
2.5% -5%
- d) Percentage variation / step : 2.5 %
- e) Winding in which tapings are required : HV
- 16 Short circuit withstand capability of transformer on any tapping for 3 phase and line to ground faults across LV winding : Not less then 2 secs
- 17 Insulation
  - a) One minute power frequency withstand voltage
    - HV winding : 28 kV RMS
    - LV winding : 2.5kV RMS
  - b) 1.2 x 50 micro second impulse withstand voltage level
    - HV winding : 75 kV Peak
  - c) Induced over voltage withstand
    - HV winding kV (RMS) : As per IS 2026 Part III
    - LV winding kV (RMS) : - do -
- 18 Windings insulation category
  - a) HV – uniform / non – uniform : Uniform
  - b) LVL – uniform / non – uniform : Uniform
- 19 Winding data
  - a) No. of winding : Two

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- |    |                       |                                               |
|----|-----------------------|-----------------------------------------------|
| b) | Winding material      | Copper                                        |
| c) | Winding connection    |                                               |
|    | - HV winding          | Delta                                         |
|    | - LV winding          | Star with neutral brought out fully insulated |
| d) | Vector groups (HV-LV) | Dyn 11                                        |

20 Core laminations

- |               |               |
|---------------|---------------|
| Type          | CRGO          |
| Material      | Silicon steel |
| Thickness, mm | 0.3           |

- |                                                        |                                                                                                                                                    |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 21 Diagram required:                                   | yes                                                                                                                                                |
| 22. Parallel operation:                                | Suitable for parallel operation                                                                                                                    |
| 23. Transformer size & limitation & Construction data: |                                                                                                                                                    |
| i. Type of installation:                               | Indoor                                                                                                                                             |
| ii. Terminal Details:                                  | HT & LT suitable for Bus bar connection                                                                                                            |
| iii. Fittings and accessories required:                | Lifting lugs, name plate, terminal marking plate, bi-directional rollers, earthing lugs, winding temperature indicator with alarm and Trip contact |
| 24. Class of Protection:                               | IP23                                                                                                                                               |



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#### 4.0 OTHER DETAILS:

**1. Temperature rise:** Temperature rise of the transformer above the cooling air temperature when tested at the rated KVA shall not exceed the limit in table 4 of IS 11171/1985 reaffirmed in 1991.

**2. General:** The transformer shall be suitable for continuous run and for all type of loads with high efficiency, the transformer shall conform to IS 2026/1997 IEC 726 & IS 11171 / 1985 reaffirmed in 1991 for dry type transformers as amended up to date. The supplier should give sufficient spacing between various terminals so that it can be properly terminated.

**3. RTD'S:** RTD's shall be embedded in transformer winding (both primary and secondary side) and the lads shall be brought out. The bidder shall supply Temperature Scanner to read the winding temperature. The temperature scanner shall have provision for generating "winding temperature high" trip signal to HT switch gear. The temperature scanner shall be mounted in such a way that operator has access to monitor the temperature periodically.

### III. LT SECTION

#### 1.0 General

LT Cubicle shall consist of following:

- i. 1 No. 415V, 50 KA 3 pole ACB of suitable rating with shunt trip release, auxiliary contacts, manual operated type with in-built overload and short circuit releases (magnetic-thermal releases) along with all associated accessories for incomer to LT Distribution board.
- ii. Necessary Bus bar interconnections for LT panel with secondary terminals of the transformer.
- iii. 3 Nos. indicating lamps (R Y B) with necessary fuses and toggle switches, 1 No. 0-500 V voltmeter with selector switch and ammeter with selector switch of suitable rating with matching CTs along with necessary interconnections with suitable size PVC insulated multi strand copper conductor cable.

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- iv. Energy Meter shall be provided.
- v. Outgoing feeders are indicated in the scheme provided.
- vi) The distribution board is intended to provide power supply feeders to various LT distribution Boards and to feed various contractors LT boards as shown in scheme.
- vii) The Board has MCCB as outgoing feeders.
- viii) The Board shall be of metal clad single busbar, fully compartmentalized,
- ix) The incomer and the associated items shall be housed in a partitioned panel, whereas the rest of the outgoing feeders shall be neatly distributed and compartmentally modular construction need to be adopted. However, it shall be ensured that sufficient working clearance and adequate space for cabling is provided.
- x) LT Side Instrument Transformers, indicating instruments, control circuits, Control Wiring and ferrules, inscription, shall be as per the specification indicated under HT switchgear.
- xi) The rated continuous current of the equipment and components shall be as given in the schemes. These ratings shall be obtained with the components mounted in their housing as in service without exceeding the permissible temperature rise.
- xii) Defeat interlock shall be provided for the units comprising of switch or moulded case circuit breaker as a means of isolation device, such that it is possible to open the door with device ON. It shall not be possible to close the door till the interlock has been reinstated.
- xiii) LT side shall be fitted with a fluorescent lamp.
- xiv) Bottom of LT Board shall have removable gland plates in two pieces to accommodate minimum 15 runs of LT Armoured cable, size varying from 120 sq. mm to 300 sq. mm

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## 2.0 Busbar and Connections

- i) Busbars shall be made of E91E grade aluminum alloy, Cross section of bus bars selected shall ensure the thermal rating and dynamic stability for the shortcircuit rating specified.
- ii) High tensile cadmium plated bolts with suitable spring washers shall be used busbar joints.
- iii) Busbars shall be polyeter sleeved with heat shrunk insulation. Wire mesh shall be provided wherever necessary to prevent inadvertent touching of busbars.
- iv) Bus bars shall be supported on non-hygroscopic and non-inflammable insulators of material such as glass reinforced moulded plastic material, epoxy cast resin etc. Separate supports shall be provided for each phase of the bus bars. Insulation level of neutral bus bar shall be same as that of phase bus bars.
- v) Bus bars shall be contained in a separate vermin-proof compartment within the Kiosk and shall have bolted sheet steel covers for providing suitable access.
- vi) Busbar clearances in the air shall be as per applicable standard for 500V, 3 phase system.
- vii) Temperature for busbars, droppers and connections shall not exceed 90°C for an ambient of 50°C while carrying maximum continuous current.
- viii) The busbar, busbar connections and supports shall have sufficient strength to withstand thermal and electromechanical stresses produced by the specified short circuit level of the system.
- ix) Busbars shall be capable of carrying the short time current. The duration of short-time current shall be 1 sec. For the specified current and duration, there shall be no damage to the equipment.
- x) Main busbars and connections shall be prominently marked and displaced for standard sequence counting from rear to front, top to bottom, or left to right as viewed from the switching device operating mechanism side.

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- xi) Busbars and connections shall be provided with colour coded PVC sleeves. All live parts shall be properly shrouded with insulating material.
- xii) Earth busbar shall be provided separately. Material of earth busbar shall be GI.

**3.0 LT Circuit Breakers (ACB)**

- i) The breaker which is provided in incomer shall be of triple pole, air break and of non-drawout type. All current carrying contacts or the breaker shall be silver plated. The main contacts shall have ample area and contact pressure for carrying the rated current of the circuit breaker. Arc chute shall be provided on each pole and so fitted that it can be easily removed for inspection of the main contacts.
- ii) The breaker shall have independent manual spring charged stored energy mechanism. The operating mechanism shall be trip free and designed to reduce mechanical shocks to a minimum during operation. The operating mechanism shall operate normally even when the circuit breaker is closed on to fault.
- iii) All breakers shall be provided with mechanical trip push button, accessible from outside.
- iv) All mechanism shall be designed to give trouble free service over extended periods and shall not deteriorate with normal usage, require attention more often than every 1000 operations or once a year whichever is earlier. Each breaker shall be equipped with mechanical 'ON' 'OFF' indications visible from the front of the panel.
- v) ACB shall be provided with earth fault, earth leakage and over current protections.
- vi) ACB shall be of triple pole construction arranged for simultaneous three pole manual closing and opening and for automatic tripping at short circuit and overload. Neutral link shall be provided for Kiosks.
- vii) Operating mechanism shall be quick make, quick break and trip free system.



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- viii) The ON, OFF & TRIP positions of the ACB shall be clearly indicated so as to be visible to the operator when mounted as in service. Operating handle shall be provided in front of the Kiosk.
- ix) ACB shall be capable of withstanding the thermal stresses caused by overloads and short circuits. The maximum tripping time under short circuit shall not exceed 20 milli seconds. Rated breaking capacity (rms) at 415 V is 10kA. Rated making current (peak) is 21kA.
- ix) ACB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.

#### 4.0 MODULAR CASE CIRCUIT BREAKERS (MCCB):

- i) Modular case circuit breakers (MCCBs) shall be provided for use in lieu of switch fuse for Kiosk incomer.
- ii) MCCBs shall be of triple pole construction arranged for simultaneous three pole manual closing and opening and for automatic tripping at short circuit and overload. Neutral link shall be provided for Kiosks.
- iii) Operating mechanism shall be quick make, quick break and trip free system.
- iv) The ON, OFF & TRIP positions of the MCCB shall be clearly indicated so as to be visible to the operator when mounted as in service. Operating handle shall be provided on front of the Kiosk.
- v) MCCBs shall be capable of withstanding the thermal stresses caused by overloads and short circuits. The maximum tripping time under short circuit shall not exceed 20 milli seconds. Rated breaking capacity (rms) at 415 V is 10kA. Rated making current (peak) is 21kA.
- vi) MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.

#### 5.0 INDICATING METERS:

Shall be as per HT Switch Gear. Section 2.4. Page 4.

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**6.0 CURRENT TRANSFORMERS:**

Shall be as per HT Switch Gear. Section 5.1; Page 11.

**7.0 CABLE GLANDS:**

i) Cable glands of suitable sizes shall be supplied for the following cables.

3 ½ C x 120 sq. mm – 3 Nos.

3 ½ C x 150 sq. mm – 3 Nos.

3 ½ C x 180 sq. mm – 4 Nos.

ii) Cable glands shall be single compression type of brass material.

ii) Cable glands shall be Nickel plated.

iv) Rubber components used in the gland shell of neoprene.

i) Name/trade name of manufacturer, type no, and applicable range of outer diameter of cable shall be engraved/indelibly printed on the cable gland.

**8.0 CABLE LUGS:**

i) Cable lugs of suitable sizes shall be supplied for the following cables.

3 ½ C x 120 sq. mm – 5 sets.

3 ½ C x 150 sq. mm – 4 sets.

3 ½ C x 180 sq. mm – 4 sets.

ii) Cable lugs shall be of tinned copper

iii) Name/trade name and size of lug shall be engraved/indelibly printed on each cable lug.

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### 9.0 Additional Requirements:

1. Fluorescent lamps for sufficient illumination shall be provided and for that power supply shall be provided from LT side of Substation.
2. DC Fluorescent lamps for emergency lighting shall be provided.

### 10.0 TECHNICAL PARTICULARS OF LT SWITCH BOARD

#### 1.0 LT SWITCH BOARD

- |    |                                                                                     |   |                                                          |
|----|-------------------------------------------------------------------------------------|---|----------------------------------------------------------|
| a) | Rated voltage and frequency                                                         | : | 415 V, 3-phase, 4-wire, 50 Hz<br>maximum voltage : 500 V |
| b) | Continuous current rating at design ambient temperature                             | : | 800 A at 50°C with IP52 enclosure with canopy.           |
| c) | (i) Type of enclosure as per IS 2147                                                | : | IP52 with canopy                                         |
|    | (ii) Min. thickness of sheet steel                                                  | : | 2 mm, 3mm for outer surface                              |
| d) | Applicable standards                                                                | : | IS 2147, 8623                                            |
| e) | Design ambient temperature                                                          | : | 50°C                                                     |
| f) | 1 sec. Short time rating of switch board with min. busbars, feeder busbars kA (RMS) | : | 20 kA                                                    |
| g) | Dynamic through fault current with complete busbars, kA (Peak)                      | : | 47 kA                                                    |
| h) | Incoming termination of LT Switchboard                                              | : | Cable 4 (3 ½ x 120) Aluminium                            |
| i) | Incoming termination top/bottom                                                     | : | Bottom                                                   |

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- j) Outgoing feeder cable entry: Bottom  
top/bottom
- k) Min. clearances at front and: 1.5m/1m  
back of switchboard
- l) Min. clearances in air in mm
  - i. Between phases : 25.4
  - ii. Between live parts and : 19.0
- m) 1 minute PF withstand : 2.5 kV  
voltage
- n) Bus Bar
  - i. Busbar material : E91E grade aluminum
  - ii. Continuous rating at Design ambient temperature
    - (a) Main bus bars : 800A
    - (b) Bus connections to circuit breakers : As per rated currents of breakers
  - (iii) Temp. rise at rated : 40 deg. C over 50 deg. C  
Continuous current of the bus bars in the bus bar chamber
  - (iv) Type of bus bar : Resin cast / fibre glass  
insulators
- 1.1 Breakers
  - (i) Type of breakers : Fixed type air breakers
  - (ii) Standards applicable : IS 2516

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- (iii) (a) Rated service voltage : 415V, 3 Ph. 50 Hz
- (b) Highest system voltage : 500V, 3 Ph. 50 Hz
- (iv) Rated current at design ambient for breakers : 800 A
- (v) Symmetrical breaking capacity in kA (RMS)
  - (a) at 415V, 0.25 PF : 20 kA RMS
  - (b) at 440V, 0.25 PF : 20 kA RMS
- (vi) Making capacity kA (peak) : 47 kA peak
- (vii) Capacitor breaking capacity:
  - at 440V Incomer : 600A (min.)
  - Outgoing : 300 A (min.)
- (viii) 1 sec. short time rating kA (RMS) : 20 kA RMS
  - (a) With release in any setting : 20 kA RMS
- (ix) Thermal release setting ranges (temp. compensated) : 600-120 A
- (x) (a) Short circuit release range : 2-4/3-6kA
- (b) Short circuit release timer setting range : 0.1 to 0.5 sec. mechanical timer/static trip release
- (xi) Operating mechanism
  - (a) Fixed trip/trip free : Trip free
  - b) Spring assisted /spring Charged stored energy : Stored energy mechanism



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- c) Electrical operation / Manual operation : Manual
- xv) Auxiliary contacts
  - a) Type : Silver plate copper contents
  - b) Number : 6 NO + 6 NC
  - c) Breaking capacity at : 5A  
440 V AC
- 1.2 MCCB**
  - (i) Type of MCCB : Fixed type air break
  - (ii) (a) Rated service voltage : 415V, 3 Ph. 50 Hz
  - (b) Highest system voltage : 500V, 3 Ph. 50 Hz
  - (iii) Rated current at design ambient for breakers : 63A - 400A ( as per scheme )
  - (iv) Thermal release setting ranges (temp. compensated) : 80% - 150%
  - (v) (a) Short circuit release range : as per standard
  - (b) Short circuit release timer setting range : 0.1 to 0.5 sec. mechanical timer/static trip release
  - (vi) Operating mechanism
    - Electrical operation / Manual operation : Manual
  - (vii) Auxiliary contacts
    - a) Type : Silver plate copper contents



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- b) Number : 2 NO + 2 NC
- c) Breaking capacity at : 5A  
440 V AC

### 1.3 Current transformers

- (i) Type : Resin cast / tape wound
- (ii) ratio : 1000 / 5A
- (iii) Accuracy class : 1.0
- (iv) Burden : 15 VA

### 1.4 METERS                      AMMETER                      VOLTMETER

- (i) Type                      Taut band                      Taut band
- (ii) Accuracy class      1.0                              1.0
- (iii) Size                      96 x 96                              96 x 96

### 1.5 Indication lamp

- (i) Type : LED

### 1.6 Feeder Details

- (i) Incomer feeder

- a) Fixed type ACB of specified rating

- Stored energy, spring charged closing mechanism,  
manually operated

- Series trip direct acting temperature compensated thermal

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release and magnetic short circuit release with mechanical timer. Independently adjustable settings as specified

- Static trip release as alternative can also be quoted
- Mechanical ON/OFF indication

- (b) 3 CTs, class 1.0, resin cast, ALF-5 for metering with CT ratio as per drawing.
  - (c) 96 x 96 mm, taut band, circular scale, ammeter, voltmeter to read phase and line voltages, class 1.5
  - (d) 1 Nos. Ammeter with selector switch and 1 No. Voltmeter with selector switch with 'OFF' position to read line currents and voltages.
  - (e) 3 Nos. tripped on fault/trip circuit healthy lamp (with push button).
  - (f) Auxiliary relays, control circuit protection, space heater, accessories for terminations, HRC fuses etc. as required.
- (ii) Outgoing feeders :MCCB's as specified below.
- 400 A 3 Pole with thermal release setting : 2 Nos
  - 200 A 3 Pole with thermal release setting : 2 Nos
  - 100 A 3 Pole with thermal release setting : 3 Nos

#### **GENERAL REQUIREMENTS:**

#### **GUARANTEED PERFORMANCE REQUIREMENTS:**

- i) The vendor shall guarantee satisfactory performance of the equipment supplied under all conditions and requirement as laid down by this specification.

#### **TESTING AND COMMISSIONING**

- i) Routine tests as per relevant IS standards to be conducted at works and at site. Test certificates shall be provided.
- ii) Type test certificates for identical equipment shall be provided.
- iii) All fittings, fabrications, hard wares etc. as specified shall be inspected and tested in accordance with IS recommendation. Type test certificates from National Test House or from reputed agency shall be considered.

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iv) The testing shall be done in accordance with the applicable Indian Standards and codes of practice. The following test shall be specifically carried out for all lighting installation.

- a) Insulation resistance.
- b) Testing of earth continuity path.
- c) Polarity test of single phase switches.

### 3.0 PACKING:

The material shall be packed as per manufacturers standard. Packing procedure shall be to the purchasers approval.

### 4.0 OTHER REQUIREMENTS:

- i) Vendor shall submit the following only with offer for evaluation.
  - a) Quality plans (QP).
  - b) Bought out quantity (BOQ).
  - c) Proposed open general arrangement (OGA) of Kiosk.

### 5.0 DRAWINGS

The following drawings shall be submitted for approval as per agreed schedule.

- a. Dimensional GA drawings of switch board indicating busbar arrangement, foundation details, gland plate location.
- b. Front view of switchboard indicating component locations
- c. Single line schematic diagram indicating feeder details
- d. Component specification details
- e. List of inscriptions



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- f. Internal wiring diagrams.
- g. Terminal plan and external connection diagram.
- h. Cross sectional drawings cubicle indicating details of busbar chamber, cable chamber, breaker chamber etc.
- i. Operation and maintenance manuals,

### 6.0 PAINTINGS

The switch unit cubicle shall be furnished with colour code to be indicated at the time of drawing approval conforming to IS 5-1961 latest. The sheet

metal parts shall be subjected to following pre-treatment before final painting.

- a) Degreasing
- b) Pickling for complete rust removal
- c) Phosphating
- d) Corrosion resistant primer painting. Two final coats spray painting shall be given.
- f) The cubicle shall be painted with colours as follows:-

Internal – Glossy white

External – dark Grey