

INDIAN MEDICINES PHARMACEUTICAL CORPORATION LTD.**CORRIGENDUM -01**

(Technical Specification for BOQ Item No. 1.1nad UPS BOQ Item No.7.6)

Subject: Modernization, Upgradation & Expansion of existing Plant facilities at IMPCL, Mohan (Package –II- Electrical Substation, DG Sets and other Electrical works)**Tender No: HLL/IDN/IMPCL/2013/14/02****Technical Specifications given at Page no 4 to 18, Vol-III: Technical Specifications Sub Head 3.00.0 SCOPE OF WORK under 3.01.0 Scope of Supply stands modified.SF6 Circuit Breaker is replaced by Vacuum Circuit Breaker(VCB) and the Technical Specifications for the HT Panel with VCB item no.1.1 shall be as follows:****3.00.0 SCOPE OF WORK****3.01. 1 HT SWITCHGEAR**

This specification covers the design, manufacture, shop floor tests, type and routine tests and delivery of **INDOOR HV switchgear of 11kV voltage rating. The type of breaker, fault level rating etc, shall be as per the specific** requirements. The equipment to be offered under this specification shall be of proven design

3.01. 2 STANDARDS

In general the equipment shall conform to all relevant IS standards, some of which are listed below. In case of any contradiction between the IS/IEC and this specification, the more stringent of the two shall apply.

| | |
|-------------------|---|
| IS 2099 | Bushings for alternating voltages above 1000V. |
| IS 13118 | AC Circuit Breakers |
| IS 2705 | Current Transformers |
| IS 3156 | Voltage Transformers |
| IS 3427 | Metal enclosed switchgear & control gear for voltages above 1000V up to and including 52000V |
| IEC 60056 | HV alternating current circuit breakers. |
| IEC 60137 | Bushings for alternating voltages above 1000V |
| IEC 60298 | AC metal enclosed switchgear and control gear for voltages above 1kV up to and including 72.5 kV. |
| IS 13947 (Part-I) | Degree of protection for enclosure and control gear standards |
| IS 3842 | Specification for electrical relays for AC system |
| IS 2208 | Specification for HRC cartridge fuse links up to 650V |
| IS 5082 | Wrought Aluminum and Aluminum alloys, bars, rods, tube and sections for electrical purposes |
| IEC 60694 | Common clauses for high voltage switchgear |
| IEC62271-100 | High voltage switchgear and control gear |

3.01. 3 CONSTRUCTION

The switchgear units shall be designed, manufactured and tested in accordance with relevant Indian Standard /IEC specifications. The panels shall be metal enclosed, epoxy coated, with circuit breaker in fully draw out (on floor) design. The insulators shall be made of high epoxy resin moulding. The bus bars and cable chambers shall be housed in separate chambers. The bus bar and cable chambers should be fitted with bolted covers with gaskets and should be fixed to avoid direct access to live parts immediately after opening respective covers. The bus bars and jumper connections shall be insulated to full maximum operating voltage. The design of the board shall permit further extension at both ends. The cubicle shall be designed for IP4X protection.

The bus bars and connectors shall be made of high conductivity copper. The bus bars shall be amply sized to carry the rated continuous current under the specified ambient temperature without exceeding the total temperature of 85 deg. C.

The bus bars and their connections shall be capable of withstanding, without damage, the thermal and mechanical effects of through fault currents equivalent to the short time rating of the switchgear.

3.01. 4 Safety Shutter Devices

- a. A set of metallic shutters shall be provided to cover each 3-phase group of stationary isolating contacts. Each set shall be capable of being individually operated and individually padlock closed.
- b. The shutter shall open automatically by a positive drive initiated by the movement of the circuit breaker.
- c. The closing operation shall also be automatic, either by positive drive or by two independent means, each capable of operating the shutter alone.
- d. When padlocked/closed, the shutters shall completely shroud the stationary contacts, and it shall not be possible to force the shutters or part of the shutters, to gain access to the stationary contacts.
- e. To facilitate testing, means other than locking shall be provided for securing the shutters in the open position.

However, such means shall be automatically cancelled and the automatic operation of the shutters restored upon reconnection of the circuit breaker or voltage transformer to the fixed isolating contacts.

- f. Bus bar shutters shall be painted signal red, and shall be clearly and indelibly labeled 'BUSBARS' in large white letters. Circuit breaker shutters shall be painted yellow, but shall not be lettered, except that on incoming feeders the circuit breaker shutters shall be clearly and indelibly labeled 'DANGER LIVE' in large red letters.
- g. Voltage transformer spout shutters shall be painted red. Durable phase colour identification shall be provided in a prominent position. Provision or access shall be made for lubricating the mechanical linkages.
- h. All shutters shall be effectively earthed.

3.01. 5 Insulators

- a. Insulators of moulded or resin bonded material shall have a durable, non-hygroscopic surface finish having a high anti-tracking index. Insulators, barriers made out of hylam, synthetic resin bonded paper, and treated wood will not be accepted.
- b. Insulators shall be mounted on the switchgear structure such that there is no likelihood of their being mechanically over-stressed, during normal tightening of the mounting and bus bars, connections etc.

3.01. 6 Circuit Breaker General Requirements

- a. The circuit breaker shall be capable of making and breaking the specified fault currents without straining or damaging any part of the switchgear. The circuit breaker shall be stored energy closing type, electrically operated with tripping mechanism.

The circuit breaker shall be provided with In-Built Power Pack unless otherwise indicated in BOQ/SLD, 12NO + 12NC of auxiliary switches required for indication, control, interlocking and other purposes. All contacts shall be wired to a terminal board. In case the same is not possible 6NO + 6NC shall be on the breaker and the remaining contacts may be multiplied by using latch relay (not Contactor), on the stationary part of the Breaker. The multiplier relay should have a reset coil distinct from the operating coil so that fuse failure will not reset the relay when the circuit breaker is ON. Additional minimum 2 NO + 2NC auxiliary contacts shall be provided for all MCCB irrespective of size for DI point connections to BMS/ PD SCADA.

- b. Circuit breakers with stored energy closing mechanism shall be capable of making the rated short-circuit current, when the stored energy is suitably charged by a spring.
- c. It shall also be capable of closing on no-load without suffering undue mechanical deterioration. The maximum make-time shall also be not exceeded.
- d. It shall not be possible for the moving contacts to move from the open position unless the spring is charged sufficiently for satisfactory completion of the closing operation.
- e. The direction of motion of the handle, for manual spring charging shall be marked. A device indicating when the spring is charged fully shall be also provided.
- f. Spring operated mechanism shall be complete with motor, opening spring, closing spring with limit switch for automatic charging and all necessary accessories to make the mechanism a complete operating unit.
- g. Motors and their electrically operated auxiliary equipment for charging a spring shall operate satisfactorily Between 85% and 110% of rated supply voltage
- h. When the breaker is closed, by releasing the closing spring, the closing spring should automatically get charged by the spring charging motor. Spring charging time shall not exceed 10 seconds.
- i. As long as power is available to the motor, a continuous sequence of at least 10 closing and opening operations shall be possible by adequate sizing of motor.
- j. The breaker operating mechanism should store energy for O-C-O operation and shall not, in any

case, get stuck in closed position during this cycle. After failure of power supply to the motor, at least one open-close-open operation of the circuit breaker shall be possible.

- k. Breaker operation shall be independent of the motor operation, which shall be used solely for compressing the closing spring.
- l. Closing action of the circuit breaker shall compress the opening spring ready for tripping.
- m. Means shall be provided for electrical, manual closing and tripping of breaker either from local mode or remote mode. Further local-manual, mechanical tripping of circuit breakers, preferably by push buttons shrouded to prevent inadvertent operation shall be provided.
- n. It shall not be possible to render the electrical tripping feature inoperative by any mechanical locking device.
- o. An operation counter (with 5 Digits) shall be provided.
- p. The breaker operating mechanism shall be electrically and mechanically trip-free in all positions. The breaker should also be provided with both mechanical and electrical anti-pumping devices.
- q. Provision shall be made for attaching an operation analyzer to perform speed tests after installation of the breakers at site.

3.01. 7 VACUUM CIRCUIT BREAKERS

- a. They shall comprise of three separate, identical single pole interrupting units, operated through a common shaft by a sturdy operating mechanism. Breakers shall be suitable for switching transformers at any load.
- b. Unipolar over-voltage at circuit breaker terminal shall not exceed two and half times nominal peak line to neutral voltage of the system while switching ON/OFF at any load.

3.01. 8 CURRENT TRANSFORMERS

- a. The current transformers shall have synthetic cast resin insulation and be of the single phase type, with number of cores as mentioned in the specific requirements.
- b. The primary & secondary connections shall be clearly labeled.
- c. All current transformers shall have insulation level and short time rating as per main switchgear. All current transformers shall be dimensioned to carry continuously a current of 120% of the rated current. The ratios shall be as per specific requirements.

3.01. 9 VOLTAGE / POTENTIAL TRANSFORMER

- a. The voltage transformers shall be insulated for full voltage rating.
- b. The PT shall be mounted on trucks and have synthetic resin insulation and be of single-phase type. Rated secondary voltage shall be $110/\sqrt{3}$ V unless otherwise specified.
- c. The PT can be integrated with incomer cubicles. Incomer PTs can be of draw-out type. All primary and secondary connections shall be clearly marked.

- d. PT primary fuses of full interrupting rating shall be provided. The fuses shall be so located that they can be replaced with safety while the main circuit is alive.

3.01.10 METERS, RELAYS AND OTHER ACCESSORIES

- a. All relays shall be of switchboard pattern, back connected draw out type suitable for flush mounting and fitted with dust tight cases and provided with flag indicators and hand reset devices. The relays shall conform to IS. A set of test block and test lead for necessary secondary injection tests shall be included. All relays in draw out cases shall have suitable spring loaded contacts for inserting test block.
- b. Main Relays shall be Numerical & compatible with IEC **61850** Protocol.
- c. Relays shall be provided with hand / auto reset type contacts. The flag indication shall be suitable for external hand resetting and mechanically interlocked to prevent falling when relays are subjected to vibration. The rating of the auxiliary contacts shall not be less than 10A at 240 V AC and 20A for 30V DC.
- d. Each incomer feeder shall be equipped with directional Numerical protection schemes for the ring main system.
- e. All protective/auxiliary relays shall be either static or electro-mechanical type.
- f. All relays shall have the following features: a) Shall be suitable for 110 V DC auxiliary supply, wherever required b) Shall be of draw out type suitable for flush mounting. c) All auxiliary relays shall be of semi-flush or surface mounting type.
- g. All protective relays shall be provided with adequate number of self reset contacts and hand reset flag indicators.
- h. Master tripping relay shall be a high speed relay with hand reset contacts and hand reset flag indicator.
- i. Indicating Lamps / Push Buttons - These shall be switchboard type, low power consumption, LED type lamps complete with necessary accessories. Lamps shall be provided with screwed translucent covers to diffuse light. The lamp covers shall preferably be unbreakable, moulded, heat resistant material and shall be provided with chromium plated bezels. Push Buttons shall be heavy duty, push to actuate type with colored button and inscription marked with its function. Each push button shall have minimum 2 NO + 2 NC contacts or as required, rated 10 A at operating voltage. Push button shall be shrouded type except for emergency trip button (if provided) which shall be mushroom type for easy identification.
- j. The MFM (Multifunction meter) shall be suitable for measuring unbalanced loads on a 3 - phase, 3wire system.

The MFM shall operate on V.T secondary voltage of 110V/415V.

- k. Shall be microprocessor-based conforming to IEC: 60687
- l. Shall have an accuracy of energy measurement of at least class 0.2 for active energy and at least Class 0.5 for reactive energy at 415V Voltage level.
- m. The active & reactive energy shall be directly computed in CT & VT primary ratings. The active

energy shall be stored in registers. The reactive energy shall be stored in two different registers as MVARh.

- n. All the registers shall be stored in a non-volatile memory. Meter registers for each metering interval, as well as accumulated totals, shall be downloadable.
- o. At least last 40 days of data shall be stored before being over-written.
- p. The power supply to the meter shall be healthy even with a single-phase VT supply. An automatic backup in the event of non-availability of voltage shall be provided by a built in long life battery and shall not need replacement for at least 10 years with a continuous VT interruption of at least 2 years.
- q. Shall have an optical port on the front of the meter for data collection from either a hand held meter reading instrument(MRI) having a display for energy readings or from a computer with suitable software. The MRI shall be complete with optical interface unit required.
- r. The meter shall have means to test MWh and MVARh accuracy and calibration at site in-situ and test terminal blocks shall be provided for the same.

3.01.11 CONTROL SWITCHES

- a. Control switches shall have integral name plate and for all other devices, the same shall be located below the respective devices. Instrument and devices mounted on the face of the panels shall also be identified on the rear with the same number.
- b. All control switches shall be rotary, back connected type having cam operation contact mechanism. Phosphor bronze contacts shall be used on switches.
- c. The handle of control switches used for circuit breaker operation shall turn clockwise for closing and anti-clockwise for tripping and shall be spring return to neutral from close/trip with lost motion device.
- d. The control switches, operating handles, meters, relays etc shall be mounted at the front of the switchgear panels. The instruments shall not be mounted less than one metre or more than two metres from the floor level. Operating handles shall not be mounted at a height more than 1.75 meters. Breaker Control switches wherever provided shall be so designed that when released by the operator it shall automatically return to a neutral position. They shall be fitted in sequence with lock to avoid inadvertent operation and shall be arranged such that after passing the "closed" position the control switch cannot be moved into the "Closed" position again without passing the "open" position. Each panel shall have indicating lamps for "ON","OFF", "TRIP", "TRIP CIRCUIT HEALTHY" and spring charged.
- e. Suitable fuses and links shall be provided for individual circuits for protection and also for isolation from bus wire without disturbing the other circuits. Bus wires from panel to panel shall be wired through necessary control terminals.
- f. Alarm relays shall be provided to annunciate failure of incoming AC and DC power supplies to switchgear panel.
- g. Incandescent lamps working on 240V A.C operated by ON/OFF switches shall be provided for internal panel illumination.
- h. A 240V 1-Phase, 5/15A, 3 Pin socket shall be provided in the panel interior of each cubicle with on - off switch for connection of hand lamps. This socket shall be Anchor make or equivalent decorative type.

- i. Panel heaters and thermostats shall be provided in all the panels. The panel heaters shall be rated at 240V AC, which shall be available at one point in the board. The panel heater shall be duly interlocked with the main breaker for automatic switching "ON" of the heater when power circuit is "OFF". A separate switch with adequately rated fuses shall be provided at every panel for AC supplies.

3.01.12 CONTROL FUSES

All control fuses shall be of HRC link type conforming to IS 2208. Fuses shall generally be mounted on the LT chamber of the panels. All fuses and links shall be provided with suitable identification labels.

3.01.13 ANNUNCIATOR

- a. Fascia type Electronic Annunciator shall be provided on the switchgear panels. There shall be one translucent window for each alarm point with engraved inscription. No. of windows shall be as per specific requirements. There shall be two lamps for each window so that visual annunciation is ensured even when one of the lamp fuses/fails.
- b. Unless stated otherwise, the Annunciator shall be suitable for operation with fault contact, which closes on a fault. They shall be suitable for operation for the voltages specified in the data sheet.
- c. One common alarm, acknowledge push button, reset push button and "lamp test" push button etc. shall be provided as standard. D.C supply failure indication shall be provided separately with DC monitoring relays. On failure of D.C supply to the panel, a lamp and a horn operated off AC shall operate. There shall be provision for canceling AC horn. The DC bell and AC horn shall have distinctly separate tones.
- d. On occurrence of a fault (s) the following alarm sequence shall be followed:

Flashing alarm with manual reset

| Alarm condition | Initiating Contact | Visual lamps | Audible alarm |
|-------------------------------------|---------------------------|---------------------|----------------------|
| 1. Normal | Normal | OFF | OFF |
| 2. Alert | Abnormal | Flashing | ON |
| 3. Accept | Abnormal | Steady-on | OFF |
| 4. Return to Normal | Normal | Steady-on | OFF |
| 5. Reset | Normal | OFF | OFF |
| 6. Reset before returning to normal | Abnormal | Flashing | ON |

3.01.14 Control Wiring

- a. Stud type terminals with identification ferrules shall be used. Local dependent marking as well as remote end dependent marking may be indicated in the ferruling at terminal blocks. Interlocking type ferrules shall be used. All wires carried within the switchgear enclosure shall be FRLS insulated and neatly arranged so as to be readily accessible and to be easily replaceable. Wherever necessary the wires should be run in flexible steel conduits and the wiring should be routed so that the same remains away from areas where electrical flame or flashover may occur. No conduit or cables shall be carried through the bus bar chamber or near to the live sockets even when the breaker is drawn out.

- b. The voltage transformer wiring shall be done by FRLS insulated, 1100 V grade multi stranded flexible Copper conductor of size 2.5 Sq.mm and all the current transformer and DC control wiring shall be of the same type of cable as specified above with conductor size of 2.5 Sq.mm. The color coding shall be as per IS 375.
- c. AC & DC wiring is to be distinguishable function wise; AC and DC terminals are to be separated by shrouded terminal separators. Colors of wires shall be as per IS.
- d. All spare contacts of switches / relays shall be wired up to the terminal blocks.
- e. 20% extra spare terminals shall be provided. All terminals shall be suitable for terminating 2 wires from front & rear side of the terminal block. However not more than one wire shall be terminated from either side on any terminal.
- f. All CT wiring shall be terminated on shorting type terminals.
- g. All wire directly connected to TRIP circuit (T- Block) of breaker device shall be distinguished by the addition of RED colored ferrule or sleeve indicated by "T" in the circuit diagram.
- h. Fuse links to neutral link in the same control current path shall be fixed side by side with supply on top and load side and load on bottom side.

3.01.15 Name Plate

Suitable anodized Aluminum name plate of 3 mm thick shall be provided on all the switchboards and individual panels.

3.01.16 Earthing

Earth buses of requisite section copper strip shall be provided. It shall extend throughout and solidly connect all panels in a line with proper terminals, at the end to connect to the station earthing system. The terminal arrangement at the ends shall be suitable for connection by 50 x 10 mm GS flat and shall be complete in the bimetallic washers etc.

3.01.17 Cable Boxes / Cable Chamber

- a. Cable boxes/cable chamber shall be suitable for the type and size of cable specified. The position of the cable boxes shall be such that the cables can be safely taken and the jointing carried out in a convenient and satisfactory manner. The cable termination arrangement for multiple cables shall permit connection and disconnection of individual cables without disturbing the other cables.
- b. Control cables shall not be taken through any live part chamber like busbar chamber etc., and preferably taken through a cable alley in the front of the panel and terminated directly in the metering/relay chamber.

3.01.18 PAINTING

- a. All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structure shall be pickled and then rinsed to remove any trace of acid. The under surface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The under surface shall be made free from all imperfections before undertaking finishing coat.

- b. After preparation of the under surface, the switchgear panel shall be Powder Coated or spray painted with two coats of final paint. Cooler shade of final paint shall be RAL 7032 (epoxy based). The finished panel shall be dried in staving oven in dust free atmosphere. Panel finish shall be free from imperfections like pin holes, orange peels, run off paint etc. The vendor shall furnish painting procedure details along with the drawings submission. The minimum painting thickness shall be 80 microns.
- c. All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust corrosion. If these parts are on moving element, then these shall be greased.

3.01.19 TESTS

All routine tests & acceptance tests as per relevant Standards.

3.01.20 SITE TEST

a) General

- Verification for completion of equipment, physical damage/deformities.
- Alignment of panel, interconnection of bus bars, tightness of bolts and connection etc.
- Interconnection of panel earth bus bar with plant earthing grid.
- Inter panel wiring between transport sections.
- Cleanliness of insulators and general cleanliness of panel to remove traces of dust, water etc.

3.01.21 Circuit Breaker & Panel

- a) Verification for completion of equipment, physical damage/deformities.
- b) Alignment of panel, interconnection of bus bars, tightness of bolts & connection etc.
- c) Interconnection of panel earth bus bar with plant earthing grid.
- d) Inter panel wiring between transport sections
- e) Cleanliness of insulators and general Cleanliness of panel to remove traces of dust, water etc.
 - Check for free movement of circuit breaker, lubrication of moving part & other parts as per manufacturers manual
 - Manual/Electrical operations of the breaker and Functional test as per drawings.
 - Megger before Hi Pot test.
 - H.T. Test – Hi Pot test (Power frequency withstand test for one minute at 70 kV RMS). At site Hi Pot test is carried out at 80% of 70 kV RMS value.
 - Megger after the Hi Pot test.
 - CT/PT ratio/polarity primary injection test
 - Secondary injection test on relays to practical characteristics

3.01.22 Drawings and Documents

- a) Drawings and Guaranteed Technical Particulars (Tenderer to be furnish) As soon as possible after the award of the Contract the manufacturers shall supply two copies of drawings which will describe the equipment in detail for Approval, and shall subsequently provide Seven completed sets of final drawings, one of which shall be reproducible. All the drawings shall be made in AUTOCAD and the final drawings shall be given to us in electronic form.
- b) The following drawings/documents of technical literature for each item are to be supplied as part of this contract.

- (i) Technical Data sheets
- (ii) Plan, Front, Back and Side views and Transport sections with weight of each panel and Transport sections (Refer clause 31.1.3 also)
- (iii) Door Equipment Layout
- (iv) Sectional View of each type of feeder and each chamber
- (v) Foundation Layout showing Base frame details, cut-outs for cables
- (vi) Single Line Diagram
- (vii) Schematic Diagram
- (viii) Equipment List
- (ix) Latest Load details
- (x) Any other drawing required for completeness
- (xi) Type test reports **Six** copies of instruction books/Operation and maintenance manuals and spare parts bulletin per switchgear.

SPECIFIC REQUIREMENTS

a) Technical Particulars

- Voltage : 11kV
- Maximum system Voltage : 12kV
- Service : Indoor
- Type of breaker : VCB, Draw out type
- Design Ambient : 50°
- Type of switchgear : Metal enclosed.
- Degree of protection : > IP55
- Temp. Rise at rated normal current above 50oC ambient temperature
- bus bars : 35 °C
- Breaker Characteristics :
 - (i) Rated Short circuit breaking current : 31.5kA
 - (ii) Rated Short circuit making current : 100kA
 - (iii) Rated operating sequence : 0-3 min-CO-3 min-CO
 - (iv) Rated short-circuit duration : 3 sec
 - (v) Rated transient recovery voltage for terminal faults : 20.6 kV
- System grounding : Solidly Grounded
- Silver plated joints : 45oC
- Cable Entry : Top / Bottom
- Impulse withstands voltage : As per Standards
- min power frequency withstands voltage : As per Standards
- Fault Level : 25 KA for 1 Sec
- (i) Support insulators : Epoxy
- (ii) Automatic shutters : Epoxy
- Panel seal-off bushings for bus bars : Epoxy 2
- Main bus bar material Aluminium / Aluminum: High conductivity, electrical grade
- Mechanism
 - (i) Trip free : Yes

- (ii) Anti-pumping : Both mechanical and electrical
- Operation : Stored energy type
- Contact position indicator : White or black (contrasting) letters to indicate open contacts. stored energy indicator: The following colors shall be used:
 - a) Yellow background with black lettering to indicate that the closing mechanism is charged.
 - b) White background with black lettering to indicate that the closing mechanism is discharged.

3.01..23 Breaker and Panel Construction

- a) Individual truck mounted or common trolley - Individual truck mounted.
- b) Positions of CB truck/Door closed with indication CB module within panel
 - SERVICE (Power and control positive
 - TEST (Power isolated control connected)
 - ISOLATED (Power and control isolated)
- c) Number of potential free auxiliary Contacts on Service/Test position monitoring Switches - 4NO + 4NC (minimum)
- d) Number of potential free Auxiliary Contacts - 12NO + 12NC. In case this is not possible, aux. contacts for circuit Breaker (directly 6NO + 6NC shall be on operated by Breaker mechanism) and the remaining may be provided on the stationary equipment. Additional 2NO+2NC for all **MCCB** irrespective of size for the connection to **SCADA**.
- e) Automatic Bypass facility for Breaker NC contacts when the truck is withdrawn from service position
- f) Type of closing –
- g) Feeder link ratings - rating at ambient temperature, as specified.
- h) Control Voltage
 - (i) For spring charging motor/space heater, cubicle illumination
 - (ii) For closing and opening coil of CB, window Annunciator, indicating lamp
- i) Panel sheet thickness
- i) Continuity of control contacts between service and test positions.
- j) Capacitor switching Capability
- k) Extensibility of panels on either side

Required Stored energy spring Charged Equal to Breaker continuous 240V 1Ph. AC 110V DC Minimum 2 mm for non-load bearing members & 3 mm for load bearing members. Required on both sides. As per IEC 60056.

3.01.24 Safety Interlocks and Features required for all CB Panels

- Truck can be moved within panel only when CB is OFF
- Can be plugged in only when OFF
- Can be closed only when service/Test position limit switches are ON
- Breaker compartment door cannot be opened when the breaker is in Service/Test position.

(Door interlock shall be provided)

- Breaker cannot be put into Service position with compartment door open.
- Mechanical trip emergency PB at the front of panel.
- Safety shutters operate automatically when CB is withdrawn.
- Earth slide beyond the test position till trolley is drawn out.
- Bus bar and jumpering enclosed and compartmentalized.
- Lock out feature.
- Anti-pumping feature.
- Trip circuit supervision.
- No operation of switches or fresh connections shall be needed when the truck is moved from service to test position for making test position controls operational.
- Mechanical operations counter. (5 Digits)

3.01.25 Protection Relays

- Instantaneous IDMT over current and earth fault relays for Incomer and Outgoing feeders.
- Restricted earth fault protection for Transformer feeders.
- Lockout VAJH13 relay or equivalent.
- Anti-pumping VAA11 relay or equivalent
- Trip circuit supervision VAX31 relay or equivalent.

3.01.26 Earthing

- | | |
|--|--|
| a) Size of earth bus running throughout panel | - Not less than 50mm x 10mm GI Flat. |
| b) Earthing facility of OG cable (No plugging in | - Provide separate truck mounted with OG earthing ON and no earthing with earthing for OG cables, and bus CB in Service/Test position) |

3.01.27 Wiring, Relays, Metering and Control Switches

- a) CT wiring (colour as per IS5578) -2.5 Sq.mm Cu (All CT wires be brought to terminal block before formation of Star/Delta connections). Star/delta connection shall be made only at terminal block and not at C.T. itself. Shorting type terminals shall be provided.
- b) PT wiring (colour as per IS 11353 Table I/IS 5578) -2.5 Sq.mm Cu
- c) DC wiring (colour as per IS 11353 Table I) -2.5 Sq.mm Cu
- d) Type of terminals -Stud type terminals with shrouding between AC and DC.
- e) Terminal marking and identification of -Local dependent and Remote Ferruling (IS 5578) dependent (IS 5578) ferruling (Interlocking Type)
- f) Mechanical lock out feature - Lost motion feature in control switch required (No two

successive closing signals can be issued unless reset by a trip command in between).

- g) Type of control switch -TRIP/NEUTRAL/CLOSE
- h) Indication lamps -ON-RED for HT CB ON
 - ON-RED for LT CB ON -ON-RED for HT switch ON
 - OFF-GREEN for HT CB OFF
 - OFF-GREEN for LT CB OFF
 - OFF-GREEN for HT switch OFF
 - TRIP-AMBER -HT CB TRIPPED

Trip Circuit Healthy-WHITE for HT TRIP CKT HEA LTH

- j) Push Buttons -One for tripping HT CB
 - One for tripping LT CB
 - 96x96 mm, digital flush mounted.
 - Individual pole draw-out with flag Indicators, hand reset devices and test plugs.
 - Required
 - Anodized Aluminum label.
 - Anodized Aluminum label.
 - 240V AC rated
 - Required.

3.01.28 Incomer PT

- a) Primary fuse – Required
- b) Secondary fuse – Required.

3.01.29 General

- a) Annunciator :-DC operated Annunciator with sequence as per clause 2.14.4 shall be provided. (FACIA type)
- b) Zinc oxide type surge arrestors shall be provided in those feeders as specified.
- c) pole relays in 3D cases shall have individual phase unit draw out feature. 3 pole gang draw out not acceptable.
- d) Bottom bus shall not be acceptable.
- e) Panel Assembly - Assemblies of indoor metal clad, dead front VCB switchgear with 3 phase fully insulated busbar and draw out circuit breakers. All necessary components and accessories shall be provided in the panels
- d) The class of accuracy of meters shall be same as that of class of accuracy of current transformers to which they are Converted.
- e) MFM (Multifunction meter) shall be of micro-processor based. All current, voltage, power including their maximum demand shall be computed & registered. The meter shall be capable to communicate with PD SCADA.

UPS :GENERAL TECHNICAL SPECIFICATIONS (REF: BOQ ITEM NO. 7.6 PAGE NO. 27)

UPS Rating 1000VA/700W ,2000VA/1400W ,3000VA/2100W**Input**

Input system 1-phase, plus PE
 Rated voltage: 220Vac / 230Vac / 240 Vac
 Voltage range 1. 160~300 Vac full load 2. 110 Vac half load
 Frequency 50/60 Hz
 Power factor 0.97 (conditions: rated voltage, full pure resistive load, fully charged battery)

Output

Output system 1-phase, plus PE
 Power factor 0.7
 Voltage 220Vac / 230 Vac / 240 Vac $\pm 2\%$
 Line regulation $\leq 2\%$ (0~100% linear load)
 Voltage harmonic distortion
 (rated input voltage, rated input frequency)
 $\leq 3\%$ (0 ~100% linear load)
 $\leq 6\%$ (0 ~100% non-linear load)
 Dynamic variation $< 5\%$ in 20 ms
 Frequency 50 / 60 Hz $\pm 0.2\text{Hz}$
 Frequency range 46-54 Hz / 56-64 Hz

Inverter overload capability (in Normal mode, 25°C)

108%~150% 30s
 >150% 300ms

Inverter overload capability (in Battery mode, 25°C)

108%~150% 30s
 >150% 300ms

Bypass overload capability

200% for < 60 mins
 300% for 5s
 Crest factor 3:1

Bypass operating voltage 80~264V

Transfer time Normal<>Battery: 0ms

DC component $\leq 200\text{mV}$

Battery mode: $\geq 83\%$ (rated battery voltage, full linear load)

Efficiency Normal mode: $\geq 88\%$ (rated mains voltage, full linear load, battery fully charged)

External battery voltage 36Vdc 96Vdc

Charging current 1A 4A 1A 8A 1A 8A

TECHNICAL SPECIFICATIONS FOR 5 KVA ONLINE UPS

| | |
|------------|--|
| Capacity | 5 KVA |
| Technology | Digital signal processor controlled True Online, |

| | |
|--|--|
| High Frequency Inverter Technology | PWM technology with IGBTs with built In galvanic isolation |
| Noise Level | Less than 50 dB |
| Operating Temperature | 0-45 degree centigrade |
| Humidity | 10 to 95% no-condensing |
| Harmonic Distortion | <2% (linear load) |
| <5% (non-linear load) | |
| Total DC bus voltage | 120 VDC |
| Battery recharge time | |
| (After Complete discharge) to 100% charge | 8 Hours |
| Crest Factor | Minimum 3:1 at full load |
| Out put Wave Form | Pure Sine wave |
| Cold Start feature | Required |
| INPUT | |
| Input | Single phase 3 wire |
| Input Voltage Range | 1 phase 230VAC+ Neutral +earth |
| Input Frequency Range | 46-54Hz |
| Line low/Hight Cutoff | 175 VAC - 276 VAC |
| Power Factor | >0.9 |
| OUTPUT | |
| Output Voltage | 220/230 VAC programmable 1 phase+N |
| Output Frequency | 50hz +/- 0.5%(Free running) |
| EFFICIENCY | |
| AC to AC | 93% |
| DC to AC | 94% |
| STATIC SWITCH | |
| (Bi-directional) for all ratings | Should take care of 100% load transfer without break |
| LOAD POWER FACTOR | 0.9% lag to unit |
| OVERLOAD CAPACITY | 125 % for 10 mts 150% for 1mts |
| UPS SHUT DOWN | |
| UPS shut down with alarm and Indication in case of | |

Note: Corrigendum/addendum shall be part of tender document

****END of ANNEXURE-B*****