b) A toggle switch or door operated switch shall be provided for control of A.C. lighting in each panel.

c) One combined 15 Amps. 3-Pin and 5 Amps. 2-Pin Power Socket outlet together with Plus Pins shall be provided at convenient points in each Panel for A.C. Supply.

7.1.3.30 CONTROL AND SELECTOR SWITCHES

All switches shall be located at a convenient operating height and so constructed, mounted and wired to facilitate the maintenance of contacts without the need to disconnect wiring. Switches shall have locks incorporated in the design. Control switches must be lockable in the inactive or neutral position and selector switches in all positions. Labels shall clearly indicate all positions and function of each switch.

7.1.3.30.1 Control Switches

Control switches shall be of either the handle type and shall be arranged to operate clockwise when closing the circuit devices and anticlockwise when opening. Handle type switches shall be so designed that when released by the operator the handle and mechanism shall return automatically to the centered neutral position and interrupt the supply of current to the operating mechanism of the circuit device. All control switches shall have additional labeling giving the reference identification of the primary device. A lamp test facility shall be provided in association with any discrepancy switch.

7.1.3.30.2 SELECTOR SWITCHES

Selector switches shall have spade type handles. Where key operated switches are specified these shall be operated by inserting and turning the key to the required position. The key shall be removable in the 'off' position only.

7.1.3.31 ANNUNCIATOR

1) Suitable electronic Annunciator for the visual and audible alarm on the control panel using bright LEDs shall be provided in each panel to indicate over current and earth fault protection operated. In addition to above, each electronic annunciator of Transformer Control Panel shall have provision to indicate Transformer trouble trip/alarm function operated. Also one window of the Annunciator shall have to be used for Non-Trip A.C. Fail Alarm Indication and one window for Trip Circuit unhealthy indication.

2) Each Electronic Annunciator shall have provision for connection with accept/reset/lamp test/mute Push buttons for proper functions. Electronic annunciator shall have provision for connection with Electronic Buzzer/Electronic Bell for Trip & Non-Trip Audio Alarm of common annunciation scheme. Electronic Annunciation shall have provision for flashing illuminating display with inscription for operation of respective Protection Relay. The Electronic Annunciator should have separate coloured windows for Trip & Non-Trip Annunciation for easy detection.

3) Annunciator fascia units shall have translucent plastic windows for each alarm point.

4) Annunciator facia plate shall be engraved in black lettering with respective alarm inscription as specified. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall be about 5 mm. The inscriptions shall be visible only when the respective facia LED will glow.

5) Annunciator facia units shall be suitable for flush mounting on panels. Replacement of individual facia inscription plate and LED shall be possible from front of the panel.

6) Unless otherwise specified, one alarm buzzer meant for non-trip alarms and one bell meant for trip alarms shall be provided in each control panel (mounted inside).

7) Each annunciator shall be provided with 'Accept', 'Reset' and 'Test' push buttons, in addition to external PB.

8) Special precaution shall be taken by the manufacturer to ensure that spurious alarm conditions do not appear due to influence of external magnetic fields on the annunciator wiring and switching disturbances from the neighbouring circuits within the panels.

9) In case 'RESET' push button is pressed before abnormality is cleared, the LEDs shall continue to glow steadily and shall go out only when normal condition is restored.

10) Any new annunciation appearing after the operation of 'Accept' for previous annunciation, shall provide a fresh audible alarm with accompanied visual alarm, even if the process of "acknowledging" or "resetting" of previous alarm is going on or is yet to be carried out.

7.1.3.32 INDICATING AMMETERS

Each 33kV GIS Cubicle will be provided with one digital ampere meter flush mounting type 3 line display to show three phase ampere with accuracy class 1.0 with configurable primary ampere setting (0-2400A) and secondary ampere setting (both 1A and 5A) for connecting to the current transformer

7.1.3.33 INDICATING VOLTMETERS

Each 33kV GIS Cubicle will be provided with one digital flush mounted voltmeter with three line display having the capacity to toggle between 33 KV line and phase voltages.

7.1.3.34 EARTHING SYSTEM

Earthing of metallic parts or metallic bodies of the equipment on the Panel shall be done with soft drawn single conductor bare Copper Tail connections shall have minimum area of 16 sq, mm. and the main earthing connection 120 sq.mm. These wires shall be connected by suitable terminals and clamps junction. Soldered connections shall not be employed.

All metal parts other than those forming part of any electrical circuit shall be earthed to the earthing system. Any necessary terminals on any part of the equipment required for this purpose shall be provided by the Manufacturer. Earthing conductor cross section shall be in accordance with the manufacturer standards which shall be proved with necessary type test reports. However, for 33kV switchgear minimum 300 mm^2 cross section copper bar shall be employed for earthing. The copper earth bar shall run along the full length of the switchboard and earthing studs shall be provided at not less than two points. The frame of the draw-out circuit breaker earthing truck shall be automatically connected to the switchgears bar through substantial plug type contact when the circuit breaker is in disconnection, service and test position.

7.1.3.35 DISTRIBUTION AND CONTROL OF AUX. POWER CIRCUIT

7.1.3.35.1 D.C. CIRCUIT

There shall be only one **110V D.C.** for the entire Control and Relay Panel fed from a D.C. Distribution Panel. A continuous D.C. Bus shall be provided in the Control and Relay Panel and D.C. supply for control, protection, indication and supervision of circuit breaker and other equipment shall be teed off from D.C. bus through a set of H.R.C. Fuse on positive and negative side. D.C. supply to be teed off shall be distributed within the Panel as below:

(a) Control DC scheme both positive and negative side with fuse

(b) Close/Trip Ckt 1 and Trip Ckt 2 without fuse; closing circuit with 10A fuse.

(c) Indication Circuit through a set of 6 Amp. HRC Fuse both at +ve and –ve side

(d) Protective relay circuits through 6A fuse both at +ve and –ve side

(e) Annunciation ckt with 6Amp fuse on both at +ve and –ve side

(f) DC Emergency Lamp with 6Amp fuse both at +ve and –ve side

Three nos. of D.C. operated no-volt auxiliary relay(self reset type) provided with hand reset type flag with inscription – Main D.C. Fail,Control Dc fail & Protection DC fail with 4NO+4NC in each relay. 2 NC contact for DC fail alarm and Indication, 1NO wired upto SCADA TB and 1NO wired upto spare TB. One Push button having N/C Contact used in Series with the above relay for D.C. Fall Test purpose.

7.1.3.35.2 A.C. CIRCUITS

230 Volts, Single Phase A.C. Aux. Supply to the Control and Relay Panel will be fed from A.C. Distribution Panel through a 16Amp MCB provided there. One 16 Amps rated HRC Fuse shall be provided at the Control & Relay Panel for the Incoming A.C. Supply. Two A.C. operated no volt auxiliary relay(self-reset type) rated for 230V shall be provided with hand reset flag with inscription —A.C. Fail & DC Fail Accept with 4NO+4NC contacts for each relay. One push button having N/C Contact used in Series with above relay for —A.C. Fail Test purpose.

7.1.3.35.3 P.T. SECONDARY CIRCUIT

There may be two nos. 33KV bus PT, one in each bus section. P.T. supply shall be available from selected 33 KV Bus P.T through suitable PT selection scheme by switch. Two sets of Fuse and link of suitable rating shall be provided for the Incoming P.T supplies and two sets, one for each PT of 3 nos. colored LED indicating lamps shall be provided for supervision of the Fuse. Lamps shall be connected between respective phases and neutral. The arrangement of distribution of P.T. Secondary Circuit shall be as follows:

a) Potential supply to the protective relay circuit for Feeder where necessary shall be fed from selected Bus P.T. supply bus.

b) Potential supply to meters, Energy meters and indicating instrument of each panel shall be fed from selected Bus P.T. supply bus.

c) Selected P.T. secondary supply to the protective relays of each panel shall be fed through 4 poles - MCB and link in neutral in each panel where necessary with two change over contacts for annunciation.

d) Selected P.T. secondary supply for metering and indicating instruments of each panel shall be fed through 4 pole MCB in each phase and link in neutral in each panel of 33KV system voltage.

e) Two position (PT-1/PT-2), minimum 4(four) way PT selector switch (stay put type), minimum 16A rating shall be provided in each panel for metering ckt. Additional 4 way PT selector switch is required for protection wherever applicable. The no. of way may increase during detailed engineering.

7.1.3.36 TRIP RELAYS

Following shall be the main features of a high speed tripping relays:

All tripping relays shall be of the heavy duty type suitable for panel mounting and shall have operating coils which are rated sufficiently to operate in conjunction with series flag relays. If necessary, normally closed contacts in series with the relay operating coil, shall be delayed for a period which will allow series flag relays to operate satisfactorily. All other tripping contacts should be instantaneous i.e. no intentional time delay. The operating time shall not exceed 10 milliseconds at rated voltage. The operating range of the relay shall be from 70% to 120% of rated voltage. Electrical reset facilities shall be available for operation, from remote and supervisory controls. High speed tripping relays shall prevent closing of the associated circuit breakers until reset. Wherever the tripping relay contacts need to break the d.c. current, sufficiently rated magnetic blow out contacts or such approved means shall be used.

Trip Relay shall be of following types:

a) Hand & Electrical reset type for O/C, E/F protection.

b) Operating Coil Voltage: 110V DC (No series resistor allowed)

c) Shall have in built freewheeling diode.

7.1.3.37 SUPERVISION RELAYS

7.1.3.37.1 Trip Circuit and Protection Supply Supervision

The trip circuit supervision function shall be part of control and protection unit provided in the switchgear. Trip circuit supervision relays shall be provided to monitor each of the trip circuits of all 11kV circuit breakers and each relay shall have sufficient contacts for visual/audible alarm and indication purposes. The trip circuit supervision scheme shall provide continuous supervision of the trip circuits of the circuit breaker in either the open or closed position and independent of local or remote selection at the local operating position. Relay elements shall be delayed on drop-off to prevent false alarms during faults on dc wiring on adjacent circuits, or due to operation of a trip relay contact. Series resistances shall be provided in trip supervision circuits to prevent mal tripping a circuit breaker if a relay element is short circuited. Relay alarm elements shall be equipped with

hand resetting flag indicators.

Trip circuit supervision relay (TCS) shall supervise not only the trip coil but the whole trip circuit during both breaker open and close position (pre-close & post-close). Each trip circuit shall be supervised by separate Trip Circuit Supervision (TCS) relay.

7.1.3.37.2 D.C. Supply Supervision

Supervision relays are required for each protection supply, Main protection, Back-up and Trip Relay Reset. Similarly for each trip circuit supply and for each alarm/ indications supply. These supervision relays are to be independent of alarms from the trip circuit supervision scheme so that the operator can clearly differentiate via the available alarms between loss of supply due to a blown fuse / tripped MCB and failure of a trip circuits supervision /faulty supervision wiring.

DC supply supervision shall be performed by the built in AC/DC fail relay of the Annunciator. Hen the Annunciator shall be powered by dual source (with internal/external AC/DC changeover switch).

7.1.3.38 MIMIC BUS

Provision shall be made for 10 mm. wide painted and overall drawing mimic diagram by the purchaser on the exterior of the front panel board to represent the single line arrangement of the station equipment. Provision shall be made in such a way that center line of the mimic bus shall be at a suitable height from the bottom of the PCM Panel.

Mimic bus material shall be brass, bronze or copper with enamel finished or anodized aluminum or plastic. The mimic bus and included symbols shall be shaped, colored and located as international standard. Light indicator showing position (opening/closing) of circuit breaker shall be installed.

The mimic bus shall be attached to the panel by mechanical devices, not with adhesive. Attachment shall be closely spaced to hold all parts of the mimic bus firmly to the panel face.

Mimic bus shall be provided with the following dimensions and color code:-

Voltage	Bus Color	Thick(mm)	Dimension (mm)
33 KV	Black	3	12
Earth	Green	3	12

7.1.3.39 Auxiliary Relay & trip relay

Trip Relay shall be provided for the tripping of CB by protection. Each 33KV PCM Cubicle will be provided with 1 (one) set separate Auxiliary and signaling relays and wiring with fuses.

7.1.3.40 Name plate & Ratings:

a) All instruments, relays and such other similar electrical devices mounted on the control and relay panel shall be provided with name plates bearing the manufacturer's name, serial identifying number and the Electrical rating data.

b) 25 mm wide name plates bearing suitable identification marks shall be fixed under the terminal wiring at the test blocks, at the fuse blocks and at the cable terminals. Similar plates shall be fixed on the exterior of the switch board in appropriate places to indicate function of control switches, push button etc. such as isolator control switch, breaker control switch, DC fail test, accept reset etc. Suitable identification marks shall be provided for individual casing part of the relays and other equipment.

c) 50mm wide plastic plate bearing suitable circuit description (which will be furnished after order is placed) etched in 30 mm size letters shall be provided for each panel and mounted on the top of both outer and inner sides of the front and rear panels. These plates shall be removable type.

d) Each unit of control and relay panel shall be provided with a label located at the bottom on the front and shall contain the following details :

I. Manufacturer's name

II. Year of Manufacturing

III. Purchase Order Number/ Contract Number and date

IV. Technical Data

V. Serial Number/ Panel Number

7.1.3.41 PAINTING

Panel painting shall be done by the modern process of painting. All unfurnished surface of the steel panel and frame work shall be sand blasted or suitably cured to remove rust, scale, foreign adhering matter or grease. A suitable rust resisting primer shall be applied on the interior and exterior surface of steel, which shall be followed by application of an undercoat suitable to serve as base and binder forth finishing coat.

7.1.3.41.1 Details of Painting:-

Surface treatment	by seven tank process
Paint type	Powder coated. Pure polyester base grade A structure finish
Paint shade	RAL 7032 for external & internal surface
Paint thickness	Minimum 80 microns

7.1.3.42 SPECIFICATION OF 63.5-110V/230-415V, 3x1(2) A, 3-PHASE, 4-WIRE, 3-ELEMENT, INDOOR TYPE MULTI-TARIFF PROGRAMMABLE METER WITH ASSOCIATED ACCESSORIES.

7.1.3.42.1 GENERAL

The meters are required for the purpose of energy metering of medium/high/extra-high voltage consumer metering at 33 kV level. KWh is the unit for the purpose. Type Tested from STL members or internationally accredited testing laboratories.

System voltage	:	Nominal service voltage 110V, 3 phase 4 wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	:	50 Hz
Standard	:	The Energy Meter should be designed, manufactured and tested in accordance with IEC 62052-11, 62053-22 and 62053-23 or ANSI C 12.16, 12.10 (latest publication) or specified in this specification
Installation	:	Indoor Type
Type	:	Solid state.
Application	:	Registration of KWh (Peak & off-peak), Total KVarh(Q1+Q4), KW on 3- phase, 4-wire supply for balanced & unbalanced load (unidirectional). Peak 17.00-23.00. hrs and off peak 23.00-17.00 hrs (programmable) Bangladesh standard time. The software for Time of Use (TOU) shall be so developed to accommodate future tariff and can be customized, if the purchaser changes the tariff. The software shall be compatible with Windows operating system.
Connection	:	3-phase 4-wire solidly grounded neutral.
Nos. of element	:	3 (Three)

Rated current	:	Basic current 1 amps and maximum current ≥2 amps.
Multiplication factor	:	The following shall be inscribe on the mater. Dial reading X CT ratio X PT ratio = Actual reading in KWh.
Register	:	Solid state LCD display type register. The display shall be programmable, automatic and include:
		• Meter ID • Time & date • Cumulative KWh (Peak & off-peak) • Cumulative Total KVarh (Q1+Q4) • Maximum demand (KW) with time & date • Cumulative Maximum demand (kW) for billing month. Maximum demand (MD) in kW shall be registered using the technique of cumulating on integration period controlled by built-in process and the MD shall be continuously recorded and the highest shall be indicated. The highest MD shall be added to the cumulative store, which shall be automatically initiated after an interval of one month / one billing period by means of built-in timing device. • Integration period: 30 (thirty) minutes. • Number of MD reset (Automatic& manually). • Average PF for billing period.
		Instantaneous: • Phase voltage with indication • Phase amps with direction. • Power factor (average). • Demand (KW) • Voltage phase angel (each phase) • Current phase angle(each phase) Tampering indication in the register.

Memory storage	:	The meter shall have sufficient capacity (minimum 2 MB) to store the following readings and data in non-volatile memory even in case of power failure. • Equipment identification codes, security codes and access codes. • Number of power interruption with date & time (minimum 100 events). • Latest power failure time & date • Date & time of meter tempering. (Voltage & Current missing, demand reset , time change). • Event logs • Current & Previous registered in month KWh (Peak & off-peak), Total KVarh (Q1+Q4) • Current & Previous month registered with maximum KW demand since last MD reset with time and date of its occurrence. The meter must have sufficient capacity to store data at 30 (thirty) minutes interval for at least 90 (ninety) days. • Load Profile data [kWh, KVarh (Q1+Q4) • Phase voltage or Vh • Phase amps or Ah
Accuracy class	:	Accuracy class is 0.2S
Number of digit		Minimum 6 (Six) integer with 2 (two) decimal (Total 8 digit).
Type of Display		Solid-state LCD display.
Time switch	:	The time switch shall be built-in type and shall be designed to perform a present cycle of operation. Time switch shall reset MDI at the end of every month (billing period) automatically. In the event of failure of power supply and battery, at the same time set memory shall not be lost i.e. the set program shall be recorded in non-volatile memory. The maximum error shall be kept within ±1 (one) second per day. Time error adjustment facility shall be provided.
Battery reserve	:	Each time switch must be provided with lithium battery which allow the switch to function for a period of not less than 10 (ten) years. The guaranteed life of the battery should not be less than 10 (ten) years and shall have provision for easy replacement. The shelf life of the battery should be minimum 15(fifteen) years or more.

Construction	:	The meter shall be completely self-contain round socket or enclosure type. The meter cover shall be made of polycarbonate/acrylic/phenolic /resin and socket cover shall be made of metal polycarbonate/ acrylic /phenolic /resin. The meter cover and socket/enclosure shall be provided with security sealing provisions to prevent unauthorized access to the internal meter works and socket/enclosure sealing shall be designed to accommodate both padlock and wire type seal. IEC meters shall be minimum IP51. The ANSI Standard meter shall be effectively sealed to prevent entrance of rain and dust into its internal parts. The meter shall pass Rain test described in underwriter's laboratory standard UL-50 (USA) for type 3 enclosures. A general purpose finish of class 1 as specified in section 7 of ANSI C12.10 shall be provided for the meter and it shall meet the requirement of weather simulation test (Sec. 7.2.1 of ANSI C12.10) and salt spray test (ASTM B117). It shall be designed to operate continuously for the normal life of the meter in unsheltered outdoor tropical location exposed to the elements without corrosion or other damage to parts to adversely affect meter accuracy or reliability.
Enclosure for IEC Standard Meter		The meter may be surface mounted in an outdoor pole mounted metering enclosure box with necessary wiring. The enclosure box should be made either of high quality flame retardant ABS Resin of minimum 3 mm thickness or of galvanized sheet steel of minimum 1.22 mm (18 SWG) thickness or of auto extinguishable, shockproof and UV resistant, hot molded glass reinforced polyester of minimum 3 mm thickness. The box shall have hinged front door with one toughened glass window or transparent UV resistant Polly carbonate to enable easy reading of meter. The metering box shall be weather proof, dust proof, rodent and inspect proof in accordance with enclosure classification IP54. Service cable entry and exit will be sides of the box and 40 (forty) mm diameter hole with black PVC conic cable gland shall be provided for side entry & exit for this purpose. All material parts shall have anti-corrosive protection. All materials shall be designed, manufactured and tested as per IEC or equivalent International standards except as mentioned. The front door shall be removable and provision must be made for sealing in the closed position.

Socket	:	Meter sockets shall be suitable for installation of offered type meter. Meter sockets shall be 3-phase, 4-wire wye, 600 volt class, made from 16 gauge sheet metal. Meter sockets shall be similar except as described below. Meter sockets shall approximately 14"(35.6 cm) Hx9"(22.9cm) Wx4"(10.2 cm) D and rectangular in shape. Sockets shall be the same size as 1-phase sockets and terminal blocks shall be interchangeable. Sockets shall be ring less type, sealing latch to be stainless steel and have adequate means for socket grounding. Meter socket shall have a 2"(5 cm) Diameter top opening complete with a 1- ¼"(3.2 cm) hub. Meter socket shall have 4 knockouts with a range up to 2"(5 cm) Diameter, one on the back, one in the bottom and one in each side. Meter socket shall comply with ANSI C 12.6, 12.10 The Socket shall have written permanently (not in paper printed) "connection diagram" distinctly marked in addition to all standard data.
Terminal	:	Socket connected type/ Non-symmetrical, bottom entry, front connection, and connection type with extended terminal cover: Minimum 10 Terminals to accommodate up to 06 sq. mm size of cable. The terminal cover for the offered energy meter shall be extended type, and which can be sealed independently. There shall be free space between bottom of the terminal and the bottom of the terminal cover.
Connection	:	3-phase, 4-wire solidly grounded neutral.
Service life of meter	:	Shall be minimum 15 (fifteen) years.
Visual indication of operation	:	Pulse indicator on the front of meter as per meter constant.
Special condition	:	a) The factory calibration conforms to relevant IEC or equivalent international standard. LCD display shall be shown consecutively and continuously one after another. The display shall be automated i.e. no external means shall be required to see the display. Each display shall last for at least 5 (five) sec. b) Meter Electronic Circuit biasing voltage shall have to be ensured from each phase to phase and each phase to neutral and minimum basing voltage 40V.
Meter Sealing	:	The Energy meter body will be hermetically sealed or ultrasonically welded to avoid unauthorized opening of meter cover. Otherwise the bid will be rejected.

Communication port	:	The meter must be provided with a suitable communication port to allow down loading of desired information stored in the meter to a PC via hand held data logger as per IEC 1107 or equivalent standard.
Remote Communication	:	The meter shall be equipped with external GSM-GPRS Modem, which will be able to interface with RS232, RS485 for data communication with the central server from meters, having all accessories like power supply adapter, necessary connecting cables, antenna with minimum 2.5-meter extension cable, connectors, enclosure box with fixing materials etc.

7.1.3.42.2 TAMPER AND FRAUD PROTECTION FEATURE:

The meter shall have the following features to prevent/detect tamper and fraud:

- **Phase Sequence Reversal:** The meter should work accurately irrespective of phase sequence of supply.
- **Missing Potentials:** The meter shall be capable of detection occurrence of missing potential of one phase or two phase(s), which can happen due to intentional/accidental disconnection of potential link(s).
- **Terminal cover** must have micro-switch provision to monitor unauthorized opening. Opening of terminal cover shall trigger an event to be recorded in the event log memory.
- **Software Access:** Software access for configuration and setting of the meters.

7.1.3.42.3 TECHNICAL FEATURE

- The body cover and socket / enclosure shall be provided security sealing provisions to prevent unauthorized access to the internal meter works.
- The meter shall be provided with connection diagram.
- The data access should be protected by minimum 3(three) steps software password in meter.
- The meter shall have provision of phase to phase and each phase to neutral biasing.
- The meter shall have minimum biasing voltage of 40V otherwise the bid will be rejected.
- The meter and socket/enclosure shall have provision of earthing.
- Meter must operate and accurately register demand and energy when service voltage is applied across any two of the three input terminals or when service voltage is applied from any input terminal to neutral. Meter will continue to operate even the neutral is missing.
- The meter and socket/ enclosure must be the same country of origin other wise the bid will be rejected.
- The registration of KWh (Peak & off-peak) on 3-phase, 4-wire supply for balanced & unbalanced load will be unidirectional. i.e. if one, two or three phase supply is/are reversed, it will take the absolute (kWh-del) + absolute (kWh-rev) and will add them together as total 3-phase KWh.
- The meter shall be equipped with remote GSM & PSTN communication option.
- It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850.
- The meter shall have permanently print nameplate distinctly marked with the following in addition to all standard data:

1. The word "WZPDCL" and insignia of WZPDCL.
2. Voltage and current rating.
3. Frequency.
4. Number of element, number of wire and multiplication factor.
5. Accuracy class.
6. Year of manufacture.
7. Serial number.
8. Name of manufacturer.
9. Meter constant.

7.1.3.42.4 Display of measured values/ Meter Display

- The Sequence of LCD display should be user programmable.
- The contrast setting of LCD display should be visible in different lighting environment and distinctly visible in broad daylight.
- The meter should be of displaying time and date, the direction of energy

  i.e. as import/export or +/-, active tariff and internal fault indicators.
- There should be up to three groups of display to priorities the display. Each showing a programmable function group.

7.1.3.42.5 Meter Parameterization Software

- The parameterization software must run on Windows operating environment.
- The software must be protected by software keys to control duplication and installation.
- The software should have a customizable printing feature by task list.
- The meter must be able to display or record meter ID, Program, Programmer ID, C. T. ratio, V. T. ratio, Total (KWh, KVarh, KVAh, KW, KVar, KVA, P.F); per phase (voltage, current, KW, KVar, KVA, P.F, phase voltage angle, phase current angel); Load profile having minimum 8(eight) Channels data stored in different interval for 90 days.
- Tamper feature: The meter must have Errors & Warnings codes, History log and Event log(minimum 400events) to record date & time of all power outages, demand resets, time change.
- In addition, each software key must bear a unique user ID and that is not transferable to another PC that has different user ID.
- The Meter should be able to display the phasor diagram.
- The software for Time of Use (TOU) shall be compatible to accommodate future tariff and can be customized, if the purchaser changes the tariff .The software shall be compatible with Windows operating system.
- The Meter must be provided with meter passwords to secure communication between meter software and meter having minimum 3(three) access levels.
- The offered meter shall be fully compatible with WZPDCL's existing AMR (Automatic Meter Reading) System. The Contractor/EPC shall be responsible for integrating the supplied meters with WZPDCL's existing AMR system (remote meter data acquisition system) at no additional cost to WZPDCL. If the Contractor/EPC fails to integrate the supplied meters with the existing AMR system, the Contractor/EPC shall provide, install, configure, and commission a separate remote meter data acquisition and logging software capable of accessing meter data through GPRS and hosting it on the WZPDCL server, including all required licenses and integration support, at no additional cost to WZPDCL.

7.1.3.42.6 EXTERNAL MODEM WITH ACCESSORIES

GSM/GPRS modem with RS-232 ports, meter interfaced power supply, connection cables, antenna with minimum 2.5 meters cable, mounting facilities, enclosure (if necessary). The modems will be capable of GSM and GPRS connectivity simultaneously. For GSm configuration the AT command will be available and for GPRS communication the APN, reset time, username, password, port number, etc. are configurable. The modem will have the following specification.

Interruption (< 1 ms), RS-232 (at least 1), GPRS class 10, operating band 900/1800, auto reset capability (with phone call, SMS). The modem will be robust, durable and compatible with the employers existing service condition.

7.1.3.43 Manufacturer of Energy Meter

ENERGY METERS KWH meter shall 3-phase 4-wire, Numerical Programmable Multifunction KWH Meter of accuracy class 0.2s with the features for measuring the parameters viz. phase voltages, phase currents, system frequency, per phase & total KW with maximum demand, KVAR, Power factor etc. It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850. However, the detail specification of the meter shall be same as that for 33 kV panel meter described in above relevant clause.

Note: Related software with licenses & accessories 02 (Two) Copies for each Switching station for Energy meters is within the scope of supply.

7.1.3.44 PROTECTIVE RELAYS

All Protective relays & Auxiliary relays shall be numerical programmable type and shall comply - relevant IEC or equivalent international standard. All the relays shall be IEC 61850 protocol type for automation network of the 33 kV Switching-station. Contract arrangement of the relays should conform to the requirements of the diagram. All relay should have rear FO port for IEC 61850 and front USB port with sufficient I/O as per requirements.

Note: Related software with licenses & accessories 02 (Two) Copies for each Switching Station for Protective Relays is within the scope of supply.

7.1.4 33 kV Outdoor Vacuum Circuit Breaker for Incomer

7.1.4.1 General Features:

1. Installation	:	Outdoor switching-station
2. Type	:	Vacuum Circuit Breakers :
3. Number of Phase	:	3 (Three)
4. Operation	:	Single Break in Service/Pole
5. Service Voltage	:	33 KV
6. Maximum Rate Voltage	:	36 KV
7. Frequency	:	50 Hz
8. Normal Rated Current for	:	2500 A
9. Symmetrical Breaking Capacity	:	31.5 KA
10. Asymmetry	:	As per IEC.
11. Short Time Current Duration	:	31.5 KA, 3 Sec.
12. Making Current (Peak)	:	78 KA :
13. Opening Time (Maximum)	:	0.05 Sec
14. Closing Time	:	2/3 Cycle
15. Capacity of Vacuum Interrupter at rated short circuit current switching	:	≥ 100 nos, of operations
16. Basic Insulation Level (1.2/50 Micro Second Wave)	:	170 KV
17. Power Frequency Test Voltage (Dry)	:	70 KV at 50 Hz, 1 Min
18. Rated Operating Sequence	:	0-0.3Sec-CO-3m-CO
19. Standard	:	Design, Manufacture, Testing Installation and Performance shall be in accordance with the latest edition of applicable IEC-60056 & IEC-62271-100

7.1.4.2 FEATURES

- Circuit Breaker terminal connectors shall be suitable for ACSR Martin, Merlin and Grosbeak (636MCM), twin t-acsr.
- Grading terminal connector. All current carrying parts shall be made of copper except Top & Bottom pad of connector, which shall be Bi-metallic/Al-Alloy.
- Externally visible circuit breaker position indicator.
- Electrically remote-controlled operating mechanism.
- Shall be capable of the interrupting duties produced by the switching of transformer magnetizing current and the switching of line charging current Tests certificate demonstrating this ability of the circuit breakers shall be submitted with the offer.
- Circuit Breaker closing mechanism shall be 230-volt AC motor wound spring-operated type such that the closing speed is independent of the operator
- Shall be two tripping coils and one closing coil
- Hand closing and tripping shall be done through manual levers.
- Trip free mechanism as specified in IEC 60056-1 ie. tripping is independent
- Local "Close" and "Trip" controller.
- VCB should be re-strike free.
- VCB should be trip free.
- Operation Counter
- Supporting Steel Structure
- Bushing Insulator as Specified in IEC-60137.
- Weather proof sheet steel control kiosk, with hinged door on three sides and necessary multi-core cable glands. Controls from this position will normally is used under maintenance and emergency conditions only. AC 230V lighting system inside the door of control kiosk shall be provided.
- ARC suppression type contacts.

- Manually operating devices for slow closing for inspection and maintenance. It shall not be possible to slow close a breaker when in normal services
- Earthing pad with provision for earth leads
- Standard sundries like anti-condensation heaters, MCBS wiring board etc. Facilities to be incorporate for tripping and lockout of the breaker in the event Vacuum failure falling below stipulated value.
- Rating plate and diagram plate shall be made of stainless steel and have engraved letters filled with black enamel paint
- Evidence of prototype tests together with test certificate from a recognized institution covering the equipment shall be furnished with the offer. The test duty shall be as per the requirements of IEC-60056.
- Laminated control & protection drawing set shall be fitted/supplied inside the control box/kiosk
- Motor-driven, spring charged
- Automatically charged after each closing operation
- 0-C-O operation without recharging
- Mechanical/electrical anti-pumping
- Provision for manual charging
- Manual closing and tripping arrangement
- Mechanical ON-OFF, operation counter and spring-charged indication
- All necessary positive interlocks installed, as per IEC guidelines.

7.1.4.3 TESTS AT MANUFACTURERS WORKS FOR OUTDOOR TYPE VCB

General
Functional electrical, material, mechanical and hydraulic tests shall be carried out at manufacturers' premises. The extent and method of recording the results shall be agreed by the Purchaser in ample time to enable the tests to be satisfactorily witnessed or to make any changes to the proposed program of tests

Material Tests
The supplier shall provide test pieces free of charge as required to enable the quality of the material to be determined at the supplier's expense. Purchaser may at its own discretion and by specific arrangement accept certified particulars of tests carried out in the absence of his authorized representative.

Type Test

Type tests are required to prove the general design of the offered equipment's/materials. The Tenderer shall submit the type test reports of the offered equipment's/materials from as per relevant clause.

Routine Tests
All equipment's/ materials shall be subjected to routine tests as per latest version of relevant IEC/ BS or equivalent international standards as mentioned in the contract at the manufacturers works and shall include, but not be limited to, an operational test.

7.1.5 33kV PCM panel for outdoor VCB

7.1.5.1 General

The panels shall be vermin and dust proof free standing type completely metal enclosed by sheet steel (minimum 1.62 mm thick) with necessary reinforcement color gray with appropriate spray painting. The approximate size will be high 2350 mm with suitable width and depth for opening at the back by hinged door with locking arrangement. The panels shall be neatly and completely wired before shipment.
The work relating to protection, control and panels for 33KV Switching-stations shall comprise of development of elementary diagram, design, manufacture, test and supply of pre-wired control panels

to be installed in the sub-station control room. The protection, control and panels are to be pre-wired with relays and meters in position. The elementary primary diagram shall be produced giving a clear representation of each protection, control and metering function. The standard design, drawing, manufacturing, testing & performance shall be in accordance to the IEC-298 standards.

7.1.5.2 33 KV CONTROL, SIGNALING METERING AND RELAY PANEL FOR OUTDOOR SWITCHGEAR

1.	AC Control Voltage.	240 ± 10% Volts
2.	DC Control Voltage.	110 ± 10% Volts
3.	Numerical programmable type Three Phase combined IDMT Over Cur-rent relay and Earth fault protection relay (with VT input) of 5 or 1 Amps (Selectable), 50 Hz, 110V dc, 3 second operating time ratings having 3 (Three) over current units and one earth fault with current setting range of the O/C & E/F relay shall be from 0.1*In to 30*In (where In is relay nominal cur-rent) for both overcurrent and earth fault element. All O/C & E/F relays shall have both IDMT & DT (51), Instantaneous (50), 52BF, and directional (67/67N) function along with IEC NI, VI, EI, LTI etc. curve setting capability. This relay should have 23 BI, 16 BO (minimum) with rear FO-LC Port for IEC 61850 Communication and rear USB port for relay configuration, Large MIMIC display, CB control button (ON/OFF) (Relay should have communication facilities as per IEC 61850).	1 set
4.	Master Trip & Trip Circuit Supervision (for each trip coil) relays.	1 Set
5.	All necessary Auxiliary & Signaling relays.	As required.
6.	Numerical Programmable 3 phase, 4 wire, 3 element solid state, indoor type, multi tariff programmable KWH Meter of accuracy class 0.2s with the features for measuring the parameters viz. phase voltages, phase currents, per phase & total KW with maximum demand, KVar, Power factor etc. Numerical Programmable Multifunction KWh Meter shall have communication facilities supported by DLMS/COSEM, IEC 61107 and Modbus or IEC 61850.	1 No.
7.	Indicating digital ampere meter flush mounting type 3 line display to show three phase ampere with accuracy class 1.0 with configurable primary ampere setting (0-2400A) and secondary ampere setting (both 1A and 5A) for connecting to the current transformer	1 No.
8.	70W, 240V AC, Single Phase space heater with thermostat and a visible light indicator which indicate the "ON"- "OFF" position of the heater	1 set
9.	All necessary AC DC MCB, TNC Switch, Selector Switch, Limit Switch, Control Switch, Toggle Switch, Link/ Base, Push Button, Indicating/ Illumination Lamp, AC Plug Socket, Wiring, Fuses, Hooter etc. i.e. complete in all respect. Mimic diagram with LED based Semaphore Indicator for Isolator/Breaker/Earth switch position. ANN ACK, ANN reset, Push Button etc.	As required.

10.	33 kV bus incomer Switchgear panel (12 windows Annunciator)	See table below
11.	Indicating digital flush mounted voltmeter with three line display having the capacity to toggle between 33 KV line and phase voltages.	1 set
12.	Multifunctional meter (MFM) capable of measuring and displaying MW, MVAR, PF, V, I, f, Φ, etc. distinguishing import and export operation.	1 set

Annunciator:

Main DC Fail	AC Fail	Main Relay Faulty	PT Failure
TCS-1 Unhealthy	TCS-2 Unhealthy	O/C Trip	E/F Trip
67 Trip	67N Trip	spare	spare

7.1.5.3 FOR 33 KV PANEL FEATURES:

Each PCM panel shall be equipped with the following:

i) Instruments and Relays described elsewhere. All the relays shall be IEC 61850 protocol type for automation network of the 33 kV Switching-station. In addition, numerical relay shall have sufficient contacts and shall be configured for SAS operation. Intermediate auxiliary relay with sufficient spare contacts shall be used for controlling CB or any other switching devices through numerical relay in case of SAS operation

ii) The numerical bay control IED's shall be mounted together with all the relevant bay protective relays in cubicles which is to be integrated with SAS.

iii) Status indicating discrepancy, Control switches for 33 kV Circuit Breaker with safety arrangements.

iv) Illuminated Circuit Breaker and Isolator position switches.

v) Signaling relays (annunciator, compact type) to yield audiovisual signals on faults and have reset feature.

vi) The inside of the panel will have all auxiliary relays to sense the operation of gas relays, over temperature, over current, differential relay operation failure of auxiliary voltage (DC & AC) etc. and to transmit for tripping and fault signaling.

vii) All inside equipment described and required shall be neatly arranged inside the panel.

viii) Thermostat control heater with status indicating illumination lamp (LED) shall be provided.

ix) The terminal blocks for connecting the incoming multi-core cables shall be placed at the bottom part and necessary glands/ opening shall be provided for the entry of the outside cables.

x) Sufficient-working spaces shall be provided inside the panel between instruments and wiring for easy approach

xi) All AC, DC auxiliary power circuits and PT secondary circuits entering the control panel shall be provided with MCCB. Separate MCBs shall be provided for DC supply to Power, Control and Alarm & Indication circuits.

xii) Provision to hang danger/caution board.

xiii) The PCM panel shall be SCADA/SAS compatible and hence all intelligent devices, digital energy meters etc. shall comply IEC61850. All physical connections for control, measurement and status indication shall be made SAS ready.

xiv) Sufficient spare terminals (at least 25%) in each terminal block.

xv) There must be two trip coils, both trip coils shall be energized by separate contacts of trip relay for protection tripping. However, for manual tripping, only one trip coil can be

engaged only.

xvi) All CT Terminal blocks shall have shorting, isolating and jacking (test barrel) facility while PT terminal blocks shall have isolating and jacking (test barrel) facility.

xvii) Circuit Breaker control indicating switches and isolating position indicating lamps to indicate spring Charge/ Readiness for closing and healthy trip circuit indicating readiness for tripping

xviii) Signaling/Indicating lamps shall be LED type only.

xix)Auxiliary relays, trip relays with spare contacts, fuses.

xx) All necessary switches etc.

xxi)Provision for lighting etc.

xxii) 70W, 230V AC, 1-phase heater with thermostat and control switch and a visible light indicator which indicate the "ON"- "OFF" position of the heater

xxiii) Mimic diagram along with semaphore for CB, DS and ES. Mimic diagram shall contain LED based Semaphore Indicator instead of moving Semaphore indicator. The color and size of the mimic shall be as described below:

33 KV	GREEN	½ "X 1/8"

xxiv) Ferrule marking and color coding for all type of wiring shall be as follows:

Ferrule marking:

i) "C"-for O/C & E/F protection circuit
ii) "D" for metering circuit x. "E"- for PT circuit
iii) "L"-for Alarm & Indication circuit
iv) "S"-for fault recorder

Color coding:

i) "Black"- for phases of AC supply
ii) "White"- for neutral of AC supply
iii) "Grey"-for control circuit x. "Brown & Grey"- for (+) and (-) DC supply respectively
iv) "Red, Yellow, Blue, Black" for CT and PT circuit
v) "Yellow with green strip"-for earthing.

xxv) Detailed schematic diagram of control circuit of PCM inside panel.

xxvi) Over current & Earth fault protection shall be combined in one relay

xxvii) Annunciator shall have 12 nos. window with built-in buzzer.

xxviii) Necessary communication cable and software shall be supplied.

xxix) Indicating/Signaling Lamps shall be of LED type. Following LED Indicators including Lamp test facility shall be provided in the panel:

DC available	AC available	CB open	CB close	Spring charged	CB tripped	CB in test position	CB in service position

xxx) The painting shall be gray outside and glazed white inside. (RAL 7032).

Besides the provisions of control, signal, protection and metering described, any other provisions to suit with the requirement of associated equipment of the concern feeder shall be provided. All meters and relays shall be flush mounting. There shall be panel grounding terminal. The bidder shall quote the particulars of various protective relays, meters, Auxiliary relays signaling relays, discrepancy control and position indicating switches etc. of the control panel, mentioning the names of the manufacturers. Each 33KV PCM panel will be connected to 02 DC supply source with redundant hot stand by configuration.

Tenderer shall supply related software with license (2 copy) and manuals describing trouble shooting procedure (3copies). Two set relay test plug has to supply for each switching station.

7.1.5.4 Alarms

The following alarm provision shall be made:

7.1.5.5 33 kV Incoming Feeder (12 window Annunciator)

Main DC Fail	AC Fail	Main Relay Faulty	PT Failure
TCS-1 Unhealthy	TCS-2 Unhealthy	O/C Trip	E/F Trip
67 Trip	67N Trip	Spare	Spare

Besides the provisions of control, signal, protection and metering described, any other provisions to suit with the requirement of associated equipment of the concern feeder shall be provided. All meters and relays shall be flush mounting. There shall be panel-grounding terminal.

The tenderer shall quote the particulars of various protective relays, meters, Auxiliary relays signaling relays, discrepancy control and position indicating switches etc. of the control panel, mentioning the names of the manufacturers.

7.1.5.6 TESTS

Complete tests shall be made at the manufacturer's factory in accordance with the latest relevant IEC 62271-200:2003 standards. Among others, at least the following test shall be included:

a) Wiring Check
b) Functional check
c) Di-electric Test
d) Verification of protection

Test plugs shall be supplied. Test results of instruments and relays are to be provided along with the bid.

7.1.5.7 Construction Details

a) The Control and Relay Board shall be of Simplex, completely metal closed and the access door shall be provided at the back of each Panel where no instruments or relays shall be mounted. The indicating and signaling devices etc. shall be mounted on the front side and the auxiliaries which shall be inside the Panel. Cubicles shall be drip-proof, and vermin proof, with the minimum IP41 protection degree. Equipment shall be arranged to give reasonable access to all components mounted on the panel front and inside.
b) The individual panel shall be approximately 2300 mm. in height with Channel base, 900 mm. in depth and of suitable width limited to 1000mm to accommodate the equipment at a suitable height, suitable gaps to facilitate easy workability as specified hereafter. Individual piece of Channel base of PCM Panel is to be provided to obtain the flexibility of inter-changing the Panel, if any.
c) Each panel shall be fabricated from steel sheet (minimum 2mm thick) with necessary steel member reinforcement to make the structure self-supporting. All joints are to be welded and ground to be made smooth.
d) Doors shall be secured by locking integral handies and locking provision shall be made.
e) Mounting brackets required shall be arranged inside the panel for mounting and fixing auxiliary devices and terminal blocks.
f) Instruments meters control switches and protective relays shall be mounted on the front panel only. Panel output mounting studs and support brackets shall be accurately located.
g) Finished panel surface shall be free of waves and other imperfections exterior panel surfaces shall be send blasted, ground smooth, filled, panel and finished with gray enamel. Interior surface shall be sand blasted, primed and finished with glass white enamel.
h) The complete panel shall incorporate all necessary instruments, meters, relays, auxiliary relays, control switches, indicating lamps, mimic, annunciator, audible alarms, horizontal and vertical wiring trough, wiring supports, interior lighting system, terminal blocks, fuses and links etc.
i) The supplier shall furnish internal panel wiring and circuit protection. The supplier shall

provide one 100W, 230, AC strip heater in the panel The heater shall have a separate switch.

j) A lamp shall be fitted inside each cubicle and a utility socket in selected cubicles and so arranged that all wiring is illuminated as evenly as possible without dazzle. The lamps shall be controlled from a door switch. The sockets shall be fused.

k) Design, material selection and workmanship shall be such as to result in neat appearance. inside and outside with no welds, rivets or bolt head apparent front outside, with all exterior surfaces tune and smooth

l) Cable entries to the panel shall be from the bottom. The bottom plates of the panel shall be fitted with removable gland plates and fixed with cable glands

m) Engraved name plate shall be provided at the top of the front enclosure.

7.1.5.8 Assembly:

Necessary items of equipment shall be assembled in the factory prior to shipment and routine tests shall be performed by the manufacturer as per the requirements of the latest issue of WZPDCL that the switchgear panels comply with the requirements of the relevant IEC standards IEC as specified under each equipment in these specifications to demonstrate to the satisfaction of

7.1.5.9 Casting:

Casting shall be true to pattern, of workmanlike finish and of uniform quality and condition, free from blowholes, porosity, hard spots, shrinkage defects, tracks or other injurious defects, shall be satisfactorily cleaned for their intended purpose.

7.1.5.10 Welding:

Wherever welding is specified or permitted, a welding proces, including stress relieve treatment as required if necessary, conforming to an appropriate and widely recognized professional standard shall be used. All welders and welding operators shall be fully qualified by such a standard.

7.1.5.11 PANEL WIRING

The supplier shall provide internal wiring and connections, in accordance with the requirements of the following paragraph:

a) All wiring shall be carried out with 1100 volts grade single core, multi strand flexible tinned copper wires with PVC insulation which has provided its utility in tropical region against hot and moist climate and vermin.

b) All wiring used within the panel shall conform to the requirements of these specifications and shall be installed and tested at the factory. All wiring shall be neatly and carefully installed in wring gutters of raceway wiring raceway shall be plastic wiring duct with covers. Instrument wiring on the panel shall be numbered sequentially with color code from the sources to the panel instrument and the number of the source equipment shall be used as a prefix for the individual wire numbers, wiring shall be terminated at terminal blocks plainly lettered or marked in accordance with the manufacturer's connection diagrams.

c) Sufficient clearance shall be provided for all the leads. All the leads for external circuit wiring shall be connected to grounded terminal blocks located for convenient connection of external circuits.

d) Splices will not be permitted in panel wiring. Each wire shall be continuous from end to end and shall not have any joint within itself individually.

e) All the terminal block connections shall be made with ring type lugs. Pre-insulated ring type terminals with crimp guide or per-insulated slotted spring spade terminals shall be provided on devices equipped with individual fitted covers.

f) Arrangement of circuits on terminal block shall be such that all the connections for one circuit, plus any spare conductors, shall have terminal blocks adjacent to the split and shall be provided with wiring required to interconnect the split unit.

g) Terminal Ends of all wires shall be provided with numbered Ferrules. At point of inter-connection where a change of number is necessary, duplicate Ferrules shall be provided with the appropriate numbers on the changing end.

h) Wire termination shall be made with solder less crimping type and tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel

wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected for any purpose. Termination shall be such that no strand of a conductor shall left loose or overhanging. Conductor termination shall be secured to the holding nuts/screws, terminal blocks etc. with washers between the terminals/holding nuts/screw heads. The terminals shall be so connected that no conductor ferrule code gets masked due to overlay of conductors.

i) Wiring connected to the space heaters in the cubicles shall have porcelain beaded insulation over a safe length from the heater terminals.
j) All spare contacts of relays shall be wired up to terminal blocks.
k) The size of the wiring used in the panel shall be conform to the following requirements:

Table 1

Circuit	**Permissible size of wire**
Metering and Relaying Circuits connected Current Transformer	minimum 4 Sq.mm.
Potential Circuits for metering and Relaying, Control, Visual Audible Alarms and Signaling Circuit	minimum 2.5 Sq.mm

The following colour schemes shall be used for the Wiring:

Table 2

Circuit where used	**Colour of Wire**
Red Phase of Instrument Transformer Circuits	Red
Yellow Phase of Instrument Transformer Circuits	Yellow
Blue Phase of Instrument Transformer Circuits	Blue
Neutral connection, earthed or not earthed in the instrument Transformer Circuit	Black
A.C. Control Wiring Circuits using auxiliary supply	Black
D.C. Control Wiring Circuit using Battery Supply	Grey
Earth Connection	Green

Closing circuit of the PCM panel shall have Interlocking mechanism with DS/ES switch. DC/AC supply of the 33 kV breaker panel shall be supervised through corresponding PCM panel. Single point grounding of the neutral of CT/PT circuits shall be ensured. It is always recommended that the neutral of CT/PT is grounded at the CT/PT junction box end. Ferrule marking and color coding shall be as per above relevant clause

7.1.5.12 POWER SUPPLY DISCONNECT

Each panel mounted devices requiring AC or DC supply shall have disconnecting devices from the power supply in the tripped or open condition. The MCCB has used in DC control circuit shall have a rating of 6A and 250 V. The tumbler switch in the heater shall have the same rating.

Each S/S will be equipped generally with the following:

3 (Three) phase MCCB for incoming from Auxiliary transformers	-1(one)no.
incoming DC for battery	-1 (one) no.
MCCB for MCCB for AC outgoing	-10 (ten) nos.
MCCB for DC outgoing	-10 (ten) nos.

The fuses shall be modular type with Bakelite frame and reinforced retaining clips.

7.1.5.13 INDICATING LIGHTS

The lamps shall be of LED type and suitable for being operated on S/S D.C. voltage or AC voltage or P.T. secondary supply as and where applicable. All Lamps shall be interchangeable, panel mounting type with rear terminal connection and shall afford easy replacement from the front of the panel. Lamps shall have translucent lamp covers to diffuse lights and coloured Red, green, Amber, clear

white or blue as specified. The lamp cover shall be of screwed type, unbreakable and mounded from heat resisting material. The indicating lamps with resistors shall withstand 120% of rated voltage on a continuous basis.

The colour scheme of the signal lamps shall be as follows:

Sl. No.	Functions	Quantity	Color of the Lamp
1.	C.B. Spring charged indication	1No	blue
2.	C.B. trip Coil/Circuit healthy Indication	2 No	white
3.	C.B. Auto tripped indication	1 No	Amber
4.	Panel D.C. Fail indication	1 No	Amber
5.	P.T. Supply indicating Lamp	2 Sets	Red/Yellow/Blue
6.	C.B.-ON indication	1 No	Red
7.	C.B.-OFF indication	1 No	green

7.1.5.14 TERMINAL BLOCKS

Terminal blocks shall be of clip-on design made out of non-trackable insulating material of 1100 V grade. All terminals shall be stud type, with all current carrying and live parts made of tinned plated brass. The studs shall be of min 4 mm dia brass. The washers, nuts, etc. used for terminal connectors shall also be of tinned plated brass. All blocks shall be shrouded by easily removable shrouds made of transparent die-electric materials.

The terminal connector/blocks shall be disconnecting type terminal connectors for PT and same with automatic shorting of C.T. secondary terminals shall be provided in CT secondary circuit. All other terminal connectors shall be Non-disconnecting type. Terminal should be shock protected in single molded piece. Terminal block should have screw locking design to prevent loosening of conductor Provision shall be made on each pillar, for holding 10% extra connection (5% incoming + 5% outgoing).

At least 25% spare terminals for each type shall be provided. All terminals shall be provided with ferrules indelibly marked or numbered and identification shall correspond to the designations on the relevant wiring diagrams. The terminals shall be rated for adequate capacity which shall not be less than 10 Amps for control circuit. For power circuit it shall not be less than 15 Amps. All CT Terminal blocks shall have shorting, isolating and jacking (test barrel) facility while PT terminal blocks shall have isolating and jacking (test barrel) facility. CT, PT, Control, Alarm etc. wiring shall be separately grouped or segregated. All physical connections for control, measurement and status indication shall be made SAS ready hence Terminal Blocks shall be kept reserved if necessary.

7.1.5.15 INSTRUMENTS AND DEVICES

Indicating instruments shall be semi flush panel type with accuracy class of 1 except for energy meters which shall be of 0.2s. They shall be approximately 100 mm square with black 250 degree scales on a white back ground. All AC instruments shall be designed for operation on 1A current transformers secondary and 110V (50 Hz) potential transformer secondary.

7.1.5.16 PANEL LIGHTING

a) The Panel interior shall be illuminated by CFL lamps connected to 230 Volt Single Phase A.C. The illumination of the interior shall be free from shadows and shall be planned to avoid any strain or fatigue to the wireman likely to be caused due to sub-normal or non-uniform illumination. One emergency D.C. light shall be provided for each panel with individual switch with proper identification mark.
b) A toggle switch or door operated switch shall be provided for control of A.C. lighting in each panel.
c) One combined 15 Amps. 3-Pin and 5 Amps. 2-Pin Power Socket outlet together with Plus Pins shall be provided at convenient points in each Panel for A.C. Supply.

7.1.5.17 CONTROL AND SELECTOR SWITCHES

All switches shall be located at a convenient operating height and so constructed, mounted and wired to facilitate the maintenance of contacts without the need to disconnect wiring. Switches shall have locks incorporated in the design. Control switches must be lockable in the inactive or neutral position and selector switches in all positions. Labels shall clearly indicate all positions and function of each switch.

7.1.5.17.1 Control Switches

Control switches shall be of either the handle type and shall be arranged to operate clockwise when. closing the circuit devices and anticlockwise when opening. Handle type switches shall be so designed that when released by the operator the handle and mechanism shall return automatically to the centered neutral position and interrupt the supply of current to the operating mechanism of the circuit device. All control switches shall have additional labeling giving the reference identification of the primary device. A lamp test facility shall be provided in association with any discrepancy switch.

7.1.5.17.2 SELECTOR SWITCHES

Selector switches shall have spade type handles. Where key operated switches are specified these shall be operated by inserting and turning the key to the required position. The key shall be removable in the 'off' position only.

7.1.5.18 ANNUNCIATOR

a) Suitable electronic Annunciator for the visual and audible alarm on the control panel using bright LEDs shall be provided in each panel to indicate over current and earth fault protection operated. In addition to above, each electronic annunciator of Transformer Control Panel shall have provision to indicate Transformer trouble trip/alarm function operated. Also, one window of the Annunciator shall have to be used for Non-Trip A.C. Fail Alarm Indication and one window for Trip Circuit unhealthy indication.

b) Each Electronic Annunciator shall have provision for connection with accept/reset/lamp test/mute Push buttons for proper functions. Electronic annunciator shall have provision for connection with Electronic Buzzer/Electronic Bell for Trip & Non-Trip Audio Alarm of common announce scheme. Electronic Annunciation shall have provision for flashing illuminating display inscription for operation of respective Protection Relay. The Electronic Annunciator should be separate coloured windows for Trip & Non-Trip Annunciation for easy detection.

c) Annunciator fascia units shall have translucent plastic windows for each alarm point.

d) Annunciator fascia plate shall be engraved in black lettering with respective alarm inscription as specified. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall be about 5 mm. The inscriptions shall be visible only when the respective fascia LED will glow.

e) Annunciator fascia units shall be suitable for flush mounting on panels. Replacement of individual fascia inscription plate and LED shall be possible from front of the panel.

f) Unless otherwise specified, one alarm buzzer meant for non-trip alarms and one bell meant for alarms shall be provided in each control panel (mounted inside).

g) Each annunciator shall be provided with 'Accept', 'Reset' and 'Test' push buttons, in addition to external PB.

h) Special precaution shall be taken by the manufacturer to ensure that spurious alarm conditions not appear due to influence of external magnetic fields on the annunciator wiring and switching disturbances from the neighboring circuits within the panels.

i) In case 'RESET push button is pressed before abnormality is cleared, the LEDs shall continue glow steadily and shall go out only when normal condition is restored.

j) Any new annunciation appearing after the operation of 'Accept' for previous annunciation, shall provide a fresh audible alarm with accompanied visual alarm, even if the process d "acknowledging" or "resetting" of previous alarm is going on or is yet to be carried out.

7.1.5.19 INDICATING AMMETERS

Each 33kV PCM panel will be provided with one digital ampere meter flush mounting type 3 line display to show three phase ampere with accuracy class 1.0 with configurable primary ampere setting (0-2400A) and secondary ampere setting (both 1A and 5A) for connecting to the current transformer