



GUJARAT ENERGY TRANSMISSION
CORPORATION LTD.

SARDAR PATEL VIDYUT BHAVAN,
RACE COURSE, VADODARA - 390 007

TECHNICAL SPECIFICATIONS
FOR
66kV CONTROL & RELAY PANELS

GETCO / E / TS- CRP 3601 /R7, May 2025

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**TECHNICAL SPECIFICATIONS
FOR 66 kV CONTROL AND RELAY PANELS**

**SECTION – I
GENERAL TECHNICAL REQUIREMENTS
FOR 66 kV CONTROL AND RELAY PANELS:**

In case, bidder is Control & Relay Panel manufacturer and not relay OEM, they have to submit Authorization and Service Back-Up Guarantee from the relay manufacturer for the offered relays.

1.1 SCOPE:

- 1.1.1 This specification covers the manufacture, assembly, testing at manufacturer's works, supply and delivery of control and relay panels complete with wiring, meters, relays, control switches and other miscellaneous equipments specified herein-after, in this Specification.

1.2 STANDARDS:

- 1.2.1 The 66kV control & relay panel and materials covered by this Specification shall comply with the requirements of the latest edition of the following standards as amended up to date except where specified otherwise in the specifications.

- 01. A.C. Electricity meter : IS: 722 (Part –I & IV) (Latest edition)
- 02. Recording instruments : IS: 6236 (Latest edition)
- 03. Protective relays : IS: 3231 & IEC 60255 (Latest edition)

- 1.2.2 However, in the event of offered 66kV control & relay panels, confirming to standard other than above Standards, the salient points of differences between the standards adopted and the specified standards shall be stated in the offer.

1.3 DRAWINGS:

- 1.3.1 Bidder shall submit following drawings, with the offer for preliminary scrutiny.
Principal dimensional details of each control and relay panel.

- i) All the drawings i.e. Front & Rear views, Top view, Side view, Internal views, etc., of the panels with instrument, devices and relay positions marked.
- ii) Details of protection schemes for lines, transformers etc. and annunciation system offered with its leaflet.

- 1.3.2 The successful bidders shall furnish the following drawings for approval to the purchaser.

- a) General arrangement drawings of control and relay panels, showing all parts / items mounted on them with height of each along with complete panel wise list of equipment and list of nameplates.

- b) Schematic internal wiring diagram of each panel, showing termination of external wiring.
- c) Schematic drawing shall follow TB Nos. as under.
 - 1 – CT Circuits,
 - 2 – PT Circuits,
 - 3 – Aux. AC & DC supply
 - 4 – Control Circuits,
 - 5 – Indication Circuits,
 - 6 – Annunciation Circuits,
 - 7 – RTU / Spare,
 - B – Bus wires
 - M – Energy meter RS485 communication wires
- d) Details of all switches.
- e) Outline drawings and internal wiring diagrams of all instruments, relays and other parts / items.
- f) Outline drawings, mounting details, internal wiring diagram and item wise bill of material for all devices not located in bidder's panels, but supplied by him with the panels.
- g) Complete three-phase diagram (AC Schematic), covering all elements controlled from the control panels. They shall show all AC Power connections, and secondary connections for relays, meters etc. with vector representation.
- h) Complete schematic control diagrams of all parts / items controlled from the panels, including synchronizing circuits, if required. These diagrams shall show complete internal circuits of the controlled parts / items and clearly indicate the terminal markings for extra connections.
- i) Complete schematic drawing for annunciation system with various purposes for which it is suitable.
- j) Foundation drawings including Cable Cut-outs and floor plans of control and relay panels.
- k) Locations of cable slot for Bus wires and weights shall also be given on these drawings.

1.3.3 They may submit any other drawing found necessary in addition to the drawings stated above.

1.3.4 The sequence of drawing sheets shall be as follows.

- 1. Title Sheet
- 2. Brief Product specifications
- 3. GA drawings – Front view, Rear View, Side View, Internal views, Foundation Drawing including Cable Cut-outs
- 4. Bill Of Materials
- 5. Station Single Line Diagram (if applicable)
- 6. Single line Diagram
- 7. Protection Single Line Diagram
- 8. AC & DC distribution
- 9. Metering Circuit
- 10. Main Protection Relay Circuit
- 11. Back up Protection Relay circuit

12. Circuit Breaker Closing & Tripping circuit
13. Indication Circuit
14. Annunciation Circuit
15. TB details
16. Wiring Table (with 'as built' drawings only)

1.4 DETAILED DESCRIPTION:

1.4.1 Construction of panel and detailed description:

1.4.1.1 The control and relay panel shall be of simplex type and comprise of one vertical stationary front panel, provided with single door (fitted and lockable with latches at three points) on the rear.

1.4.1.2 The control relay panels shall be fabricated out of structure levelled, finished sheet steel of minimum thickness 3mm for front side and 2.5mm for all other sides and necessary stiffening members. They shall form rigid, unyielding freestanding, completely assembled enclosures, neat in appearance. All structural members shall be bolted or welded together. All joints shall be made flush and all edges shall be bent at right angles and rounded. Necessary arrangements shall be made for bolting the adjacent panels together as well as for fastening them to the floor. Suitable vibration absorption devices and kickplates along the base shall be bent at right angles and rounded. The opening required for mounting the parts / items shall be punched or cut and filed smooth.

Panel shall be painted first with anti -rusting paint and then by two coats of synthetic enamel grey paint of shade 631 of IS: 5 for exterior and white for interior respectively.

1.4.1.3 Dimensions:

The dimension of the panels shall be as stated below.

Height	-	2312mm including M.S. frame of 50 x 50 x 4mm size for base.
Depth	-	610mm
Width	-	610 mm

1.4.1.4 Controls, relays and instruments shall be mounted on the front of the panel and not on any moving parts of panel. The panels shall be vermin proof and suitable for IP54 protection. They will be suitable for tropical climate. The panels shall be supplied complete with wiring, through wiring supports, interior lighting device, wiring, terminal blocks, space heaters, channels, base grounding M.S. bolts, nuts, washers, etc.

1.4.2 Mimic Diagram and Symbols:

Coloured mimic diagrams of metal or plastic, with symbols to facilitate exact representation of the system shall be fixed on the front of control panel. Control switches and ***LED*** semaphore indicators shall be incorporated in the mimic diagram to represent the respective circuit breaker and isolators. Scheme of mimic diagram shall be subject to the approval of the Purchaser.

1.4.3 Name plates and Marking:

Name plates shall be with black background with white engraved letters. Each part / item on the panels shall, also, have an appropriate nameplate. Nameplates for relays shall be marked with their function standard code number.

1.4.4 Indicating Lamps:

1.4.4.1 Indicating lamps shall be of “LED” type, the supply for which shall be 110V/220V D.C. unless stated otherwise. Lamp covers shall be preferably of screwed type, unbreakable and moulded from heat resisting material. They shall be translucent to diffuse light and shall be of following unless otherwise stated. The overall diameter of lamp shall be 30 mm while that of cut out shall be 22.5 mm

- a) 'RED' for indicating “CLOSED” position of breakers.
- b) 'GREEN' for indicating “OPEN” position of breakers.
- c) 'BLUE' for indicating Spring charged position
- d) 'MILKY WHITE' for SF6 Gas Pressure Normal.
- e) 'WHITE' for 'TRIP CIRCUIT HEALTHY' indication (2 Nos with Push buttons).
- f) 'AMBER' FOR 'AUTO TRIP' indication.

1.4.5 LED Semaphore Indicators:

1.4.5.1 LED Semaphore indicators shall be provided on the front side of the panel on Mimic diagram for indicating position of circuit breakers, isolators and earthing switches. Their operating voltage shall be 110V / 220V D.C., unless otherwise stated.

1.4.6 Switches:

1.4.6.1 All switches shall be of rotary operated type with silver to silver contacts of adequate making, carrying and breaking current ratings and shall be provided with easily removable protective terminal covers. The contacts of all switches shall preferably open and close with snap action to minimize arcing. Switches shall be suitable for accommodating spare / additional contacts, if required subsequently, and this point shall be brought out in the offer. The bidder shall clearly state the continuous current ratings and interrupting current rating for D.C. and A.C. inductive and non-inductive circuits. The type of switches used shall be subject to approval of the Purchaser.

1.4.6.2 Circuit breaker and isolator control switches shall be of “THREE POSITION SPRING RETRUN” type with pistol grip handles. The spring return type switch shall have spring return from close and trip position to 'After Close' and 'After Trip' positions respectively. The control springs shall be strong and robust enough to prevent inadvertent operation due to light touch. The continuous rating of the switches shall not be less than 25 Amps. and that for one second shall be 150 Amps. Breaker control switches shall be provided with adequate nos. of spare contacts for control, interlocking, annunciation and discrepancy indication. Breaker control switches shall be with lost motion device for indicating auto trip indication.

1.4.7 Instruments, Meters and Recorders:

1.4.7.1 All instruments, meters and recorders shall be enclosed in dust-proof, moisture resistant, black finished cases and shall be suitable for tropical atmosphere. All accessories, including test switches and test plugs, wherever required, shall be furnished. They shall be capable of withstanding over currents due to faults in primary circuits. Their elements shall be shock-resistant and shielded from external magnetic field. These shall be mounted semi-flush on the panel with only flange projecting. Dials shall be white with black numbers.

1.4.7.2 1 No. of Digital Multi Function Meter (MFM):

Multifunctional, Flush Mounted, 3-phase Digital Power Meter showing RMS values of all the three phase Voltages (Phase to Neutral, Phase to Phase Voltages in KV), Currents (Line Currents in Amp), Power (in KVA, KW & KVAR), Power factor, Frequency, Total Harmonic Distortion (THD) for both Voltage and Current.

Technical Parameters

1. Rated Aux Power Supply: 110/220 V DC $\pm 15\%$
2. Voltage Inputs: 63.5/110 V, 4 Nos (V_r, V_y, V_b, V_n) **Primary and Secondary PT input shall be programmable on site**
3. Current Inputs: 1 A, 3 Nos (I_r, I_y, I_b), **and Primary and Secondary CT input shall be programmable on site**
4. Burden: (i) 0.2 VA max for each phase voltage input
: (ii) 0.3 VA max for each phase current input
: (iii) 10 VA max for Aux Supply
5. Accuracy Class: **0.5S**
6. Meter Size: 96x96mm
7. Display: **Bright Seven Segment Digital LCD/LED display, 3 or 4 Line, 6 Digits display along with selection Key pad**
8. Communication port: Standard RS-485 port at rear side
9. Communication Protocol: Modbus
10. Terminal Connectors: Suitable to connect 2 Nos of 2.5 Sq. mm, Multi Stranded Cu wires
11. Standards: It shall comply to relevant EMI, EMC, Safety and Environmental Standards

1.4.7.3 Energy Meter:

The Energy Meter shall be as per separately attached technical specifications.

1.4.8 Annunciation System:

1.4.8.1 General:

Alarm annunciation system shall be provided for the control board in order to draw the attention of the operator to the abnormal operating conditions or the operation of any protective device. The annunciation equipment shall be suitable for operation on 220/110V DC in normal conditions and on 230V AC in case the DC supply to Annunciation is failed i.e. it shall work on both AC & DC supply with AC supply as standby.

Annunciation scheme shall have provision of AC fail and DC fail alarm internally without any external relays or wiring. Trip and Non-Trip alarms shall be distinguished by separate Hooter while DC fail alarm shall be through AC Buzzer.

1.4.8.2 Annunciation:

This annunciation is used to draw the attention of the operator, when the circuit breaker / relay trips due to fault or abnormality. The audible annunciation shall be provided by means of a "Bell". The visual annunciation shall be by flickering of a facia window.

1.4.8.3 Warning / Non Trip Annunciation:

This is used during occurrence of an abnormal operating condition, other than the tripping of the circuit breaker / relay. The audible annunciation shall be provided by means of 'Hooter'. The visual annunciation shall be obtained by flickering of the respective facia window.

1.4.8.4 DC Fail Annunciation:

This shall be used for indicating DC fail condition. The audible annunciation shall be provided by means of 'Buzzer'. The visual annunciation shall be obtained by flickering of the respective facia window.

1.4.9 Relays:

Shall be as per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

1.4.10 Auxiliary Relays:

Shall be as per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

1.4.11 Trip Circuit Supervision Relays:

Shall be as per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

1.4.12 Electrical Equipment and Wiring:

1.4.12.1 Electrical equipment furnished by the contractor shall be designed for use under the climatic conditions, prevailing at site. Metal parts shall be protected against corrosion by plating and / or painting. Power & control wiring, shall have insulation of non-hygroscopic type unless specifically stated otherwise.

1.4.12.2 Control wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks voltage grade 1.1 kV. Each wire shall be provided with identifying ferrule at each end or connecting point. Colour coding of control wiring shall be as per standard modern practice. All wires shall be flexible, multi strand copper wires with P.V.C. insulation of 1100 volts grade and shall be suitable for specified control & relay panel and shall be of adequate cross section not less than 2.5mm² stranded copper wire. The wire shall be flame-retardant and vermin proof, type, suitable for the tropical climate.

1.4.13 Terminal Blocks:

1.4.13.1 One piece moulded, barrier type, terminal block of non-inflammable plastic, having voltage grade of 800 V shall be used complete with washers, and heads strips etc. and stud type terminals. Continuous current ratings for the terminal blocks shall not be less than 41 Amps. At least twenty percent spare terminals shall be provided in each panel and evenly distributed in all TBs. The terminal blocks shall be located, on both sides of the panel.

1.4.13.2 Purchaser's control cable shall be of 2.5, 4.0, mm² size copper. The terminals shall be suitable for connection of copper conductors. In case of 2.5 sq.mm. size, the number of cables to be taken inside the terminal may be four. Accordingly, the terminal size shall be suitable.

1.4.13.3 The control schemes shall incorporate necessary arrangements for isolation purpose, while testing and checking faults in control and signalling circuits.

1.4.14 Space Heaters:

1.4.14.1 Tubular space heaters of 60 watts with thermostat control of suitable rating for connection to single phase, 240 Volts, A.C. Supply complete with switches conveniently located, shall be provided at the bottom of the cubicle to prevent condensation of moisture. The loss of power shall be low enough to keep the temperature of surface well below permissible limits.

1.4.15 Test Blocks:

1.4.15.1 Switch board type, back connected, semi-flush mounting type test blocks having Voltage rating 1100 V and Current rating 45A shall be provided with links or other devices to enable insertion of a device into the circuit without causing open circuit secondary of CT or to enable short circuiting of secondary of the CT.

1.4.15.2 Test Terminal Blocks shall be used to facilitate complete isolation of meters, instruments and relays, so that power for testing can be supplied either from the instrument transformers or from an external source.

1.4.15.3 Loose Test Plugs / handles required for online testing of the relays through Test Blocks shall be in the scope of the tender and shall be supplied with the panels. However, its quantity shall be 5% of the panel quantity.

1.4.16 Safety Earthing:

1.4.16.1 Control panels shall be provided with earthing bus of copper having a minimum cross sectional area of 150 sq.mm. Earthing bus shall be securely mounted across the inside base of the panels. Earthing bus shall run throughout the width of panel. It shall be provided with M4 holes and Nuts & Bolts at a distance of 100mm. Provisions shall be made for extending the grounding bus bar to future adjoining panels. Earthing wires shall be connected by using suitable terminals and clamp connections. Solder connections shall not be employed.

1.4.17 Switch Board Lighting:

1.4.17.1 The switchboard shall be illuminated by 11W, CFL/**9W LED lamp** with fixture including reflector, front cover, etc. The voltage rating shall be 230 Volts, 1Ph, 50 Hz, AC supply. This light shall be operated by door operated switch.

1.4.18 Supporting Steel:

1.4.18.1 All necessary embedded levelling steel, steel, anchor bolts, channels and other parts for supporting and fastening the panels shall be supplied by the successful bidder.

1.4.19 Accessories:

1.4.19.1 The successful bidder shall supply necessary accessories like test blocks, test links, special terminal boards etc. for testing, operation and maintenance of all relays and meters, as specified.

1.4.20 **Tropicalization:**

1.4.20.1 Wiring, terminal blocks, relays, instruments, meters and control devices shall be suitable for installation in a tropical monsoon area, having a hot humid climate and dry and dusty season with ambient conditions specified Section-II. All equipment and accessories shall be painted by means of spray or dip coating and shall be protected against fungus growth condensation, vermin and other harmful effects due to tropical environment.

1.4.21 **Painting:**

A suitable rust resisting primer paint shall be applied on the interior and exterior steel surfaces of control panel after removing rust by sand blasting, foreign adhering matter of grease, scale etc. An under coat to serve a base and binder for the finishing coat shall be applied. The finishing coat on the exterior of the panels shall be of shade No. 631 (Light grey) of IS 5. Polished cellulose enamel of light grey evenly sprayed on the outside and egg shall white paint evenly sprayed on the inside shall be applied as finishing coat. Sufficient quantity of finishing paint shall be supplied for minor touching up required at site.

1.4.22 **Fire Protection:**

1.4.22.1 All equipment connections and cabling shall be designed and arranged to minimize the risk of fire and damage, which may be caused by fire.

1.5 PROTECTIVE SCHEME REQUIREMENT:

Shall be as per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

1.6 TESTS:

1.6.1 **Type Tests:**

The following tests from NABL accredited laboratory shall be carried out in accordance with latest / amended / up to date IS/IEC. The bidder has to submit all the type test reports as stated hereunder for the offered item along with the technical bid. The type test reports from NABL approved laboratory shall not be older than seven years. Type test reports shall be valid as on the last date of submission of bid.

(A) Type Test of Control & Relay Panels

i. Degree of Protection IP54

(B) Type Tests of Relays

- As per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

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Important Note:

In case of non-submission / partial submission or type test reports of which validity is over, the bidder shall submit pending type test report/s from NABL accredited laboratory, in the event of an order, before commencement of supply without affecting delivery schedule, free of cost to GETCO. Confirmation for above shall be invariably submitted along with technical bid.

1.6.2 Routine & Acceptance Tests:

Before commencement of supply, one prototype shall be offered for inspection, if the supplier is supplying the offered panel first time to the purchaser. Accordingly, the Mass production shall only be allowed after clearing this inspection. This inspection shall be in addition to the regular lot wise inspection to be offered by the supplier

All control & relay panels shall be subjected to routine tests according to the relevant standards and to such other tests as may be required to ensure that each panel is satisfactory and in accordance with this specification. The Purchaser reserves the right to witness all the tests and advance intimation shall be given regarding these tests. Test reports of all such tests shall be submitted to the purchaser for approval before inspection. Any modification required in the testing procedure shall be made as directed by the Purchaser at no additional cost to the Purchaser. No panel shall be dispatched from the manufacturer's work before the relevant tests reports have been approved by the purchaser. The successful bidder shall send two copies of the certified final test reports to each consignee of all factory tests carried out on each panel, relay, meter, switch, instrument, transformer and other devices, which shall furnish complete information including the method of application and duration of test. List of routine tests to be performed on the panel shall, be as per the Quality Assurance Plan, approved by the purchaser.

1.6.3 Quality Assurance Plan:

- 1.6.3.1 The bidder shall invariably furnish, along with his offer, the quality assurance plan adopted by him/his sub-suppliers in the process of manufacturing all major equipment/component.
- 1.6.3.2 Precaution taken for ensuring usage of quality raw materials and subcomponents shall be stated in the quality assurance plan.
- 1.6.3.3 The bidder should specifically express their consent to accept additions, revisions to their quality assurance plan to meet the purchaser's requirements if needed. The final quality assurance plan to be adopted, with mutual consent, shall be decided after discussion with successful bidder.

1.6.4 Inspection:

All the material / item shall be offered for inspection by purchaser. The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications and shall not prevent subsequent rejection if the equipment is found to be defective. No material / item shall be dispatched without dispatch instruction from purchaser.

1.7 CO-ORDINATION WITH OTHER MANUFACTURERS:

The control panel manufacturer shall also co-operate and co-ordinate in every respect with the suppliers of the switchgear, equipment and other associated equipment and shall provide complete technical data, schematic drawings of control, indication, protection etc.

1.8 PACKING AND TRANSPORTATION:

1.8.1 After satisfactory final inspection and tests and after written approval has been given by the purchaser, the successful bidder shall suitably pack for transportation of panels by rail / road transport and deliver the same to the site. The marking shall include the contact number, name and address of the consignee.

1.8.2 The supplier shall be responsible for arranging transport to site and shall satisfy himself that the transport arrangements are satisfactory.

1.8.3 The panels may be transported with all instruments. Relays, switches and other devices mounted in position and wired. Instruments, relays etc. shall be specially covered so as they shall not be damaged during the panel transportation & handling. Four copies of the packing list shall be sent well in advance before the goods are delivered.

1.8.4 The packing list for each panel shall indicate complete details of the panel being dispatched to enable the consignee to identify the parts and to ensure that no part / item stated to have been supplied / transported has either been lost in transit or damaged to initiate procedure for replacement and also to enable loading of insurance claims. If the invoice does not contain full details and if any part has not been specifically mentioned in the packing list & is missing in transit, the supplier shall be responsible for the same and shall supply such parts to the purchaser without any extra cost.

1.9 GUARANTEED TECHNICAL PARTICULARS:

The bidder shall furnish complete guaranteed technical particulars as called for in Appendix – I of Section-III of this Specification. Incomplete details against GTP, shall be considered as incomplete offer.

1.10 INSTRUCTION MANUAL & DRAWINGS:

- 1.10.1 A copy of operating, maintenance & erection manuals and Drawings in English language shall be supplied with each panel.
- 1.10.2 The manuals shall be bound volume and shall contain all the printed drawings, requisite information for erection, operation and maintenance of the panels and the following particulars.
- a) Marked erection prints, identifying the components parts / items of the panels as dispatched with assembly drawings.
 - b) Performance curves, nameplate details and other data of all devices.
 - c) Complete list of spare parts.
 - d) All the drawings of the panel

SECTION – II

SPECIFIC TECHNICAL REQUIREMENTS FOR 66kV CONTROL AND RELAY PANELS:

2.1 SCOPE:

- 2.1.1 This specification covers the specific technical particulars, climatic and isoceraunic conditions, system particulars, to be considered for the control and relay panels whose Technical Requirements have been described under Section-I of this Specification and the Schedule of requirements.

2.2 SYSTEM AND CLIMATIC CONDITIONS:

2.2.1 System details:

- (i) Normal system voltage (kV) : 66
- (ii) Highest system voltage (kV) : 72.5
- (iii) Number of phases. : 3
- (iv) System frequency (Hz) : 50
- (v) Earthing : Solidly earthed.
- (vi) AC Auxiliary supply : 3-phase 4-Wire, 415V AC
: 1-phase 2-Wire, 50 C/s,
230V AC. Voltage variation +10% & - 15%,
Frequency Variation $\pm 3\%$
- (vii) DC Auxiliary supply : 2 Wire, 110/220V DC
With $\pm 10\%$, ungrounded.

2.2.2 Climatic Particulars :

- a) Maximum ambient temperature of Air in: 50
shade ($^{\circ}\text{C}$).
- b) Minimum ambient temperature of Air : 4
in shade ($^{\circ}\text{C}$).
- c) Maximum yearly average ambient: 40
Temperature ($^{\circ}\text{C}$).
- d) Minimum yearly average ambient: 30
Temperature ($^{\circ}\text{C}$).
- e) Maximum relative humidity (%). : 95
- f) Average number of thunder storm Days : 15
per annum.
- g) Average annual rain fall (CM). : 115
- h) Maximum wind pressure (Kg/M^2). : 150

- i) Earth quake acceleration : 0.08 x 2 g.
- j) Height above mean sea level. : Not exceeding 1000m.

2.2.3 The panels offered shall be suitable for continuous operation at the full rated capacity under the above conditions.

2.2.4 Since the Sub-Stations are near seashore or in an industrial area, the offered panels shall be suitable for heavily polluted atmosphere.

2.3 SPECIFIC REQUIREMENTS:

2.3.1 Type – I - 66kV Transformer C & R Panel: with differential protection

2.3.1.1 Instruments:

- (a) 1 **No.** – Digital Multi Function Meter (MFM)
- (b) 1 **No.**- Static KWh meter, flush pattern, connected to CT and PTs **as mentioned in Cl. 2.4.1 & 2.4.2.** The detailed specifications are attached separately.
- (c) 1 **No.**- Mimic diagram to represent bus bars, Isolators, circuit breaker etc.
- (d) 1 **No.**- Pistol Grip, spring return type, 3 position control switch with lost motion device for 66kV circuit breakers with one spare contact in each position.
- (e) 2 **Nos.**- Automatic LED semaphore indicators for position indication of the breaker and the isolator **in 1 bus system.**
3 Nos.- Automatic LED semaphore indicators for position indication of the breaker and the isolator in 2 bus system.
(size of LED semaphore for breaker shall be 63 mm while that for isolator shall be **48 mm**)
- (f) 2 **Nos.**- One 'RED' and one 'GREEN' - 'ON' and 'OFF' indicating lamps, suitable for 110/220V DC, for the circuit breaker.
- (g) 2 **Nos.**- 'WHITE' Indicating lamp, for 'Trip Circuit' healthy' indication with push button.
- (h) 1 **No.**- 'Blue' indicating lamp for 'spring charged' position of the breaker.
- (i) 1 **No.**- 'AMBER' indicating lamp for 'Auto Trip' indication of breaker.
- (j) 1 **No.**- 'Milky White' indicating lamp for 'SF6 Gas Pressure Normal' indication Breaker.

2.3.1.2 Annunciation:

- a) 1 No. - 18 Way illuminated facia window type alarm annunciation for indication of individual types of faults as under: -
- (i) Differential Protection Operated
 - (ii) Over current/ Earth fault Protection Operated
 - (iii) LBB Optd
 - (iv) Buchholz Trip
 - (v) Winding / Oil Temp. High Trip
 - (vi) PRV Trip
 - (vii) OLTC Surge Relay Trip
 - (viii) Buchholz Alarm
 - (ix) Winding / Oil Temp. High Alarm
 - (x) Low oil level Alarm /Air cell puncture Alarm
 - (xi) DC Fail
 - (xii) AC Fail
 - (xiii) CB Lockout
 - (xiv) SF6 Gas Pressure Low
 - (xv) Differential Relay Faulty
 - (xvi) Trip Circuit -1 / 2 Faulty
 - (xvii) Over Current & Earth fault Relay Faulty
 - (xviii) Trip Relay Operated

The unit shall be complete with necessary, bell, hooter lamps, push key units for alarm reset, alarm acknowledgment and lamp test. It shall be mounted on the front of the panel.

- b) 1 - Set of alarm accept, reset and lamp test push buttons, if required separately.

2.3.1.3 Protection (Transformer C & R panel with differential protection)

1. Transformer Differential Relay
2. Non directional O/C & E/F Relay
3. Transformer Trouble Relays
4. Trip Circuit Supervision Relays
5. Master Trip Relay

It shall be as per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

2.3.2 Type – II – 66kV Feeder Control & Relay Panel: **Dir O/C E/F protection**

2.3.2.1 Instruments:

- a) 1 No.- Digital Multi Function Meter(MFM)
- b) 1 No.- static KWh meter as in 2.3.1.1(b) above
- c) 1 No.- Mimic diagram as in 2.3.1.1(c) above.
- d) 1 No.- Pistol grip, spring return type, 3 position control switch as in 2.3.1.1(d) above.
- e) 4 Nos.- Automatic LED semaphore indicators as in 2.3.1.1 (e)above, for breaker and isolator & earth switch position indication **in 1 bus system panel. OR**
5 Nos.- Automatic LED semaphore indicators as in 2.3.1.1(e)above, for breaker and isolator & earth switch position indication in 2 bus system panel.
- f) 2 Nos.- One ‘RED’ and one ‘GREEN’ indicating lamps, working on 110V/220V D.C. to show circuit breaker 'ON' and 'OFF' position.
- g) 2 Nos.- ‘White’ trip circuit healthy indicating lamps with push button.
- h) 1 No.- ‘Blue’ indicating lamp for ‘spring charged’ position of breaker as in Cl.2.3.1.1(h)above.
- i) 1 No.- ‘Amber’ indicating lamp for “Auto trip” of breaker as in Cl.2.3.1.1-(i)above.
- j) 1 No.- ‘Milky White’ indicating lamp for ‘SF6 Gas Pressure Normal’ indication of the breaker.

2.3.2.2 Annunciation:

- a) 1 No.- 12 window annunciator for annunciation.
 - (i) Over Current Protection Operated
 - (ii) Earth Fault Protection Operated
 - (iii) Trip Relay Operated
 - (iv) Trip Circuit -1 Faulty
 - (v) Trip Circuit -2 Faulty
 - (vi) O/C & E/F Relay Faulty
 - (vii) CB SF6 Gas Pressure Low
 - (viii) CB Lockout
 - (ix) **LBB Operated**

- (x) DC Fail
- (xi) AC Fail
- (xii) **PT Fuse Fail**

b) 1 - Set of alarm accept reset and lamp test push buttons, if required separately.

2.3.2.3 Protection (66 kV Feeder) :

- 1. Directional O/C & E/F Relay
- 2. Trip Circuit Supervision Relays
- 3. Master Trip Relay

It shall be as per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

2.3.3 Type – III - 66kV Transformer Control & Relay Panel: Without differential protection

The 66kV C&R Panel for 66kV side of 220/66kV or 132/66kV Power Transformers shall be similar to type – II 66kV feeder C/R Panels with consideration of the following points.

2 **Nos** - Automatic LED semaphore indicator for isolator and breaker instead of 4 nos **in 1 bus system panel. OR**
3 **Nos** - **Automatic LED semaphore indicator for isolator and breaker instead of 5 nos in 2 bus system panel.**

CT ratio shall be 600-300 / 1-1-1A or 1200-600 / 1-1-1A

2.3.4 Type IV - 66 kV Bus Coupler C & R panel

2.3.4.1 Instruments:

- a) 1 **No.**- Digital Multi Function Meter(MFM)
- b) 1 **No.**- Section of mimic diagram as in 2.3.1.1(**c**)above.
- c) 1 **No.**- Pistol grip, spring return type, 3 position control switch as in 2.3.1.1.(**d**) above.
- f) 5 **Nos.**- Automatic LED semaphore indicators as in 2.3.1.1(**e**)above, for breaker and isolator & PT isolators position indication.
- g) 2 **Nos.**- One 'RED' and one 'GREEN' indicating lamps, working on 110V/220V D.C. to show circuit breaker 'ON' and 'OFF' position.

- h) 2 **Nos.**- ‘White’ trip circuit healthy indicating lamps with push button.
- i) 1 **Nos.**- ‘Blue’ indicating lamp for ‘spring charged’ position of breaker as in Cl.2.3.1.1**(h)**above.
- j) 1 **No.**- ‘Amber’ indicating lamp for “Auto trip” of breaker as in Cl.2.3.1.1 **(i)**above.
- k) 1 **No.**- ‘Milky White’ indicating lamp for ‘SF6 Gas Pressure Normal’ indication of the breaker.

2.3.4.2 **Annunciation:**

- a) 1 **No.**- 12 window annunciator for annunciation as in 2.3.2.2(a) above.
- b) 1 - Set of alarm accept reset and lamp test push buttons, if required separately.

2.3.4.3 **Protection (66 kV Bus Coupler):**

- 1. Non Directional O/C & E/F Relay
- 2. Trip Circuit Supervision Relays
- 3. Master Trip Relay

It shall be as per the ‘Technical Specifications of Protection Relays for 66kV System’ given separately, along with the tender documents.

2.3.5 **Type – V – 66kV Capacitor Bank Control & Relay Panel:**

2.3.5.1 **Instruments:**

- a) 1 **No.**- Digital Multi Function Meter(MFM)
- b) 1 **No.**- static **KVARh** meter as in 2.3.1.1(b)above
- c) 1 **No.**- Mimic diagram as in 2.3.1.1 (c)above.
- d) 1**No.**- Pistol grip, spring return type, 3 position control switch as in 2.3.1.1. **(d)**above.
- e) **For 1 Bus system**
 - 4 **Nos.**- Automatic LED semaphore indicators as in 2.3.1.1**(e)** above, for breaker and isolator & earth switch position indication. OR
 - 5 **Nos.**- Automatic LED semaphore indicators as in 2.3.1.1 **(e)** above, for breaker and isolator & earth switch position indication, if Panel is asked for controlling 2 Banks.

For 2 Bus system

5 Nos.- Automatic LED semaphore indicators as in 2.3.1.1(e) above, for breaker and isolator & earth switch position indication. OR

6 Nos.- Automatic LED semaphore indicators as in 2.3.1.1 (e) above, for breaker and isolator & earth switch position indication, if Panel is asked for controlling 2 Banks.

- f) 2 **Nos.**- One 'RED' and one 'GREEN' indicating lamps, working on 110V/220V D.C. to show circuit breaker 'ON' and 'OFF' position.
- g) 2 **Nos.**- 'White' trip circuit healthy indicating lamps with push button.
- h) 1 **No.**- 'Blue' indicating lamp for 'spring charged' position of breaker as in 2.3.1.1(**h**) above.
- i) 1 **No.**- 'Amber' indicating lamp for "Auto trip" of breaker as in Cl.2.3.1.1 (**i**)above.
- j) 1 **No.**- 'Milky White' indicating lamp for 'SF6 Gas Pressure Normal' indication of the breaker.

2.3.5.2 **Annunciation:**

- a) 1 **No.**- 12 window annunciator for annunciation.
 - (i) **LBB Operated**
 - (ii) Unbalance Current Protection Operated
 - (iii) O/C & E/F Protection Operated
 - (iv) Trip Relay Operated
 - (v) **Trip Circuit -1/2 Faulty**
 - (vi) **60N/50/51** Relay Faulty
 - (vii) CB SF6 Gas Pressure Low
 - (viii) CB Lockout
 - (ix) Over Voltage/ **Under Voltage** Protection Operated
 - (x) **Leading Power factor Protection Operated**
 - (xi) DC Fail
 - (xii) AC Fail
- b) 1 - Set of alarm accept reset and lamp test push buttons, if required separately.

2.3.5.3 **Protection (66 kV Capacitor Bank):**

- 1. Unbalance Current Protection
- 2. Over Voltage & Under Voltage Protection
- 3. Non - Directional O/C & E/F Relay

4. Leading Power Factor Controller Relay
5. Trip Circuit Supervision Relays
6. Master Trip Relay

It shall be as per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

2.3.6. Type – VI – 66kV Feeder Control & Relay Panel : With Line differential protection (with built in Dir O/C - E/F Protection)

2.3.6.1 Instruments:

- a) 1 No.- Line Interface unit
- b) 1 No.- Digital Multi Function Meter(MFM)
- c) 1 No.- static KWh meter as in 2.3.1.1(b)above
- d) 1 No.- Mimic diagram as in 2.3.1. (c) above.
- e) 1 No.- Pistol grip, spring return type, 3 position control switch as in 2.3.1.1.(d) above.
- f) 4 Nos.- Automatic LED semaphore indicators as in 2.3.1.1 (e)above, for breaker and isolator & earth switch position indication in 1 bus system panel. OR 5 Nos.- Automatic LED semaphore indicators as in 2.3.1.1(e)above, for breaker and isolator & earth switch position indication in 2 bus system panel.
- g) 2 Nos. - One 'RED' and one 'GREEN' indicating lamps, working on 110V/220V D.C. to show circuit breaker 'ON' and 'OFF' position.
- h) 2 Nos.- 'White' trip circuit healthy indicating lamps with push button.
- i) 1 No.- 'Blue' indicating lamp for 'spring charged ' position of breaker as in Cl.2.3.1.1(h)above.
- j) 1 No.- 'Amber' indicating lamp for "Auto trip" of breaker as in Cl.2.3.1.1(i) above.
- k) 1 No. - 'Milky White' indicating lamp for 'SF6 Gas Pressure Normal' indication of the breaker.

2.3.6.2 Annunciation:

a) 1 No.- 12 window annunciator for annunciation.

- i) Line differential protection Operated
- ii) Over Current / Earth fault Protection Operated

- iii) **Trip Relay Operated**
- iv) **Trip Circuit -1/2 Faulty**
- v) **Line Differential Relay Faulty**
- vi) **CB SF6 Gas Pressure Low**
- vii) **CB Lockout**
- viii) **DC Fail**
- ix) **AC Fail**
- x) **Communication failure/Line Differential Protection blocked**
- xi) **LBB OPTD**
- xii) **PT Fuse Fail**

b) 1 - Set of alarm accept reset and lamp test push buttons, if required separately.

2.3.6.3 Protection (66 kV Feeder) :

- 1. **Line differential relay with built in Dir O/C- E/F protection**
- 2. **Trip Circuit Supervision Relays**
- 3. **Master Trip Relay**
- 4. **Line Interface Unit (LIU)**

It shall be as per the 'Technical Specifications of Protection Relays for 66kV System' given separately, along with the tender documents.

2.3.7 Indicating lamp, instruments and vector group of power transformer, instrument transformer

- 1. **Multi function meter shall be of flush type and of 96mm x 96mm size.**
- 2. Coloured mimic diagram of 10mm width shall be for main bus and that of 5mm for remaining. Colour shade shall be as under:
 - Earth - Green.
 - 66 kV - Golden brown shade 414 of IS: 5.

2.4 Vector Group of 10MVA/15MVA/20MVA : Dyn – 11
66/11.55kV Power transformer.

2.4.1 Particulars of 66kV Current transformer:

<u>1</u>	<u>CT Ratio</u>	<u>(a) 100- 50 / 1-1-1 A</u>
		<u>(b) 150-100 / 1-1-1 A</u>
		<u>200-100 / 1-1-1 A</u>
		<u>(c) 300-150 / 1-1-1 A</u>
		<u>300-200 / 1-1-1 A</u>
		<u>400-200 / 1-1-1 A</u>
		<u>(d) 600-300 / 1-1-1 A</u>
		<u>(e) 1200-600 / 1-1-1 A</u>
<u>2</u>	<u>Purpose</u>	<u>(f) 1600-1200/1-1-1A</u>
		<u>(g) 2500-1600-1200/1-1-1A</u>
<u>3</u>	<u>Rated Burden (VA)</u> <u>(Lowest ratio)</u> <u>(Minimum tap)</u>	<u>Core-1 Metering</u>
		<u>Core-2 Relaying</u>
		<u>Core-3: Differential</u>
<u>4</u>	<u>Class of accuracy</u>	<u>15 (Core-1)</u>
		<u>15 (Core-2)</u>
		<u>-- (Core-3)</u>
<u>5</u>	<u>Accuracy limiting factor</u>	<u>0.5 (Core-1)</u>
		<u>5P (Core-2)</u>
		<u>P.S.(Core-3)</u>
<u>6</u>	<u>Instrument security Factor</u> <u>(I.S.F)</u>	<u>10 at minimum ratio for all 66 kV</u>
		<u>CTs</u>
<u>7</u>	<u>Minimum knee point</u> <u>voltage (at highest</u> <u>ratio)</u>	<u>5 or less at minimum ratio</u>
		<u>600V for a & b</u>
		<u>650V for c & d</u>
		<u>950V for e & f</u>
		<u>1200V for g</u>

2.4.2 Particulars of 66kV Potential transformer:

<u>1</u>	<u>Nominal system voltage</u>	<u>66kV</u>
<u>2</u>	<u>Number of Windings</u>	<u>Two</u>
<u>3</u>	<u>i) Ratio: Winding – I</u>	<u>38.1 kV/63.5V</u>
	<u>ii) Ratio: Winding – II</u>	<u>38.1 kV/63.5V</u>
<u>4</u>	<u>i) Rated Burden, Winding – I</u>	<u>100VA</u>
	<u>ii) Rated Burden, Winding – II</u>	<u>200VA</u>
<u>7</u>	<u>i) Class of accuracy windings – I</u>	<u>0.5 (metering)</u>
	<u>ii) Class of accuracy windings – II</u>	<u>3P (protection)</u>

STATEMENT – I

66kV CONTROL AND RELAY PANELS – SPECIFIC REQUIREMENT PER PANEL:

Sr. No.	Particulars	Unit	Transformer panel		Feeder Panel		Capacitor Panel	Bus coupler panel
			With diff. protection	Without differential protection / LV side of 220/66kV or 132/66kV Trans.	<u>With Line Diff. Protection</u>	Without Line Diff Protection		
01	Automatic LED semaphore for breaker	No	01	01	01	01	01	01
02	Automatic LED semaphore for isolator & Earth switch <u>(For 1 Bus system)</u>	No	01	01	03	03	03/04(For 2 bank)	-
03	<u>Automatic LED semaphore for isolator & Earth switch (For 2 Bus)</u>	<u>No</u>	<u>02</u>	<u>02</u>	<u>04</u>	<u>04</u>	<u>04/05 (For 2 bank)</u>	<u>04</u>
04	Indication lamp (C.B. closed, open, trip circuit healthy, spring charged, auto trip, gas pressure Normal).	No	07	07	07	07	07	07
05	Breaker control switch (Pistol grip 3 position with lost motion device and bell alarm contacts).	No	01	01	01	01	01	01
06	Digital multifunction meter	No	01	01	01	01	01	01
07	Static KWh meter	No	01	01	01	01	--	01
08	<u>Static KVARh meter</u>	No	--	--	--	--	<u>01</u>	--
09	Numerical Non-Directional O/C-E/F relay	No	01	--	--	--	01	01
10	Numerical Directional O/C-E/F relay	No	--	01	--	01	--	--
11	<u>Numerical Line Differential relay with built in Dir O/C-E/F Protection</u>	No	--	--	<u>01</u>	--	--	--
12	Numerical Unbalance Current relay	No	--	--	--	--	01	--

13	Electromagnetic / Static Over voltage relay	No	--	--	--	--	01	--
14	Electromagnetic / Static Under voltage relay	No	--	--	--	--	01	--
15	Leading Power Factor Controller Relay	No	--	--	--	--	01	--
16	5 Minute Delay Relay / Timer	No	--	--	--	--	01	--
17	PT Selection Relay (applicable to C&R panel for two main bus system)	No	02	02	02	02	02	--
18	Trip circuit supervision relay	No	02	02	02	02	02	02
19	<u>Two/Three</u> element auxiliary relay for Buchholz, oil temp, winding temp, PRV Trip. OLTC surge Relay Trip & Low oil level Trip	No	01	--	--	--	--	--
20	Master Trip Relay No	No	01	01	01	01	01	01
21	12/18 way facia annunciation scheme, complete, with 3 nos. push buttons for accept. Reset and lamp test with bell, hooter, Buzzer for Trip, Non trip & DC fail	No	01	01	01	01	01	01
22	Panel illumination with door operated switch	No	CFL/ <u>LED</u> lamp with fixture shall be provided for each panel					
23	Space heater with thermostat control, Cam type ON / OFF switch and required fuses.	No	--- To be provided with each Panel ---					
24	Mimic diagram	No	--- To be provided with each Panel ---					
25	Car type lockable handle	No	--- do ---					
26	Multi pin 15A Socket	No	--- do ---					
27	3.0 / 2.5 mm thick sheets steel for front / all sides respectively.	No	--- do ---					
28	Circuit wiring to comply to specification with required fuses, links terminal blocks.	No	--- do ---					
29	Push buttons for trip ckt. healthy	No	02	02	02	02	02	02
30	Test terminal block. 1100V grade (For energy meter)	No	01	01	01	01	01	0
31	M.S. foundation bolts/nuts, size 18mm dia x 120mm long	No	04	04	04	04	04	04
32	Relay Test Block, 1100 V, 45A	No	02	01	01	01	03	01
33	Suitably rated fuses and fuse links	No	shall be provided as per schematic drawing requirement in each Panel					
34	<u>Line interface unit</u>	No	-	-	<u>01</u>	-	-	-

Note:

1. The energy meter shall be as per **separately** attached technical specifications and it shall be compatible to the existing DAS (Data Acquisition System) working in GETCO network.
2. Indicating lamps offered shall be as under:
 - a) C.B. Closed. :‘Red’ colour
 - b) C.B. open. :‘Green’ colour
 - c) Trip circuit healthy. :‘White’ colour
 - d) Spring charged. :‘Blue’ colour
 - e) Auto trip. :‘Amber’ colour
 - f) SF6 Gas Pressure Normal : ‘Milky White’ colour

PART – II
GENERAL REQUIREMENTS

1. SCOPE:

This part covers design, manufacture, inspection, dispatch and delivery of electric control and relay panels and accessories. 'Control Panel' shall be suitable for interchangeability. Both parts of this specification are mutually dependent and are essential for correct and complete interpretation. Part I covers specific requirements and part II covers general requirements which hold good for all projects. When requirements of two parts conflict, those of part one shall prevail.

1.1 The following works have been included within the scope of this specification:

- (a) Design and fabrication of complete panel including provision for all parts / items and wiring.
- (b) Painting of all panels specified in part one of this specifications, together with such auxiliary items as may be incidental or complementary to those specified.
- (c) All internal wiring to equipment and terminals and inter panel wiring.
- (d) Furnishing of all necessary material and parts / items required for the control panel/desk to perform as specified in part I.
- (e) Electrical detailing as outlined in this specification.
- (f) Preparation and furnishing of all drawing as required.

1.2 Bidder shall separately state, in his offer all deviations from this specification, in the specified annexure only. Unless the proposed deviations are brought out clause by clause in the prescribed schedule, the proposal shall be deemed to be in total conformity with this specification.

2. STANDARDS:

2.1 The intent of this specification is to specify essential general requirements rather than all details of design construction and equipment. The supplier shall be responsible for furnishing a control board complete in all respects and details, within the limits outline above in "SCOPE" and conforming in all respects to high standards of engineering, design and workmanship. The supplier shall be responsible to make good at his own expense, any failure of circuits to function as intended when the Board is installed.

2.2 All materials and parts / items offered shall conform to the requirements of the latest editions of the relevant Indian Standards and Codes of Practices. However, in the event of offering equipment, conforming to standard other than Indian standard or this specification, the salient points of comparison between the standard adopted and Indian Standards shall be indicated in the offer.

2.3 Any materials, parts / items or methods which the supplier considers preferable to those specified here in, for the purpose intended, may be offered for consideration and prior approval.

3. GENERAL DESCRIPTION:

Simplex Control Board shall comprise of single vertical standing control or relay panels sections bolted together at their sides to form a single control or relay panel or control relay board. Each panel shall have a hinged rear access door provided with locks.

4. GENERAL CONSTRUCTIONS:

Control Board shall be completely closed, constructed from specially selected smooth finished sheet steel, not less than 3mm for front and 2.5 mm for all other sides and top, in thickness, bent and formed into a rigid unit and suitable for mounting auxiliary apparatus. There shall be sufficient reinforcement to provide flat level surfaces, resistance to vibration and rigidity during transportation and installation. Support and enclosure of cables and wiring shall be safe, neat and shall provide sufficient accessibility.

4.1 Design, material selection and workmanship shall be such as to result in a neat appearance outside and inside, with no welds, rivets or bolt heads apparent from outside and with all exterior surfaces true and smooth.

4.2 Cut outs and small wiring for items / parts shall be according to items / parts manufacturer's drawings and diagrams.

4.3 Items / parts shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent parts / items. Parts / items mounted inside the panel shall be so located that terminals and adjacent devices are readily accessible without the use of special tools.

Terminal markings shall be clearly visible.

4.4 Relays and devices mounted on or inside the control board shall have identification markings clearly visible from the insider, of control board enclosure. Devices mounted on the control board shall also be labelled on the outside of the control board.

4.5 Control Board base shall be designed with a flat bearing surface for mounting on two strips each of 10mm thick of approved type of shock absorbing materials which shall be supplied by the supplier. Foundation pamphlets describing by details in regard to method of mounting and cable trench, to be provided in the foundation platform shall be furnished by the supplier well in advance of the dispatch of the panels.

5. DESIGN DETAILS:

Panels and openings shall have edges and corners slightly rounded for safe handling.

- 5.1 Supports shall be provided for purchaser's incoming and outgoing cables. Terminal blocks shall be provided for connections between these cable and control board wiring, wiring gutter shall be provided for vertical panel wiring and for interconnecting wiring.
- 5.2 Auxiliary parts / items shall be mounted inside the panels in a manner that will not interfere with the inspection or maintenance of the wiring and the terminal connections. Wiring through, gutters, cable supports and mountings for terminal blocks shall be provided for future circuits, whenever these are specified in part I.
- 5.3 One piece moulded, barrier type, 800 Volt grade terminal blocks complete with washers heads, terminal screws and identification strips shall be used. Continuous current ratings for the terminal blocks shall not be less than 45 Amps. At least twenty percent spare terminal blocks shall be provided on each panels.

Terminal blocks shall be suitable for connection up to three conductors of purchaser's cables which will be of following sizes:

- | | | |
|-----|------------------------|----------------------------------|
| i) | PT and Control Circuit | - 2.5 – 4mm ² Copper. |
| ii) | CT Circuits. | - 4 mm ² Copper. |

- 5.4 The supplier shall be solely responsible for correctness of the internal wiring and for the proper functioning of the panels furnished by him.
- 5.5 Designation for the panel sections, relay instruments and meters, control devices circuit breakers, test blocks, fuses etc. shall be clearly marked close to the equipment. Laminated plastic name plate shall be provided for small relays, meters, test facilities and control devices.
- 5.6 A mimic bus shall be mounted on the face of the panels in the general location indicated on the switch board layout drawings accompanying this specification.
This mimic bus shall be of screwed on type, anodized aluminium or plastic.
- 5.7 Terminal Blocks for bus wires i.e. AC and DC supply, PTs, and other common services shall be provided near the top of the panels, running throughout the length of the Board.
- 5.8 Adequate illumination shall be provided for the access to interior of the switch board.
Illumination for simplex panels shall be through provision of a 240V, 1 phase 50 C/s. AC CFL/**LED** mounted in each panel controlled through rear door operated 'ON/OFF' switched.

- 5.9 Tubular space heaters with thermostat suitable for operation at 240V, 1 phase, 50 Cycles, AC supply complete with switches located at convenient positions shall be provided at the bottom of the cubicle to prevent condensation of moisture. The watt loss per unit surface of the heaters shall be low enough to keep surface temperature well below visible heat.
- 5.10 Auxiliary parts / items which has to be mounted adjacent or complementary to the parts / items specified in part one shall be mounted inside the enclosure on inner surface of panels or on supplementary structures.
- 5.11 Clamping devices shall be provided for fixing purchaser's incoming multicore control cables. These clamps shall be of robust construction, capable of clamping the cable firmly without injury to insulation. Cable type and sizes will be specified later.

6. PAINING:

A suitable rust resisting primer shall be applied on the interior and exterior surfaces of the steel after removing rusts, greases, scale etc. An under coat to serve as base and binder for the finishing coat shall be provided. Polished cellulose enamel of light grey colour specified in part one, evenly spread on the exterior of the panel & egg shall colour on the inside of panel shall be applied as finishing coat. A small quantity of finishing paint shall be supplied for minor touching up required at site.

7. WIRING:

Control Board panels shall be furnished completely wired, ready for purchaser's connections at the terminal blocks. All inter panel wiring and connections shall be furnished by the supplier.

- 7.1 Control wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminal and terminal blocks. Terminals on the terminal blocks shall be marked and numbered by the supplier to show wiring designation and shall be suitable for connecting purchaser's cables. Terminal marking shall correspond to the designations on the wiring diagrams.
- 7.2 Wiring shall be carried out with 1100V grade cable of minimum 2.5mm² copper wire. Wiring shall comprise of switchboard type, single core, multi-conductor (Minimum three strands), and annealed copper wire with PVC insulation and shall be fire retardant and vermin proof type suitable for the climatic conditions outlined in part I.
- 7.3 Wire terminals shall be made with compression type tinned copper lugs which firmly grip the conductor and the insulation. Wire terminations shall be provided with insulated sleeves to reduce the possibility of short circuits.
- 7.4 Numbered sleeves shall be used in the control panel wiring. Sleeves bearing identical numbers shall be placed at both ends of the wire, the sleeve number being shown in the panel wiring diagram. This is to facilitate checking of panel wiring and to permit easy replacement of components during maintenance.

8. TROPICALIZATON:

Wiring, terminal blocks, relays instruments, meters and control devices shall be suitable for application in tropical and shall be with suitable treatments to protect them against tropical conditions which are conducive to rust and fungus growth.

9. TEST FACILITIES:

Protective relays and electric meters shall have built-in test blocks. Devices which are not available with built-in test blocks or which have been specified to have separate auxiliary devices in their test circuits, shall be supplied with external test facilities. Test blocks in such case, shall be mounted near the auxiliary device.

9.1 Test blocks shall provide complete isolation of energy meters, instruments and relays, so that testing power can be supplied either from the instrument transformers or from an out external source.

9.2 Terminal blocks with disconnecting facilities shall be used for CT, PT secondary circuits and Auxiliary AC & DC supply.

10. GROUNDING:

Control panels shall be equipped with a ground bus bar of copper having a minimum cross sectional area of 150 Sq.mm. Ground bus shall be securely mounted across the inside base of the panels. Provisions shall be made for extending the grounding bus bar to future adjoining panels. Earthing wires shall be inter connected by using suitable terminals and clamp connections. Solder connections shall not be employed.

11. Instruments

Multi function meter shall be of flush type and of 96mm x 96mm size.

SEAL OF THE FIRM

SIGNATURE OF BIDDER

APPENDIX – I
SECTION-III
BIDDING SCHEDULES

Schedule of Guaranteed Technical Particulars(GTP) for 66kV Control and Relay Panels

The bidder must fill up all the points of GTP for offered item/s. Instead of indicating “refer drawing, or as per IS/IEC”, the exact value/s must be filled in.

I. Control and Relay panels:

1. Dimensions of control and relay panels. (mm)
2. Complete dimensions of supporting channel. (mm)
3. Thickness of the steel plates proposed for use of panels.
 - (a) Front - (mm)
 - (b) Other sides – (mm)

II. Control Switches for Circuit Breakers:

4. Make.
5. Type.
6. Type of handle provided.
7. No. of positions.
8. No. of contacts:
 - i) Normally closed.
 - ii) Normally open

III. LED SEMAPHORE INDICATORS:

For isolators & breaker. earth switches.

9. Make.
10. Type.
11. Diameter of the disc. (mm)
12. Operating voltage. (Volts)
13. Burden. (Watts)
14. Whether latch in Mechanism provided.

IV. INDICATING LAMPS:

15. Make.
16. Type.
17. Operating voltage.
18. Size of lens.
19. Wattage of lamp. (Watts)
20. Colour of lamp.

V. SWITCH BOARD WIRING:

21. Insulation of wiring.
22. Size of wiring conductor for the following:
 - i) PT circuits. (mm²)
 - ii) CT circuits. (mm²)
 - iii) DC supply circuit. (mm²)
 - iv) Other circuits. (mm²)
23. Size of earthing bar for safety earthing. (mm²)
24. Type of terminals provided on wiring.
25. Wiring conductor / copper.

VI. Instruments and Meters:

Digital Multi Function Meter and KWH meter etc. :

26. (a) Type of instruments.
(b) Applicable IS
27. Size.
28. Rated Aux. Power Supply
29. Current Inputs & Voltage Inputs
30. Maximum scale length.
31. Accuracy Class
32. V.A. burden. (VA)
33. Display
34. Maker's name and country.
35. Communication Port & Protocol

VII. Annunciators:

36. Type & make of annunciator.
37. Type of particulars of window.
38. Particulars of wiring.
39. Rated voltage. (Volts)
40. Power consumption. (Watts.)
41. Instantaneous making capacity of contacts.
42. Breaking capacity.
43. Overall dimensions of annunciator.
44. Description leaflet No.

VIII. Terminal Blocks:

45. Make & Type
46. Voltage grade

47. Current Rating
- IX. Energy meter TTB:
48. Make & Type
49. Voltage grade
50. Current Rating
- X. Relay Test Block
51. Make & Type
52. Voltage grade
53. Current Rating
- XI. Line Interface Unit
54. Make
55. Type
56. No. of FO cable
57. No. of connector ports
58. Mounting
59. Size
60. Metal box material
- XII. RELAYS :
- Schedule - B (GTP) of the 'Technical Specifications of Protection Relays for 66kV System' (Specification ID: GETCO / E / TS- CRP 3604A / **-R3 May,2025**) given separately, along with the tender documents, shall be filled in by the Bidder.

SEAL OF THE FIRM

SIGNATURE OF BIDDER

APPENDIX – II 66kV Control & Relay Panels

Details to be furnished by the Bidder

SR No	Particulars	Make	Type/Designation	Catalogue/ Literature attached
1	Automatic LED semaphore for breaker			
2	Automatic LED semaphore for isolator and Earth Switch			
3	Indication lamps			
4	Breaker control switch			
5	Digital Multi Function Meter(MFM)			
6	Static KWh meter			
7	<u>Static KVARh meter</u>			
8	Numerical Non directional O/C-E/F relay			
9	Numerical Differential relay			
10	Numerical Directional O/C-E/F relay			
11	<u>Numerical line differential relay with built in Dir O/C-E/F Protection</u>			
12	Numerical Unbalance Current Relay			
13	Electromagnetic / Static Over Voltage Relay			
14	Electromagnetic / Static Under Voltage Relay			
15	Leading Power Factor Controller Relay			
16	5 Minute Delay Relay / Timer			
17	PT Selection Relay (applicable to C & R Panel for two bus system)			
18	Trip circuit supervision relay			

SR No	Particulars	Make	Type/Designation	Catalogue/ Literature attached
19	<u>Two/ Three element</u> auxiliary relay for Buchholz, oil temp, winding temp, PRV Trip. OLTC surge Relay Trip & Low oil level Trip			
20	Master Trip Relay			
21	12/18 way facia annunciation scheme			
22	Panel illumination with door operated switch			
23	Space heater			
24	Thermostat			
25	Cam type ON / OFF switch for space heater			
26	Mimic diagram			
27	Car type lockable handle			
28	Multipin 15A Socket			
29	3.0 / 2.5 mm thick sheets steel for front / all sides respectively			
30	Circuit wiring			
31	Push buttons for trip ckt. healthy			
32	Test terminal block. 1100V grade. (for energy meter)			
33	M.S. foundation bolts/nuts, size 18mm dia x120mm long.			
34	Relay Test Block, 1100 V, 45A			
35	Suitably rated fuses and fuse links			
36	<u>Line interface unit for line differential relay</u>			

NOTE: The bidder should clearly indicate the Make & Type of the above items instead of indicating 'or its equivalent'.

TECHNICAL SPECIFICATIONS OF RELAYS REQUIRED FOR 66kV CONTROL & RELAY PANELS

Protection Relays shall be as per the dedicated ‘Technical Specifications of Protection Relays for 66 kV System’ (Specification Id: GETCO / E / TS-CRP 3604A / **R3 May 2025**) given separately, along with the tender documents.