CORRIGENDUM -3 FOR NIT NO CMC/BR/24-25/FK/PR/KG/1231 for Survey, Design, Supply, Erection, Installation, Testing, Commissioning, Handing over of 03 Nos GIS Grid Substations along with associated Civil work and 08 Nos Cable In-feed/ Laying works on Turnkey Basis			
CORRIGENDUM DATE: 22-01-2025			
Sl. No.	**Clause no**	**Description**	**Revised**
1	Clause no.2, RFQ	Qualification Criteria	Revised Qualification Criteria attached below. Terms & Conditions to apply as a consortium is also attached. Sample form of Power of Attorney for Consortium is also attached.
2	Annexure-II	Technical Specifications	Revised 66kV & 33kV Control & Relays panels specification attached

Please find the final amended PQR for review of PQR Committee and approval.

Qualification Criteria for Package A

Qualification Criteria QR -01 : For the GIS OEM OR EPC Vendor for GIS/AIS Substation:

S No	Conditions	Qualification Criteria
1	OEM with Manufacturing base in India / EPC Bidder with GIS/AIS Substation Work	Bidder shall be the Manufacturer (OEM) of "GIS Panels" of 66 kV or Higher Voltage rating, with manufacturing base in India. Offered GIS equipment shall be supplied from Indian manufacturing unit only. OR Bidders shall be "EPC Bidder" with the relevant experience in the field of installation and commissioning of 66 KV or Higher Voltage rating GIS/AIS Substation, along with the complete Supply, Installation, including all associated Civil Works. Erection of GIS panels shall be executed by "OEM" Only. Undertaking for the same has to be submitted by EPC Bidder. For GIS Panel- EPC Bidder shall supply from the GIS –OEMs who adhere to the Qualification Criteria as specified in Points 1-4 of QR-01 of Package A EPC Bidder shall furnish the name of GIS – OEM, along with the Bid Submitted.
2	Experience	GIS OEM bidder must have designed, supplied, installed & commissioned at least 2 Nos. of GIS Grid Sub-stations of 66 kV or higher voltage Rating on turnkey basis in last Five (5) years from date of Bid opening in any utilities/SEB's/PSU's/Govt Organization/reputed firm wherein the end user shall be Utility/SEB's/PSU's/ Govt Organization. OR

		EPC Bidder must have designed, supplied, installed & commissioned at least 2 Nos. of GIS/AIS Grid Sub-stations of 66 kV or higher voltage Rating on turnkey basis in last Five (5) years from date of Bid opening in any utilities/SEB's/PSU's/Govt Organization/reputed firm wherein the end user shall be Utility/SEB's/PSU's/ Govt Organization. The copies of orders/LOI for such installations shall be furnished.
3	Performance Certificate	GIS OEM Bidder shall submit two (2) performance certificates of satisfactory performance from any utilities/SEB's/PSU's/Govt. Organization/reputed firm wherein the end user shall be Utility/SEB's/PSU's/Govt. organization for the 66 KV or Higher Voltage Rating of GIS Grid Substation work completed in past on turnkey basis in last 07 years from the date of bid opening. OR EPC Bidder shall submit two (2) performance certificates of satisfactory performance from any utilities/SEB's/PSU's/Govt. Organization/reputed firm wherein the end user shall be Utility/SEB's/PSU's/Govt. Organization for the 66 KV or Higher Voltage Rating of GIS/AIS Grid Substation work completed in past on turnkey basis in last 07 years from the date of bid opening. Note: Performance Certificate hast to be issued by End User In case bidder has a previous association with BRPL/BYPL for similar product and service, the performance feedback for that bidder by BRPL/BYPL shall only be considered irrespective of performance certificate issued by any third organization.
4	Servicing Base	GIS OEM bidder shall have servicing, repairing, testing & refurbishment facility in India with necessary spares and testing equipment for providing prompt after sales service for GIS and other major items. OR Incase Bidder is the EPC Bidder, shall have necessary tie-up with OEMs for servicing, repairing, testing & refurbishment facility in India with necessary spares and testing equipment for providing prompt after sales service for GIS and other Major equipments.
5	Turnover	Bidder should have minimum Average Annual Turnover of Rs. 400 Cr in last 03 financial years.
6	Litigation	The Bidder shall submit an undertaking that "No Litigation" is pending with the BRPL or its Group/Associates Companies
7	Electrical License	The bidder should possess valid Electrical Bidder License issued by competent statutory agency to undertake work in NCT Delhi. In case bidder is not having this license, Bidder to give the undertaking that it will be obtained by them before the start of the work at site or suitable sub-Bidder having the valid license shall be engaged for works at site where copy of valid license shall be submitted to BRPL before the start of the work.
8	ISO	The bidder must possess valid ISO 9001:2015 certification

9	Blacklisting	An undertaking (self-certificate) that the bidder has not been blacklisted/debarred by any central/state government institution/Electricity utilities
10	Registration documents	The bidder must have valid PAN No., GST Registration Number, in addition to other statutory compliances. The bidder must submit the copy of registrations and submit an undertaking that the bidder shall comply all the statuary compliances as per the laws/rules etc. before the start of the supply/work.

Qualification Criteria for Package B (B1 & B2)

Qualification Criteria QR -02 : For the Cable OEM/EPC Bidder for Cable laying Works:

S No	Conditions	Qualification Criteria
1	OEM/ EPC Bidder with Manufacturing base in India	Bidder must be a manufacturer of 33 kV or higher grade HV Power cable in India, for past 2 years through CCV or VCV line with following: Cable OEM shall have true triple extrusion machine along with CCV line with dry curing and dry cooling in Nitrogen Cable eccentricity monitoring system during triple extrusion in CCV line. Charted Engineer certificate should to be submitted in support of this QR. Cable OEM can enter into Consortium /JV with the contractors who can jointly fulfil the Qualification Criteria. OR Bidders shall be "EPC contractor " with the relevant experience in the field of turnkey execution including supply, laying, testing & commissioning of 33KV or higher voltage grade cables in at least one utility/SEB/PSU **For Cable** - Bidders shall supply all the Cable required for the Cable In-feed works from vendors meeting Qualification Criteria mentioned in QR-03
2	Experience	Bidder along with consortium, shall have experience of execution of 25 KMs or more cable quantity including supply, laying, testing & commissioning of 33KV or higher voltage grade cables in any utility/SEB/PSU/Govt. organization in last five (05) years. Cable OEM along with Consortium /JV Partner can jointly fulfil the Qualification Criteria. EPC Bidders shall supply all the Cable required for the Cable In-feed work from vendors meeting Qualification Criteria mentioned in QR-03. The copies of orders/LOI for such installations shall be furnished.
3	Performance Certificate	Bidder along with consortium, should have at least two Performance Certificates of two (2) years of satisfactory performance of successful supply, laying, testing & commissioning of 33 KV or higher voltage cable in last Seven (07) from the date of technical bid opening from utilities/SEBs/Govt Bodies/reputed firms for

		installation in distribution network. Out of these, one certificate should be more than 10 KMs of cable. Cable OEM along with Consortium /JV Partner can jointly fulfil the Qualification Criteria. In case bidder has a previous association with BRPL/BYPL for similar product and service, the performance feedback for that bidder by BRPL/BYPL shall only be considered irrespective of performance certificate issued by any third organization.
4	Servicing Base	The bidder shall have servicing, repairing, testing & refurbishment facility in India with necessary spares and testing equipment for providing prompt after sales service for GIS and other major items. Incase Bidder is the EPC Bidder, shall have necessary tie-up with OEMs for servicing, repairing, testing & refurbishment facility in India with necessary spares and testing equipment for providing prompt after sales service for GIS and other Major equipments.
5	Turnover	Bidder should have minimum Average Annual Turnover of Rs.250 Cr in last 03 financial years.
6	Litigation	The Bidder shall submit an undertaking that “No Litigation” is pending with the BRPL or its Group/Associates Companies
7	Electrical License	The bidder should possess valid Electrical Bidder License issued by competent statutory agency to undertake work in NCT Delhi. In case bidder is not having this license, Bidder to give the undertaking that it will be obtained by them before the start of the work at site or suitable sub-Bidder having the valid license shall be engaged for works at site where copy of valid license shall be submitted to BRPL before the start of the work.
8	ISO	The bidder must possess valid ISO 9001:2015 certification
9	Blacklisting	An undertaking (self-certificate) that the bidder has not been blacklisted/debarred by any central/state government institution/Electricity utilities
10	Registration documents	The bidder must have valid PAN No., GST Registration Number, in addition to other statutory compliances. The bidder must submit the copy of registrations and submit an undertaking that the bidder shall comply all the statuary compliances as per the laws/rules etc. before the start of the supply/work.

Qualification Criteria QR -03 : Criteria For the selection of Cable Supplier

Bidder shall adhere to the following guidelines for the Selection of Cable supplier for 33 KV & 66 KV Cable Size

S No	Conditions	Qualification Criteria

1	OEM (Manufacturing base in India)	Proposed Cable Suppliers must be an OEM, manufacturer of 33kV or higher grade HV Power cable in India, for past 2 years through CCV or VCV line with following: Cable OEM shall have true triple extrusion machine along with CCV line with dry curing and dry cooling in Nitrogen Cable eccentricity monitoring system during triple extrusion in CCV line. Charted Engineer certificate should to be submitted in support of this QR.
2	Supply Quantity	Proposed Cable Supplier/OEM should have supplied at least 25 KMS of cable of size 33KV, 3CX300 sq.mm or 66kV, 1Cx1000 sq.mm or higher size and voltage cable during last 5 years in major Utilities/SEBs. Purchase order copy in support of this QR to be submitted.
3	Testing Facility	Proposed Cable Supplier/OEM, should have In –house testing facilities for raw material, routine and acceptance testing facilities as per relevant IS/IEC. Self-declaration & List of testing equipment to be submitted in support of this QR.
4	Manufacturing Capacity	The bidder should have a manufacturing capacity of a minimum 20 km per month.
5	Turnover	Proposed Cable Supplier/ OEM, should have Average Annual Sales Turnover of Rs. 100 Crore or more in last three (3) financial years and positive net worth, duly certified CA certificate to be submitted.
6	Certification	The Bidder must possess valid ISO 9001:2015 certification and BIS License.
7	Performance Certificate	Performance certificate for minimum 2 year satisfactory performance for cable of size 33KV, 3CX300 sq.mm or 66kV, 1Cx1000 sq.mm or higher size and voltage cable supplied in last 7 years from at least two utilities/ SEB/ PSUs / Govt Organization/reputed company (wherein the end user shall be Utility/SEB's/PSU's/ Govt Organization). Note: Performance Certificate hast to be issued by End User In case of bidder has a previous association with BRPL/BYPL for similar product and service, the performance feedback for that bidder by BRPL/BYPL shall only be considered irrespective of performance certificate issued by any third organization.
8	New Vendor	In case of vendor is not registered with BRPL, factory inspection, and evaluation shall be carried out to ascertain bidder's manufacturing capability and quality procedure. However, BRPL reserves right to carry out factory inspection and evaluation for any bidder prior to technical qualification evaluation.
9	Debarred / Blacklisted	An undertaking (self-certificate) that the bidder has not been blacklisted/debarred by any central/state government institution including electricity boards.

TERMS & CONDITIONS TO APPLY AS CONSORTIUM:

i. Cable OEM may form a consortium with BRPL enlisted contractors and apply against this tender specification, provided they jointly qualify as per qualification criteria of the tender.

ii. Cable OEM shall be lead partner (Bidder) and this authorization shall be supported by submitting a power of attorney signed by legally authorized signatories of all the partners; Refer Annexure-I for Sample Format

iii. The Bidder (Lead partner) shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partner of the Consortium and the entire execution of the contract including payment shall be done exclusively with the Bidder (lead partner). This authorization shall be evidenced by submitting by a Power of Attorney signed by legally authorized signatories of all partners.

iv. The Bidder (Lead partner) shall be solely liable for the execution of the contract in accordance with the contract terms and a copy of the agreement entered into by the consortium partners having such a provision shall be submitted with the Bid.

v. In the event of any default by any partner/partners of the Consortium, BRPL reserves the right to get the work executed from any other source at the Risk & Cost of the Bidder (Lead Partner). The Extra Expenditure so incurred shall be debited to the Bidder (Lead Partner)..

vi. Responsibilities in respect of execution of tendered work by the Bidder (lead partner) as well as of each Consortium member shall be clearly indicated in the agreement.

vii. The Consortium agreement shall not be cancelled or amended unilaterally without consent of the purchaser and a statement to this effect should appear in the consortium agreement.

viii. A firm can submit only one bid in the same bidding process, either individually as a bidder or as a partner of a Consortium. A bidder who submits or participates in more than one bid will cause all the bids in which the bidder has participated to be disqualified.
Original consortium agreement on Non judicial stamp paper duly registered with sub registrar office/Notarized of appropriate value satisfying the above conditions shall be submitted along with the bid indicating role and duties of each consortium member.

Note:

- **In case of non-furnishing the requisite documents along with the bid, the bid will be considered as non-responsive and bid may be summarily rejected.**
- **Purchase Order & Work Order shall be issued in favour of the Lead Partner/Bidder only**

FORM OF POWER OF ATTORNEY FOR CONSORTIUM

(On Non –Judicial Stamp Paper of Appropriate value to be purchased in the Name of Lead Member)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Members whose details are given hereunder…….. have formed a Consortium and having our Registered Office (s)/Head Office (s) at …….(hereinafter called the 'Consortium' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) do hereby constitute, nominate and appoint M/s……. a company incorporated under the laws of ……..and having its Registered/Head Office at …….as our duly constituted lawful Attorney hereinafter called "Attorney" (hereinafter called Bidder) to exercise all or any of the powers for and on behalf of the Consortium in regard to Tender Notice No…….. for "Supply, Installation, Testing & Commissioning of 11 kV feeders including RMU, Cable and accessories on single point responsibility basis in connection with providing new load of 1345 kw on HT system for NICF, Ghitroni " under jurisdiction of BRPL (hereinafter called the "**Owner**") for which bids have been invited by the Owner, to undertake the following acts :

(i) To submit proposal, participate and negotiate in respect of the aforesaid Bid – Specification of the Owner on behalf of the "Consortium".

(ii) To negotiate with Owner the terms and conditions for award of the contract pursuant to the aforesaid Bid and to sign the contract with the Owner for and on behalf of the "Consortium".

(iii) To do any other act or submit any document related to the above.

(iv) To receive, accept and execute the contract for and on behalf of the "Consortium".

(v) To submit the Contract performance security in the form of an unconditional irrecoverable Bank Guarantee in the prescribed format and as per terms of the contract.

It is clearly understood that the Bidder/Lead Partner shall ensure performance of the contracts(s) and if one or more Member fail to perform their respective portion of the contracts(s), the same shall be deemed to be a default by all the Partners.

It is expressly understood that this power of Attorney shall remain valid, binding and irrevocable till expiry of contract period or any extension thereof.

The Consortium hereby agrees and undertakes to ratify and confirm all the whatsoever the said Lead Partner quotes in the bid, negotiates and signs the Contract with the Owner and / or proposes to act on behalf of the Consortium by virtue of this Power of Attorney and the same shall bind the Joint Consortium as if done by itself.

IN WITNESS THEREOF the Members Constituting the Consortium as aforesaid have executed these presents on this …… day of …….. under the Common Seal (s) of their Companies.

For and on behalf of the members of Consortium

……

……

……

The Seal of the above Partners of the Consortium:

The Seal has been affixed there unto in the presence of:

WITNESS

1. Signature ……

Name ……

Designation ……

Occupation ……

2. Signature ……...

Name ……

Designation ……

Occupation ……

BSES

Technical Specification

Of

66/33 kV Control and Relay Panel

Specification no – BSES-TS-86-CRP-R1

Rev:		1
Date:		23 Dec 2024
Prepared by	Shanmugam Boopalan	
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1.0 SCOPE

- This specification covers design, manufacture, testing at manufacturer's works, packing and delivery of control and relay panel (CRP) for 66kV and 33kV substations.
- The control and relay panel shall be complete with all components and accessories, which are necessary or usual for their efficient performance and trouble free operation under the various operating and atmospheric conditions. Such parts that may have not been specifically included, but otherwise form part of the CRP as per standard trade and/or professional practice and/or are necessary for proper operation of control and relay panel, will be deemed to be included in this specification.
- Scope also Includes-Licensed programming software and communication cord for offered numerical relays, one set of special tools and tackles (if any) required for maintenance of CRP and its components, Spares as per Annexure C, All relevant drawings, data and instruction manuals.

2.0 CODES AND STANDARDS

Control and Relay panels strictly designed and manufactured in accordance IS/IEC Std standards & purchaser requirements for smooth of the primary system equipments for proper power distribution.

Sl no.	Heading	Function Description
2.1	IS:1248, Part 1- 1993	Direct acting indicating analogue electrical measuring instruments and their accessories.
2.2	IEC:60688	Electrical measuring transducers.
2.3	IS:3231, Part 1- 1986 Part 2 &3 -1987	Electrical relays for power system protection.
2.4	IS:12729	Routine tests.
2.5	IEEE: 908-2018	Standard Guide for Safety in Substations.
2.6	IS:9000 Part 1 -1988	Basic environmental testing procedures for electronics & electrical items.
2.7	IEC:60255	Specification for electrical relays. Measuring relays and protection equipment.
2.8	IEE:C37.24-2018	Standard for Power System Relaying terms and definitions.
2.9	IEEE:C37.90-2005	All Protection Trip Relays.
2.10	IEEE:C37.112-2010	Guide for relay application in power systems.
2.11	IS:9000 part1-1998	Basic environmental testing procedures for electronics & electrical items.
2.12	IEEE:80	Guide for Safety in AC Substation Design.
2.13	IS:13703 - 1993	Low voltage fuses for voltages not exceeding 1000V AC or 1500V DC.
2.14	IEC:60629	Low Voltage fuses.

2.15	IEC:60282	High Voltage fuses.
2.16	IS:9244(part3)	HRC fuses.
2.17	IS:694	PVC insulated cables for working voltages upto and including 1100V.
2.18	IS:722	AC Electricity meters.
2.19	IEC:61850	Communication Networks and Systems in substations.
2.20	IEC:60529	Degrees of Protection provided by Enclosures.
2.21	IS:2982	Copper conductor in insulated cables.
2.22	IS:3961 (part1-part5)	Current rating for cables.
2.23	IS:5831	PVC insulating and sheath of electrical cables.
2.24	IS:375	Auxiliary wirings.
2.25	IS:1248	Indicating instruments and other applicable standards.
2.26	IEC:62351	Cyber Security type tests of IEDs/Numerical relays/Gateways/Transformer Tap controllers/Changers, etc with IEC 61850, IEC101, IEC103, IEC104 communication protocol network systems.
2.27	IEC:27036 IEC:20243 IEC:62443	Supply Electrical Devices from outside India, type tests for communications, cyber security conformance tests.
2.28	IEC:60973	OFC used for various equipments & panels located in AC/DC Switchyards, Control rooms, valve halls to transmit the required signals for integration, control, monitor, etc.

3.0 PANEL CONSTRUCTION

Sl no.	Heading	Function Description
3.1	Panel Type	Simplex panels with Width min.900mm to ~max.1200mm and Depth min.900mm to max.1000mm and Total Height 2315mm(Inc. AV pad and Base frame). Equipment shall be mounted on the front of the panel and doors for wiring access shall be at the back of panels. Size of panel shall be decided during engineering.
3.2	Enclosure type	Completely metal enclosed and dust, moisture and vermin proof. Degree of protection not less than IP4X in accordance with IS 13947.
3.3	Enclosure material	Pre-galvanized, cold-rolled sheet steel of thickness not less than 2mm. Stiffeners shall be provided wherever necessary.
3.4	Doors	Double leaf doors shall be provided at the rear. Doors shall have handles with built-in locking facility. Doors hinged with

		padlocking type / Locks of the door shall be lever type(min 130º hinges). Door handles shall be of protruding type with three point locking facility as per industrial standards of IS/IEC.
3.5	Equipment mounting	The SLD, MFM, TVM, Control switches, indication lamps between 400mm~1150mm from bottom of panels. From 1200 ~ 1600 mm protection relays shall be fixed. (shall be decided during engineering stage)
3.6	Mounting plates	Mounting plates inside the cabinet's sheet steel of 3mm. Vertical front panel equipment mounted thereon and having wiring access from rear for relays. Any wiring between enclosures or mounting plates to the door shall be performed in cable conduits made of lupolen with fireproofing along with suitable conduit clips, providing conduit fixing, strain relief and cable tie eyelets.
3.7	Drawing placement	In each panel door shall be equipped with >A3 size steel pocket for wiring plan/scheme drawing placement of actual A3 drawings with proper "U" cut edge at center of pocket for easy handling of drawing placement and removals with safe hands by human. The vendor supply QR code in two places of CRP panel for SCAN and collecting reports The QR Code as built drawings shall be placed at : 1. It shall be provided in front side near door handle. 2. It shall be placed at A3 packet center.
3.8	Gland Plate	At least four separate gland plates of removable type with gasket shall be provided for each panel. They shall be of sheet steel of thickness not less than 3 mm.
3.9	Cable Entry	Shall be from the bottom unless otherwise specified.
3.10	Cable clamping	Cable glands shall not be used to support control cables. Vendor must provide clamping arrangement of control cable.
3.11	Gaskets	All doors, removable covers and panels shall be Gasketed all around with neoprene gaskets.
3.12	Ventilating louvers	Ventilating louvers (Top/bottom) required & shall have screens and filters. The screens shall be made of either brass or GI wires mesh.
3.13	Foundation	The panels shall be fixed on the embedded foundation channels with intervening layers anti vibration strips made of shock absorbing materials.
3.14	Base Frame	Base frames shall be supplied along with panels. 100mm channel painted black.
3.15	Mounting	Equipment on front of panel shall be flush mounted. No equipment shall be mounted on the doors.

3.16	Working level	The center lines of switches, SLDs, push buttons and indicating lamps, 750mm and 1100mm. Height of aux.relays, meters >300 mm from the bottom of the panel and Numerical relays fix at 1200~1600mm from panel base. (shall be decided during engineering stage) SLD, MFM, TVM, Control switches, indication lamps between 650mm~1150mm from bottom of panels. From 1200 ~ 1600 mm protection relays. (shall be decided during engineering stage)
3.17	Appearance	The center lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Likewise the top lines of all meters, relays and recorders etc, shall be matched.
3.18	Fluorescent Lamps for illumination	Enclosure lighting with fluorescent tube light with quick-start facility, suitable for local LVAC supply and controlled by a door or swing frame operated switch shall be fitted at the top of each single cubicle or cabinet part.
3.19	Make	To be provided by Vendor.

4.0 WIRING

Sl no.	Heading	Function Description
4.1	Internal wiring	All wiring shall be carried out with 1100V grade single core multi strand flexible copper conductor wires with PVC insulation and shall be Flame Retardant Low Smoke (FRLS) type, vermin and rodent proof. The current carrying capacity of wire shall be adequate for the duty assigned to it considering short circuit condition and shall have sufficient flexibility to facilitate proper termination at any location. Make of wire shall be of Polycab/KEI/Finolex,etc.
4.2	Wiring size	Energy metering : CT,VT circuits of 2.5 SQ.MM Current Transformer : CT circuits of 2.5 SQ.MM Voltage Transformer : VT circuits of 2.5 SQ.MM Control Circuits(ckts) : DC circuits of 1.5 SQ.MM Tripping ckts : DC circuits of 2.5 SQ.MM AC/DC Bus wirings : DC circuits of 4.0 SQ.MM AC & Earthing ckts : Unless otherwise specified shall be of 2.5 SQ.MM. In case of space constraint imposed by equipment terminal blocks 1.5 Sq mm wire shall be allowed after prior approval for RTU/SCADA signal ckts.
4.3	Color Code	

4.3.1	Current Transformer (CT) circuits	RED, YELLOW, BLUE, BLACK.
4.3.2	Voltage Transformer (VT or PT) circuits	RED, YELLOW, BLUE, BLACK.
4.4	Others	DC Control Circuits : GREY. AC Circuits : WHITE. Earthing Circuits : YELLOW-GREEN.
4.5	Ferrules	Ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire.
4.6	AC & DC Circuits ferrules	CT,VT circuits, Control ckts, AC/DC ckts, Earthing ckts : WHITE tube with BLACK text letters.
4.7	Tripping Circuits	Tripping ckts : RED tube with BLACK or WHITE text letters (suitable text colour shall be decided with prior approval) Wires directly connected to trip circuit shall be distinguished by the addition of red colored ferrule. Note: In case of tripping circuits "T" marked in ferrules. Example: K101T.
4.5	Termination	Fork type, pin type and ring type (as applicable) tinned copper lugs to be used. Only ring type lugs should be used in CT circuits. Insulated sleeves shall be provided at all the wire terminations. All the lugs shall be Dowells / Jaison make only.
4.6	Wiring Enclosure	Plastic channels to be used as enclosures. PVC sleeves to be used for interpanel wiring.
4.7	Spare Contacts	Spare contacts of relays and contactors etc. should be wired up to the terminal block.
4.8	Inter-panel wiring	When panels are arranged to be located adjacent to each other inter panel wiring of common bus wires between the panels should be supplied with one end terminated and the other end bunched and coiled with proper lugs crimped and insulation for safe handling at site. Inter panel wiring shall be clearly indicated in the wiring tables.
4.9	Auxiliary supply	Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided on the same set of terminals in all the panels with proper segregation.

4.10	DC selection scheme	Fed by two DC incoming sources in Bus coupler panel or individual DC source from DCDB & DC Bus wiring between panels shall be provided as redundancy of DC wiring circuits.
4.11	DC Safe Wiring methodology	Panel wiring shall be securely supported, installed by lacing, tying, readily accessible and connected to equipment terminals and terminal blocks. Accidental short circuiting of certain wires is likely to result in malfunction of equipment, such as CB closing/tripping of or Positive/Negative wires, these wires shall not be terminated on adjacent terminal blocks (Except source input DC positive/negative terminals).
4.12	Termination at TB	Maximum of two wires shall be at one side of terminal block allowed. Not more than two wires shall be connected to any terminals such terminal block, relay contacts, auxiliary relay, etc where ever wiring connected in CRP panels. If necessary additional looping with adjacent terminal blocks shall be allowed as per scheme requirements.

5.0 TERMINAL BLOCKS

Sl no.	Heading	Function Description
5.1	Rating and Type	Terminal blocks(TB) of 1100 V grade, continuous current rating of max.35A on the terminals and non-breakable type. Molded piece, stud type screw terminals complete with insulated barriers, melamine housing brass terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, channel/rail mounted terminals can be used in place of stud type terminals as per requirements.
5.2	Suitability	Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of cable on each side- a. All circuits including current / voltage transformer circuits: 6mm^2 flexible copper. b. AC / DC power supply circuits: one no of 10 mm^2 Al(aluminum)./ 6 mm^2 flexible Cu(copper).
5.3	Marking and covers	White fiber markings strip with clear plastic, slip-on / clip-on terminal covers to be provided or A reflective prints on HIP(High Intensity Prismatic) films which contain lens to reflect at night when light shines with clear plastic, slip-on / clip-on terminal covers to be provided.(Shall be discussed during engineering)
5.4	Disconnecting Facility	To be provided in CT,VT terminals.
5.5	Shorting & Earthing Facility	To be provided in CT, VT Terminals.

5.6	CT,VT terminals	Refer Single Line Diagram for details of CT,VT wiring/communications cables as per purchaser approved documents.
5.7	Spare Terminals	20% in each TB row. The spare terminals shall be provided with lugs mounted on it.
5.8	Segregation	TBs shall be segregated by application i.e separate terminal blocks shall be provided for each application as follows (a) CT (b) VT or PT (c) Circuit Breaker (d) Transformer Cubicle/OLTC Cubicle (e) Individual Bay Marshalling kiosk (f) Bus Isolator / Disconnector -1,2 (g) Line/Transformer Isolator / Disconnector -1 (h) Line Isolator-2 (i) Line/Transformer/Bus Earth Switch-1 (j) Line/Transformer/Bus Earth Switch-2 (k) Interpanel Bus wiring (l) RTU/SCADA wiring etc. (m) AC source ckts. (n) DC source ckts. (o) Bus Interpanel wiring ckts of AC/DC/VT/Control ckts.
5.9	Vertical clearance with gland plate	Minimum 250mm.
5.10	Clearance between two rows of TBs	Minimum 150mm.
5.11	Test Terminal Blocks	Screw driver operated stud type for metering circuits.
5.12	TB contact materials	The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The TB conducting part in contact with cable/wire shall be preferably tinned/silver/nickel/copper/zinc shall be preferred.
5.13	Arrangement	Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that a row of terminal block runs in parallel and close proximity to each side of the wiring duct. The side of the terminal block opposite the wiring duct shall be reserved for the external cable connection.
5.14	Categorization	For ease of external connections, terminal blocks shall be categorized based on their usage i.e all terminals for wiring of particular equipment like circuit breaker should form one terminal block.
5.15	Tightness	The Terminal block wiring shall be tight with respect to its function as per standard Torque limit wherever applicable as per IS/IEC Std and OEM recommended values.

6.0 PAINT

Sl no.	Heading	Function Description
6.1	Paint Type	Powder coated. Pure Polyester base grade-A, structure finish.
6.2	Paint Shade	Exterior: RAL7032 “Siemens Grey”.
6.3	Paint Shade	Interior: RAL 9003 “Glossy White”.
6.4	Paint Thickness	Minimum 70 microns.

7.0 MIMIC DIAGRAM

Sl no.	Heading	Function Description
7.1	System Representation	Colored mimic diagram and symbols showing the exact representation of the system shall be provided in the front of control panels.
7.2	Material	Mimic diagram shall be made preferably of painted aluminum or plastic (approved material), which shall be screwed on to the panel and can be easily cleaned. Painted overlaid mimic is also acceptable. The mimic bus shall be 2-3 mm thick. The width of the mimic bus shall be 12mm for bus bars and 10 mm for other connections.
7.3	Mimic Indications	LED indications are to be used for breaker and isolator position and semaphore indicators shall be used for earth switch position.

8.0 NAMEPLATES AND MARKINGS

Sl no.	Heading	Function Description
8.1	Nameplates	To be provided as per the following description.
8.2	Equipment Nameplates	a. All equipment mounted on front side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. b. All front mounted equipment shall be also provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.
8.3	Feeder Nameplates	(a) Large and bold name plate carrying the feeder identification numbers shall be provided for circuit / feeder designation on the top of each panel on front

		as well as rear side. (b) Rear bottom of each panel shall have a nameplate clearly indicating the following: (i) Purchaser Name (ii) BSES, PO No. & date (iii) Drawing Reference No (iv) Year of Manufacture (v) Control Voltage (vi) Customer care No
8.4	Material	Non-rusting metal or 3 ply lamacoid. Nameplates shall be black with white engraving lettering with reflection Or Reflective Stickers are allowed which have a reflective prints on HIP(High Intensity Prismatic) films which contain lens to reflect at night when light shines on them [Suitable text/background colours] with suitable base material fixture.(shall be discussed during engineering stage).
8.5	Fixing	All nameplates/rating plates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
8.6	Markings	Each switch shall bear clear inscription identifying its function. Similar inscription shall also be provided on each device whose function is not otherwise identified. If any switch or device does not bear this inscription separate nameplate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating e.g. Trip-Neutral close, ON-OFF etc.

9.0 EARTHING

Sl no.	Heading	Function Description
9.1	Panel Earthing	All panels shall be equipped with an earth bus securely fixed.
9.2	Location of earthing bus	Earthing bus shall be at rear side of CRP panel (Flush mounting front equipment back side).
9.3	Material	The material and the sizes of the bus bar shall be 25 x 6 mm copper flat unless specified otherwise. Bimetallic strips shall be provided in order to connect external earth grids as per site requirements.(if required)
9.4	Earth Bus joints	All bolted joints in the bus should be connection of two bolts.
9.5	Hinged Doors	Earthed through flexible copper braid wires of at least 16mm^2.

9.6	Instrument and Relay Earthing	All metallic cases of relays, instruments and other panel mounted equipment including gland plate, shall be connected to the earth bus by copper wires of size not less than 2.5 mm^2. The color code of earthing wires shall be yellow-green.
9.7	CT and VT circuit earthing	CT and VT secondary neutral shall be earthed at one place only at the terminal blocks through links.

10.0 NUMERICAL RELAYS

Sl no.	Heading	Function Description
10.1	**General features of Protection Numerical Relays**	
10.1.1	Relay details	All relays shall be provided with min. 60 month to max. 66 month warranty as per PO details & relays must be conformal coated. The repair cost within 5 years after lapse of warranty shall not be more than 30% of Relay purchase price. All relay shall comply with latest cyber security guidelines. Relay-1 & Relay -2 shall be of same/different make. The Relay shall be finalized during details CRP panel scheme final approval and relays must fulfill site commissioning requirements with integration of RTU/SCADA system stage and it is deemed to be without any cost implications.
10.1.2	Technology and Functionality	Numerical/Artificial intelligence based with latest version, provision for multifunction protection, control, metering and monitoring, etc
10.1.3	Coating	Conformal Type. Coatings shall also protect relays against corrosive gases such as H_2S or SO_2 other gases for safe & reliable function of Hardware/Firmware/Comm. modules.
10.1.4	Mounting	Flush Mounting, IP5X. In case of vents/perforations on Top of relay necessary wedge covers with side vents/perforations to be provided. Relays shall be fixed above 400mm from base plate.
10.1.5	Architecture	Hardware and software architecture shall be modular and dis-connectable to adapt the protection and control unit to the required level of complexity as per the application.
10.1.6	Redundant Ethernet Port	2xfiber, 2xelectrical port running PRP, HSR, Failover (two fiber pairs/two copper pair), Dual IP and a mixture of Fiber ports & Copper ports and Maintenance/Engineering port additional. ❖ Communication port: LC duplex/RJ45. As per SCADA protection & SCADA requirements.
10.1.7	Data Transfer rates	The Fiber port/Copper Ethernet ports connections shall be 1310nm with single mode/multi mode 100Base Fx – High

		speed data rates with multiple masters “Clients” capability.
10.1.8	Date Model layers	The Standard practice of Data model layer with Physical device, Logical device, Wrapper/Logical node instance, Data object, Data attribute shall be followed & meet latest IEC formats.
10.1.9	Protection relay System	The protection relay shall be carefully designed for independent electrically, physically from equipments of CRP and terminal wirings from other segregated circuits of primary systems & other associated panels during cable wiring connections.
10.1.10	Protection relay operation with primary system	The protection relays shall be carefully designed such a way that there will be no operational restrictions for control interlocks & operations of primary system equipments [SWGR / CB/ ISOLATOR / EARTH SWITCH, etc] of AIS / GIS / SWGR, etc. for its normal operations, including conditions of ON LOAD BUS TRANSFER function of individual feeders.
10.1.11	Relay interference with primary system	The relay must be carefully programmed with latest software, firmware, hardware versions for control, operations, Interlocking logics, GOOSE signals [interlock signals, reports measurement, IO signals] between IEDs for safe operation of primary system without abnormal protection alarms & events [Volt – functions like under/over volt/VT fuse fail; Current – CT supervision, protection starts or trip] in DCS/SAS/SCADA.
10.1.12	Protection relay & auxiliary interface	All protection relay shall be provided functions with internal timer logics for safe operations of respective binary input/output commands, aux.relay pickup/drop off for voltage selection & contact multiplications in scheme drawings. At any condition these aux.relays OFF/Fail/Mal operation conditions must not trip main primary system CB/SWGR devices. If any deviations which result power loss then suitable penalty imposed on vendor/supplier based on BSES standards & Indian Govt.rules of power ministry & other respective organizations. (Ex.CPRI, CBIP, CEA, PowerGrid, etc)
10.1.13	Relay wiring circuits	All protection and its aux.relay wiring carefully provided in such a way that there should not be different voltage levels AC/DC volts (RTU volts/DC volts/ Other device volts) within a single relay IO module(NO,NC), aux.relay (NO, NC) contacts. This may cause unwanted magnetic interference between NO, NC contacts leads to failure of relay IO module/aux.relay contact failure and produce abnormal conditions for primary system of feeder.
10.1.14	Protection relay communication cable power limits	The attenuation and receive power shall be measured and confirmed to be within the specified limits as per relay OEM recommendations/instruction sheets/manuals.

10.1.15	Relay communication Protocol	IEC 61850-1, IEC 61850-9-2LE OR IEC 61850-9-2/IEC 61869 Flexible streams, IEC 60870-5-103, IEC 60870-5-104, MODBUS TCP, DNP 3.0 Serial/TCP, IEEE C37.94, IEEE 802.1X VLAN, LON, SPA, etc. as per IS/IEC Std & SCADA requirements.
10.1.16	Advanced Security	Extensive security like AAA, Radius, RBAC(Role Based Access Control), logging of security-related events(Syslog), signed firmware, authenticated network access, etc.
10.1.17	Processing Indications	SCADA functions in monitoring direction shall be executed on SPI (Single Point Input) and DPI (Double Point Input). DPI shall only be used in case of Isolator and Circuit breaker “close” and “open” indication.
10.1.18	Command Processing	Functionality of command processing offered for SCADA interface shall include the processing of single and double commands i.e SCO (Single Command Output) and DCO (Double object command Output). DCO shall only be used in case of Isolator and Circuit Breaker “close” and “open” command. If any other commands shall be same discussed during engineering stage.
10.1.19	PC/Laptop Interface port	For each relay type one set of communication leads with necessary accessories/converters (USB type required- For PC/Laptop side) must be provided along with original licensed software of Unlimited users application (min.10 users) for all relay programming & settings, etc. The software and communication cable for each site must be provided separately without any cost implications.
10.1.20	GOOSE messaging	Relays shall communicate all status signals, commands, analog signals, interlocks signals and events on GOOSE messaging. Status of GOOSE signal shall be monitored. Goose signal shall be reported without time delay at SCADA & between IEDs.
10.1.21	Relay Characteristics	Relay shall integrate all necessary protections for different applications in accordance with IS and IEC. Relay shall provide wide setting ranges and choice of all IEC, IEEE, ANSI and other tripping curves through a minimum of three setting groups.
10.1.22	Relay Event & Fault records	i. Relay shall have the facility of recording of various parameters during event/fault with option to set the duration of record through settable pre fault and post fault time. ii. Relay shall store records for last 500 events (minimum) iii. Relay shall store records for last 10 faults (minimum). iv. Fault/Disturbance records must be downloaded locally to PC/Laptop and to remote SCADA. v. All BI , soft command , Power down shall be recorded in event & Disturbance recorder. vi. Relay shall provided Maximum fault current value on 61850 for all the protection settings

		vii. Sys Log for minimum 180 days. viii. It should be possible to trigger fault record from User defined signals. Relay should record not less than 10 Waveform Records of not less than 1sec each which can be triggered through user selectable inputs such as Protection start, trip stage signals, BI, BO, Virtual/goose signals and other user defined signals. Waveform record should show user selectable inputs such as all protection start, trip stage signals, BI, BO, Virtual/goose signals, other user defined signals and analog measurement values along with labels. The waveform record should support standard Comtrade file explorer software. Waveform recorder configuration should be user friendly. For Differential Protection relay, Waveform recorder of relay should record all differential and Bias current along with standard Current and Voltage channel. All Virtual Signals(Input, Output), Commands should be user configurable as latched and un-latched. ix. Disturbance recorder shall have minimum recording time of 3 sec(0.5 sec for prefault and 2.5sec for postfault) per fault generated.
10.2	**Relay supply and analog input, binary input & outputs ratings and details**	
10.2.1	Power supply	48 ~ 250V DC/AC universal power supply module as per purchaser requirement.
10.2.2	Temperature	-20ºC to +70ºC with humidity parameters.
10.2.3	Analog Module	Refer Single Line Diagram for details of CT,VT secondary circuit for wiring/communications as per purchaser approved documents. Example: CT 1/5 A AC; VT 110V AC.
10.2.4	Ratio corrections	Software based CT,VT Ratio & Vector corrections feature (Without Interposing CT, other CTs). Line/cable capacitive current compensation protection functions.
10.2.5	Thermal rating of voltage circuit	Continuous: 2xVn.
10.2.6	VA Burden	≤ 0.4VA.
10.2.7	Operating Frequency range of 50Hz	At least : 20 ~ 65 Hz.
10.2.8	High Break contacts	30VA, 40W (resistive loads), 25VA for L/R≤40ms 25W.
10.2.9	Operating time of contacts	≤ 12ms.
10.2.10	Transducer Input Module	Transducer 4 – 20mA inputs shall be required for as per site requirements.

10.2.11	RTD inputs	Resistance Temperature detection inputs shall be required as per site requirements.
10.2.12	PT100	PT100 inputs shall be required as per site requirements.
10.3	**Numerical Relay protection program, setting, signals, communication details**	
10.3.1	Relay capability	Relay programmable for logic, control, settings, events, fault recorders, GOOSE and block of unused ports. The LEDs shall be RESET via both HMI/Relay software/SCADA system shall be preferred. Software based Ratio & Vector corrections feature (Without ICTs). All programs/settings shall be with password lock facility is must.
10.3.2	Relay measurement	Relays shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, BIs ,BOs etc to SCADA.
10.3.3	Relays stability	High stability during external fault with heavy CT saturation due to transients.
10.3.4	Relay HMI (Human Machine Interface)	The protection relays HMI must be provided with alphanumeric keys, function keys, 1/0 control key(CB/SWGR), menu selection keys, local/remote/off selection keys with interlock for operation from HMI/Remote SCADA and graphical LCD display with backlight indicating measurement values and operating messages, events, SLD display of respective feeder. It must allow to access and change all settings and parameters without the use of PC/Laptop with necessary password protected.
10.3.5	Relay communication	Dedicated port for communication with remote end relay through optical fiber. This port should be in addition to PC/Laptop interface and SCADA interface ports.
10.3.6	Self-diagnosis	Relay shall be able to detect internal failures and same shall be transmitted to SCADA as a soft signal. A watchdog relay with changeover contact shall provide information about the failure for annunciation. Any binary input & output contact failure by internal a event shall be provided as alarm & report to SCADA. The IRF shall not be generated in such cases. Watchdog should be other than BO count. Two watchdog contact shall be provided as per purchaser requirements.
10.3.7	Time synchronization	All relays shall be capable of being synchronized with the system clock through SCADA, PC/Laptop, SNTP, IRIG-B, PTP. (To be discussed during engineering stage)
10.3.8	HMI Indication/LEDs	Multicoloured /Coloured LEDs with push button for resetting. RESET of LEDs must be provided via HMI/Relay software (PC/Laptop), SCADA(Work stations) possible from SCADA through dedicated function blocks.
10.3.9	Signal Integration for binary inputs & outputs	Relays must have provision for inversion of binary input signal High/Low as per control/protection logic requirements without affecting external wiring connections. All signal integration shall only be through NO,NC contact as per site & purchaser

		requirements.
10.3.10	Relay Function keys with Locking facility	Relay shall have properly defined function key set as per Protection requirements with locking facilities of Local/Remote control modes of functions.
10.4	**CRP Panels & Relay Sales, Service Supports**	
10.4.1	Numerical Relay performance	The relay performance certificates (<5 year) must be submitted by vendor as per IS/IEC std during bidding stages.
10.4.2	Num. Relay Life cycle	Protection relay shall be chosen in such a way that OEM supplier shall not phase out relay for next 10 years in International/India origin manufacturing units.
10.4.3	Num. Relay Rejection	Relays likely to be phased out in next 5 years must not be offered by vendor & if found offered will be rejected at any stage even post award/drawing approval/site execution.
10.4.4	Num. Relay Operation & Maintenance	The vendor shall supply relay such a way that where OEM supply support spare modules of relay if in case fail, relay configuration modifications along with updates as per firmware/software for 15 years duration after expiry of warranty period.
10.4.5	Warranty & Guarantee	Warranty & Guarantee period 60 months will start after successful commissioning of individual CRP panels with actual commissioned date. Protection Dept & SCADA Dept provide actual commissioned date for warranty start periods accordingly to Engineering Dept/C&M Dept.
10.4.6	CRP panel & numerical relay warranty	The vendor/supplier CRP panels all products & devices including numerical relays shall be five year warranty period from commissioned date. If any material found faulty during warranty period shall be replaced within min.24hrs to max.one weeks time. If purchaser replaced with any cost implication, the same shall be deducted or borne by vendor/supplier.
10.4.7	Warranty sales & service supports	A service to enable any faulty items of protection equipments to be rectified or replaced within 24 hours by vendor or OEM during warranty periods. Suitable spares and support engineers shall be available to meet this equipment normalization without any additional cost implications & there by charging primary system for its stable operation & monitoring. If purchaser replaced with any cost implication, the same shall be deducted or borne by vendor/supplier.
10.5	**Protection Relay Requirement for Line CRP (66kV/33kV)**	
10.5.1	Relay 1: M1FP	Line/Cable Differential protection, Line/Cable Distance protection of relay with latest version & necessary additional protection functions as per site requirements.(shall be decided during detailed engineering)
		Combine Line/Cable differential (Dual Channel, ST/SC/LC port compatible for Single Mode fibre having wavelength min.1310nm max.1510nm.(shall be decided during detailed engineering)

		Distance Protection	
		Current Protection: Dir.OC, Dir.EF, Ins.OC, Ins.EF, TOC, TEF, SOTF, etc.	
		Voltage Protection: OV, VT Fail, etc.	
		Power Swing Block	
		Auto reclose functions (3phase) with its enable/disable, interlock inputs internal logic/external inputs shall be provided.	
		Other protection & control logic functions shall be decided during engineering stage.	
		Communication port	1. ST/SC/LC – Line/Cable Differential OFC. 2. LC duplex/RJ45 copper – SCADA.
		The attenuation and receive power shall be measured and confirmed to be within the specified limits as per relay OEM recommendations/instruction sheets/manuals.	
10.5.2	Relay 2: M2FP	Bay control relay of 3 phase operations of Isolators/Disconnector, Circuit Breaker, Earth Switches with latest version & necessary additional protection functions as per site requirements.(shall be decided during detailed engineering)	
		Current Protection: Dir.OC, Dir.EF, Ins.OC, Ins.EF, TOC, TEF, etc.	
		Voltage Protection: UV, OV, Sync, VT Fail, etc.	
		Auto reclose functions (3phase) with its enable/disable, interlock inputs internal logic/external inputs shall be provided.	
		Reverse Blocking Function.	
		Local Breaker Backup protection functions.	
		Other protection & control logic functions shall be decided during engineering stage.	
		Communication port: LC duplex	
10.5.3	Configurable Binary input/outputs	Relays Analog, Binary inputs, Binary outputs shall be provided as per scheme requirements with additional 4 BI, 4BO for future use.	
10.5.4	SLD	Refer annexure D1 and D5 for SLD of 66kV and 33kV line bays respectively or Refer Single Line Diagram as per purchaser approved documents.	
10.6	**Protection Relay Requirement for Transformer CRP (66kV/33kV)**		
10.6.1	Relay 1: M1PTP	Two or Three winding low impedance biased differential protection / high impedance differential protection & necessary additional protection functions as per site requirements.(shall be decided during detailed engineering)	

		2nd Harmonic & 5th Harmonic function.
		High Impedance REF (HV/LV) / Low Impedance REF (HV/LV).
		Current Protection: Dir.OC, Dir.EF, Ins.OC, Ins.EF, TOC, TEF, etc.
		Overflux protection.
		StandBy EF (HV/LV) protection
		Sensitive EF (HV/LV) protections.
		Other protection & control logic functions shall be decided during engineering stage.
		Communication port: LC duplex
10.6.2	Relay 2: M2PTP	Bay control relay of 3 phase operations of Isolators/Disconnector, Circuit Breaker, Earth Switches with latest version & necessary additional protection functions as per site requirements.(shall be decided during detailed engineering)
		Current Protection: Dir.OC, Dir.EF, Ins.OC, Ins.EF, TOC, TEF, etc.
		Voltage Protection: OV, Sync, VT Fail, etc.
		Frequency Protection: OF, UF, df/dt, etc.
		Reverse Blocking Function.
		Local Breaker Backup protection functions.
		Other protection & control logic functions shall be decided during engineering stage.
		Communication port: LC duplex
10.6.3	Configurable Binary input/outputs	Relays Analog, Binary inputs, Binary outputs shall be provided as per scheme requirements with additional 4 BI, 4BO for future use.
10.6.4	Stabilizing resistor & Metrosil	The protection relays which requires setting of stabilizing resistor, non-linear resistor (Metrosil) shall be provided as per IS/IEC std & site requirements.
10.6.5	SLD	Refer annexure D2 and D6 for SLD of 66kV and 33kV transformer bays respectively or Refer Single Line Diagram as per purchaser approved documents.
10.7	**Protection Relay Requirement for Bus Coupler CRP (66kV/33kV)**	
10.7.1	Relay 1: M1BCP	Protection functions as per site requirements.(shall be decided during detailed engineering)
		VT fuse fail monitoring Bus-2 VT ckt
		Voltage Protection: OV, UV, Sync, VT Fail, etc.

		Other protection & control logic functions shall be decided during engineering stage.
		Communication port: LC duplex
10.7.2	Relay2: M2BCP	Bay control relay of 3 phase operations of Isolators/Disconnector, Circuit Breaker, Earth Switches with latest version & necessary additional protection functions as per site requirements.(shall be decided during detailed engineering)
		Current Protection: Dir.OC, Dir.EF, Ins.OC, Ins.EF, TOC, TEF, etc.
		Voltage Protection: OV, UV, Sync, VT Fail, etc.
		Local Breaker Backup protection functions.
		Reverse Blocking Function.
		Other protection & control logic functions shall be decided during engineering stage.
		Communication port: LC duplex
10.7.3	Configurable Binary input/outputs	Relays Analog, Binary inputs, Binary outputs shall be provided as per scheme requirements with additional 4 BI, 4BO for future use.
10.7.4	SLD	Refer annexure D3 and D7 for SLD of 66kV and 33kV bus coupler bays respectively or Refer Single Line Diagram as per purchaser approved documents.
10.8	**Protection Relay Requirement for Capacitor Bank CRP (66kV/33kV)**	
10.8.1	Relay 1: M1CBP	Current Protection: Dir.OC, Dir.EF, Ins.OC, Ins.EF, TOC, TEF, etc.
		Frequency Protection: UF, df/dt, etc.
		Out of balance protection with Close inhibit function with timer with min.0.0 sec to max.60 minute.
		Over load protection
		Under Current protection
		Other protection & control logic functions shall be decided during engineering stage.
		Communication port: LC duplex
10.8.2	Relay 2: M2CBP	Bay control relay of 3 phase operations of Isolators/Disconnector, Circuit Breaker, Earth Switches with latest version & necessary additional protection functions as per site requirements.(shall be decided during detailed engineering)
		Current Protection: Dir.OC, Dir.EF, Ins.OC, Ins.EF, TOC, TEF, etc.

		Voltage Protection: OV, UV, Sync, VT Fail, etc.		
		Frequency Protection: OF, UF, df/dt, etc.		
		Reverse Blocking Function.		
		Local Breaker Backup protection functions.		
		Other protection & control logic functions shall be decided during engineering stage.		
		Communication port: LC duplex		
10.8.3	Configurable Binary input/outputs	Relays Analog, Binary inputs, Binary outputs shall be provided as per scheme requirements with additional 4 BI, 4BO for future use.		
10.8.4	Stabilizing resistor & Metrosil	The protection relays which requires setting of stabilizing resistor, non-linear resistor (Metrosil) shall be provided for protection functions as per site requirements.(shall be decided during detailed engineering)		
10.8.5	SLD	Refer annexure D4 and D8 for SLD of 66kV and 33kV capacitor bays respectively or Refer Single Line Diagram as per purchaser approved documents.		
10.9	**SCADA Interfacing of Protection Systems details**			
10.9.1	The following signals shall be hardwired between SCADA/RTU & Protection panels for reference only. (To be discussed with SCADA Dept)			
10.9.2	Analog Inputs	All analog inputs shall be SCADA Compatible. I. mA inputs for Tap Position II. mA inputs for Temp OTI III. mA inputs for Temp WTI_HV IV. mA inputs for Temp WTI_LV min 4 spares for purchaser use. 1. RTD sensor input for PT100 2. RTD sensor input for PT100 3. RTD sensor input for PT100 min 4 spares for purchaser use.		
10.9.3	Binary Input & Binary Output	The Protection Binary input & Binary output signals shall be provided from CRP panels & Transformer cubicle as per site requirements.		
	Binary input signals			
10.9.3.1	Line Feeder	Transformer Feeder	Bus Coupler Feeder	Capacitor Feeder
10.9.3.2	DC Supply -1 &2 Fail	DC Supply -1 &2 Fail	DC Supply -1 &2 Fail	DC Supply -1 &2 Fail
10.9.3.3	TCS – 1&2 Fail	TCS – 1&2 Fail	TCS – 1&2 Fail	TCS – 1&2 Fail
10.9.3.4	VT MCB Off/Trip/VT Fail	VT MCB Off/Trip/VT Fail	VT MCB Off/Trip/VT Fail	VT MCB Off/Trip/VT Fail

10.9.3.5	CB_ON Status	CB_ON Status	CB_ON Status	CB_ON Status
10.9.3.6	CB_OFF Status	CB_OFF Status	CB_OFF Status	CB_OFF Status
10.9.3.7	CB Ready	CB Ready	CB Ready	CB Ready
10.9.3.8	Bay Ready for Energization	Bay Ready for Energization	Bay Ready for Energization	Bay Ready for Energization
10.9.3.9	L/R SW in Remote	L/R SW in Remote	L/R SW in Remote	L/R SW in Remote
10.9.3.10	Ann. Alarm/Trip	Ann. Alarm/Trip	Ann. Alarm/Trip	Ann. Alarm/Trip
10.9.3.11	AC Supply Fail	AC Supply Fail	AC Supply Fail	AC Supply Fail
10.9.3.12	Line ES Open Status	Transformer ES Open Status	Bus-1 ES Open Status	Cap bank ES Open Status
10.9.3.13	BRC/CTS/UV/PSB Alarm	Transformer Trouble Alarm	Bus-2 ES Open Status	Cap.Bank Alarm
10.9.3.14	spare	Transformer Trouble Trip	Ethernet Switch#1 Fail	spare
10.9.3.15	spare	spare	Ethernet Switch#2 Fail	spare
10.9.3.16	And other additional signals as per site requirements.			
	Binary output signals			
	Line Feeder	Transformer Feeder	Bus Coupler Feeder	Capacitor Feeder
10.9.3.17	CB_ON Command	CB_ON Command	CB_ON Command	CB_ON Command
10.9.3.18	CB_OFF Command	CB_OFF Command	CB_OFF Command	CB_OFF Command
10.9.3.19	86 RESET Command	86 RESET Command	86 RESET Command	86 RESET Command
10.9.3.20	Ann. Acknowledge Command	Ann. Acknowledge Command	Ann. Acknowledge Command	Ann. Acknowledge Command
10.9.3.21	Ann. RESET Command	Ann. RESET Command	Ann. RESET Command	Ann. RESET Command
10.9.3.22	spare	spare	spare	spare
10.9.3.23	And other additional signals as per site requirements.			
10.9.3.24	Transformer Main Tank, OLTC, Cooler Control cubicle, BC, ACDB, DCDB, etc and other substation equipments signals as per protection & SCADA & Site requirements.			
10.10	**Transformer Monitoring Cum AVR Relay**			

10.10.1	Functions	As per annexure – A.	
10.10.2	Requirement	To be provided in Transformer CRP. (Take off price to be mentioned in price bid)	
10.11	**General Features of Auxiliary Relays**		
10.11.1	Power supply	48 ~ 250V DC/AC universal power supply module as per purchaser requirement.	
10.11.2	Voltage ratings	All relays shall be suitable for continuous operations at min.20% over voltage & min.30% under voltage levels as per above rated voltage.	
10.11.3	Temperature	-20ºC to +70ºC with humidity working parameters.	
10.11.4	Type	Miniature / Numeric / Static / Electromechanical type relays	
10.11.5	Reset Characteristic	Aux.Relays	Self RESET aux.relays with Indication LED/Flag as per purchaser requirements.
		Master Trip relay	Both Electrical RESET and Hand RESET types.
		Bistable Relays	For VT Selection, CB contact multiplication.
		Time	Operating time ≤ 15ms.
		Resistor	External resistor not acceptable with relay ckt.
10.11.6	Spare Contacts	All spare to be wired upto the terminal block.	
10.11.7	Signal Integration	All signal integration shall only be through NO, NC contact as per site & purchaser requirements.	
10.12	**Auxiliary relays – Panel wise requirement**		
10.12.1	Lockout relay	To be provided in all panels.	
10.12.2	DC fail relay		
10.12.3	AC fail relay		
10.12.4	Trip circuit supervision relay	To be provided in all panels for supervision of two trip coils.	
10.12.5	Aux.relay	All aux.relays must be provided with actual NO,NC contacts only and without ADD ON BLOCK contacts.	
10.12.6	Aux.relay characteristics	The aux.relays must be provided without external resistor for supervision, contact multiplication, lockout relays, trip circuit supervision, etc.	
10.12.7	VT selection relays	To be provided in all panels as per purchaser requirement.	
10.12.8	Sync check relay	To be provided in all panels as per purchaser requirement.	
10.12.9	Voltage Monitor Relay (VMR)	DC (+Ve) or (-Ve) voltage shall be monitored for each CRP panel DC distribution ckts and report in case of UV/OV values exceeds set limits.	

10.12.10	Earth Leakage Relay(ELR)	By simulating DC Earth Fault through resistor that gives leakage current of ≥50mA. (min. Earth leakage 5mA~50mA) and report in case of Earth leakage current exceeds set limits.	
10.12.11	Aux. Relay contacts make	All auxiliary relays contacts with Nickel cadmium material is preferred. If other material like Silver-Copper-Nickel (Ag-Cu-Ni), etc. used then necessary boot insulation must be provided in order to avoid false operation of contacts. (Engg stage shall be decided)	
	Transformer Aux.Relays	Auxiliary relays with indicating flags/LEDs (contactors will not be accepted) should be provided in transformer panel for the following trip and alarm commands	
		(a) MainTank Buchholz trip (b) MainTank OSR Trip (c) MainTank PRV trip (d) MainTank WTI HV Trip (e) MainTank WTI LV Trip (f) MainTank OTI Trip (g) MainTank MOG Alarm (h) MainTank NIFPS Trip	(a) MainTank Buchholz Alarm (b) MainTank OTI Alarm (c) MainTank WTI HV Alarm (d) MainTank WTI LV Alarm (e) OLTC PRV Trip (f) OLTC Buchholz Trip (g) OLTC OSR Trip (h) OLTC MOG Alarm (i) OLTC Buchholz Alarm (j) MainTank TCIV Close Alarm, etc
10.12.12	Transformer Aux.Relays spare contacts	All Transformer trouble relays shall be provided additionally with 2 NO and 2 NC contact as spare. Also 3 nos aux.relays shall be wired as spare in panel for future use.	
10.12.13	Operational Data	Bidder shall provide the reference list of the type of relays offered.	
10.12.14	Push button	Push button with suitable rating must be provided for RESET necessary equipments like Annunicator(Accept/RESET buttons), Master trip, SF6 Lockout & other Flag operated aux.relays (Transformer trouble trips Main Tank/OLTC – OTI, WTI(HV/LV), BZ, OSR, PRV,SPR, NIFPS, etc), TCS wherever needs as per purchaser requirements.	
10.13	**SF6 Gas**	**SF6 GAS Low/Lock Aux.relays requirements**	
10.13.1	SF6 lockout relay	To be provided in all 66kV control and relay panels.	
		A separate aux.relay for Tripping Circuit#1 & Tripping Circuit#2 per circuit breaker.	
		DC supply for aux.relays shall be from the tripping supply if these relays are located in LCC. For the cases where this aux.relays is located in GIS CB M.Box/cubicle, DC supply shall be tapped from LCC panel. (Engg stage shall be decided)	
		The aux.relays contact shall make/break the negative side of the respective circuit breaker close/trip coils for avoiding	

		unwanted commands from SCADA/Local operations team.
10.13.2	SF6 low relay	To be provided in all 66/33kV control and relay panels.
		For the cases where aux.relays is located in GIS CB Marshalling Box/LCC cubicle, DC supply shall be tapped from LCC panel.

11.0 SYNCH CHECK PHILOSPHY

Sl no	Heading	Function description
11.1	Dead Bus – Live Line	(a) Application - Required for Charging of Bus from Line Supply (b) Logic - Sync check relay installed on line panel will check the line and bus voltage and derive that the line is live and bus is in dead condition i.e bus has to be charged by the line breaker. Hence Sync check relay will allow the line breaker to close in this condition.
11.2	Dead Line – Live Bus	(a) Application - Required for Charging of Line from Bus Supply. (b) Logic - Sync check relay installed on line panel will check line and bus voltage and derive that the line is dead and bus is in live condition i.e line has to charged from bus. Hence Sync check relay will allow the line breaker to close in this condition.
11.3	Live Bus – Live Line	(a) Application - Required for paralleling of bus and line supply. (b) Logic - Sync check relay installed on line panel will compare magnitude and phase sequence of line and bus voltages. If the variations are within the range set in the relay, sync check relay will allow the closing of line breaker.
11.4	Live Bus – Dead Bus	(a) Application – Required for charging of dead bus through another live bus. (b) Logic – Sync check relay installed on bus coupler/bus section panel will check voltage of both buses and derive that one bus is dead and other bus is live i.e dead bus is being charged from live bus. Hence Sync check relay will allow the bus coupler/bus section breaker to close in this condition.
11.5	Live Bus – Live Bus	(a) Application – Required for paralleling of two buses/bus sections. (b) Logic – Sync check relay installed on bus coupler/bus section panel will compare the magnitude and phase sequence of voltage of both buses (and bus sections). If the variations are within the range set in the relay, sync check relay will allow the bus coupler/bus section breaker to close.

12.0 MANAGED ETHERNET SWITCH

Sl no	Heading	Function description
12.1	**Ethernet Switch**	
12.1.1	Numbers	Two or more as per site requirements with 20% redundancy of switch. (To be discussed with SCADA)
12.1.2	FO Port (Downlink)	Minimum 24 nos i. FO:20nos LC,1310nm, multimode, 100 Mbit/s. ii. RJ45:4nos(CAT VI usable) Ethernet port copper, 1310nm,100 Mbits/s.
12.1.3	FO Port (Uplink)	SFP type : Minimum 2 Nos, 1000 Mbits/s.
12.1.4	RJ 45 Port (Uplink)	SFP type : Minimum 2 Nos, 1000 Mbits/s.
12.1.5	Network Protocol	PRP, HSR compatibility.
12.1.6	Coating	Conformal type.
12.1.7	Power Supply	48-240V DC, 180 ~ 260 V AC, dual source power. Universal power supply module with less power consumptions.
12.1.8	ETH Grade	Industrial Layer 2 type.
12.1.9	ETH Module	Ethernet Switch shall be Universal Modular type
12.1.10	Certification	KEMA,CE & FCC & IEC 61850 compliance.
12.1.11	Operating Temperature	-10ºC to +70ºC.
12.1.12	Placement type	Protection Panel / RTU panel Power supply – Modular Type Ethernet switch – Modular Type
12.1.13	Blinking LED Indicators	On each FO/RJ45 ports.
12.1.14	Maintenance /console Part	Required.
12.1.15	Latency	Less than or equal to 10 ms.
12.1.16	Fiber Optic Compatibility	Multimode, 1310 nm as per SCADA requirements.
12.1.17	Fiber Optics/ RJ45 comm. Cables/cords	As per SCADA & Purchaser requirements.
12.1.18	Connection: PRP type	From Relays, Meters to Ethernet Switch. Ref: ANNEXURE – E SCADA Architecture SLD
12.1.19	Cyber security	Refer cyber security clause 19.0 in CRP specifications
12.1.20	Wavelength	1310 nm as per SCADA requirements.
12.1.21	Ethernet RJ45 Cable Type	CAT VI.
12.1.22	Associated Connectors and Accessories	As per SCADA requirements.

13.0 ANNUNCIATION

Sl no	Heading	Function description			
13.1	Type	Static type/Numerical type along with alarm. Annunciations shall be repetitive type and shall be capable of registering the fleeting signal. Fascia test facility should also be provided.			
13.2	Power	Universal power supply 24 ~ 240V DC/AC.			
13.3	Ann. push button	Potential isolation of all electrical circuits, with Indication lamps TEST, ACKNOWLEDGE, RESET buttons.			
13.4	Temperature	-20°C to +70°C with humidity 75% relative humidity.			
13.5	Power consumption	≤ 2.0W.			
13.6	Mounting	Flush mounted.			
13.7	Electromagnetic compatibility	Noise immunity, Noise irradiation as per IS/IEC std.			
13.8	Wiring	Announciator must have provision for inversion of Input signal High/Low as per control/protection requirements without affecting external wiring connections. Output signal for hooter/bell circuit shall be as per purchaser requirements.			
13.9	Fascia Window	Min.24 windows, 30x30mm, Size Type: 3D, Trip Facia:RED, NonTrip Facia:Yellow, Factory set Seq.Manual Reset"M", AC&DC Fail in Last two windows with RS485/TCP IP Modbus communication.			
		Ref. Facia Windows signal list connections for reference and shall be provided as per purchaser requirements during detailed engineering.			
	1	Line	Transformer	Bus Coupler	Capacitor
	2	M1FP Fail	M1PTP Fail	M1BCP Fail	M1CBP Fail
	3	M1FP Trip	M1PTP Trip	M1BCP Trip	M1CBP Trip
	4	M2FP Fail	M2PTP Fail	M2BCP Fail	M2CBP Fail
	5	M2FP Trip	M2PTP Trip	M2BCP Trip	M2CBP Trip
	6	86.1&86.2 Optd	86.1&86.2 Optd	86.1&86.2 Optd	86.1&86.2 Optd
	7	TCS 1&2 Fail	TCS 1&2 Fail	TCS 1&2 Fail	TCS 1&2 Fail
	8	CB Trouble alarm	CB Trouble alarm	CB Trouble alarm	CB Trouble alarm
	9	VT MCB Off/Trip/VT Fail	VT MCB Off/Trip/VT Fail	VT MCB Off/Trip/VT Fail	VT MCB Off/Trip/VT Fail
	10	DC ckt-1 Fail	DC ckt-1 Fail	DC ckt-1 Fail	DC ckt-1 Fail
	11	DC ckt-2 Fail	DC ckt-2 Fail	DC ckt-2 Fail	DC ckt-2 Fail
	12	AC Fail	AC Fail	AC Fail	AC Fail

	13	M2 CH 1 Fail	TRF.Trouble alarm	ETH SW-1 Fail	Cap.Bank alarm
	14	M2 CH 1 Fail	TRF.Trouble Trip	ETH SW-2 Fail	spare
	15	86.1, 86.2 Fail	86.1, 86.2 Fail	86.1, 86.2 Fail	86.1, 86.2 Fail
	16	LBB Trip	LBB Trip	LBB Trip	LBB Trip
	17	BRC/CTS/UV/PSB Alarm	TRF OLTC Trouble alarm	spare	spare
	18	spare	TRF OLTC DM drive Trip	spare	spare
	19	spare	TMU/AVR relay Fail	spare	spare
	20	spare	TMU/AVR relay Trip	spare	spare
		Other Ann.window's spare shall be wired upto terminals.			
13.10	Others	Hooter & Bell shall be provided as per IS/IEC std. Provision for hooter out of service shall needs to be provided.			
13.11	Potential Free contacts	To be provided for event logger.			
13.12	Overall Dimension of Group	To be Provided by Vendor.			
13.13	Operation of windows	Sequence of operation of the annunciator shall be as follows.			

		Alarm Condition	Fault Contact	Visual Annunciation	Audible Annunciation
	1	Normal	OPEN	OFF	OFF
	2	Abnormal	CLOSE	FLASHING	ON
	3	Accept	CLOSE	STEADY ON	OFF
	4	Return to normal	OPEN	STEADY ON	OFF
	5	Reset	OPEN	OFF	OFF
	6	Reset before return to normal	CLOSE	FLASHING	ON

14.0 INSTRUMENTS

Sl no.	Heading	Function Description
14.1	Multifunction Meter	

14.2	Auxiliary Supply	48 – 250V DC as per requirement.
14.3	Make	Schneider/Siemens/ABB/LT/Rishab/Conserv.
14.4	Type/Model/ VA Burden	To be Provided by Vendor & approved by purchaser.
14.5	Multifunction Meter	Digital type with programmable ratio.
14.6	SCADA Interfacing	RS485/TCP IP rear port suitable for integration on Modbus Protocol.
14.7	Size	96x96 mm.
14.8	Panels where to be provided	All panels.
14.9	Accuracy Class	0.2S.
14.10	Energy meter provision	Energy meter is not in supplier's scope. Only space and CT/VT wiring is to be provided in all panels except bus coupler and bus VT. Space shall be 350 mm (H) x200 mm (W) for flush mounting meter with holes for meter connection, wiring which shall be decided during Engineering.
14.11	Stablizing resistor	To be provided by vendor shall be approved make.
14.12	Metrosil	To be provided by vendor shall be approved make.
14.13	Aux.relays	Refer Clause. 10.11 onwards.

15.0 INDICATIONS

Sl no	Heading	Function description
15.1	Indicating Lamps	Flush mounted Clustered LED type with rear terminal connections. Lamp Cover to be screwed type an moulded from heat resistant material.
15.2	Breaker On	Red.
15.3	Breaker Off	Green.
15.4	Isolator Close	Red.
15.5	Isolator Open	Green.
15.6	Spring Charged	Blue.
15.7	CB Ready	Orange.
15.8	DC control supply healthy	Amber.
15.9	DC Faulty	Red.
15.10	Heater circuit healthy	White.

15.11	Trip circuit healthy	Yellow.
15.12	Trip circuit Faulty	Red
15.13	VT supply	R, Y, B.
15.14	Voltage	48-240 Vdc/Vac universal power supply module.
15.15	Rating	To be Provided by Vendor.
15.16	Wattage	To be Provided by Vendor.
15.17	Series Resistance	To be Provided by Vendor.
15.18	10% extra Lamp Furnished?	To be Provided by Vendor.
15.19	Size of lens	To be Provided by Vendor.
15.20	Make	To be Provided by Vendor.
15.21	Type	To be Provided by Vendor.
15.22	Semaphores	To be provided for all earth switches.
15.23	Make	To be Provided by Vendor.
15.24	Type	To be Provided by Vendor.
15.25	Diameter of the Disc	To be Provided by Vendor.
15.26	Operating voltage	48~250 VDC as per purchaser requirements.
15.27	Burden (Watt DC)	To be Provided by Vendor.
15.28	Whether latch in type or supply Failure type	To be Provided by Vendor.
15.29	Discrepancy Switch	To be Provided by Vendor.

16.0 SELECTOR SWITCHES AND PUSH BUTTONS

Sl no	Heading	Function description
16.1	Switches	Flush Mounted with shrouded terminals.
16.2	TNC Switch	Lockable Pistol Grip type with spring return to normal position.
16.3	Local/Remote [SCADA] selector switch	2 pole. Different colour switch for Breaker / Isolator or Disconnector control switchs preferred.
16.4	Rotary On/Off Switches	For CB Test-Service Mode/ Heater ckt / Illumination ckt/ Interlock BY PASS ckt, etc as per site requirements.
16.5	DC Selector switch	DC-1 + OFF + DC-2 as 3 pole selection switch & as per site requirements.
16.6	Rating of switches	16 A.

16.7	Push buttons	Flush Mounted with shrouded terminals.
16.8	Accept Push Button	Flush Mounted Black Color- Trip alarm/DC fail alarm.
16.9	Reset Push Button	Flush Mounted Yellow Color- Trip alarm/DC fail alarm.
16.10	Test Push Button	Flush Mounted Blue Color.
16.11	Rating of Push button	10A.

17.0 ACCESSORIES

Sl no	Heading	Function description
17.1	Space heaters	Thermostat controlled with switch for isolation.
17.2	Voltage	240 V AC.
17.3	Wattage	To be provided by Vendor.
17.4	Thermostat Range	To be provided by Vendor.
17.5	Provided with Individual fuse unit	To be provided by Vendor.
17.6	Power Socket and switch	240V, 5/15A universal type socket to be provided in each panel with single pole MCB shall be provided 02 nos.
17.7	Test point	The CRP panel front side 65Wx50Hmm size gap cover with suitable dummy plate for accessing must be provided. Power socket (01no) shall be placed rear side accessible. The protection relays test leads, communication cables, power cables of laptop shall be moved freely.
17.8	MCBs and Fuses	Provision for receiving, distribution, isolation and fusing of DC and AC supplies to various control circuits should be made using MCBs, RCDs, RCCBs, ELM and Fuses of appropriate ratings as per purchaser requirements.
17.9	Panel illumination	240V AC illumination lamp controlled by panel door switch to be provided in each panel.

18.0 APPROVED MAKES OF COMPONENTS

Sl no	Heading	Function description

18.1	Numerical Relays	Relay Model no/Order code/MLFB must be as per BSES requirements only. Ex. ABB / HitachiABB / Siemens / Schneider / GE / SEL / Alstom. (Only Approved component list of BSES relay list shall be used or prior approval required)
18.2	Transformer Monitoring Cum AVR relay	REU615/RET670/EasunMR/7UT85 relay with latest software/hardware version. (Only Approved component list of BSES relay list shall be used or prior approval required)
18.3	Miniature Aux.relay/Aux.relays	Jyoti/ Hitachi abb/ Omron / Siemens/ Schneider/ Alstom/ C&S/ EasunReyrolle,etc. (Only Approved component list of BSES relay list shall be used or prior approval required)
18.4	Discrepancy Switch	Multimode or equivalent
18.5	MCBs	Siemens/Schneider/Legrand/ABB.
18.6	Control switches	Alstom/Schneider/Switron/Kaycee/L&T.
18.7	Annunciator	Minilec/Alan.
18.8	Test terminal block	IMP/DAV.
18.9	Terminal blocks	Elmex/Connectwell.
18.10	CRP panel wiring	Polycab/KEI/Finolex/Havells
18.11	Lugs	Dowells/Jaison
18.12	Indication lamps, push buttons	Siemens/Schneider/Binay.
18.13	Semaphore indication	Binay or equivalent
18.14	Meters	Schneider/Siemens/ABB/LT/Rishab/Conserv.
18.15	Multi Function Meter	Rishabh (Rish Delta Energy)
18.16	Managed Ethernet Switch	Ruggedcom/ Hirschman/Advantech(To be discussed with SCADA)
18.17	Sync check relay	Different make to be provided by vendor for approval.
18.18	DC Voltage Monitor	Different make to be provided by vendor for approval.
18.19	DC Earth leakage Monitor (ELM)	Different make to be provided by vendor for approval.
18.20	Stabilizing Resistor	Pentagon or equivalent
18.21	Metrosil	M&I/Siemens or equivalent
18.22	Other devices	All devices & if any other device needs to meet site requirements must be as per BSES recommendations only.

19.0 CYBER SECURITY

Sl no	Heading	Function description

19.1	Reference Standards	IEC:61850 – 5 to 10, IEC:27036, IEC:20243, IEC:62443, IEC:62351 and other relevant standards of IS/IEC/ANSI/IEEE,etc must be incorporated and Rules & Standards of Govt. of India, Ministry of Power/Other Central, State Departments & International best practice on Cyber security in Electrical Power Systems.
19.2	Policy	The documented type test & conformance valid parameters for a set of business rules and process for protecting information, computer resources, networks, devices, electrical/electronic programmable devices, software's, industrial control systems and other Information Technology (IT) / Operation Technology (OT) systems shall be used to protect a sensitive & critical infrastructure of Electrical Power generation, transmission, distribution in protections, control operations, measurements, monitoring purposes.
19.3	Cyber Security Threats, Violations, Incidents, Unauthorized access on Power System ITs/OTs.	Cyber security violation/incident occurs by unauthorized or illegitimate accessor a person, group of persons, entity, of data, applications, services, networks and/or devices through bypass of the underlying cyber security protocols, policies and mechanisms resulting in the compromise of the confidentiality, integrity or availability of data/information maintained in a computer resource, protection equipment's, protection devices, sensors, meter devices, mechanism, automation, RTUs, PLCs, SCADA and other connected within respective electrical utilities & organizations.
19.4	Cyber Security systems	The cyber security of electrical power systems/ networks shall be available to protect the security, integrity and reliability.
19.5	Critical Assets	The critical assets shall be of system, equipments and facilities which, if destroyed, degraded or otherwise declared unavailable, would affect the reliability or operability of the electrical power system.
19.6	Type test reports IEC:62443, IEC:62351 (India made devices)	The IEDs, RTU, FRTUs, PLCs, SCADA, Communication network switches, any related programmable software's/hardware's, etc systems that involved in electrical power sector for control & monitoring critical information shall be verified for a sample size for testing minimum one number from each make, type and having same firmware version for the supply one lot size of 200 numbers or less.
19.7	Type test reports IEC:62443, IEC:62351 (India made devices)	The Smart meters, other energy meters the sample six for testing shall be minimum one number for each make, type and have same firmware version for the supply one lot size of 5000 numbers or less.

19.8	Type test reports IEC:27036 IEC:62443 IEC:62351 IEC:20243 (Other country made devices)	The IEDs, RTU, FRTUs, PLCs, SCADA, Meters, Communication network switches, any related programmable software's/hardware's, etc systems that involved in electrical power sector for control & monitoring critical information for importing products/system shall be verified for a sample size 5% of the supply lot for each make, type and having same firmware version for the supply lot.
19.9	Protection & Control devices, Network & Programmable devices of substation equipments	The IEDs, Communication Networks related devices, Software's, Hardware's in relation of critical electrical equipment which ever transfer data files, control & monitoring data files within power sector, state utilities for reliable power sector, which is a strategic & critical sector.
19.10	IED'S like Protection devices, Control devices.	Communication protocol conformance standards shall be followed as per IEC 61850-5 to IEC 61850-10 and respective clauses.
19.11	RTUs,FRTUs,SCADA, PLC, etc with IEC communications.	Communication protocol conformance standards shall be followed as per IEC:60870-5-101/ IEC:60870-5-103/ IEC: 60870-5-104 and respective clauses.
19.12		Protocol Security conformance standards shall be followed as per IEC:60870-7, IEC:62351-100 part1&3 and respective clauses.
19.13	Smart meters with IEC 62056	Protocol Security conformance & Communication protocol conformance standards shall be followed as per IS:15959 series, IS:16444 series and respective clauses.
19.14	Mandatory tests case	The test is referencing a clause that is mandatory in IEC: TS 62351-5, IEC: TS 60870-5, IEC: 62351-3 which defines the requirements related to the authentication/encryption protocol, procedures and methods to be implemented at Fiber, TCP/IP(transport) level, Modbus,etc.
19.15	Approved/ Designated Laboratories	Central Power Research Institute (CPRI) approved laboratory for IEDs, RTU, FRTUs, SCADA, PLC systems. Central Power Research Institute (CPRI) Electrical Research & Development Association (ERDA), Yadav Measurements Pvt Ltd(YMPL) for Smart meter devices. If any other departments if approved shall be as per Ministry of Power/Other related departments for confirmation of Cyber security in power systems. If any changes according to Govt.rules/notifications/MoP,etc the same shall be incorporated time to time without cost implications.
19.16	Miscellaneous	Words and expressions used and not identified in these above regulations but defined in the information technology Act 2000 and the Electricity Act, 2003 shall be followed for cyber security of power system time to time.
19.17	Certificates Validity	Product certifications/type test reports of any Electrical/Electronic devices connected in power systems for respective protection/functions/controls/monitoring shall

		not be older than 5 years during supply of same items.
19.18	Reports	All necessary type test reports, certifications shall be submitted for CRP panel/ Equipments at Pre Bid / Engineering/ Inspection by supplier/vendor.

20.0 DEVIATIONS

Deviation from this specification shall be stated in writing with the tender by reference to the specification clause/ GTP/ Drawing and description of alternative offer. In absence of such a statement, it shall be assumed by the buyer that the seller complies fully with this specification.

21.0 DRAWINGS AND DATA SUBMISSION MATRIX

- ❖ Document checklist for each stage is given in table below. (Refer equipment specification for details)
- ❖ Document check sheet compliance shall be the first sheet for each submission stage i.e. Technical bid, Drawing Approval, Pre Dispatch, Pre closure.
- ❖ No submission is acceptable without check list compliance.
- ❖ Deficient/ improper document/ drawing submission shall be liable for rejection.
- ❖ Order of documents shall be strictly as per the check list with in Soft copy with separate folder in proper nomenclature.
- ➢ Any drawing not included in the below table but necessary for detailed engineering shall be deemed to be included in bidder's scope.

Sl.no	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
21.1	Contact Person Name, Email ID and Mobile Number	Required			
21.2	Consolidated Deviation Sheet	Required	Required		
21.3	GTP	Required	Required		
21.4	Type Test as per IS/IEC	Required			
21.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
21.6	Sizing Calculation of Associated Equipment		Required		
21.7	Recommended Spares Apart from spares stated in Spec(for 10 years of operation)		Required		
21.8	Schematic		Required		
21.9	CRP Individual Feeders				
21.10	General Arrangement	Required	Required		
21.11	Sectional Layout		Required		
21.12	Door Layout		Required		

Sl.no	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
21.13	Panel wise BOQ		Required		
21.14	Index Sheet		Required		
21.15	Symbols		Required		
21.16	SLD	Required	Required		
21.17	Trip Logic		Required		
21.18	AC Distribution Circuit		Required		
21.19	DC Distribution Circuit		Required		
21.20	CT Distribution Circuit		Required		
21.21	VT Distribution Circuit		Required		
21.22	Voltage Selection Circuit		Required		
21.23	Metering Circuit		Required		
21.24	Indication Circuit		Required		
21.25	Isolator Control Circuit		Required		
21.26	Protection Circuit		Required		
21.27	Relay Circuit with BI and BOs		Required		
21.28	BI and BO Sheet of each relay		Required		
21.29	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
21.30	Logic Operation Diagram		Required		
21.31	Communication Architecture		Required		
21.32	Transformer Monitoring Relay Circuit in case of Transformer Panel		Required		
21.33	CB Closing interlock circuit		Required		
21.34	Tripping relay Circuit		Required		
21.35	CB status &CB trouble multiplication aux.relay circuit		Required		
21.36	Isolator , ES and transformer trouble contact multiplication circuit		Required		
21.37	Annunciation circuit		Required		
21.38	TB Reference page		Required		
21.39	Synch Logic Diagram		Required		
21.40	QAP		Required		
21.41	Inspection Reports			Required	
21.42	As manufacturing Drawings			Required	
21.43	Operation and Maintenance Manual			Required	Required
21.44	Trouble shooting manual			Required	Required
21.45	As built Drawings				Required
21.46	Test Report				Required
21.47	Soft Copy				
21.48	In Pen drive/mail/CD/DVD	Required	Required	Required	Required

22.0 QUALITY ASSURANCE, INSPECTION & TESTING

Sl no	Heading	Function description
22.1	Vendor quality plan	To be submitted for purchaser approval.
22.2	Type tests	Product must be type tested as per Indian Standards or IEC. Vendor shall be submitting & get approval from BSES team for inspection relevant documents.
22.3	Type test report validity	Last five years from the date of bid submission.
22.4	Acceptance and Routine tests	The documents furnished for details of method of inspection, checking & acceptance standards and results shall be approved by Inspection team of BSES. Any hold points raised, then the supplier shall comply with the remarks made by BSES representative on such reviews with regards to further testing, rectification or rejection, etc.
22.5	Notice to Purchaser for conducting tests	Five weeks in advance.
22.6	Inspection	The supplier to proceed with the work past a hold point only after clearance by purchaser (if any) or a witness waiver letter from BSES.
22.7	Inspection visit	Successful bidder has to bear all factory inspection/testing expenses of Engineer (3 nos) including To & Fro Flight travels, foods, accommodation, lodging & boarding – Minimum 4 Star rated Logde/Hotel (As per Govt.approved list).
22.8	Test reports of acceptance and routine test before dispatch	The vendor supply QR code in two places of CRP panel for SCAN and collecting reports i. As built drawings of each panel. ii. Acceptance & Routine Test reports iii. Quality & Type Test reports iv. Manuals of each device. v. Inspection reports & FAT reports. vi. Numerical relays cortec codes. vii. Sizing calculation of associated equipments. viii. Compliance sheets of each scheme drawing. ix. Material Dispatch clearance certificate (MDCC) The QR Code shall be placed at : 3. Bus coupler panel rear door inner side. 4. Transformer # 2 panel front side near door handle. 5. It shall be provided in front side near door handle if separate panel order.

22.9	Deliverable	Hard Copies: ➢ 6 sets : A3 size - As Built Drawing of panels. ➢ 6 sets : A4 size - Maintenance Manual protection panels including Aux.relays, Ethernet switches, Metrosil, Calculation of sizing of various equipments, DC/AC sizing calculations,etc & other devices fixed in panels as per IS/IEC std. Soft Copies: ➢ 2 CD/DVD copy : (As per purchaser requirements) Approved Drawings, As Built Drawings including Autocad/Enggcad files, pdf files. Maintenance manuals in .pdf files. (bidder shall discuss with BSES for actual format of submission of documents)

23.0 PACKING

Sl no	Heading	Function description
23.1	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration. During transportation/ transit and storage, panels may be subjected to outdoor conditions. Hence, packing of each panel shall be weatherproof.
23.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label.
23.3	Packing Identification Label to be provided on each packing case with the following details.	
23.4	Individual serial number.	
23.5	Purchaser's name.	
23.6	PO number (along with SAP item code, if any) & date.	
23.7	Equipment Tag no. (if any)	
23.8	Destination.	
23.9	Project Details.	
23.10	Manufacturer / Supplier's name.	
23.11	Address of Manufacturer / Supplier / it's agent.	
23.12	Description and Quantity.	

23.13	Country of origin.
23.14	Month & year of Manufacturing.
23.15	Case measurements.
23.16	Gross and net weights in kilograms.
23.17	All necessary slinging and stacking instructions.

24.0 SHIPPING

Sl no	Heading	Function description
24.1	**Shipping**	The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, Overhead lines, free access etc. from the Manufacturing plant to the project site. Bidder shall furnish the confirmation that the proposed. Packages can be safely transported, as normal or oversize packages, up to the site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser.
		On completion of manufacturing the items can be dispatched only after issue of shipping release by the purchaser.
		The seller shall be responsible for all transit damages due to improper packing.

25.0 HANDLING AND STORAGE

Sl no	Heading	Function description
25.1	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

26.0 ANNEXURE – A – TRANSFORMER MONITORING UNIT / AVR RELAY

Sl no	Heading	Function description
	General features	
26.1	Technology and Functionality	Microprocessor based with provision for multifunction control and monitoring.
26.2	Mounting	Rack Mounting.
26.3	Architecture	Hardware and software architecture shall be modular and disconnectable to adapt the control unit to the required level of complexity as per the application.
26.4	Programming and configuration	AVR shall utilize a user friendly setting and operating multi-lingual software in windows environment with menus and icons for fast access to the data required.
26.5	Human Machine Interface	HMI with an alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. Capability to access and change all settings and parameters.
26.6	PC Interface port	Front port (preferably serial) for configuration using PC. Software and communication cord, required for programming of offered protection relays using PC, shall be mentioned separately in the bid.
26.7	SCADA Interface port	Communication port: LC
26.8	Communication protocol	Relays shall be compatible to transfer all AI, BI, BO, Event, DR, etc. for interfacing with SCADA on IEC61850, IEC103 (Data Type-9), IEC104, etc. protocols as per SCADA requirements.
26.9	Self diagnosis	Relay shall be able to detect internal failures and same shall be transmitted to SCADA as a soft signal. A watchdog relay with changeover contact shall provide information about the failure.
26.10	Cable Termination	Termination of cable shall be at rear side.
26.11	Time Synchronization	Relay shall be capable of being synchronized with the system clock through SCADA, PC and GPS.
26.12	Auxiliary supply	48 ~ 240V DC universal type.
26.13	**Inputs and Outputs**	
26.14	Analog Module	Refer Single Line Diagram for details of CT,VT secondary circuit for wiring/communications as per purchaser approved documents.
26.15	Ratio corrections	Software based CT,VT Ratio & Vector corrections feature (Without Interposing CT, other CTs).
		Line/cable capacitive current compensation protection

		functions.
26.16	Analog mA input	Min. 04 nos.
26.17	PT-100 direct input	Min.02 nos
26.18	Direct Resistance Input	For tap position indication. (18 steps)
26.19	Configurable Binary input/outputs	Minimum of 24 BIs and 16 BOs as per purchaser requirements. 2 BIs and 2 BO shall be spare for future use.
26.20	**Control**	
26.21	Control Tasks	Ability to implement control functions through programmable logics.
26.22	Voltage setting	Programmable Voltage set point.
26.23	Voltage Regulation	Raise/Lower tap position to maintain the preset value of voltage.
26.24	Voltage Regulation modes	Automatic and Manual.
26.25	Operation Modes	Local and Remote.
26.26	Fan and Pump control	To be provided.
26.27	Transformer Paralleling	Capability to parallel transformers whose AVRs are interconnected via a communication network. 1. Master – Follower upto 4 transformers. 2. Minimizing circulating current principle.
26.28	**SCADA Interfacing:** As per SCADA specification & site requirements.	
26.29	**Measurement, Event Recording and Monitoring**	
26.30	Measured Quantities (optional)	Voltage, Current, Active Power, Reactive Power, Apparent Power, Power factor, frequency.
26.31	Event Recording	Facility for recording parameters during various events such as tap change, change in binary input status etc.
26.32	Monitoring	Capability to monitor important transformer parameters such as Oil temperature, Winding Temperature etc and give indication/alarm when the value of a particular parameter exceeds the preset value.

27.0 ANNEXURE- B – GUARANTEED TECHNICAL PARTICULARS

Vendor must submit clause wise compliance against specification at the time of drawing approval clearly highlighting the deviations from specification against each clause.

28.0 ANNEXURE- C – SPARES REQUIREMENT

Sl No.	Description	Unit Rate
28.1	Numerical relay of each type	1 nos.
28.2	Auxiliary relay of each type	1 nos.
28.3	Contact multiplication relays (Bi-stable type for CB, isolator and earth switch auxiliary contact multiplication)	6 nos.
28.4	Contactor of each rating	2 nos.
28.5	Voltmeter	1 nos.
28.6	Local/Remote Selector switch	2 nos.
28.7	TNC switch for CB	2 nos.
28.8	TNC switch for Isolators	3 nos.
28.9	Semaphore indicators	4 nos.
28.10	MCB of each rating	1 nos.
28.11	Lugs of each type & rating	200 nos.
28.12	2.5Sq.mm, 1.5Sq.mm of coil	300 meter each.
28.13	Special lugs (Combiflex or other different type lugs)	300 nos.
28.14	Crimping tool (Special lugs if provided)	1 nos.

29.0 ANNEXURE-D-SLDs

30.0 ANNEXURE-E-SCADA SLDs

31.0 ABBREVATIONS

Sl No.	Name	Description
31.1	AC	Alternating Current
31.2	DC	Direct Current
31.3	CT	Current Transformer
31.4	VT or PT	Voltage Transformer or Potential Transformer
31.5	SLD	Single Line Diagram
31.6	ICT	Interposing Current Transformer
31.7	CRP	Control & Relay Panel
31.8	BC	Bus Coupler
31.9	Cap.Bank	Capacitor Bank
31.10	LCC	Local Control Cubicle
31.11	RTU	Remote Terminal Unit

31.12	SCADA	Supervisory Control And Data Acquisition
31.13	AIS	Air Insulated Substation
31.14	GIS	Gas Insulated Substation
31.15	SWGR	Switch gear
31.16	OLTC	On Load Tap Changer
31.17	IED	Intelligent Electronic Device
31.18	HMI	Human Machine Interface
31.19	LCD	Liquid Crystal Display
31.20	LED	Light Emitting Diode
31.21	CB	Circuit Breaker
31.22	TNC	Trip Neutral Close
31.23	ES	Earth Switch
31.24	MCB	Miniature Circuit Breaker
31.25	PT100	Platinum Temperature resistance sensor “100” denotes its nominal resistance at “0ºC”.
31.26	PC	Personal Computer
31.27	DM	Derive Mechanism
31.28	Sync	Synchronization
31.29	Dir.OC	Directional Over Current
31.30	Dir.EF	Directional Earth Fault
31.31	Ins.OC	Instantaneous Over Current
31.32	Ins.EF	Instantaneous Earth Fault
31.33	TOC	Time delayed Over Current
31.34	TEF	Time delayed Earth Fault
31.35	SOTF	Switch On To Fault
31.36	REF	Restricted Earth Fault
31.37	BRC	Broken Conductor
31.38	CTS	Current Transformer Supervision
31.39	LBB/BFR	Local Breaker Backup or Breaker Failure
31.40	VOC	Voltage depended over current
31.41	UF	Under Frequency
31.42	OF	Over Frequency
31.43	df/dt	Rate of Change of Frequency
31.44	OV	Over Voltage
31.45	UV	Under Voltage
31.46	VT Fail	Voltage Transformer Fail
31.47	VMR	Voltage Monitoring Relay
31.48	Sync	Synchronization function

31.49	PSB	Power Swing Block
31.50	M1FP	Main-1 Feeder Protection
31.51	M2FP	Main-2 Feeder Protection
31.52	M1PTP	Main-1 Power Transformer Protection
31.53	M2PTP	Main-2 Power Transformer Protection
31.54	M1BCP	Main-1 Bus Coupler Protection
31.55	M2BCP	Main-2 Bus Coupler Protection
31.56	M1CBP	Main-1 Capacitor Bank Protection
31.57	M2CBP	Main-2 Capacitor Bank Protection
31.58	AVR	Automatic Voltage Regulator
31.59	TMU	Transformer Monitoring Unit
31.60	TCIV	Transformer Conservator Isolation Valve
31.61	MCB	Miniature Circuit Breaker
31.62	ELR	Earth Leakage Relay
31.63	AI	Analog Input
31.64	BI	Binary Input
31.65	BO	Binary Output
31.66	GPS	Global Positioning System
31.67	IRIG – B	Inter Range Instrumentation Group – B
31.68	USB	Universal Serial Bus
31.69	CAT-VI	Category – 6 [Standardized Twisted Pair cable]
31.70	RS485	Recommended Standard - 485
31.71	PLC	Programmable Logic Controller
31.72	FRTU	Feeder Remote Terminal Unit
31.73	OFC/FOC	Optical Fiber cable / Fiber Optic Cable
31.74	FO	Fiber Optic
31.75	RJ	Registered Jack
31.76	LC	Lucent Connector
31.77	SC	Standard Connector
31.78	ST	Standard Connector with Spring loaded
31.79	ST	Standard Connector with Push In & Twist
31.80	RSTP	Rapid Spanning Tree Protocol
31.81	HSR	High-availability Seamless Redundancy
31.82	PRP	Parallel Redundancy Protocol
31.83	STP	Shielded Twisted Pair
31.84	FTP	Foil Twisted Pair
31.85	NO	Normally Open
31.86	NC	Normally Close

31.87	L/R	Local / Remote
31.88	O/L	Over Load
31.89	QAP	Quality Assurance Plan
31.90	GTP	General Technical Particular
31.91	SO_2	Sulfur Dioxide
31.92	H_2S	Hydrogen Sulfide