BSES Yamuna Power Limited

NIT NO: CMC/BY/26-27/RS/SkS/MD/9 (RFX No. 2200000210)

CORRIGENDUM-1 Dated 10.06.2026

Refer to NIT No. CMC/BY/26-27/RS/SkS/MD/9 (RFX No. 2200000210) dated 05.05.2026 for "Survey, design, engineering, supply, erection, testing, & commissioning of 11KV & 33KV AIS panels along with miscellaneous items and activities at Shastri Park (Central) Grid.''

Please note the following amendments to the aforesaid NIT:

1. **Change in Scope of supply & ETC.**
   The scope of supply and work/ETC has been revised. Refer the revised Volume–III: Scope of Supply, Work and Technical Specification.

2. **Change in price bid formats.**
   Consequent to the revision in scope of supply and work/ETC, the Price Bid Formats have also been revised. Refer the revised Volume–II: Price Bid Formats.

3. **Extension of Bid Submission Date:**
   The due date for bid submission has been extended up to **22.06.2026**.

4. **Change in Tender estimate and EMD amount.**
   In line with the revised scope of supply and word/ETC, the Tender Estimate and EMD amount stand revised as indicated below and shall replace the corresponding values stipulated in the original NIT.

S N	Items	Tender Fee (₹)	Estimated Cost (₹)	EMD Amount (₹)
1	SURVEY, DESIGN, ENGINEERING, SUPPLY, ERECTION, TESTING, & COMMISSIONING OF 11KV & 33KV AIS PANELS ALONG WITH MISCELLANEOUS ITEMS AND ACTIVITIES AT SHASTRI PARK (CENTRAL) GRID IN BYPL.	1,180	4.95 Crore	9.90 Lakh

The revised Volume–III: Scope of Supply, Work and Technical Specification, Volume–II: Price Bid Formats, Tender Estimate and EMD amount notified through this Corrigendum shall supersede the corresponding provisions/documents issued with the original NIT.

The earlier versions thereof shall stand withdrawn and shall not be considered for bid submission and evaluation purposes.

All other terms, conditions, specifications and provisions of the above NIT shall remain unchanged and continue to be applicable. This Corrigendum forms an integral part of the Tender Document and shall be submitted along with the bid.

Enclosures:
1. Revised Volume–II: Price Bid Formats.
2. Revised Volume–III: Scope of Supply, Work and Technical Specifications.

VOLUME – II

PRICE BID FORMAT

GRAND SUMMARY

ALL PRICES IN INR (Rs)

Item Name/Work	Total Supply Price Landed (A)	Total ETC price Landed (B)	Total Cost (C=A+B)
SURVEY, DESIGN, ENGINEERING, SUPPLY, ERECTION, TESTING, & COMMISSIONING OF 11KV & 33KV AIS PANELS ALONG WITH MISCELLANEOUS ITEMS AND ACTIVITIES AT SHASTRI PARK (CENTRAL) GRID IN BYPL.			

NOTE: Cost of all tests as per technical specification is to be included. No separate/extra charges will be paid.

The Un-priced bid should be marked as **"Quoted"** and to be submitted with Part – A

We declare that the following are our quoted prices in INR for the entire switchboard.

Date: Bidders Name:

Place: Bidders Address:

Signature: …… Designation: ……..

Printed Name: …… Common Seal: …….

PRICE FORMAT – SUPPLY

ALL PRICES IN INR (Rs)

S No.	DESCRIPTION OF GOODS	UOM	QTY	UNIT BASIC PRICE INCL FREIGHT(Rs)	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (Rs)		UNIT LANDED COST(Rs)	TOTAL LANDED COST (Rs)
			(A)	(B)	(C)		(D=B+C)	(E=DXA)
1	11kV Outgoing Panel	Nos	8					
2	11kV Incomer Panel	Nos	1					
3	11kV Adaptor Panel	Nos	2					
4	11kV Bus Coupler Panel	Nos	1					
5	11kV Bus Riser cum Bus PT Panel	Nos	1					
6	11kV Capacitor Bank Panel	Nos	1					
7	33kV Incomer Panel with Line PT	Nos	4					
8	33kV Transformer Panel	Nos	1					
9	33kV Bus coupler Panel	Nos	1					
10	33kV Riser With PT Panel	Nos	1					
11	33kV bus PT Panel	Nos	1					
12	66kV Control & Relay panel for Transformer (66/33kV,50MVA PTR)	Nos	1					
13	66kV Control & Relay panel for Transformer (66/11kV,25MVA PTR)	Nos	1					
14	66kV Control & Relay panel for Bus coupler	Nos	1					
15	Ethernet Switches	Nos	6					
16	Bay Marshalling box	Nos	6					
17	Optical Fiber cable (Patch Cord)	LOT	1					
18	Recommended & Mandatory spares	LOT	1					
19	Earthing	LOT	1					
20	Insulated Floor Coating	LOT	1					
GRAND TOTAL LANDED COST								
In words …….								

PRICE FORMAT – E/T/C

ALL PRICES IN INR (Rs)

S No.	DESCRIPTION OF SERVICE (ETC)	UOM	QTY	UNIT BASIC PRICE (Rs)	UNIT GST & CESS AS APPLICABLE (CGST & SGST/UTGST or IGST) (Rs)		UNIT LANDED COST(Rs)	TOTAL LANDED COST (Rs)
			(A)	(B)	(C)		(D=B+C)	(E=DXA)
1	ETC of 11kV Outgoing Panel	Nos	8					
2	ETC of 11kV Incomer Panel	Nos	1					
3	ETC of 11kV Adaptor Panel	Nos	2					
4	ETC of 11kV Bus Coupler Panel	Nos	1					
5	ETC of 11kV Bus Riser cum Bus PT Panel	Nos	1					
6	ETC of 11kV Capacitor Bank Panel	Nos	1					
7	ETC of 33kV Incomer Panel with Line PT	Nos	4					
8	ETC of 33kV Transformer Panel	Nos	1					
9	ETC of 33kV Bus coupler Panel	Nos	1					
10	ETC of 33kV Riser With PT Panel	Nos	1					
11	ETC of 33kV bus PT Panel	Nos	1					
12	ETC of 66kV Control & Relay panel for Transformer (66/33kV,50MVA PTR)	Nos	1					
13	ETC of 66kV Control & Relay panel for Transformer (66/11kV,25MVA PTR)	Nos	1					
14	ETC of 66kV Control & Relay panel for Bus coupler	Nos	1					
15	ETC of Ethernet Switches	Nos	6					
16	ETC of Bay Marshalling box	Nos	6					
17	ETC of Optical Fiber cable (Patch Cord)	LOT	1					
18	ETC of Earthing	LOT	1					
19	Insulated Floor Coating	LOT	1					
20	Shifting and reinstallation of LIU Unit from the CRP room to 33kV room	Nos	2					
21	Dismantling of 11 KV Switchgear with its Associated items Including Cables	Nos	1					
22	Dismantling of 33 KV Switchgear with its Associated items Including Cables	Nos	13					

23	Dismantling of 66kV and 33kV CRP Panel with its Associated items Including Cables	Nos	16					
24	Dismantling of RTCC with its associated items	Nos	2					
25	Transportation of dismantled Switchgear panels/CRP/RTCC and associated items to BYPL store	Lot	1					
Civil works								
26	New Trench/Complete modification and repair of existing power cable & control trench in 11 KV and 33kV Switchgear room for installation of offered Switchgears	Lot	1					
27	Power Cable Trench other than 11 KV and 33kV Switchgear room (If required)	Mtr	1					
28	Chequered Plate for dismantled CRP panels and RTCC Panels	Lot	1					
29	Cable Clamping Arrangement	Lot	1					
30	Construction of RCC type foundation for capacitor bank	Lot	1					
31	Painting of Unique Equipment ID number (which is to be provided by BYPL) on the supplied panels	Lot	1					
GRAND TOTAL LANDED COST								
In words …….								

VOLUME – III

SCOPE OF SUPPLY, WORK AND TECHNICAL SPECIFICATION

Scope of Supply				
S. No	**Item**	**Shastri Park Central**		**Remarks**
		UOM	**Quantity**	
1	11 KV Switchboard			a) Control Voltage is-220VDC b) Numerical Relay - P5 / 7SR5 / MICOM/Siprotec c) Relay SCADA communication port shall be IEC 61850
1.1	Outgoing	Nos	8	
1.2	Incomer	Nos	1	
1.3	Adapter Panel	Nos	2	For coupling the bus using 1CX1000 sqmm cables with three runs per phase or direct bus bar coupling as per site requirement.
1.4	BUS COUPLER PANEL	Nos	1	
1.5	BUS RISER PANEL WITH PT	Nos	1	
1.6	Capacitor feeder Panel	Nos	1	
2	33 KV Switchboard			a) Control voltage - 220V DC b) Numerical Relay - P5 / 7SR5 / MICOM/Siprotec c) Relay SCADA communication port shall be IEC 61850
2.1	33kV Incomer Panel with Potential Transformer	Nos	4	a) One Panel shall have Line Differential relay for both ends i.e. Panel end and Remote end b) For Other panels, only line differential relay at Panel end shall be provided.
2.2	33kV Transformer Panel (66/33kV, 50MVA Auto Transformer)	Nos	1	
2.3	Buscoupler Panel	Nos	1	
2.4	Bus Riser with PT panel	Nos	1	
2.5	Bus PT panel	Nos	1	
3	Control Relay panel (CRP)			a) Control Voltage is-220VDC b) Numerical Relay - P5 / 7SR5 / MICOM/Siprotec c) Relay SCADA communication port shall be IEC 61850
3.1	66kV Transformer CRP Panel (66/33kV, 50MVA PTR)	Nos	1	
3.2	66kV Transformer CRP Panel (66/11kV, 25MVA PTR)	Nos	1	
3.3	66kV Bus Coupler CRP Panel	Nos	1	
4	Ethernet Switches	Nos	6	a) Number of Ethernet Switches shall be governed by System Architecure b) 20% Spares as per the tender specification
5	Optical Fiber Cable (Patch Cord)	LOT	1	For Communication between Relay and Ethernet Switch
6	Recommended and Mandatory Spares	LOT	1	Spares Required for 11 kV & 33 kV Switchgear as per Technical Specifications
7	Civil	LOT	1	a) All Material Required for civil works

				b) Kindly refer "Scope of Work"
8	Earthing	LOT	1	a) Earthing for Items specified in "Scope of Supply" with 50x10 GI flat b) Two earthing per equipment shall be considered c) Connection of GI Flat with existing earth mesh shall be in bidder's scope
9	Insulated Floor Coating	LOT	1	a) For Supplied Panels & Switchgears b) b) Insulated Floor coating shall be 2m meter around supplied equipment
10	Bay Marshalling Box	Nos	5	

Scope of Work				
S. No	**Item Description**	**Shastri Park Central**		**Remarks**
		UOM	**Quantity**	
	Erection, Testing and Commissioning of all items specified in "Scope of Supply" and "Free Issue Items"	LOT	1	1) BYPL shall free issue the Auxiliary Power Cable and Control cable & lay the Control cables from Yard to CRP Panel, Between CRP to 11kV & 33kV Panels. However, termination of Auxiliary Power Cable and control cable at both ends & testing and commissioning shall be in the in the Scope of vendor. It includes a) Control cables for LV REF, Capacitor bank and Station Transformer b) C&R panel to Transformer Marshalling Box, Bay Marshalling Box and Bay Marshalling Box to CT, PT, CB, Isolator, Earth switch etc. c) Auxiliary cable from ACDB & DCDB to 11kV panels, 33kV Panels and CRP Panels 2) Coupling of New panels with existing one and inter panel wiring.
	Shifting and reinstallation of LIU Unit from the CRP room to 33kV room	Nos	2	
	Dismantling of 11 KV Switchgear with its Associated items Including Cables	Nos	1	a) It also includes disconnection of Power and Control cables b) It includes bus duct if any
	Dismantling of 33 KV Switchgear with its Associated items Including Cables	Nos	13	a) It also includes disconnection of Power and Control cables b) It includes bus duct if any
	Dismantling of 66kV and 33kV CRP Panel with its Associated items Including Cables	Nos	16	a) It also includes disconnection of Power and Control cables
	Dismantling of RTCC with its associated items	Nos	2	a) It also includes disconnection of Power and Control cables

	Transportation of dismantled Switchgear panels/CRP/RTCC and associated items to BYPL store	LOT	1	
	Civil Work			
8.1	New Trench/Complete modification and repair of existing power cable & control trench in 11 KV and 33kV Switchgear room for installation of offered Switchgears	LOT	1	It includes a) Angle, Channel Arrangement b) RCC, Plastering works c) Anchor Fastener Works d) Resizing of trench e) Trench Covers, cable tray and cable support Structure f) All the hardware items shall be Hot Dip Galvanized g) It includes conduits
8.2	Power Cable Trench other than 11 KV and 33kV Switchgear room (If required)	meter	1	a) Unit rate shall be provided for 1.5 meter (Depth)X1.5 meter (Width) Trench b) Cable trench shall be of RCC type c) It Includes Trench Covers, cable tray and cable support Structure
.3	Chequered Plate for dismantled CRP panels and RTCC Panels	LOT	1	
.4	Cable Clamping Arrangement	LOT	1	For items specified in "Scope of Supply" and "Free Issue Items"
.5	Construction of RCC type foundation for capacitor bank	LOT	1	Considering soil bearing capacity of 7.5 T/m2 at 1.5m depth
	Painting of Unique Equipment ID number (which is to be provided by BYPL) on the supplied panels	LOT	1	

Scope Demarcation				
S. No	**Head**	**BSES**	**Bidder**	**Remarks**
1	Permit to work request to BYPL authority	×	✓	Permit Should be applied to Engineer Incharge prior to work through proper procedure
2	Permit to work issuance from BYPL authority	×	✓	
3	Testing Equipment	×	✓	
4	Lighting Arrangement	×	✓	
5	Construction Power and Construction Water	×	✓	For construction power, bidder may take temporary connection from BYPL on chargeable basis.

6	Safety and Security of Manpower(Labor, Engineers, Supervisors etc)	×	✓	
7	Various Tools and Tackles related to Job	×	✓	
8	Loading, Unloading and Transportation of Material	×	✓	It includes transportation of dismantled equipment to BYPL store in stacked manner.
9	Cleanliness around work premises	×	✓	
10	Document/Drawing Submission	×	✓	It includes trench drawing
11	Document/Drawing Approval	✓	×	
12	Security and Safety of material until handover	×	✓	
13	Various Machines e.g. Crane, Hydra, JCB etc to complete the Job	×	✓	
14	Maintenance of Equipment Until Handover to Engineer Incharge and EHV O&M	×	✓	
15	Electrical Inspector Clearance	×	✓	Only statutory fees will be borne by BYPL if applicable
16	Permit issuing agency for Works inside BYPL Premises	✓	×	
17	Permit requesting Agency	×	✓	Permit Should be applied to Engineer In charge prior to start of work. Isolation & permit of only one Feeder at a time, shall be given at a time, during final hook up. All necessary preparation works to be made, in order to minimize the Shutdown Time.
18	Temporary office near work premises	×	✓	After handing over the equipment, contractor has to evacuate the premises within one week otherwise deemed fit action will be taken
19	Temporary store at work premises	×	✓	
20	Yard aesthetics at work place should be maintained at the time and after the completion of Work	×	✓	Disposal of Scrap/Debris etc from site and complete cleaning of working area till handover
21	Any damages done to the existing system, shall be repaired/ rectified/ replaced	×	✓	
22	Clearance certificate	×	✓	Clearance Certificate shall be taken from BYPL Departments (Quality, Safety, Protection, O&M, SCADA, EHV, Civil, etc) before Final Charging of the Systems. Any Site Observations/ Punch points, observed during execution, shall be attended.
23	Various compliances pertaining to	×	✓	IE rules, CEA latest Regulation

	Job			

BSES

Technical Specification

Of

HT Indoor Switchgear (33 & 11 kV)

Specification no – BSES-TS-66-HTSWG-R0

Rev:		0
Date:		22 Jun 2022
Prepared by	Abhishek Harsh	
	Hemanshi Kaul	
Reviewed by	Srinivas Gopu	
	Abhinav Srivastava	
Approved by	Gaurav Sharma	
	Gopal Nariya	

INDEX

1 SCOPE OF SUPPLY

a. This specification covers the design, manufacture, testing, supply, erection & commissioning of 33kV and 11kV, Air Insulated, metal-enclosed and factory assembled switchgear.

b. This specification shall be used in conjunction with all specifications, switchgear data sheets, single line diagrams, and other drawings attached to the specification / purchase requisition.

2 CODES & STANDARDS

Materials, equipment and methods used in the manufacture of switchboards shall conform to the latest edition of following

2.1	Indian Electricity Rules 1956	Latest edition
2.2	Indian Electricity act 1910	Latest edition
2.3	Switchgear and control gear	IEC : 60694, IEC: 60298, IEC : 62271-200, IEC : 60529, IS: 3427, IS: 12729, IS: 12063, IS: 13947, IS: 9046
2.4	Circuit breaker	IEC 62271 - 100, IS 13118, IS 2516
2.5	Isolators & earthing switches	IEC 62271 - 102
2.6	Current transformers	IS:2705, IEC:60185
2.7	Voltage transformer	IS:3156, IEC:60186,
2.8	Indicating Instruments	IS:1248
2.9	Energy meters	IS 13010
2.10	Relays	IS:8686, IS:3231, IS:3842
2.11	Control switches and push buttons	IS 6875
2.12	HV fuses	IS 9385
2.13	Arrangement of Switchgear bus bars, main connections and auxiliary wiring	IS:375
2.14	Code of practice for phosphating iron & steel	IS 6005
2.15	Colours for ready mixed paints	IS 5
2.16	Code of practice for installation and maintenance of switchgear	IS 3072

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3 SERVICE CONDITION

3.1	Max Ambient Temperature	50 deg C
3.2	Max Daily average ambient temp	40 deg C
3.3	Min Ambient Temp	0 deg C
3.4	Maximum Humidity	95%
3.5	Minimum Humidity	10%
3.6	Maximum annual rainfall	750 mm
3.7	Average no of rainy days per annum	60
3.8	Rainy months	June to Oct
3.9	Altitude above MSL	300 M
3.10	Seismic Zone	IV

4 PANEL CONSTRUCTION

4.1	Enclosure Type	Free standing, Indoor, Fully compartmentalised, Metal clad, Vermin proof
4.2	Enclosure degree of protection	IP 4X for high voltage compartment IP 5X for low voltage compartment
4.3	Enclosure material	Pre-Galvanized CRCA steel
4.3.1	Load bearing members	2.5 mm thick
4.3.2	Doors and covers	2.0 mm thick
4.3.3	Gland plate	3.0 mm MS for multicore and 5. 0 mm Aluminium for single core cables. All gland plates should be detachable type with gasket
4.4	Dimension of Panel	Maximum 2700mm, Operating height maximum 1600mm. In case of Extension of Existing make panels, vendor shall match the dimension of existing panel.
4.5	Extensibility	On either side
4.6	Separate Compartments for	Bus bar, Circuit Breaker, HV incoming cable, HV outgoing cable, PT, LV instruments & relays
4.7	Transparent inspection window	For cable compartment at height of cable termination.
4.8	Bus end cable box	For direct cable feeder from bus
4.9	Rear Doors	Rear doors shall not be interlocked i.e. all door opening shall be independent to each other.

4.10	Breaker compartment door	Separate, with lockable handle (Design with breaker trolley as the front cover is not acceptable). Door of one panel should not cause hindrance for opening of adjacent panel.
4.11	Inter compartmental connections	
4.11.1	Breaker to bus bar compartment	Through seal-off bushings
4.11.2	Breaker to cable compartment	Through seal-off bushings
4.12	Nut Bolt	Shall be as less as possible for ease of opening of compartments
4.13	Pressure relief devices	To be provided for each HV compartment
4.14	Bus support insulator	Non-hygroscopic, track-resistant, high strength, Epoxy insulators (Calculation for validating dynamic force withstand capability to be submitted during detailed engineering)
4.15	Fixing arrangement	Doors - Concealed hinged, door greater than 500mm shall have minimum three sets of hinges Covers - SS bolts Gasket - Neoprene
4.16	Required HV cable termination height in the cable compartment	650 mm for 11 KV. 1000mm for 33 KV
4.17	Panel Base Frame	Steel Base frame as per manufacturer's standard.
4.18	Handle	Removable bolted covers with handle for cable chamber and busbar chamber. Panel no./identification to be provided on cable box cover also.

4.19	APFC	a. Controlling of Capacitor Banks' switching shall be done by APFC. Although APFC shall not be in bidder's scope, Space for cut out shall be provided in the Capacitor panel. Space requirement-150X150 mm^2 b. Wiring of Bus PT , Incomer CT and Capacitor CT upto spare terminal for APFC shall also be provided in Capacitor Panel
4.20	Technical particulars	As per Annexure –C

5 CIRCUIT BREAKER

5.1	Type	Truck or cassette type
5.2	Mounting	On withdrawable truck or carriage, with locking facility in service position.
5.3	Switching duty	c. Transformer (oil filled and dry type) d. Motor (of small and large ratings – DOL starting with starting current 6 to 8 times the full load current & with a maximum of 3 starts per hour) e. Underground cable with length up to 10 km
5.4	Interrupting medium	Vacuum
5.5	Contact	Tulip contact shall be provided without any gap between contacts
5.6	Breaker operation	Three separate identical single pole units operated through the common shaft
5.7	Operating Mechanism	Re-strike free, Trip free, with electrical anti-pumping feature
5.7.1	Type	Motor wound, spring charged, stored energy type with manual charging facility
5.7.2	Operation on supply failure	One O-C-O operation possible after failure of power supply to the spring charging motor
5.8	Breaker indications & push buttons	

5.8.1	ON/ OFF / Emergency trip push button	a. Manual / mechanical. b. Emergency Off push button should be provided with a protective flap. c. Mechanical ON shall have padlocking facility.
5.8.2	Mechanical ON – OFF indication	On breaker trolley front
5.8.3	Operation counter	On breaker trolley front
5.8.4	Test-service position indicator	On breaker trolley front
5.8.5	Mechanism charge / discharge indicator	On breaker trolley front
5.9	Breaker positions	Service, Test and Isolated
5.10	Inter changeability	Possible, only with breaker of same rating
5.11	Breaker Control	On panel front only
5.12	Handle	Breaker shall be provided with handles for easy handling, rack in–out operation and manual spring charging as applicable.
5.13	Pin Sequence and Configuration of Pin of Adaptor Plug	(a) Pin sequence and No of Pins of Adaptor plug shall be same in Outgoing and Capacitor Panel (b) Pin sequence and No of Pins of Adaptor plug shall be same in Incoming and Bus Coupler Panel
5.14	Technical particulars	As per Annexure-C

6 FUNCTIONAL REQUIREMENTS

6.1	Interlocks	
6.1.1	Breaker compartment door opening	Opening of door and rack out to test/isolated position should be possible with breaker in OFF position only.
6.1.2	Breaker compartment door closing	Should be possible even when breaker is in isolated position
6.1.3	Racking mechanism safety interlock	Mechanical type
6.1.4	Racking in or out of breaker inhibited	When the breaker is closed

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6.1.5	Racking in the circuit breaker inhibited	Unless the control plug is fully engaged
6.1.6	Disconnection of the control plug inhibited	As long as the breaker is in service position
6.1.7	Opening of cable compartment cover of Incomer Panels inhibited	As long as cable end is alive
6.2	Safety Devices	
6.2.1	Exposure to live parts	In case the breaker panel door is required to be opened during a contingency, the personnel should not be exposed to any live part. Suitable shrouds/barriers/insulating sleeves should be provided.
6.2.2	Breaker handing	In case the breaker is mounted on a carriage which does not naturally roll out on the floor, a trolley for handling the breaker is to be provided.
6.3	Operation of breaker	In either service or test position
6.3.1	Closing from local	Only when local/remote selector switch is in local position
6.3.2	Closing from remote	Only when local/remote selector switch is in remote position
6.3.3	Tripping from local	Only when local/remote selector switch is in local position
6.3.4	Tripping from remote	Only when local/remote selector switch is in remote position
6.3.5	Tripping from protective relays	Irrespective of position of local/remote switch
6.3.6	Testing of breaker	In test or isolated position keeping control plug connected
6.4	Safety shutters.	

6.4.1	Automatic safety shutter for female primary disconnects	To fully cover contacts when breaker is withdrawn to test. Independent operating mechanism for bus bar & cable side shutters, separately pad-lockable in closed position.
6.4.2	Label for identification	For Bus side and cable side shutters
6.4.3	Warning label on shutters of incoming and other connections	Clearly visible label "Isolate elsewhere before earthing" be provided
6.5	Breaker electrical operation features	
6.5.1	Trip circuit supervision	To be given for breaker close & open condition
6.5.2	Trip circuit supervision relay contact	For indication, alarm & to inhibit closing of breaker
6.5.3	Emergency trip push button contact	Wired directly to trip coil (wired to Master trip relay if second trip coil provided)
6.5.4	Emergency trip push button contact	Wired to inhibit closing of breaker
6.5.5	Master trip relay contact (if given)	Wired to inhibit closing of breaker
6.5.6	Tripping or opening of breaker through relay but not routed through Lockout (Example- SCADA Opening, Undervoltage, Overvoltage)	Wired to Contact multiplication Relay and then from CMR to tripping of breaker
6.5.7	Closing of breaker through relay	Wired to Contact multiplication Relay and then from CMR to closing of breaker
6.6	DC control supply bus in all panels	Fed by two DC incoming sources in Bus coupler panel with auto changeover facility
6.7	PT supply bus in all panels	Fed normally by bus PT with automatic changeover facility to incomer line PT
6.8	Flaps for Internal Arc Protection	Flaps shall not have any pores/ opening during normal operation

7 SURGE SUPPRESSOR

7.1	Provision	To be provided in all panels except bus coupler and BPT.
7.2	Type	Gapless, metal oxide type
7.3	Technical particulars	As per Annexure -C

8 CURRENT TRANSFORMER

8.1	Type	Shall be cast resin type with insulation class of E or better.
8.2	Rating and technical particulars	As per Annexure – C (Technical particulars) and Annexure – F (SLDs)
8.3	CBCT	If specified, bidder shall clearly mention his proposal for mounting the same.

9 POTENTIAL TRANSFORMER

9.1	Type	Shall be cast resin type with insulation class of E or better.
9.2	Rating and technical particulars	As per Annexure – C (Technical particulars) and Annexure – F (SLDs)
9.3	Mounting	It shall be mounted on a withdrawable carriage. Mounting of PT on the breaker truck is not acceptable. Mounting of PT on the panel top is also not acceptable. Primary PT fuse shall be easily accessible.
9.4	Neutral	The HV neutral connection to earth shall be easily accessible for disconnection during HV test.

10 FEEDER AND BUS EARTHING

10.1	Earthing arrangement	Through separate earthing truck for bus & feeder
10.2	Short time withstand capacity of earthing truck	Equal to rating of breaker. Refer technical parameters.
10.3	Operation from front	Mechanically operated by separate switch.

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10.4	Interlocks and Alarm	To prevent inadvertent closing on live circuit, with padlocking arrangement to lock truck in close or open position.

11 EQUIPMENT EARTHING

11.1	Material of earthing bus	Aluminium
11.2	Earthing Bus Position	It shall run through whole switchgear passing nearer to Power Cable Position
11.3	Earth bus joints	All bolted joints in the bus should be made by connection of two bolts.
11.4	Rating	Sized for rated short circuit current for 3 seconds
11.5	Enclosure & non -current carrying part of the switchboard / components	Effectively bonded to the earth bus.
11.6	Hinged doors	Earthed through flexible copper braid
11.7	Circuit breaker frame /carriage	Earthed before the main circuit breaker contacts/ control circuit contacts are plugged in the associated stationary contacts
11.8	Metallic cases of relays, instruments and other LT panel mounted equipment	Connected to the earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation. For this purpose LT compartment should have a clear designated earth bus to which earth connections from all components are to be connected.
11.9	CT and PT neutral	Earthed at one place at the terminal blocks through links.

12 METERS

12.1	Mounting	Flush mounted
12.2	Multifunction Meter	
12.2.1	SCADA Interfacing	RS485 rear port suitable for integration on Modbus Protocol
12.2.2	Size	96x96 mm^2

12.2.3	Panels where to be provided	All panels except Bus PT Panel
12.2.4	Accuracy Class	0.2
12.2.5	Signal List	R-Ph Current, Y-Ph Current, B-Ph Current, Neutral Current, R-Y Ph Voltage, Y-B Ph Voltage, B-R Ph Voltage, Active Power, Active Energy, Reactive Power, Power Factor, Max Demand, Phase angle 1, Phase angle 2, Phase angle 3, THD Mean Current, THD Mean Voltage
12.2.6	Data Type	MFI
12.2.7	Compatibility with RTU	ABB 560
12.2.8	Programmability	CT secondary shall be programmable i.e for both 1 A and 5 A
12.2.9	Auxiliary Supply	a. 48 – 240VDC and AC i.e universal type. b. Although in Scheme, MFM must be wired up with DC only
12.3	Voltmeter	Digital type with programmable ratio
12.3.1	Size	96x96 mm^2
12.3.2	Panels where to be provided	Incomer and bus PT panel
12.3.3	Voltmeter switch	Inbuilt in meter
12.3.4	Accuracy Class	1.0
12.4	Energy meter provision	Energy meter is not in supplier's scope. Only space and CT/PT wiring is to be provided in all panels except bus coupler and bus PT. Space for Energy meter shall be 200(w) X 350(h) mm^2

13 INDICATION, ALARMS & ANNUNCIATION

13.1	Indications	Flush mounted, High intensity, clustered LED type
13.1.1	Breaker ON	Red
13.1.2	Breaker Off	Green
13.1.3	Spring Charged	Blue
13.1.4	DC control supply fail	Amber
13.1.5	AC control supply fail	Amber
13.1.6	Auto trip	Amber
13.1.7	Test Position	White
13.1.8	Service Position	White

13.1.9	Heater circuit healthy	Yellow (Indication with integrated push button for checking)
13.1.10	Trip circuit healthy	White
13.1.11	PT supply as applicable	R,Y B
13.2	Annunciator (For 33kV Panels only)	
13.2.1	Type	Static type alongwith alarm. Annunciations shall be repetitive type and shall be capable of registering the fleeting signal. Fascia test facility should also be provided.
13.2.2	Note	LED type indications may not be provided for alarm signals provided on annunciator.
13.2.3	Mounting	Flush mounted
13.2.4	Fascia	12 window
13.2.5	Signals to provided on Fascia	Window 1 – Main Protection Operated (Distance /Differential) Window 2 – Backup O/C & E/F Protection Operated Window 3 – LBB operated Window 4 – CB Autotrip Window 5 – Trip Circuit Unhealthy Window 6 – DC Fail Window 7 – AC Fail Window 8 – VT Fuse Fail Window 9 – Protection Relay Faulty
13.2.6	Push Buttons	For test, accept and reset
13.2.7	Potential Free Contacts	To be provided for event logger
13.3	Alarm scheme with isolation switch	a. For DC fail, TC fail and CB auto trip in 11kV panels b. For all signals wired to annunciator in 33kV panels

Sequence of operation of the annunciator shall be as follows-

S No.	Alarm Condition	Fault Contact	Visual Annunciation	Audible Annunciation
a.	Normal	Open	Off	Off
b.	Abnormal	Close	Flashing	On
c.	Accept	Close	Steady on	Off
d.	Return to normal	Open	Steady On	Off
e.	Reset	Open	Off	Off
f.	Reset before return to normal	Close	Flashing	On

14 SELECTOR SWITCHES & PUSH BUTTONS

14.1	Selector switches	Flush mounted on LV compartment door, with shrouded terminals
14.1.1	TNC switch with pistol grip	Lockable, spring return to normal position
14.1.2	Local / SCADA selector switch	2 pole Lockable Switch
14.1.3	Rotary ON/OFF switches	For heater / illumination circuit
14.1.4	Rating	16 A
14.2	Push Button	Flush mounted on LV compartment door, with shrouded terminals
14.2.1	Emergency trip push button	Red color with stay put
14.2.2	Accept push buttons	Black color – Trip alarm / DC fail alarm
14.2.3	Reset push buttons	Yellow color – Trip alarm / DC fail alarm
14.2.4	Rating	10 A

15 INTERNAL WIRING

15.1	Internal wiring	1100 V grade, PVC insulated (FRLS) stranded flexible copper wire.
15.2	Size	2.5 sq mm for CT circuit, 1.5 sq mm for PT & control circuits
15.3	Colour code	
15.3.1	CT & PT	R Ph – Red Y Ph – Yellow B Ph – Blue Neutral – Black

15.3.2	Others	DC– grey, AC-black, Earth – green
15.4	Ferrules	At both ends of wire
15.5	Ferrule type	Interlocked type (one additional red colour ferrule for all wires in trip circuit)
15.6	Lugs	Tinned copper, pre-insulated, ring type, fork type and pin type as applicable. CT circuits should use ring type lugs only.
15.7	Spare contacts	Spare contacts of relays and contactors etc. should be wired upto the terminal block.
15.8	Wiring enclosure	Plastic channels, Inter panel wiring through PVC sleeves
15.9	Interpanel wiring	Wires with ferrule to be terminated in the adjacent shipping section should be supplied with one end terminated and the other end bunched and coiled.
15.10	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.

16 TERMINAL BLOCKS

16.1	Rating and Type	1100 V grade, moulded piece, stud type screw driver operated terminals complete with insulated barriers, washers, nuts and lock nuts.
16.2	Segregation	TBs shall be segregated.
16.3	Suitability	Terminal Block shall be Stud Type Screw Driver Operated suitable for 6sqmm control cable. Disconnecting facility shall be provided in CT and PT terminal. Shorting and Earthing facility shall be provided in CT
16.4	Marking and covers	White fibre markings strip with clear plastic, slip-on / clip-on terminal covers to be provided.
16.5	Disconnecting Facility	To be provided in CT and PT terminals

16.6	Shorting & Earthing Facility	To be provided in CT Terminals
16.7	Spare Terminals	20% in each TB row
16.8	Spare Terminal Block in Capacitor Bank Panel	Separate Terminal Block with 50 number terminals required (20 Numbers Disconnecting and 30 Number Non Disconnecting type)
16.9	TB shrouds & separators	Moulded non- inflammable plastic material
16.10	Clearance between 2 sets of TB	100 mm min
16.11	Clearance with cable gland plate	250 mm min
16.12	Clearance between AC / DC set of TB	100 mm min
16.13	Test terminal blocks	Screw driver operated stud type for metering circuit

17 RELAYS

17.1	Protection Relays – General Features	
17.1.1	Technology and Functionality	Numerical , microprocessor based with provision for multifunction protection, control, metering and monitoring
17.1.2	Mounting	Flush Mounting, IP5X
17.1.3	Architecture	Hardware and software architecture shall be modular and disconnectable to adapt the protection and control unit to the required level of complexity as per the application.
17.1.4	Programming and configuration	Relay 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. Programming software and communication cord for offered relays should be included in scope of supply.
17.1.5	Conformal Coating	a. Required on all cards and Components to protect against moisture, dust, chemicals, temperature extremes etc b. Testing shall be as per IEC 60068-2-60

17.1.6	SCADA Interface port	LC type Dual fibre optic port for interfacing with SCADA on IEC 61850 & PRP compatible. Through this port relays shall be connected to Ethernet switches..
17.1.7	Processing Indications	SCADA functions for monitoring 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.
17.1.8	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.
17.1.9	PC Interface port	Front port (preferably serial) for configuration/data downloads using PC. Cost of licensed software and communication cord, required for programming of offered protection relays shall be included in the cost of switchgear.
17.1.10	User Interface	An alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. It should be possible to access and change all settings and parameters without the use of PC.
17.1.11	SCADA Interface	Relay shall communicate all measured & monitored parameters, analog signals, event record, fault record, DIs , DOs etc to SCADA
17.1.12	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 and other tripping curves through a

		minimum of two setting groups.
17.1.13	GOOSE Messaging	Relays shall communicate all status signals, commands and events on GOOSE messaging.
17.1.14	Event and Fault records	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. Relay shall store records for last 10 events and 10 faults (minimum). It should be possible to download records locally to PC and remotely to SCADA.
17.1.15	Self diagnosis	Relay shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
17.1.16	Time synchronization	All relays shall be capable of being synchronized with the system clock using SCADA interface and PC.
17.1.17	Operation Indicators	LEDs with push button for resetting.
17.1.18	Test Facility	Inbuilt with necessary test plugs.
17.2	Protection Relays for 11kV Incomer panel	
17.2.1	Relay 1	3-phase Directional Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Undervoltage and overvoltage protection
		Trip Circuit Supervision
		Sync Check function
		PT supervision (fuse failure monitoring)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs ,

		DOs etc to SCADA
17.2.2	Relay 2	Auto Re-closer (If Specified in Tender document)
		High Impedance Restricted Earth fault protection.
17.2.3	User Configurable DIs and Dos	Relay-1 & 2 should have a total of 16 Dis and 10 Dos (minimum). Each relay should have atleast 2 Dis and 4 Dos
17.2.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.2.5	SLD	Refer annexure – F1
17.3	Protection Relays for 11kV Bus Section panel	
17.3.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Sync Check function
		Trip Circuit Supervision
		PT supervision (fuse failure monitoring)
		User Configurable 16 Dis and 8 Dos (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.3.2	SLD	Refer annexure – F2
17.4	Protection Relays for 11kV Outgoing panel	
17.4.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		User Configurable 12 Dis and 6 Dos (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active

		power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.4.2	SLD	Refer annexure – F3
17.5	Protection Relays for 11kV Station Transformer panel	
17.5.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		User Configurable 12 DIs and 6 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.5.2	SLD	Refer annexure – F4
17.6	Protection Relays for 11kV Capacitor panel	
17.6.1	Relay 1	3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Undervoltage and Overvoltage protection(From Bus PT)
		Trip Circuit Supervision
		Neutral Unbalance protection(From RVT associated to Cap Bank)
		Timer for on time delay (minimum 600 seconds)
		User Configurable 12 DIs and 6 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power

		factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.6.2	SLD	Refer annexure – F5.
17.7	Protection Relays for 33kV Incomer	
17.7.1	Relay 1	Line differential protection (Dual channel, ST Port Compatible for Single Mode Fibre having wavelength 1310 nm)
		Distance Protection
		Software based CT ratio correction
		Dedicated port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
17.7.2	Relay 2	Bay control unit having MIMIC with 3-phase Directional Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Trip Circuit Supervision
		Sync check function
		Under Frequency, Over Frequency, Rate of Change of Frequency
		Circuit Breaker failure protection
		Reverse blocking function
		PT supervision
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.7.3	User Configurable DIs and Dos	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 Dos

17.7.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.7.5	SLD	Refer annexure – F6
17.8	Protection Relays for 33kV Transformer Feeder Panel	
17.8.1	Relay 1	Biased differential protection
		REF protection
		Software based ratio and vector correction feature (without ICT)
		H2 and H5 harmonic restraint
17.8.2	Relay 2	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		Under Frequency, Over Frequency, Rate of Change of Frequency
		Reverse Blocking function
		Circuit Breaker failure protection
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.8.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 DOs.
17.8.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.8.5	SLD	Refer annexure – F7
17.9	Protection Relays for 33kV Buscoupler Panel	
17.9.1	Relay 1	Bay control unit having MIMIC with 3-phase Overcurrent and earthfault protection with IDMT,

		Definite time and instantaneous characteristics.
		Trip Circuit Supervision
		Sync check function
		Reverse Blocking Function
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring) for Bus PT-1
		User Configurable 16 DIs and 8 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.9.2	Relay 2	Under Frequency, Over Frequency, Rate of Change of Frequency
		PT supervision (fuse failure monitoring) for Bus PT-2
		Auto Re-closer (If Specified in Tender document)
17.9.3	SLD	Refer annexure – F8
17.10	Protection Relays for 33kV Outgoing Panel (For Installation at KCC Consumer Premises)	
17.10.1	Relay 1	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		Reverse Blocking Function
		Under Frequency, Over Frequency, Rate of Change of Frequency
		Circuit Breaker failure protection
		User Configurable 12 DIs and 6 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power

		factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.10.2	SLD	Refer annexure – F9
17.11	Protection Relays for 33kV Incomer from 66/33kV Autotransformer	
17.11.1	Relay 1	High Impedance Restricted Earth fault protection
17.11.2	Relay 2	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics
		Trip Circuit Supervision
		Under Frequency, Over Frequency, Rate of Change of Frequency
		Reverse Blocking Function
		Sync check function
		Undervoltage and overvoltage protection
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.11.3	User Configurable DIs and DOs	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 Dos
17.11.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable
17.11.5	SLD	Refer annexure – F10
17.12	Protection Relays for 33kV Outgoing from 66/33kV Autotransformer	
17.12.1		Power swing blocking
	Relay 1	Line differential protection(Dual channel, ST Port

		Compatible for Single Mode Fibre having wavelength 1310 nm)
		Distance Protection
		Software based CT ratio correction
		Dedicated port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
17.12.2	Relay 2	Bay control unit having MIMIC with 3-phase Overcurrent and Earthfault protection with IDMT, Definite time and instantaneous characteristics.
		PT Supervision
		Under Frequency, Over Frequency, Rate of Change of Frequency
		Trip Circuit Supervision
		Reverse Blocking Function
		Circuit Breaker failure protection
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
		Auto Re-closer (If Specified in Tender document)
17.12.3	User Configurable DIs and Dos	Relay-1 & 2 should have a total of 16 DIs and 12 DOs (minimum). Each relay should have atleast 2 DIs and 6 Dos
17.12.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
17.12.5	SLD	Refer annexure – F11
17.13	Protection Relays for 33kV Buscoupler for Switchboard of 66/33kV Autotransformer	
17.13.1	Relay 1	Bay control unit having MIMIC with 3-phase Overcurrent and earthfault protection with IDMT, Definite time and instantaneous characteristics.
		Trip Circuit Supervision

		Sync check function
		Circuit Breaker failure protection
		PT supervision (fuse failure monitoring) for Bus PT-1
		User Configurable 16 DIs and 8 DOs (minimum)
		Relay shall communicate all measured and monitored parameters like current, voltage, active power, reactive power, apparent power, power factor, phase angle, event record, fault record, DIs , DOs etc to SCADA
17.13.2	Relay 2	Under Frequency, Over Frequency, Rate of Change of Frequency
		PT supervision (fuse failure monitoring) for Bus PT-2
		Auto Re-closer (If Specified in Tender document)
17.13.3	SLD	Refer annexure – F12
17.14	Protection Relays – SCADA Interfacing	
17.14.1	Configuration and wiring of DIs in Protection Relays (All panels) for routing status signals to SCADA	DI-1 – TC-1 Healthy DI-2 – TC-2 Healthy DI-3 – CB Autotrip (contact from lockout relay) DI-4 – CB Open DI-5 – CB Close DI-6 – CB in service DI-7 – CB in test DI-8 – Spring Charged DI-9 – L/R switch Remote DI-10 – AC fail DI-11 – Adjacent Panel DC Fail/DC MCB Trip DI-12 – Adjacent Panel Protection Relay fail DI-13 – PT MCB trip (metering and protection, for incomer and capacitor panel only) Sequence of DIs should be strictly as mentioned above. Change in sequence of DIs will not be acceptable.
17.14.2	Configuration and wiring of	DO-1 – CB Open

	DOs in Protection relays (all panels) for execution of SCADA commands through SCADA interface port (refer clause 16.1.5).	DO-2 – CB close DO-3-Electrical Reset Sequence of DOs should be strictly as mentioned above. Change in sequence of DOs will not be acceptable.
17.14.3	Looping of numerical relays	All relays in the switchboard have to be looped to form a common bus for interfacing with SCADA.
17.14.4	Spare DIs and DOs	Should be wired upto terminal block for future use.
17.15	Transformer Monitoring cum AVR Relay	
17.15.1	Features	As per annexure –B
17.15.2	Requirement	To be provided in 33KV Transformer panel only
17.16	Auxiliary Relays – General Features	
17.16.1	Relays for auxiliary, supervision, trip and timer relays	Static or electromechanical type.
17.16.2	Reset mechanism for auxiliary relays	Self reset contacts except for lock-out relays.
17.16.3	Reset mechanism for lockout relays	Electrical reset type for 11kV outgoing panels only. Hand reset type for all other panels.
17.16.4	Operation indicators	With hand-reset operation indicators (flags) or LEDs with pushbuttons for resetting.
17.17	Auxiliary relays – Requirement	
17.17.1	Anti pumping (94), lockout (86),	a. For each breaker b. Lock Out Relay mounting shall be flush type on front side of Panel
17.17.2	PT selection relays	To be provided in bus coupler panel for selection between Bus PT and Line PT of respective sections.
17.17.3	Switchgear with two incomer & bus coupler	Lockout relay (86) contact of each incoming breakers to be wired in series in closing circuit of other incoming breakers & bus coupler.
17.17.4	Contact Multiplication Relay for Tripping and closing of Breaker	a. One for Tripping and one for closing with each breaker b. Current Rating shall be 30 percent more than closing and tripping coil current rating c. Shall be of closed type i.e. direct

		unauthorised access shall not be provided.
17.17.5	Auxiliary Relays, contact multiplication relays etc.	To effect interlocks and to exchange signals of status & control
17.17.6	Transformer trouble relays (For 33kV Transformer feeder panel only)	Auxiliary relays with indicating flags (contactors will not be accepted) should be provided for the following trip and alarm commands – a. Buchholz trip b. OSR trip c. PRV trip d. SPR trip e. WTI Trip f. OTI Trip g. Buchholz Alarm h. Low oil level alarm i. OTI Alarm j. WTI Alarm.
17.18	General Requirements for all relays/contactors	Auxiliary supply will be 50/220VDC based on requirement. All relays/contactors shall be suitable for continuous operation at 15% overvoltage.

18 SYNCH CHECK PHILOSOPHY

18.1	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.
18.2	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.

18.3	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.
18.4	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.
18.5	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 (or 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.

19 ETHERNET SWITCHES & FIBRE OPTICS

19.1	Ethernet Switch	
19.1.1	Numbers	Two at each site
19.1.2	FO Port	16 Nos
19.1.3	RJ 45 Port	4 Nos
19.1.4	Communication Protocol	IEC 61850
19.1.5	Network Protocol	PRP
19.1.6	Downlink Rate	100 MBPS
19.1.7	Uplink Rate	1 GBPS
19.1.8	Coating	Conformal
19.1.9	Power Supply Voltage	220 / 50 VDC as per site condition
19.1.10	Grade	Industrial
19.1.11	Certification required	KEMA,CE & FCC for IEC 61850 compliance
19.1.12	Operating Temperature	
19.1.13	Mounting	In Switchgear Panel
19.1.14	Blinking LED Indicators	On each RJ45 ports

19.1.15	Separate Maintenance/console Part	Required
19.1.16	Latency	Less than or equal to 10 ms
19.1.17	Fibre Optic Compatibility	Multimode, 1310 nm
19.1.18	Placement	Din Rail Arrangement Inside Switchgear
19.2	Fibre Optics (Patch Cord) and Ethernet cable	
19.2.1	Connection	From Relays, Meters to Ethernet Switch
19.2.2	Mode of Fibre Optics	Multimode
19.2.3	Wavelength	1310 nm
19.2.4	Ethernet Cable Type	CAT VI
19.2.5	Associated Connectors and Accessories	Required

20 SPACE HEATERS

20.1	Type	Thermostat controlled with switch for isolation
20.2	Location	In Breaker & HV cable compartment, mounted on an insulator. Heater position in cable compartment should be easily accessible after cable termination. Heater position in breaker chamber shall be accessible with breaker racked-in.

21 SOCKETS, SWITCHES ,ILLUMINATION LAMPS & MCBs

21.1	Illumination lamp with switch	For LV & cable chamber
21.2	Universal type (5/15 A) Socket with Switch	In LV chamber
21.3	MCBs	a. MCBs of Proper rating may be provided. b. Although Main MCB shall be directly wired up to Trip Circuit, No other MCB shall be provided in between c. Rating of MCB shall be 300% of full load current of relevant circuit

22 NAMEPLATES AND MARKING

22.1	Nameplates	To be provided as per the following description
22.1.1	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.
22.1.2	Feeder Nameplates	a. Large and bold name plate carrying the feeder identification/ numbers shall be provided on the top of each panel on front as well as rear side. On rear side, nameplate should be provided on frame. b. Rear bottom of each panel shall have a nameplate clearly indicating the following: Customer Name – BSES Delhi; PO No. & date; Drawing Reference No. etc.
22.1.3	Rating Plate	Following details are to be provided on Panel rating plate: a. Customer Name – BSES Yamuna Power Limited b. PO No. & Date – c. Complete CT Rating plate details d. Complete PT Rating plate details e. Complete CB Rating Plate details f. Date of Manufacturing- g. Warranty Period- h. Customer care No- i. Control Voltage-
22.1.4	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are

		not allowed.
22.1.5	Fixing	All nameplates/rating plates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
22.2	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.

23 SURFACE TREATMENT & PAINTING

23.1	Surface Treatment	Sand blasting or by seven tank process.
23.2	Paint type	Powder coated. Pure polyester base grade-A structure finish.
23.3	Paint shade	RAL 7032 for external & internal surface
23.4	Paint thickness	Minimum 50 microns

24 APPROVED MAKES OF COMPONENTS

24.1	Numerical Relays	Siprotec series of Siemens, Micom series of Schneider/Alstom. Numerical relays used in complete switchboard should be of same make. Use of two different makes of relays in a switchboard is not acceptable.
24.2	Transformer monitoring cum AVR relay	A-eberle
24.3	Electromechanical Relays	Alstom/Schneider/Siemens/ABB/ER
24.4	Aux Relays	ABB/Jyoti/Omran
24.5	Contactors	ABB/Siemens/Telemechanique

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24.6	Instrument transformers	ECS/ Pragati/ Gemini/Schneider/CGL/Kappa/Narayan power tech
24.7	MCBs	Siemens/Schneider/Legrand/ABB
24.8	Control switches	Switron/Kaycee
24.9	Test terminal blocks	IMP/Schneider/Alstom
24.10	Terminal blocks	Elmex/Connectwell
24.11	Indicating lamps	Siemens/ Teknic/ Binay
24.12	Surge Suppressors	Oblum/Tyco
24.13	Meters	Rishabh(Rish delta Energy)/Conzerv
24.14	Ethernet Switch	Ruggedcom/Hirschman

25 INSPECTION , TESTING & QUALITY ASSURANCE

25.1	Type Tests	The product must be of type tested as per applicable Indian standards / IEC
25.1.1	Type test report validity period	Last five years from date of bid submission. Bidder with type test report more than 5 years old needs to re-conduct the tests without any commercial implication to BSES
25.1.2	Pressure relief device operation	Test certificate for panel to be submitted
25.2	Acceptance & Routine tests	As per the specification and relevant standards. Charges for these tests shall be deemed to be included in the equipment price. In addition to these tests, following tests have to be carried out as acceptance tests -
25.2.1	Primary injection test	To be carried out on panels selected for testing
25.2.2	Temperature rise test	One panel per Purchase order (PO with minimum 10 panels) without any commercial implication to BSES. In-house testing is acceptable.
25.2.3	Paint Thickness/ Peel off	To be carried out on panels selected for testing

25.3	Inspection	The purchaser/owner reserves the right to witness all the acceptance/routine tests during inspection.
25.4	Notice to purchaser for conducting type tests	At least three weeks in advance
25.5	Quality Assurance	
25.5.1	Vendor quality plan	To be submitted for purchaser approval
25.5.2	Inspection points	To be mutually identified & agreed in quality plan

26 PACKING

26.1	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.
26.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification
26.3	Details of Packing Identification Label on each packing case	a. Individual serial number b. Purchaser's name c. PO number (along with SAP item code, if any) & date d. Equipment Tag no. (if any) e. Destination f. Project Details g. Manufacturer / Supplier's name h. Address of Manufacturer / Supplier / it's agent i. Description and Quantity j. Country of origin k. Month & year of Manufacturing l. Case measurements m. Gross and net weights in kilograms n. All necessary slinging and stacking instructions

27 SHIPPING

27.1	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.
		The seller shall be responsible for all transit damage due to improper packing.

28 HANDLING AND STORAGE

28.1	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

29 DEVIATION

29.1	Deviation	Deviations from this Specification shall be provided in excel sheet with tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification.

30 ACCESSORIES & TOOLS

30.1	Type and Quantity	Bidder to indicate
30.2	Special tools & tackles required for erection, testing, commissioning and maintenance of the switchboard	The cost of these items shall be indicated separately in the bid as optional.
30.3	Suitable handling truck / trolley for lifting and moving the circuit breaker	To be supplied. (Two trolleys for each type/rating of breaker)

31 DRAWINGS & DATA SUBMISSION MATRIX

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet (based on legibility) in box file with separators for each section. PDF shall also be provided of all documents via USB. Deviation sheet and GTP shall be provided in excel sheet .Language of the documents shall be English only. Deficient/ improper document/ drawing submission shall be liable for rejection.

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
31.1	Contact Person Name, Email ID and Mobile Number	Required			
31.2	Consolidated Deviation Sheet	Required	Required		
31.3	GTP	Required	Required		
31.4	Relevant Type Test as per IS/IEC	Required			
31.5	Power Cable and control cable Philosophy and Schedule		Required		
31.6	Manufacturer's quality assurance plan and certification for quality standards		Required		
31.7	Sizing Calculation of Associated Equipment		Required		

31.8	Recommended Spares Apart from spares stated in Spec(for five years of operation)		Required		
31.9	11 kV / 33 kV Switchgear drawing				
31.9.1	General Arrangement	Required	Required		
31.9.2	Sectional Layout		Required		
31.9.3	Door Layout		Required		
31.9.4	LV Box Internal Layout		Required		
31.9.5	SLD	Required	Required		
31.9.6	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
31.9.7	Communication Architecture		Required		
31.9.8	Bus Bar Arrangement		Required		
31.9.9	QAP		Required		
31.9.10	Panel wise BOQ		Required		
31.9.11	Logic Operation Diagram		Required		
31.9.12	Plan		Required		
31.9.13	Synch Logic Diagram		Required		
31.9.14	Foundation Diagram		Required		
31.9.15	DI sheet		Required		
31.9.16	DO Sheet		Required		
31.9.17	TB Details		Required		
31.9.18	Make of all Component as per specification		Required		
31.10	Drawing of CT, PT and Surge Arrestor		Required		
31.11	Drawing of Substation Room		Required		
31.12	Ventilation detail requirement of GIS Room		Required		

31.13	Installation, erection and commissioning manual for switchgear		Required		
31.14	Inspection Reports			Required	
31.15	As manufacturing Drawings			Required	
31.16	Operation and Maintenance Manual			Required	Required
31.17	Trouble shooting manual			Required	Required
31.18	As built Drawings				Required
31.19	Test Report				Required
31.20	Weekly progress report				Required

ANNEXURE – A - SCOPE OF SUPPLY

Scope of supply should include the following –

1.1 Design, manufacture, assembly, testing at manufacturer's works, properly packed for transport, supply and FOR delivery at site of following 11kV / 33kV Switchgears as per enclosed specification and single line diagram.

1.2 Base channel frame of the switchgears with hardware.

1.3 Two trolleys for breaker of each size are to be provided per switchboard.

1.4 Programming software and communication cord for numerical relays.

1.5 Unit price of 33kV Incomer with Distance relay as primary protection and 33kV Incomer with Line differential relay as primary protection should be mentioned separately in the bid. Primary protection to be used in Incomer panel will be finalized based on site requirement.

1.6 Unit price of Bus PT should be indicated separately in the bid to enable addition/deletion based on site requirement.

1.7 Bidder should indicate price of one set of special tools and tackles (if any) required for maintenance of switchgear and its components.

1.8 Bidder should indicate price of each spare as per Annexure E.

1.9 All relevant drawings, data and instruction manuals.

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ANNEXURE – B – TRANSFORMER MONITORING CUM AVR RELAY

1	General features	
1.1	Technology and Functionality	Microprocessor based with provision for multifunction control and monitoring.
1.2	Mounting	Flush Mounting
1.3	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.
1.4	Programming and configuration	AVR shall utilize a user friendly setting and operating multilingual software in windows environment with menus and icons for fast access to the data required.
1.5	User Machine Interface	UMI 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.
1.6	PC Interface port	Front port (preferably serial) for configuration using PC. Cost of licensed software and communication cord, required for programming of offered protection relays using PC, shall be mentioned separately in the bid.
1.7	SCADA Interface port	LC Type Dual fibre optic port for interfacing with SCADA on IEC 61850 & PRP compatible. Through these ports relays shall be connected to Ethernet switches.
1.8	Self diagnosis	Shall be able to detect internal failures. A watchdog relay with changeover contact shall provide information about the failure.
1.9	Cable Termination	Termination of cable shall be at rear side.
1.10	Auxiliary supply	220VDC or 48VDC
2	Inputs and Outputs	
2.1	CT Input	1/5A selectable through programming
2.2	PT Input	110VAC
2.3	Binary Inputs	Sixteen programmable binary inputs should be provided

2.4	Analog Inputs (4-20mA)	One input to be provided
2.5	PT-100 direct input	Two inputs to be provided
2.6	Direct Resistance Input	For tap position indication (18 steps)
2.7	Binary Outputs	Ten programmable binary outputs should be provided
3	Control	
3.1	Control Tasks	Ability to implement control functions through programmable logics
3.2	Voltage setting	Programmable Voltage set point
3.3	Voltage Regulation	Raise/Lower tap position to maintain the preset value of voltage.
3.4	Voltage Regulation modes	Automatic and Manual
3.5	Operation Modes	Local and Remote
3.6	Fan and Pump control	To be provided
3.7	Transformer Paralleling	Capability to parallel transformers whose AVRs are interconnected via a communication network.
4	SCADA Interfacing	
4.1	Configuration of DIs for routing alarm/trip signals to SCADA.	DI-1 – Buchholz trip DI-2 – OSR Trip DI-3 – PRV trip DI-4 – SPR trip DI-5 – OTI trip DI-6 – WTI trip DI-7 – Buchholz alarm DI-8 – Oil Level low alarm (MOG alarm) DI-9 – WTI alarm DI-10 – OTI alarm DI-11 – Tap changer trouble/stuck/out of step DI-12 – Tap changer motor supply fail DI-13 – Tap changer in local control All signals from DI-1 to DI-10 are to be wired up from transformer trouble auxiliary relays.
4.2	Configuration of DOs for	DO-1 – Tap raise

	executing commands from SCADA through interface port/CRP	DO-2 – Tap lower DO-3 – Fan group 1 control DO-4 – Fan group 2 control
4.3	Spare DIs and DOs	To be wired upto the terminal block.
5	Measurement, Event Recording and Monitoring	
5.1	Measured Quantities (optional)	Voltage, Current, Active Power, Reactive Power, Apparent Power, Power factor, frequency
5.2	Event Recording	Facility for recording parameters during various events such as tap change, change in binary input status etc.
5.3	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.

ANNEXURE – C - TECHNICAL PARTICULARS

1.0	SWITCHGEAR		
1.1	Type	Metal clad, air insulated with VCB type circuit breaker	
1.2	Service	Indoor	
1.3	Mounting	Free standing, floor mounted	
1.4	System Voltage	11 KV	33kV
1.5	Voltage variation	+/- 10%	
1.6	Frequency	50 Hz +/- 5%	
1.7	Phase	3	
1.8	Rated voltage	12 KV	36 kV
1.9	Rated current	As per SLDs given in Annexure-F	
1.10	Short time rating for 3 sec.	25kA	25kA
1.11	Internal arc classification and rating		
1.11.1	Classification	IAC – A - FLR	IAC – A - FLR
1.11.2	Rating	25kA for 1 second	25kA for 1 second.
1.12	Insulation level (PF rms / Impulse peak)	28 kV / 75 kV	70 kV/ 170 kV
1.13	System ground	Effectively earthed	Effectively earthed
1.14	Enclosure degree of protection	IP – 4X for high voltage compartment and IP – 5X for metering and protection compartment	
1.15	Bus bar - Main	Rating as per SLDs given in annexure - F, Short time rating as per clause 1.10.	
1.15.1	Material	Tinned Electrolytic copper	
1.15.2	Bus bar sleeve	Sleeved with shrouds on joints. Tape on joints is not acceptable.	
1.15.3	Bus identification	Colour coded	
1.15.4	Temperature rise	40 deg. C for conventional joints. 55 deg. C for silver plated joints	
1.16	Auxiliary bus bar	Electrolytic grade tinned copper	

1.17	Auxiliary DC Supply	220 V DC / 48 V DC	
1.18	Auxiliary AC supply	240 V AC 50 Hz	
1.19	Hardware	Stainless steel.	
1.20	Earth bus	Aluminium	
1.21	Bus duct entry	From top (where ever applicable)	
1.22	Power cable entry	From bottom and rear	
1.23	Control cable entry	From bottom and front (i.e breaker compartment)	
2.0	CIRCUIT BREAKER		
2.1	Voltage class, insulation level, short time rating	As specified for switchgear	
2.2	Rated current	As per SLDs given in annexure - F. Use of two breakers in parallel to meet the required current rating shall not be acceptable.	
2.3	Duty cycle	O – 0.3 sec – CO - 3min - CO	
2.4	Short circuit rating		
2.4.1	A.C sym. breaking current	25kA	25kA
2.4.2	Short circuit making current	62.5kA	62.5kA
2.5	Operation time		
2.5.1	Break time	Not more than 4 cycles	
2.5.2	Make time	Not more than 5 cycles	
2.6	Range of Auxiliary Voltage		
2.6.1	Closing	85% - 110%	
2.6.2	Tripping	70% - 110%	
2.6.3	Spring Charging	85% - 110%	
2.7	No. of spare aux. Contacts of Breaker, for Owner's use.	Minimum 6 NO + 6 NC	
2.8	No. of spare contacts of Service and Test position limit switch	2 NO	

3.0	CURRENT TRANSFORMERS		
3.1	Voltage class, insulation level and short time rating	As specified for switchgear	
3.2	Type	Cast resin, window / bar primary type	
3.3	Class of insulation	Class E or better	
3.4	Ratio	As per SLDs given in annexure - F	
3.5	Number of secondaries	As per SLDs given in annexure - F	
3.6	Accuracy class		
3.6.1	Protection core	5P20	
3.6.2	Protection (Diff. / REF)	PS	
3.6.3	Metering	0.2s	
3.6.4	Core balance CT	PS	
3.7	Burden (VA)	Adequate for the protection & instruments offered	
3.8	Excitation current of PS Class CTs	30 mA at Vk/4	
3.8	Knee Point Voltage of PS Class CTs (Vk)	>= 40 (Rct + 4)	
3.9	Primary operating current sensitivity of CBCTs	5A	
4.0	VOLTAGE TRANSFORMERS		
4.1	Type	Cast resin, draw out type, single phase units	
4.2	Rated Voltage		
4.2.1	Primary	11000/sq.rt.3	33000/sq.rt.3
4.2.2	Secondary	110V/sq.rt.3	
4.3	No. of phases	3	
4.4	No. of secondary windings	2	
4.5	Method of connection	Star/Star	
4.6	Rated voltage factor	1.2 continuous, 1.9 for 30 seconds	
4.7	Class of insulation	Class E or better	

4.8	Accuracy class		
4.8.1	Protection	3P	
4.8.2	Metering	0.2	
4.9	Primary and secondary fuses	HRC current limiting type, Primary fuse replacement shall be possible with VT in withdrawn position	
5.0	HV FUSES		
5.1	Voltage class	12kV	36kV
5.2	Rupturing capacity	50kA	
5.3	Rated current	As per application	
6.0	SURGE ARRESTORS	For 11kV switchgear	For 33kV switchgear
6.1	Rated Voltage	9kV	30kV
6.2	Maximum continuous operating voltage (MCOV)	7.65kV	25kV
6.3	Discharge current	10kA	10kA
6.4	Discharge class	3	3

Note - The auxiliary DC voltage shall be checked on a case to case basis by Purchaser

ANNEXURE – D - GUARANTEED TECHNICAL PARTICULARS (DATA BY BIDDER)

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

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ANNEXURE – E – SPARES REQUIREMENT

Unit rate of all below mentioned spares have to be provided in the bid.

S No.	Description	Qty
1	Line voltage transformer	3 (1 set)
2	Bus voltage transformer	3 (1 set)
3	Current transformer of each ratio	3 (1 set)
4	Trip Coil	4
5	Closing Coil	4
6	CB Spring charging motor	2
7	Auxiliary switch	2 sets (2 Nos. each type)
8	Bursting disc / pressure relief plate complete	2
9	Numerical relay of each type	1 nos. (each type)
10	Ethernet Switch	1 No (Each Site)
11	Optical Fibre	20% of Supplied Items
12	CAT VI Ethernet cable for Communication	20% of Supplied Items
13	Vacuum Interrupter Bottle	1 set (3 nos.) of each rating
14	Breaker contacts for busbar	1 set (3 nos.) of each rating
15	Breaker testing cable with plug suitable for breaker on one side and plug suitable for the panel on the other side	3 meter(each type)
16	SCADA Spare	20% of Supplied Items

ANNEXURE – F – SLDs

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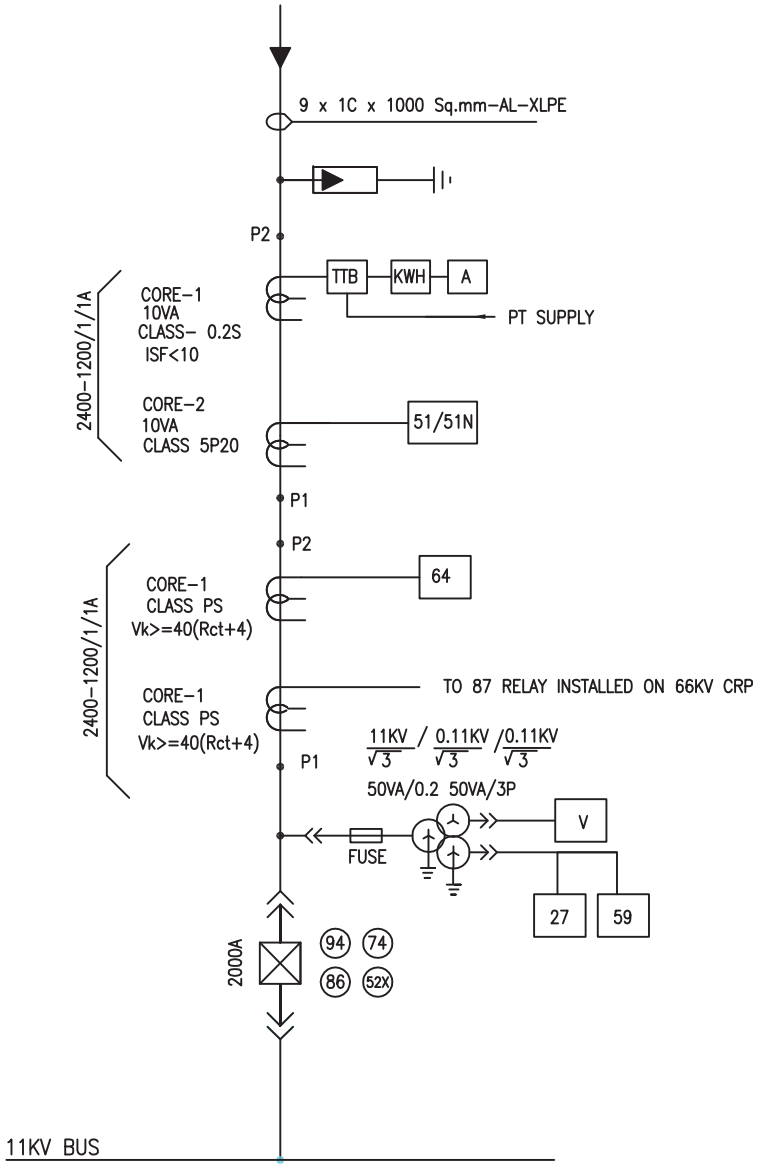
ANNEXURE–F1



25 KA for 3 secs, 2000A at 50 degree celsius

LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

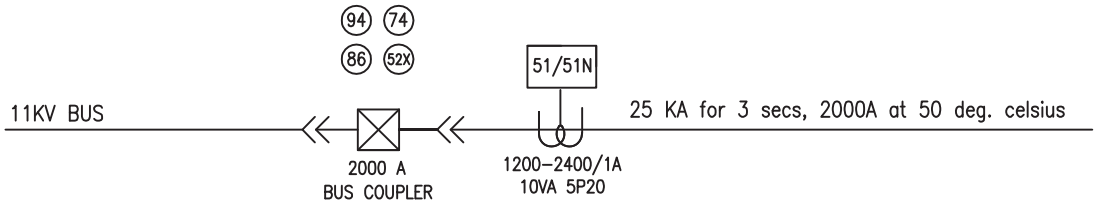
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV INCOMER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
APPD.	G.S/G.N		SLD–SWG–11KV–01
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F2



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
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SYMBOL	DESCRIPTION
KWH	ENERGY METER
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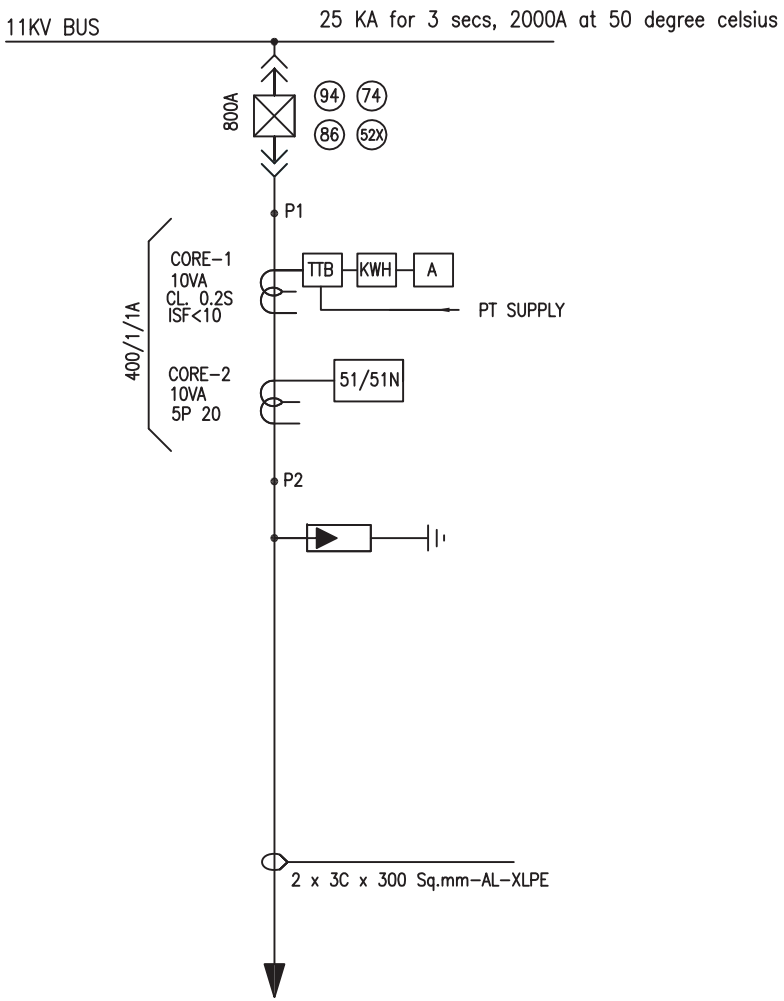
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV BUS SECTION	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
DATE	29.04.22		SLD–SWG–11KV–02
SCALE	NTS		

ANNEXURE–F3



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
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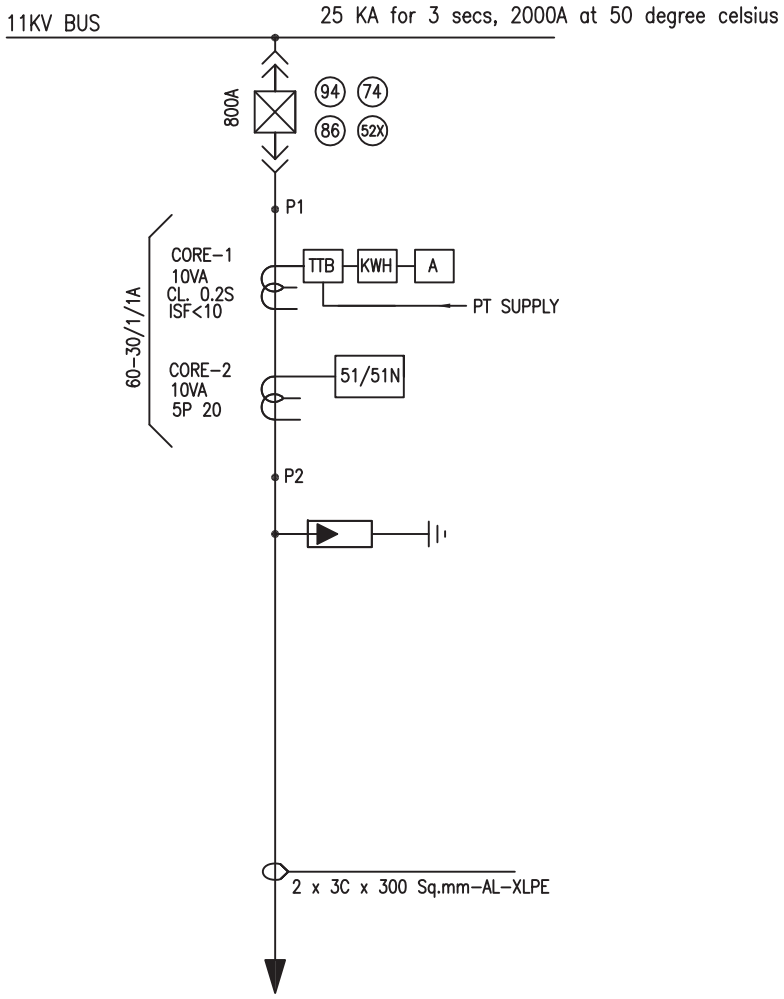
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV OUTGOING FEEDER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
APPD.	G.S/G.N		SLD–SWG–11KV–03
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F4



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
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SYMBOL	DESCRIPTION
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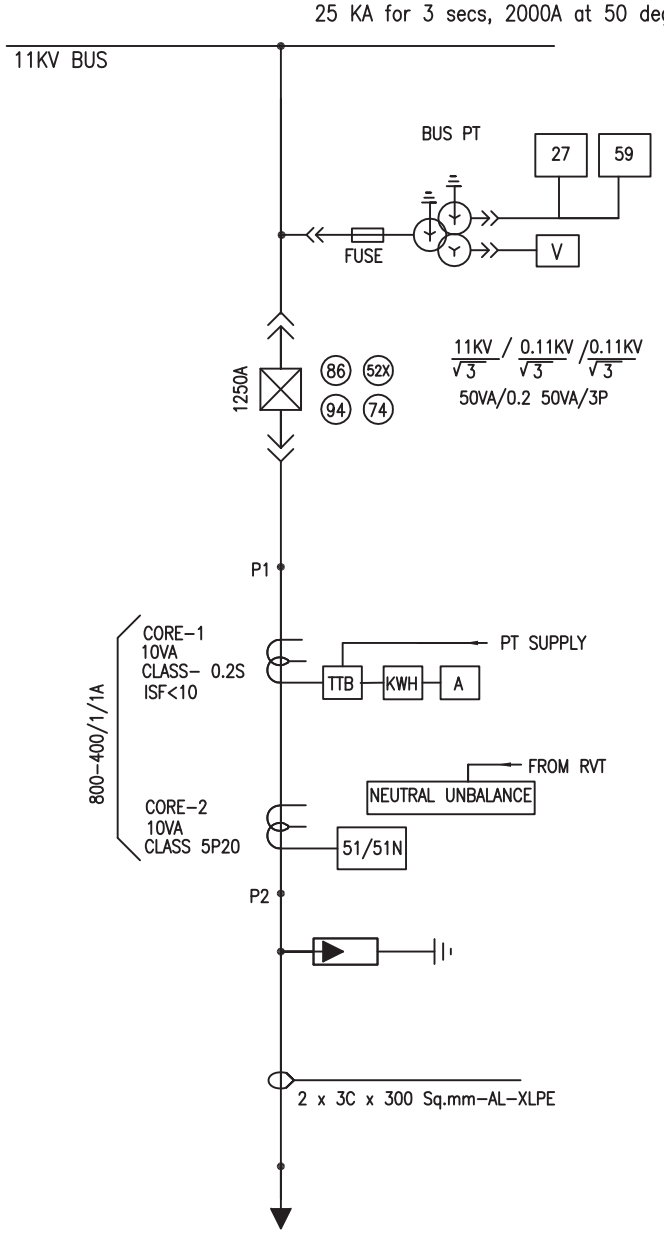
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV STATION TRANSFORMER FEEDER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
APPD.	G.S/G.N		SLD–SWG–11KV–04
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F5



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

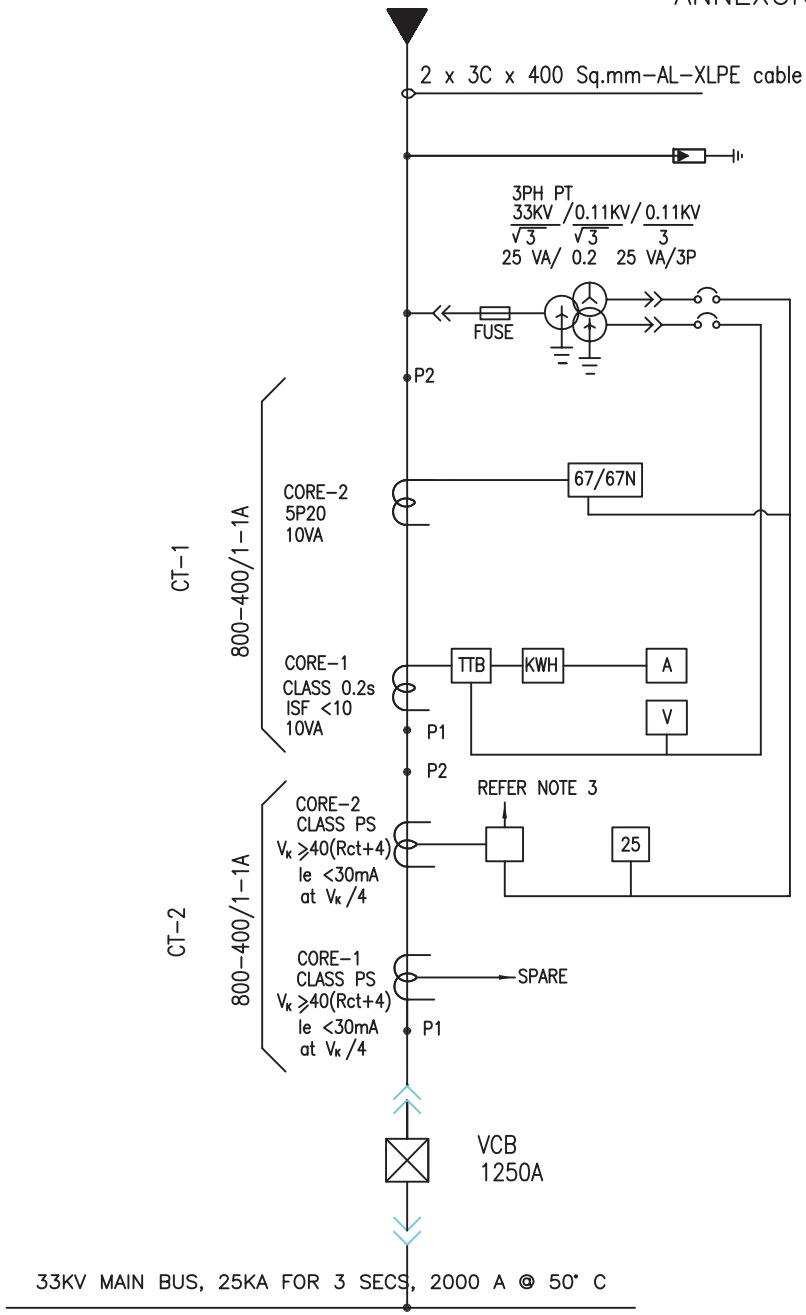
SYMBOL	DESCRIPTION
KWH	ENERGY METER
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. ONE BPT TO BE CONSIDERED FOR EACH CAPACITOR PANEL

DRAWN	R.K/A.H H.K	TITLE:– STANDARD SLD FOR 11KV CAPACITOR FEEDER	BSES
CHECKED	S.G/A.S		
APPD.	G.S/G.N		SPECIFICATION NO. BSES–TS–66–HTSWG–R0
DATE	29.04.22		SLD–SWG–11KV–05
SCALE	NTS		

ANNEXURE–F6



LEGEND

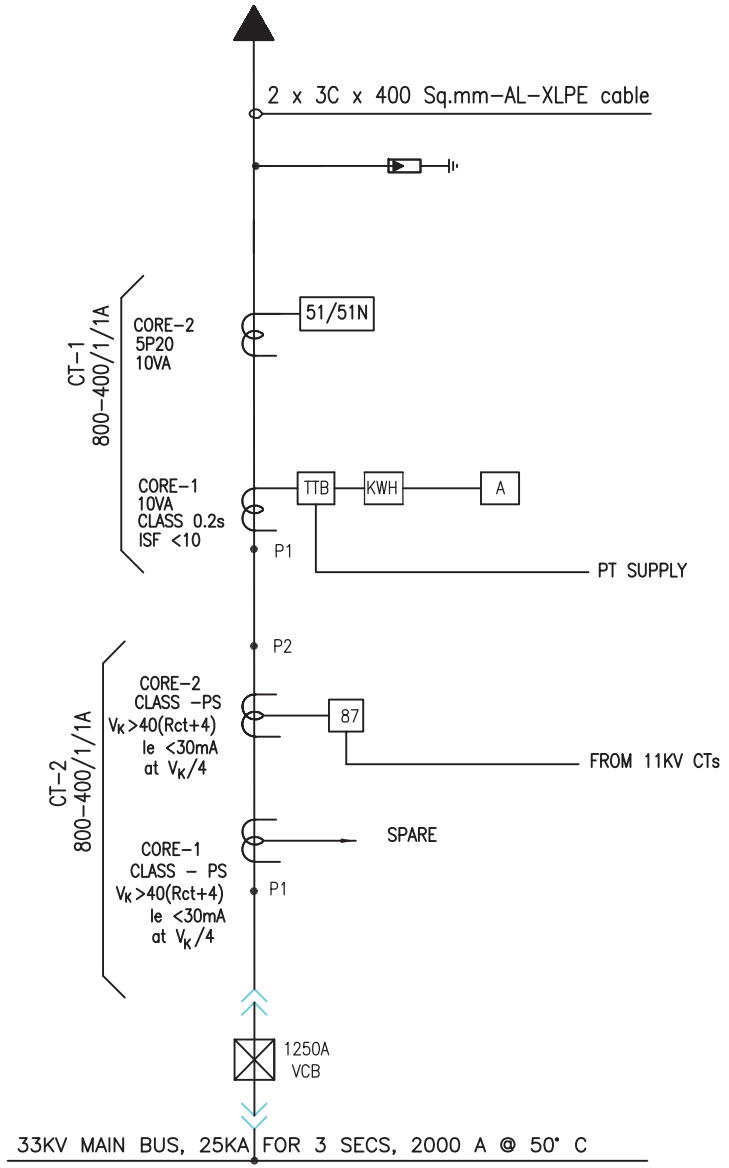
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. LINE DIFFERENTIAL OR DISTANCE RELAY. REFER CLAUSE 16.7.1 OF SPECIFICATION

DRAWN	R.K/A.H H.K	TITLE TYPICAL SLD FOR 33KV INCOMER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES-TS-66-HTSWG-R0
APPD.	G.S/G.N		SLD-SWG-33KV-01
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F7



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	29.04.22
SCALE	NTS

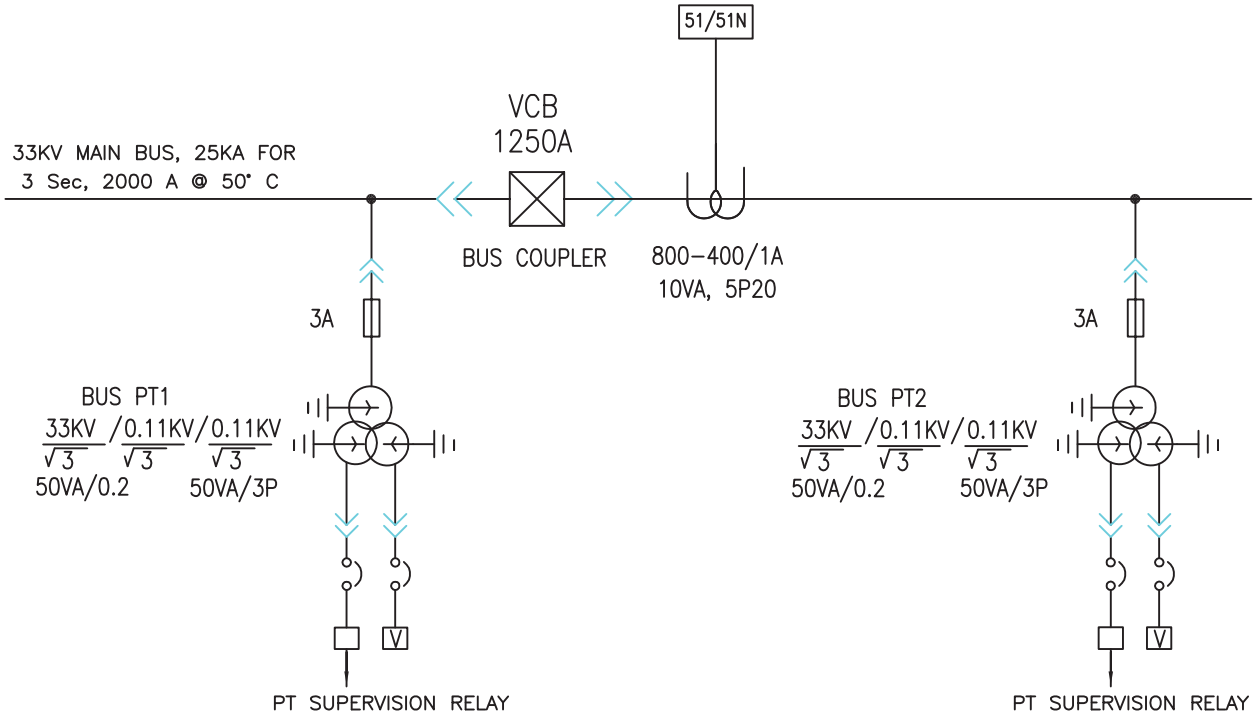
TITLE
TYPICAL SLD FOR 33/11KV TRANSFORMER FEEDER

BSES

SPECIFICATION NO. BSES-TS-66-HTSWG-R0

SLD-SWG-33KV-02

ANNEXURE–F8



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

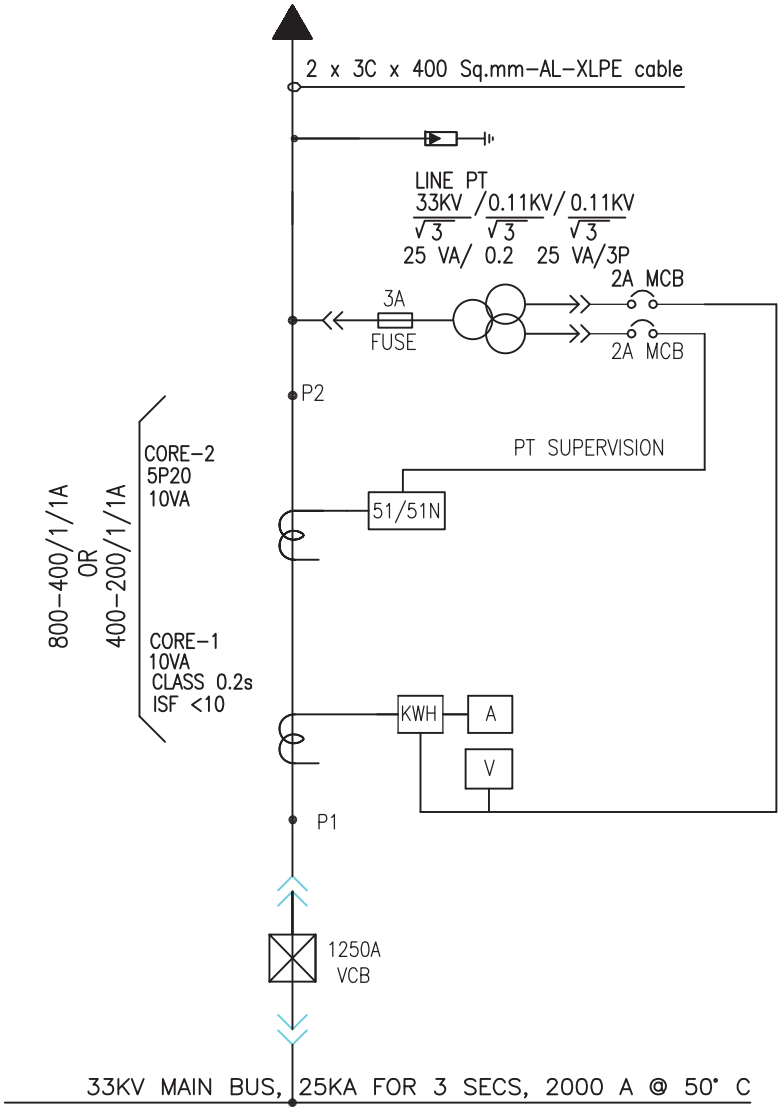
SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE	BSES
CHECKED	S.G/A.S	TYPICAL SLD FOR 33KV BUS COUPLER CUM BUS PT	SPECIFICATION NO. BSES-TS-66-HTSWG-R0
APPD.	G.S/G.N		SLD-SWG-33KV-03
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F9



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. TTB NOT REQUIRED IN THIS PANEL

DRAWN	R.K/A.H H.K
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	29.04.22
SCALE	NTS

TITLE

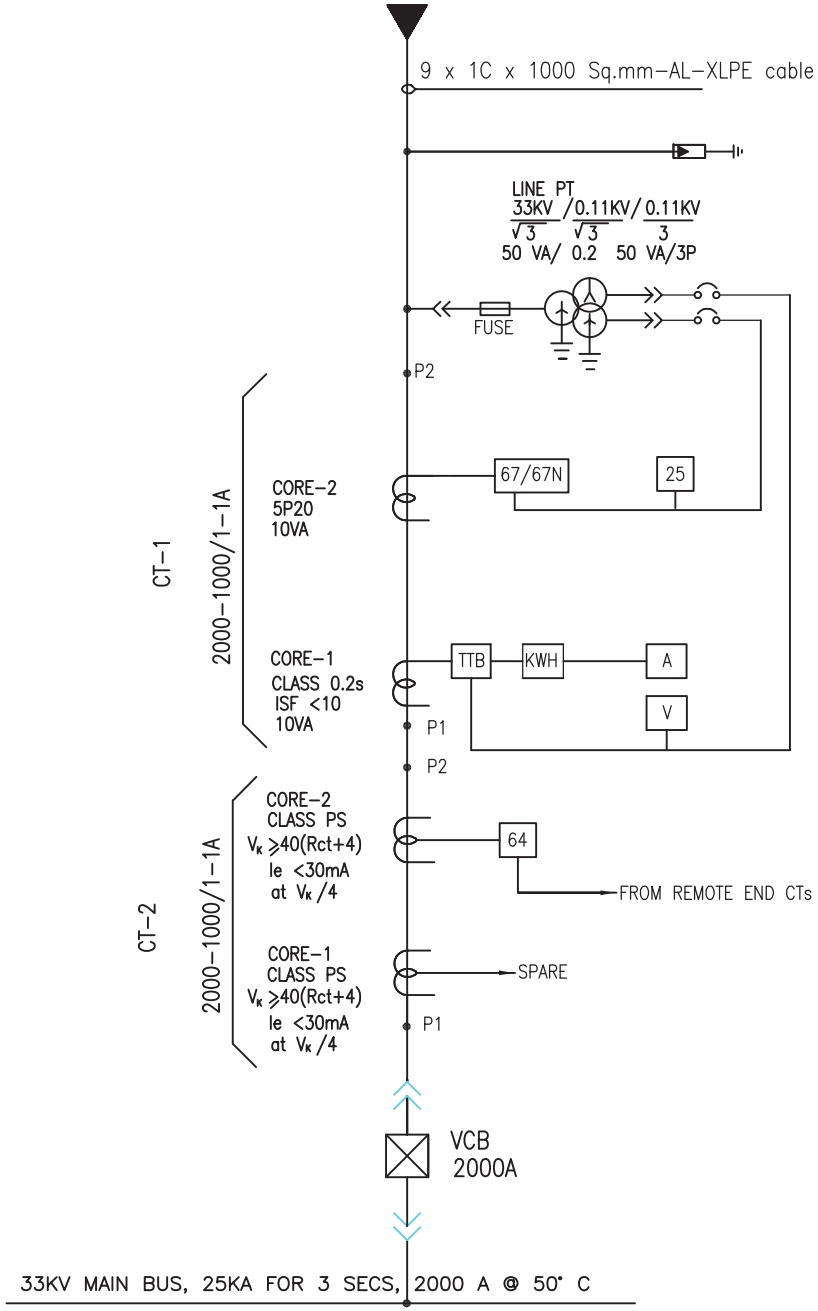
TYPICAL SLD FOR 33 KV OUTGOING FEEDER (FOR INSTALLATION AT KCC CONSUMERS PREMISES)

BSES

SPECIFICATION NO. BSES-TS-66-HTSWG-R0

SLD-SWG-33KV-04

ANNEXURE–F10



LEGEND

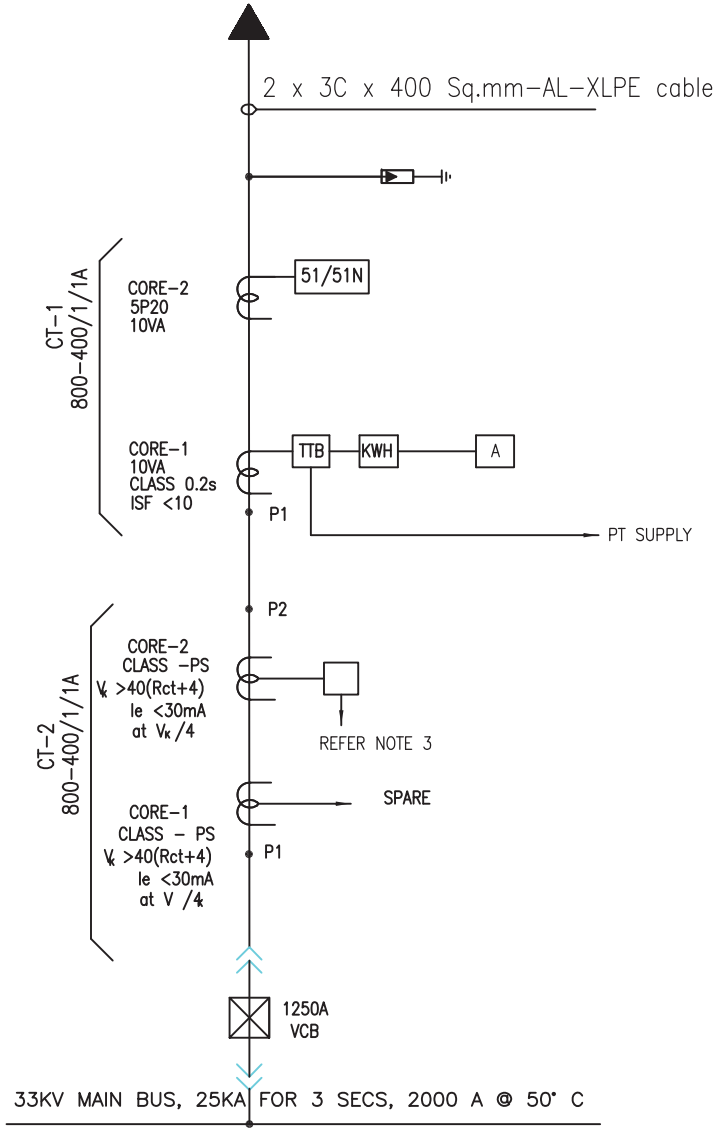
SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE: 1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K	TITLE: TYPICAL SLD FOR 33KV INCOMER FROM 66/33KV AUTO TRANSFORMER	BSES
CHECKED	S.G/A.S		SPECIFICATION NO. BSES-TS-66-HTSWG-R0
APPD.	G.S/G.N		SLD-SWG-33KV-05
DATE	29.04.22		
SCALE	NTS		

ANNEXURE–F11



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:
1. KWH METER NOT IN SUPPLIER'S SCOPE
2. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS
3. LINE DIFFERENTIAL OR DISTANCE RELAY. REFER CLAUSE 16.12.1 OF SPECIFICATION

DRAWN	R.K/A.H H.K
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	29.04.22
SCALE	NTS

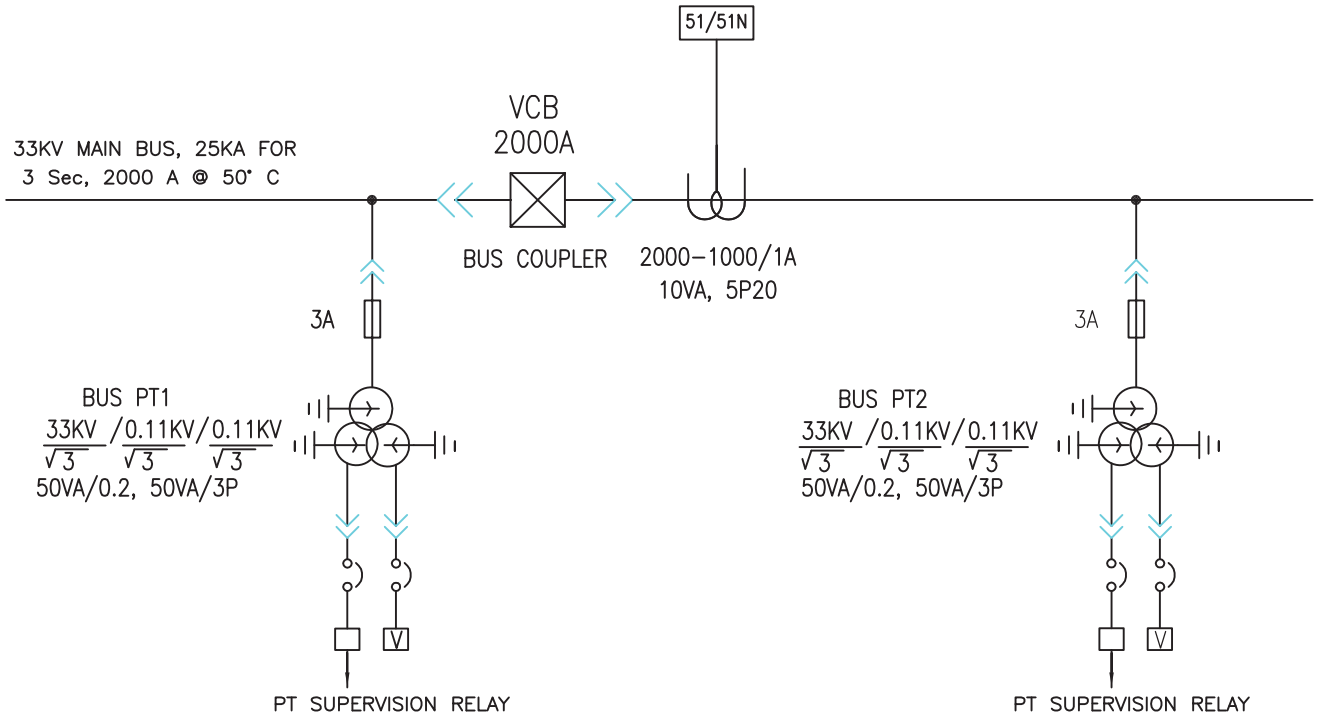
TITLE
TYPICAL SLD FOR 33KV OUTGOING FROM 66/33KV AUTO TRANSFORMER

BSES

SPECIFICATION NO. BSES-TS-66-HTSWG-R0

SLD-SWG-33KV-06

ANNEXURE–F12



LEGEND

SYMBOL	DESCRIPTION
	11KV SF6/VACUUM CKT. BKR. DRAWOUT TYPE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	SURGE ARRESTOR
	FUSE
52X	BREAKER AUX CONTACT MULTIPLIER
74	TRIP CIRCUIT SUPERVISION RELAY
94	ANTI PUMPING RELAY
86	HIGH SPEED TRIP RELAY
V	VOLTMETER
A	AMMETER

SYMBOL	DESCRIPTION
KWH	ENERGY METER
46	NEGATIVE PHASE SEQUENCE PROTECTION
25	SYNC CHECK
51/51N	O/C & E/F RELAY
27	UNDER VOLTAGE RELAY
87	DIFFERENTIAL RELAY
21	DISTANCE RELAY
59	OVER VOLTAGE RELAY
64	REF RELAY
67/67N	DIRECTIONAL O/C & E/F RELAY
TTB	TEST TERMINAL BLOCK

NOTE:–

1. REFER CLAUSE 16 OF SPECIFICATION FOR DETAILED FUNCTIONAL REQUIREMENTS OF PROTECTION RELAYS

DRAWN	R.K/A.H H.K
CHECKED	S.G/A.S
APPD.	G.S/G.N
DATE	29.04.22
SCALE	NTS

TITLE

TYPICAL SLD FOR BUS COUPLER CUM BUS PT PANEL FOR 33KV SWITCH BOARD OF 66/33KV AUTO TRANSFORMER

BSES

SPECIFICATION NO. BSES-TS-66-HTSWG-R0

SLD-SWG-33KV-07

BSES

Technical Specification

Of

66/33 kV Control and Relay Panel

Specification no – BSES-TS-86-CRP-R0

Rev:		0
Date:		03 Jun 2022
Prepared by	Abhishek Harsh	
	Alok Mandal	
Reviewed by	Srinivas Gopu	
	Abhinav Srivastava	
Approved by	Gaurav Sharma	
	Gopal Nariya	

Contents

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 panel should be designed and manufactured in accordance with the following standards.

2.1	IS-1248, Part 1- 1993	Direct acting indicating analogue electrical measuring instruments and their accessories.
2.2	IS-3231, Part 1- 1986 Part 2 &3 -1987	Electrical relays for power system protection
2.3	IS-9000 Part 1 -1988	Basic environmental testing procedures for electronics & electrical items
2.4	IS-13703 1993	Low voltage fuses for Voltages not exceeding 1000V AC or 1500 V DC
2.5	IS-13947 Part 1 - 1993	Low voltage switchgear & control gear
2.6	IEC-60255 - 1989	Specification for electrical relays
2.7	IEC 60688 1997	Electrical measuring transducers

3.0 PANEL CONSTRUCTION

3.1	Panel Type	Simplex panels with Width - 1000mm/1250 mm and Depth – 800 to 1000mm. Equipment shall be mounted on the front of the panel and doors for wiring access shall be at the back of panels.

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 2.0 mm. 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. Locks of the door shall be lever type.
3.5	Gland Plate	At least two 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 3.0 mm.
3.6	Cable Entry	Shall be from the bottom
3.7	Cable clamping	Cable glands shall not be used to support control cables. Vendor must provide clamping arrangement of control cable.
3.8	Gaskets	All doors, removable covers and panels shall be Gasketed all around with neoprene gaskets.
3.9	Ventilating louvers	Ventilating louvers, if required, shall have screens and filters. The screens shall be made of either brass or GI wires mesh.
3.10	Foundation	The panels shall be fixed on the embedded foundation channels with intervening layers anti vibration strips made of shock absorbing materials.
3.11	Base Frame	Base frames shall be supplied along with panels. 100mm channel painted black.
3.12	Mounting	Equipment on front of panel shall be flush mounted. No equipment shall be mounted on the doors.
3.13	Working level	The center lines of switches, push buttons and indicating lamps shall not be less than 750mm and higher than 1600mm from panel base. Height of relays, meters and recorders shall not be less than 450 mm from the bottom of the panel.
3.14	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.
3.15	Make	To be provided by Vendor

4.0 WIRING

4.1	Internal wiring	1100V grade, FRLS type, single core, stranded copper conductor wires with PVC insulation.
4.2	Size	2.5 sqmm for CT circuits, 2.5 sqmm for PT and control circuits.
4.3	Color Code	
4.3.1	CT & PT	R Ph – Red Y Ph – Yellow B Ph – Blue Neutral – Black
4.3.2	Others	DC– grey, AC-black, Earth – green
4.4	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. Wires directly connected to trip circuit shall be distinguished by the addition of red colored unlettered ferrule.
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.
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. 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.

5.0 TERMINAL BLOCKS

5.1	Rating and Type	1100 V grade, molded piece, stud type screw driver operated terminals complete with insulated barriers, washers, nuts and lock nuts.
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./ 6 mm^2 flexible Cu.
5.3	Marking and covers	White fibre markings strip with clear plastic, slip-on / clip-on terminal covers to be provided.
5.4	Disconnecting Facility	To be provided in CT and PT terminals
5.5	Shorting & Earthing Facility	To be provided in CT Terminals
5.6	Spare Terminals	20% in each TB row
5.7	Segregation	TBs shall be segregated by application i.e separate terminal blocks shall be provided for each application as follows (a) CT (b) PT (c) Circuit Breaker (d) Bus Isolator (e) Line Isolator-1 (f) Line Isolator-2 (g) Earth Switch-1 (h) Earth Switch-2 (i) Interpanel Bus wiring etc.
5.8	Vertical clearance with gland plate	Minimum 250mm
5.9	Clearance between two rows of TBs	Minimum 150mm
5.10	Test Terminal Blocks	Screw driver operated stud type for metering circuits.
5.11	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.

5.12	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.

6.0 PAINT

6.1	Paint Type	Powder coated. Pure Polyester base grade-A, structure finish.
6.2	Paint Shade	RAL7032 'Siemens Grey'
6.3	Paint Thickness	Minimum 50 microns

7.0 MIMIC DIAGRAM

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

8.1	Nameplates	To be provided as per the following description
8.1.1	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.
8.1.2	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) Customer Name (ii) BSES, PO No. & date (iii) Drawing Reference No (iv) Year of Manufacture (v) Control Voltage (vi) Customer care No
8.1.3	Material	Non-rusting metal or 3 ply lamicoid. Nameplates shall be black with white engraving lettering. Stickers are not allowed.
8.1.4	Fixing	All nameplates/rating plates shall be riveted to the panels at all four corners. Bolting/screwing is not acceptable.
8.2	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

9.1	Panel Earthing	All panels shall be equipped with an earth bus securely fixed.
9.2	Location of earthing earthing bus	Earthing bus shall be at rear side of CRP(Door Side)
9.3	Material	The material and the sizes of the bus bar shall be 25 x 6 mm copper flat unless specified otherwise.
9.4	Earth Bus joints	All bolted joints in the bus should be effected by connection of two bolts.
9.5	Hinged Doors	Earthed through flexible copper braid.
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 green.
9.7	CT and PT circuit earthing	PT and CT secondary neutral shall be earthed at one place only at the terminal blocks through links.

10.0 INSTRUMENTS

10.1	Mounting	Flush mounted

10.2	Voltmeter	Digital type with programmable ratio
10.2.1	Size	96x96 mm
10.2.2	Panels where to be provided	Incomer and Buscoupler
10.2.3	Voltmeter selector switch	Required
10.2.4	Accuracy Class	1.0
10.2.5	Auxiliary Supply	48 – 240VDC and AC i.e universal type.
10.2.6	Make	To be Provided by Vendor
10.2.7	Type/Model	To be Provided by Vendor
10.2.8	VA Burden	To be Provided by Vendor
10.3	Multifunction Meter	Digital type with programmable ratio
10.3.1	Model	Rish Delta Energy,
10.3.2	Make	Rishabh
10.3.3	SCADA Interfacing	RS485 rear port suitable for integration on Modbus Protocol
10.3.4	Size	96x96 mm
10.3.5	Panels where to be provided	All panels
10.3.6	Accuracy Class	1.0
10.3.7	Auxiliary Supply	48 – 240VDC and AC i.e universal type.
10.4	Energy meter provision	Energy meter is not in supplier's scope. Only space and CT/PT wiring is to be provided in all panels except bus coupler and bus PT. Space shall be 350 mm (H)x200 mm (W)

11.0 RELAYS

11.1	General features of Protection Relays	
11.1.1	Technology and Functionality	Numerical, microprocessor based with provision for multifunction protection, control, metering and monitoring
11.1.2	Mounting	Flush Mounting, IP5X
11.1.3	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.
11.1.4	Programming and configuration	Relay 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. Programming software and communication cord for offered relays should be included in scope of supply.
11.1.5	SCADA Interface port	(a) RS485 for IEC 103 communication. (b) LC Type Dual fibre optic port for interfacing with SCADA on IEC 61850 with PRP compatibility. Through this port relays shall be connected to Ethernet switches.
11.1.6	Communication Protocol	IEC103(Data Type 9) and Dual fibre optic port for interfacing with SCADA on IEC 61850 with PRP compatibility. Through these ports relays shall be connected to switches. Communication protocol shall be selectable at site.
11.1.7	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.
11.1.8	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.
11.1.9	PC Interface port	Front port (preferably serial) for configuration/data download using PC.
11.1.10	GOOSE messaging	Relays shall communicate all status signals, commands and events on GOOSE messaging. Interlocks if any shall also be on GOOSE Messaging and wiring for that shall be in vendor’s scope.
11.1.11	User Interface	An alphanumeric key pad and graphical LCD display with backlight indicating measurement values and operating messages. It should be possible to access and change all settings and parameters without the use of PC.
11.1.12	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 and other tripping curves through a minimum of two setting groups.
11.1.13	Event and Fault records	(c) 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. (d) Relay shall store records for last 100 events (minimum) (e) Relay shall store records for last 10 faults (minimum). (f) It should be possible to download records locally to PC and to remote SCADA.
11.1.14	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, DIs , DOs etc to SCADA SCADA Integration Relays shall communicate all measured and monitored parameters like current, voltage, power, event record, fault record, DIs , DOs etc to SCADA
11.1.15	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.
11.1.16	Time synchronization	All relays shall be capable of being synchronized with the system clock through SCADA, PC and GPS.
11.1.17	Operation Indicators	(a) LEDs with push button for resetting. (b) Resetting of LEDs shall be possible from SCADA
11.1.18	Test Facility	Inbuilt
11.1.19	Coating	Conformal Type
11.2	Protection Relay Requirement for Line CRP (66kV/33kV)	
11.2.1	Relay 1	Combined Line differential (Dual channel, ST Port Compatible for Single Mode Fibre having wavelength 1310 nm) and distance protection
		Power Swing Blocking
		Software based CT ratio correction
		Dedicated port for communication with remote end relay through optical fibre. This port should be in addition to PC interface and SCADA interface ports.
11.2.2	Relay 2	Bay Control unit having MIMIC with 3-phase Directional Overcurrent and Earth fault protection with IDMT, Definite time and instantaneous characteristics.
		Under and Over voltage
		Sync check function
		Trip Circuit Supervision- 1&2
		Reverse Blocking Function
		Under Frequency, Over Frequency and Rate of change of frequency
		PT supervision
		Circuit Breaker failure protection (CBFP)
11.2.3	User Configurable DIs and DOs	(a) Relay-1 should have DIs and DOs as per scheme requirement. Same shall be finalized during detailed engineering. 2 DIs and 2 DO shall be spare for future use. (b) Relay-2 should have minimum of 32 DIs and 16 DOs Exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme

		requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs should be available as spare in each panel for future use.
11.2.4	Note	Combining functions of Relay-1 and Relay-2 in single relay is not acceptable.
11.2.5	SLD	Refer annexure D1 and D5 for SLD of 66kV and 33kV line bays respectively
11.3	Protection Relay Requirement for Transformer CRP (66kV/33kV)	
11.3.1	Relay-1	Biased Differential Protection
		High Impedance REF protection
		Software based ratio and vector correction feature (without ICT)
		H2 and H5 harmonic restraint
11.3.2	Relay-2	Bay Control unit having MIMIC with 3-phase Directional Overcurrent and Earth fault protection with IDMT, Definite time and instantaneous characteristics.
		Under and Over voltage
		Sync check function
		Trip Circuit Supervision- 1&2
		Reverse Blocking Function
		Under Frequency, Over Frequency and Rate of change of frequency
		PT supervision
		Circuit Breaker failure protection (CBFP)
11.3.3	User Configurable DIs and DOs	(a) Relay-1 should have DIs and DOs as per scheme requirement. Same shall be finalized during detailed engineering. 2 DIs and 2 DO shall be spare for future use. (b) Relay-2 should have minimum of 32 DIs and 16 DOs Exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs should be available as spare in each panel for future use.
11.3.4	Note	Combining the functions of Relay-1 and Relay-2 in a single relay is not acceptable.
11.3.5	SLD	Refer annexure D2 and D6 for SLD of 66kV and 33kV transformer bays respectively

11.4	Protection Relay Requirement for Bus Coupler CRP (66kV/33kV)	
11.4.1	Relay-1	Bay Control unit having MIMIC with 3-phase Directional Overcurrent and Earth fault protection with IDMT, Definite time and instantaneous characteristics.
		Under and Over voltage
		Sync check function
		Trip Circuit Supervision- 1&2
		Reverse Blocking Function
		Under Frequency, Over Frequency and Rate of change of frequency
		PT supervision for Bus PT-1 and Bus PT-2
		Circuit Breaker failure protection (CBFP)
11.4.2	Relay-2	PT supervision (fuse failure monitoring) for Bus PT-2 if not provided as part of relay-1
		Reverse Blocking Function
11.4.3	User Configurable DIs and DOs	(a) Relay-1 should have DIs and DOs as per scheme requirement. Same shall be finalized during detailed engineering. 2 DIs and 2 DO shall be spare for future use. (b) Relay-2 should have minimum of 32 DIs and 16 DOs Exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs should be available as spare in each panel for future use.
11.4.4	SLD	Refer annexure D3 and D7 for SLD of 66kV and 33kV bus coupler bays respectively
11.5	Protection Relay Requirement for Capacitor CRP (66kV/33kV)	
11.5.1	Relay-1	Neutral unbalance relay (current based)
		Timer for ON time delay (600 seconds minimum)
11.5.2	Relay-2	Bay Control unit having MIMIC with 3-phase Directional Overcurrent and Earth fault protection with IDMT, Definite time and instantaneous characteristics.
		Overvoltage and Under voltage protection
		Sync check function
		Trip Circuit Supervision- 1&2

		Reverse Blocking Function
		Under Frequency, Over Frequency and Rate of change of frequency
		PT supervision
		Circuit Breaker failure protection (CBFP)
11.5.3	User Configurable DIs and DOs	(a) Relay-1 should have DIs and DOs as per scheme requirement. Same shall be finalized during detailed engineering. 2 DIs and 2 DO shall be spare for future use. (b) Relay-2 should have minimum of 32 DIs and 16 DOs Exclusively for SCADA interfacing. DIs and DOs for tripping and interlocking shall be additional as per scheme requirement. If DIs and DOs for tripping and interlocking are integrated with DIs and DOs meant for SCADA (may be done to optimize DI/DO configuration), atleast 4 DIs and 4 DOs should be available as spare in each panel for future use.
11.5.4	Note	Combining the functions of Relay-1 and Relay-2 in a single relay is not acceptable
11.5.5	SLD	Refer annexure D4 and D8 for SLD of 66kV and 33kV capacitor bays respectively
11.6	SCADA Interfacing of Protection Relays	
11.6.1	Configuration and wiring of DIs of protection relays for routing status signals to SCADA	DI-1 – CB Open DI-2 – CB Close DI-3 – Earth switch 1 close DI-4 – Earth switch 2 close DI-5 – Line Isolator Open (For Bus Coupler Panel - Earth switch 3 close) DI-6 – Line Isolator Close (For Bus coupler panel - Earth switch 4 close) DI-7 – Bus 1 Isolator Open DI-8 – Bus 1 Isolator Close DI-9 – Bus 2 Isolator Open DI-10 – Bus 2 Isolator Close DI-11 – TC Healthy DI-12 – CB Spring Charged DI-13 – SF6 Low/ SF6 Lockout DI-14 – Local/Remote switch in Remote DI-15 – CB Autotrip DI-16 – Protection/Trip relay faulty DI-17 – DC fail/DC MCB trip from adjacent panel (DC -1/2 fail for bus coupler panel) DI-18 – PT MCB trip (wherever relevant) Sequence of DIs should be strictly as mentioned above. Change in sequence of DIs will not be acceptable.
11.6.2	Configuration and	DO-1 – CB Open

	wiring of DOs of protection relays for executing SCADA commands through SCADA interface port (refer clause 12.1.5).	DO-2 – CB Close DO-3 – Line Isolator Open DO-4 – Line Isolator Close DO-5 – Bus 1 Isolator Open DO-6 – Bus 1 Isolator Close DO-7 – Bus 2 Isolator Open DO-8 – Bus 2 Isolator Close Sequence of DOs should be strictly as mentioned above. Change in sequence of DOs will not be acceptable.
11.6.3	Looping	All relays should be looped to form a common bus for interfacing with SCADA.
11.7	Transformer Monitoring Cum AVR Relay	
11.7.1	Functions	As per annexure –A
11.7.2	Requirement	To be provided in Transformer CRP (Take off price to be mentioned in price bid)
11.8	General Features of Auxiliary Relays	
11.8.1	Type	Static or electromechanical.
11.8.2	Reset Characteristic	Self reset contacts except for lockout relays.
11.8.3	Operation Indicators	(a) Hand reset operation indicators or LEDs with pushbutton for resetting. (b) Resetting of LEDs shall be possible from SCADA
11.8.4	Lockout relay	Manual and Electrical reset type
11.8.5	Operational Data	Bidder shall provide the reference list of the type of relays offered
11.8.6	Spare Contacts	Minimum 1NO and 1NC. To be wired upto the terminal block.
11.9	Auxiliary relays – Panel wise requirement	
11.9.1	Lockout relay	To be provided in all panels
11.9.2	DC fail relay	
11.9.3	AC fail relay	
11.9.4	Trip circuit supervision relay	To be provided in all panels for supervision of two trip coils.
11.9.5	Bistable Relays	To be provided in all panels for multiplication of auxiliary contact of breakers, isolators and earth switches. Multiplied contacts to be used for interlocks, indications and numerical relay input. 2NO + 2NC contacts shall be spare after multiplication in each case.
11.9.6	PT selection relays	To be provided in all panels as per scheme requirement.
11.9.7	Contact Multiplication relay	a. To be provided in all panels b. SCADA Close and Open Command shall be wired

		up through CMR to Closing and Tripping circuit
11.9.8	Transformer Trouble Relays	Auxiliary relays with indicating flags (contactors will not be accepted) should be provided in transformer panel for the following trip and alarm commands – (a) Buchholz trip (b) OSR trip (c) PRV trip (d) SPR trip (e) WTI Trip (f) OTI Trip (g) OLTC PRV Trip (h) Buchholz Alarm (i) Low oil level alarm (j) OTI Alarm (k) WTI Alarm.
11.9.9	Transformer Trouble Relay Contact Multiplication	(a) Contact multiplication of Transformer trouble relays shall be provided with 2 NO and 2 NC contact as spare. (b) 1 NO contact of Buchholz, Differential, OSR, PRV, SPR, REF contact multiplication relay for NIFPS (Nitrogen Injection fire protection system) shall be provided.
11.9.10	SF6 low and SF6 lockout relay	To be provided in all 66kV control and relay panels
11.9.11	DC selection scheme	Fed by two DC incoming sources in Bus coupler panel with auto changeover facility
11.10	General Requirements for all relays/contactors	
11.10.1	Auxiliary supply	(a) 48-250 VDC. All relays/contactors shall be suitable for continuous operation at 15% overvoltage and 15% under voltage. (b) No external resistor shall be provided in relays /contactor to achieve desired voltage.
11.10.2	Spare contacts	Shall be wired upto the terminal block
11.10.3	Signal Integration	All signal integration shall only be through NO Contact

12.0 SYNCH CHECK PHILOSPHY

12.1	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.
12.2	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.
12.3	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.
12.4	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.
12.5	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 (or 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.

13.0 MANAGED ETHERNET SWITCH

13.1	Ethernet Switch	
13.1.1	Numbers	Two at each site
13.1.2	FO Port	Minimum 16 Nos
13.1.3	RJ 45 Port	4 Nos
13.1.4	Communication Protocol	IEC 61850
13.1.5	Network Protocol	PRP
13.1.6	Downlink Rate	100 MBPS

13.1.7	Uplink Rate	1 GBPS
13.1.8	Coating	Conformal
13.1.9	Power Supply Voltage	220 / 50 VDC as per site condition
13.1.10	Grade	Industrial
13.1.11	Certification required	KEMA,CE & FCC for IEC 61850 compliance
13.1.12	Operating Temperature	
13.1.13	Mounting	In Switchgear Panel
13.1.14	Blinking LED Indicators	On each RJ45 ports
13.1.15	Separate Maintenance/console Part	Required
13.1.16	Latency	Less than or equal to 10 ms
13.1.17	Fibre Optic Compatibility	Multimode, 1310 nm
13.1.18	Placement	Din Rail Arrangement Inside Switchgear
13.2	Fibre Optics (Patch Cord) and Ethernet cable	
13.2.1	Connection	From Relays, Meters to Ethernet Switch
13.2.2	Mode of Fibre Optics	Multimode
13.2.3	Wavelength	1310 nm
13.2.4	Ethernet Cable Type	CAT VI
13.2.5	Associated Connectors and Accessories	Required

14.0 ANNUNCIATION

14.1	Type	Static type alongwith alarm. Annunciations shall be repetitive type and shall be capable of registering the fleeting signal. Fascia test facility should also be provided.
14.2	Mounting	Flush mounted
14.3	Fascia	16 window
14.4	Signals to provided on Fascia	Window 1 – Main Protection Operated (Distance /Differential) Window 2 – Backup O/C & E/F Protection Operated Window 3 – CBFP operated Window 4 – CB Autotrip Window 5 – SF6 Low/SF6 Lockout (For 66kV CRP only) Window 6 – Trip Circuit Unhealthy Window 7 – DC Fail Window 8 – AC Fail Window 9 – VT Fuse Fail Window 10 – Protection Relay/Trip relay Faulty Window 11 – Tarfo Trouble trip (For trafo panel only)

		Window 12 – Trafo Trouble alarm (For trafo panel only)
14.5	Push Buttons	For test, accept and reset
14.6	Potential Free Contacts	To be provided for event logger
14.7	Alarm	For all signals wired to the annunciator
14.8	Overall Dimension of Group	To be Provided by Vendor

Sequence of operation of the annunciator shall be as follows-

S No.	Alarm Condition	Fault Contact	Visual Annunciation	Audible Annunciation
a.	Normal	Open	Off	Off
b.	Abnormal	Close	Flashing	On
c.	Accept	Close	Steady on	Off
d.	Return to normal	Open	Steady On	Off
e.	Reset	Open	Off	Off
f.	Reset before return to normal	Close	Flashing	On

15.0 INDICATIONS

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
15.1.1	Breaker On	Red
15.1.2	Breaker Off	Green
15.1.3	Isolator Close	Red
15.1.4	Isolator Open	Green
15.1.5	Spring Charged	Blue
15.1.6	DC control supply healthy	Amber
15.1.7	Heater circuit healthy	Yellow
15.1.8	Trip circuit healthy	White
15.1.9	PT supply	R, Y, B
15.1.10	Voltage	220VDC/50 VDC
15.1.11	Rating	To be Provided by Vendor
15.1.12	Wattage	To be Provided by Vendor

15.1.13	Series Resistance	To be Provided by Vendor
15.1.14	10% extra Lamp Furnished?	To be Provided by Vendor
15.1.15	Size of lens	To be Provided by Vendor
15.1.16	Make	To be Provided by Vendor
15.1.17	Type	To be Provided by Vendor
15.2	Semaphores	To be provided for all earth switches.
15.2.1	Make	To be Provided by Vendor
15.2.2	Type	To be Provided by Vendor
15.2.3	Diameter of the Disc	To be Provided by Vendor
15.2.4	Operating voltage	220VDC/50 VDC
15.2.5	Burden (Watt DC)	To be Provided by Vendor
15.2.6	Whether latch in type or supply Failure type	To be Provided by Vendor

16.0 SELECTOR SWITCHES AND PUSH BUTTONS

16.1	Switches	Flush Mounted with shrouded terminals
16.1.1	TNC Switch	Lockable Pistol Grip type with spring return to normal position
16.1.2	Local/SCADA selector switch	2 pole
16.1.3	Rotary On/Off Switches	For heater/illumination circuit
16.1.4	Rating of switches	16 A
16.2	Push buttons	Flush Mounted with shrouded terminals
16.2.1	Accept Push Button	Black Color- Trip alarm/DC fail alarm
16.2.2	Reset Push Button	Yellow Color- Trip alarm/DC fail alarm
16.2.3	Test Push Button	Blue Color
16.2.4	Rating	10A

17.0 ACCESSORIES

17.1	Space heaters	Thermostat controlled with switch for isolation
17.1.1	Voltage	240 V AC

17.1.2	Wattage	To be provided by Vendor
17.1.3	Thermostat Range	To be provided by Vendor
17.1.4	Provided with Individual fuse unit	To be provided by Vendor
17.2	Socket and switch	240V, 5/15A universal type socket to be provided in each panel with on-off switch
17.3	MCBs and Fuses	Provision for receiving, distribution, isolation and fusing of DC and AC supplies to various control circuits should be made using MCBs and Fuses of appropriate ratings
17.4	Panel illumination	240V AC illumination lamp controlled by panel door switch to be provided in each panel

18.0 APPROVED MAKES OF COMPONENTS

18.1	Numerical Relays	(a) R Series of ABB (b) Siprotec series of Siemens (c) Micom series(PX40) of Schneider (d) Micom Series of GE (e) All numerical relays in a panel should be of same make. Use of two different makes of relays in a panel is not acceptable.
18.2	Trafo Monitoring Cum AVR relay	A-Eberle/Easun MR
18.3	Auxiliary Relays & Contact Multiplication Relays	Alstom/Schneider/ABB/Siemens/ER
18.4	Miniature Relays	ABB/ OMRAN
18.5	Contactors	ABB/Siemens/Schneider
18.6	MCBs	Siemens/Schneider/Legrand/ABB
18.7	Control switches	Switron/Kaycee
18.8	Annunciator	Minilec/Alan
18.9	Test terminal block	IMP/DAV
18.10	Terminal blocks	Elmex/Connectwell
18.11	Indicating lamps	Siemens/ Teknic/ Binay
18.12	Meters	Rishabh/Conzerv
18.13	Multi Function Meter	Rishabh (Rish Delta Energy)
18.14	Managed Ethernet Switch	Ruggedcom/ Hirschman/ GarrettCom

19.0 QUALITY ASSURANCE, INSPECTION & TESTING

19.1	Vendor quality plan	To be submitted for purchaser approval
19.2	Type tests	Product must be type tested as per Indian Standards or IEC
19.3	Type test report validity	Last five years from the date of bid submission
19.4	Acceptance and Routine tests	As per specifications and relevant standards. Charges of these tests shall be deemed to be included in the equipment price. Purchaser reserves the right to witness all the tests.
19.5	Notice to Purchaser for conducting tests	Atleast three weeks in advance
19.6	Test reports of acceptance and routine test before dispatch	Six copies to be submitted.

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.

S. 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	Relevant 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 five years of operation)		Required		
21.8	Schematic		Required		
21.9	CRP				
21.9.1	General Arrangement	Required	Required		
21.9.2	Sectional Layout		Required		
21.9.3	Door Layout		Required		
21.9.4	Panel wise BOQ		Required		
21.9.5	Index Sheet		Required		
21.9.6	Symbols		Required		
21.9.7	SLD	Required	Required		
21.9.8	Trip Logic		Required		
21.9.9	AC Distribution Circuit		Required		
21.9.10	DC Distribution Circuit		Required		
21.9.11	CT Distribution Circuit		Required		
21.9.12	VT Distribution Circuit		Required		
21.9.13	Voltage Selection Circuit		Required		
21.9.14	Metering Circuit		Required		
21.9.15	Indication Circuit		Required		

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
21.9.16	Isolator Control Circuit		Required		
21.9.17	Protection Circuit		Required		
21.9.18	Relay Circuit with DI and DOs		Required		
21.9.19	DI and DO Sheet of each relay		Required		
21.9.20	Schematic Circuit diagram and Scheme of Each type of Panel		Required		
21.9.21	Logic Operation Diagram		Required		
21.9.22	Communication Architecture		Required		
21.9.23	Trafo Monitoring Relay Circuit in case of Transformer Panel		Required		
21.9.24	CB Closing interlock circuit		Required		
21.9.25	Tripping Circuit		Required		
21.9.26	CB status & CB trouble cont. mult. circuit		Required		
21.9.27	Isolator , E/S and trafo trouble contact multiplication circuit		Required		
21.9.28	Annunciation circuit		Required		
21.9.29	TB Reference page		Required		
21.9.30	Synch Logic Diagram		Required		
21.9.31	QAP		Required		
21.10	Inspection Reports			Required	
21.11	As manufacturing Drawings			Required	
21.12	Operation and Maintenance Manual			Required	Required
21.13	Trouble shooting manual			Required	Required
21.14	As built Drawings				Required
21.15	Test Report				Required
21.16	Soft Copy				
21.16.1	In Pen drive	Required			

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
21.16.2	Through Mail		Required	Required	Required

22.0 PACKING

22.1	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.
22.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
22.3	Packing Identification Label to be provided on each packing case with the following details	
22.3.1	Individual serial number	
22.3.2	Purchaser's name	
22.3.3	PO number (along with SAP item code, if any) & date	
22.3.4	Equipment Tag no. (if any)	
22.3.5	Destination	
22.3.6	Project Details	
22.3.7	Manufacturer / Supplier's name	
22.3.8	Address of Manufacturer / Supplier / it's agent	
22.3.9	Description and Quantity	
22.3.10	Country of origin	
22.3.11	Month & year of Manufacturing	
22.3.12	Case measurements	
22.3.13	Gross and net weights in kilograms	
22.3.14	All necessary slinging and stacking instructions	

23.0 SHIPPING

23.1	**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.
		The seller shall be responsible for all transit damage due to improper packing.

24.0 HANDLING AND STORAGE

24.1	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

25.0 ANNEXURE – A – TRANSFORMER MONITORING CUM AVR RELAY

25.1	**General features**	
25.1.1	Technology and Functionality	Microprocessor based with provision for multifunction control and monitoring.
25.1.2	Mounting	Rack Mounting

25.1.3	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.
25.1.4	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.
25.1.5	User Machine Interface	UMI 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.
25.1.6	PC Interface port	Front port (preferably serial) for configuration using PC. Cost of licensed software and communication cord, required for programming of offered protection relays using PC, shall be mentioned separately in the bid.
25.1.7	SCADA Interface port	LC Type Dual fibre optic port for interfacing with SCADA on PRP protocol. Through this port relays shall be connected to Ethernet switches.
25.1.8	Communication protocol	Relays shall be compatible for interfacing with SCADA on both IEC61850 and IEC103 (Data Type-9) protocol. Communication protocol shall be selectable at site. Relay shall be capable of transmitting all parameters including measured values, DI, DO, AI, Events and fault records to SCADA.
25.1.9	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.
25.1.10	Cable Termination	Termination of cable shall be at rear side.
25.1.11	Time Synchronization	Relay shall be capable of being synchronized with the system clock through SCADA , PC and GPS.
25.1.12	Auxiliary supply	220VDC or 48VDC
25.2	**Inputs and Outputs**	
25.2.1	CT Input	1/5A selectable through programming
25.2.2	PT Input	110VAC
25.2.3	Binary Inputs	Sixteen programmable binary inputs should be provided
25.2.4	Analog Inputs (4-20mA)	One input to be provided
25.2.5	PT-100 direct input	One input to be provided
25.2.6	Direct Resistance Input	For tap position indication (18 steps)

25.2.7	Binary Outputs	Ten programmable binary outputs should be provided
25.3	**Control**	
25.3.1	Control Tasks	Ability to implement control functions through programmable logics
25.3.2	Voltage setting	Programmable Voltage set point
25.3.3	Voltage Regulation	Raise/Lower tap position to maintain the preset value of voltage.
25.3.4	Voltage Regulation modes	Automatic and Manual
25.3.5	Operation Modes	Local and Remote
25.3.6	Fan and Pump control	To be provided
25.3.7	Transformer Paralleling	Capability to parallel transformers whose AVRs are interconnected via a communication network.
25.4	**SCADA Interfacing**	
25.4.1	Configuration of DIs for routing alarm/trip signals to SCADA.	DI-1 – Buchholz trip DI-2 – OSR Trip DI-3 – PRV trip DI-4 – SPR trip DI-5 – OTI trip DI-6 – WTI trip DI-7 – Buchholz alarm DI-8 – Oil Level low larm (MOG alarm) DI-9 – WTI alarm DI-10 – OTI alarm DI-11 – Tap changer trouble/stuck/out of step DI-12 – Tap changer motor supply fail DI-13 – Tap changer in local control All signals from DI-1 to DI-10 are to be wired up from transformer trouble auxiliary relays.
25.4.2	Configuration of DOs for executing commands from SCADA through interface port/CRP	DO-1 – Tap raise DO-2 – Tap lower DO-3 – Fan group 1 control DO-4 – Fan group 2 control
25.4.3	Analog Inputs	All analog inputs shall be SCADA Compatible
25.5	**Measurement, Event Recording and Monitoring**	
25.5.1	Measured Quantities (optional)	Voltage, Current, Active Power, Reactive Power, Apparent Power, Power factor, frequency
25.5.2	Event Recording	Facility for recording parameters during various events such as tap change, change in binary input status etc.

25.5.3	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.

26.0 ANNEXURE- B – GUARANTEED TECHNICAL PARTICULARS

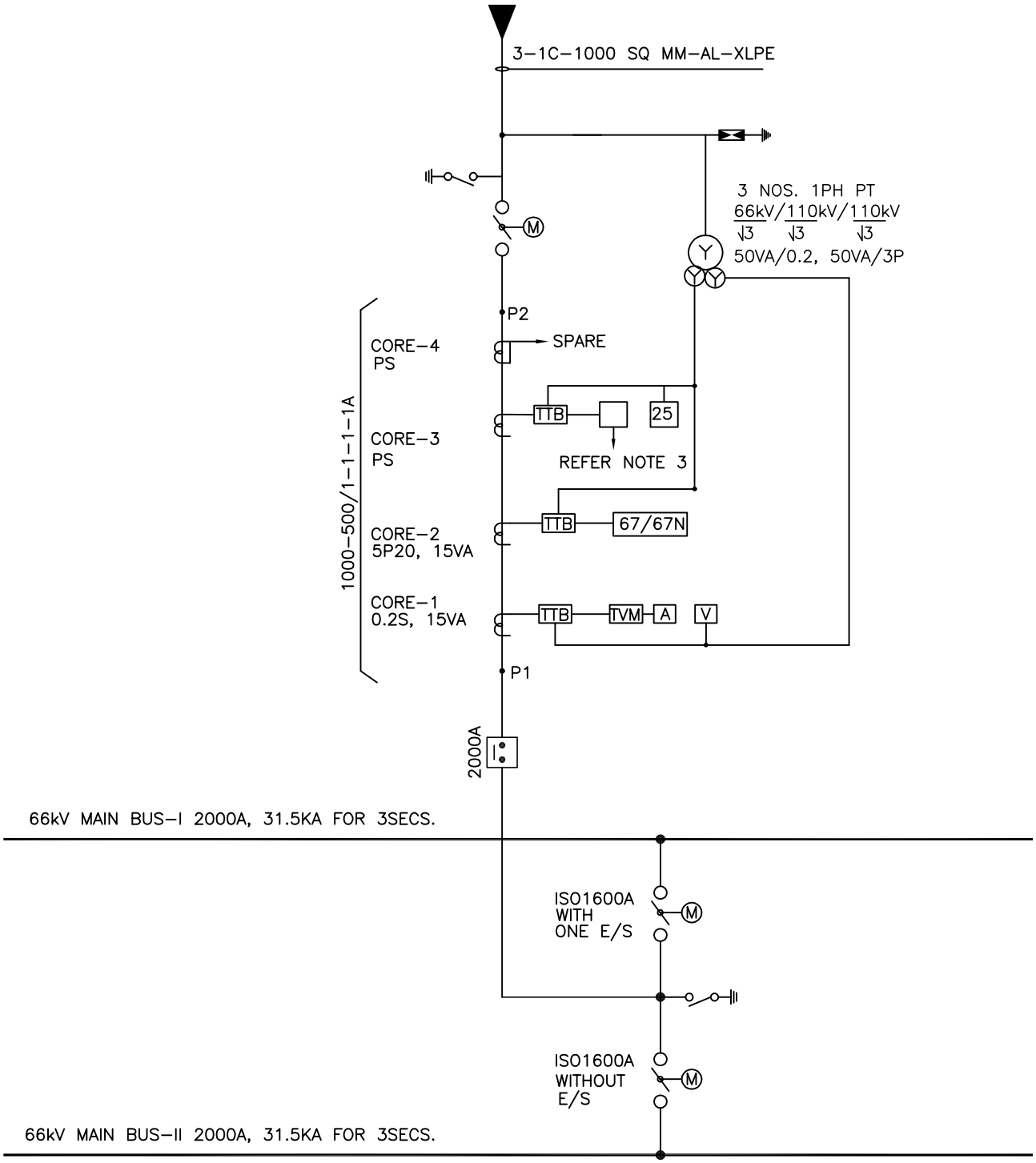
Vendor must submit clause wise compliance against specification at the time of drawing approval clearly highlighting the deviations from specification against each clause.

27.0 ANNEXURE- C – SPARES REQUIREMENT

S No.	Description	Unit Rate
27.1	Numerical relay of each type	1 nos.
27.2	Auxiliary relay of each type	1 nos.
27.3	Contact multiplication relays (Bistable type for CB, isolator and earth switch auxiliary contact multiplication)	6 nos.
27.4	Contactor of each rating	2 nos.
27.5	Voltmeter	1 nos.
27.6	Local/Remote Selector switch	1 nos.
27.7	TNC switch for CB	2 nos.
27.8	TNC switch for Isolators	3 nos.
27.9	Semaphore indicators	4 nos.
27.10	MCB of each rating	1 nos.

28.0 ANNEXURE-D-SLDs

ANNEXURE–D1



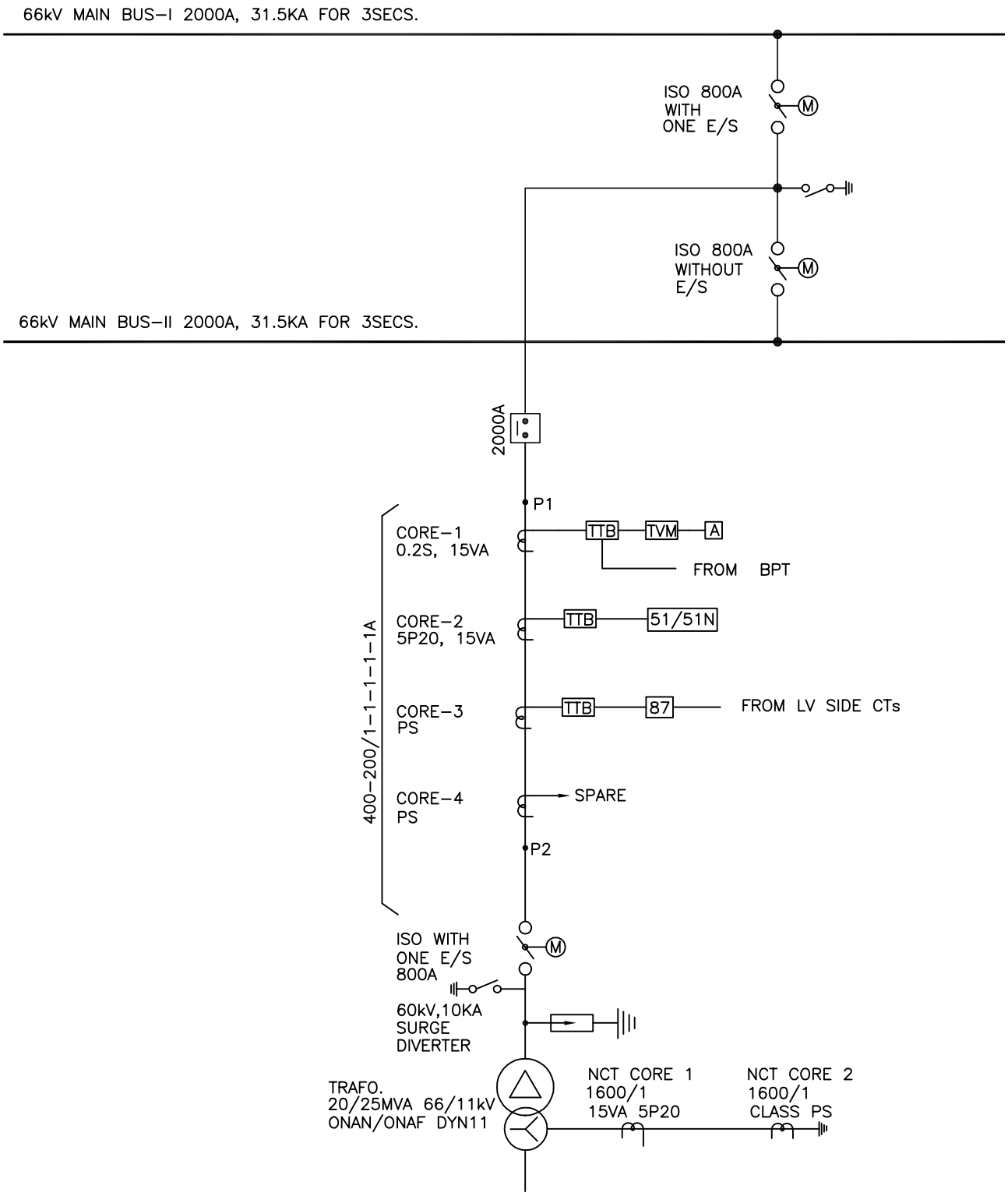
LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MOTORISED ISOLATOR WITH ONE E/S	TTB	TEST TERMINAL BLOCK
	MOTORISED ISOLATOR WITH DOUBLE E/S	51/51N	O/C & E/F RELAY
	SURGE DIVERTER	21	DISTANCE RELAY
	CURRENT TRANSFORMER	27/59	U/V & O/V RELAY
	POTENTIAL TRANSFORMER	67/67N	DIRECTTIONAL O/C & E/F RELAY
	CIRCUIT BREAKER	87	DIFFRENTIAL RELAY
V	VOLTMETER	46	NEUTRAL UNBALANCE RELAY
A	AMMETER	25	SYNC CHECK
TVM	TRIVECTOR METER		

NOTE; 1. REFER SPECIFICATION CLAUSE 11.0 FOR FUNCTIONAL DETAILS OF PROTECTION RELAYS.
2. TVM IS NOT IN SUPPLIER'S SCOPE.
3. LINE DIFFERENTIAL OR DISTANCE RELAY AS PER CLAUSE 11.2.1 OF SPECIFICATION

DRAWN	AH/AM	TITLE:– TYPICAL 66KV LINE SLD	BSES
CHECKED	SG/AS		
APPD.	GS/GN		SPEC No – BSES–TS–86–CRP–RO
DATE	03.06.22		
SCALE	NTS		DWG No.:– SLD–CRP–66KV–01

ANNEXURE–D2



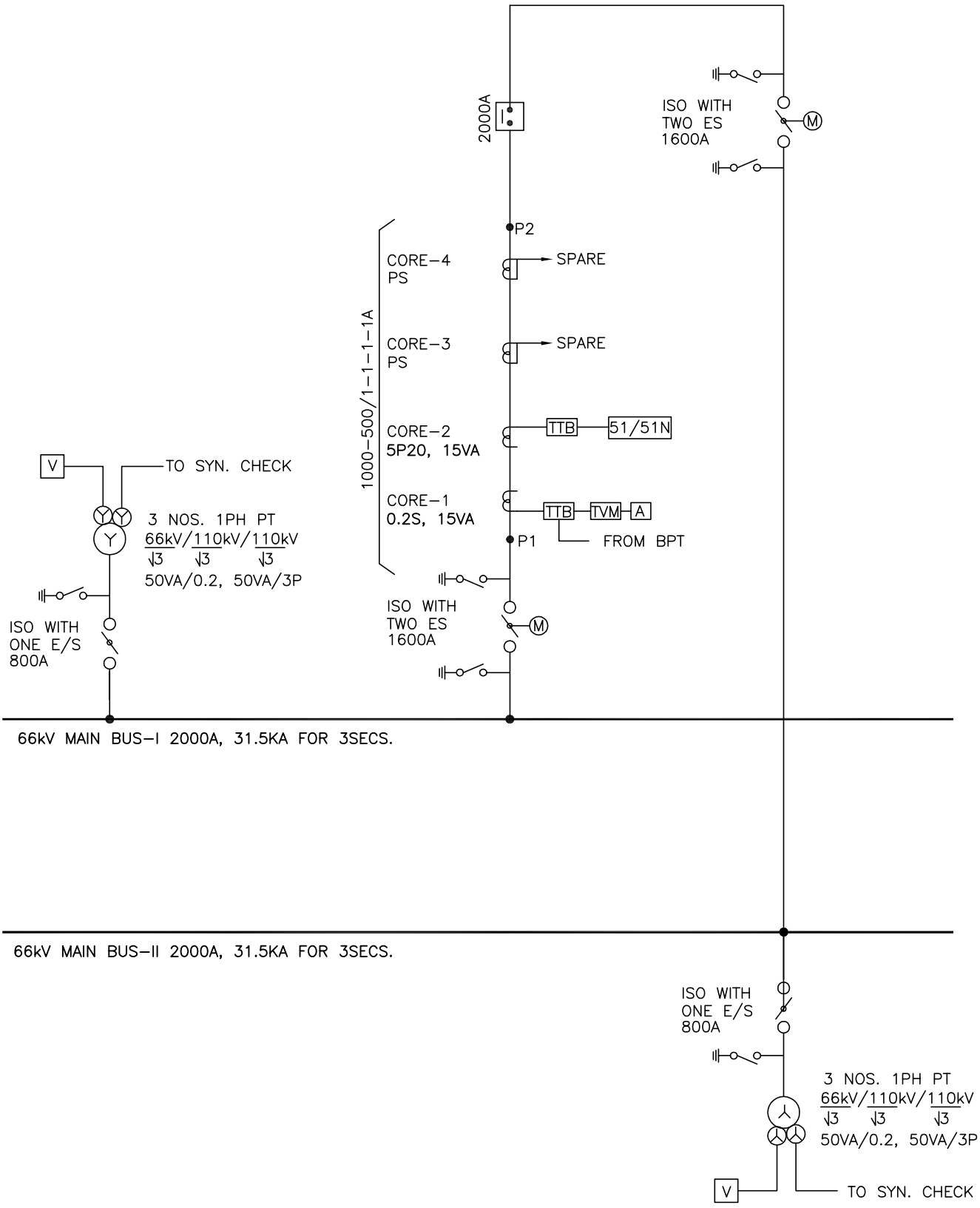
LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MOTORISED ISOLATOR WITH ONE E/S	TTB	TEST TERMINAL BLOCK
	MOTORISED ISOLATOR WITH DOUBLE E/S	51/51N	O/C & E/F RELAY
	SURGE DIVERTER	21	DISTANCE RELAY
	CURRENT TRANSFORMER	27/59	U/V & O/V RELAY
	POTENTIAL TRANSFORMER	67/67N	DIRECTIONAL O/C & E/F RELAY
	CIRCUIT BREAKER	87	DIFFRENTIAL RELAY
V	VOLTMETER	46	NEUTRAL UNBALANCE RELAY
A	AMMETER	25	SYNC CHECK
TVM	TRIVECTOR METER		

NOTE; 1. REFER SPECIFICATION CLAUSE 11.0 FOR FUNCTIONAL DETAILS OF PROTECTION RELAYS.
2. TVM IS NOT IN SUPPLIER'S SCOPE.

DRAWN	AH/AM	TITLE:– TYPICAL 66/11KV TRANSFORMER FEEDER SLD	BSES
CHECKED	SG/AS		
APPD.	GS/GN		SPEC No – BSES–TS–86–CRP–RO
DATE	03.06.22		DWG No.:– SLD–CRP–66KV–02
SCALE	NTS		

ANNEXURE–D3



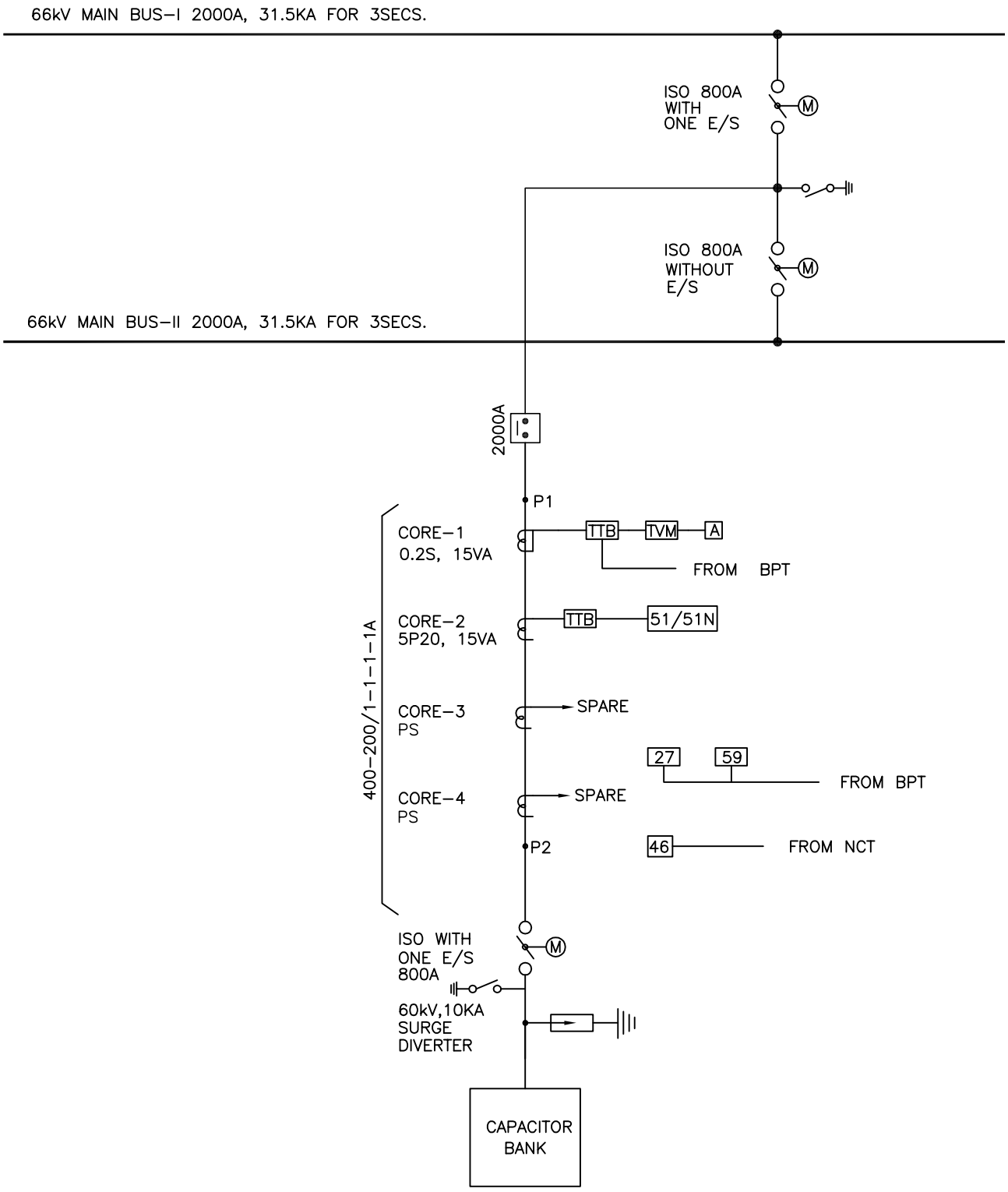
LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MOTORISED ISOLATOR WITH ONE E/S	TTB	TEST TERMINAL BLOCK
	MOTORISED ISOLATOR WITH DOUBLE E/S	51/51N	O/C & E/F RELAY
	SURGE DIVERTER	21	DISTANCE RELAY
	CURRENT TRANSFORMER	27/59	U/V & O/V RELAY
	POTENTIAL TRANSFORMER	67/67N	DIRECTTIONAL O/C & E/F RELAY
	CIRCUIT BREAKER	87	DIFFRENTIAL RELAY
V	VOLTMETER	46	NEUTRAL UNBALANCE RELAY
A	AMMETER	25	SYNC CHECK
TVM	TRIVECTOR METER		

NOTE; 1. REFER SPECIFICATION CLAUSE 11.0 FOR FUNCTIONAL DETAILS OF PROTECTION RELAYS.
2. TVM IS NOT IN SUPPLIER'S SCOPE.

DRAWN	AH/AM	TITLE:– TYPICAL 66KV BUSCOUPLER SLD	BSES
CHECKED	SG/AS		
APPD.	GS/GN		SPEC No – BSES–TS–86–CRP–RO
DATE	03.06.22		DWG No.:– SLD–CRP–66KV–03
SCALE	NTS		

ANNEXURE–D4



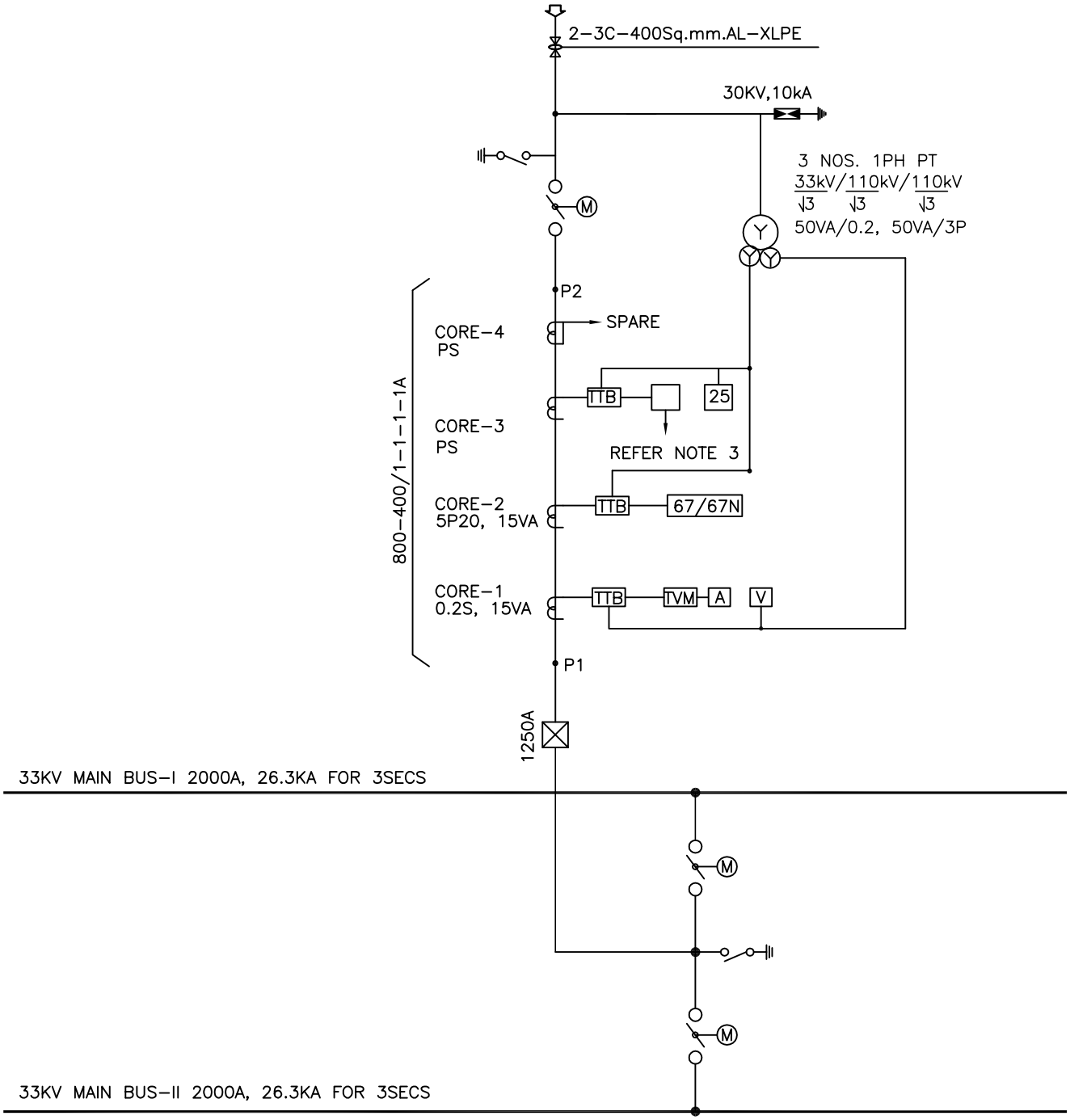
LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MOTORISED ISOLATOR WITH ONE E/S	TTB	TEST TERMINAL BLOCK
	MOTORISED ISOLATOR WITH DOUBLE E/S	51/51N	O/C & E/F RELAY
	SURGE DIVERTER	21	DISTANCE RELAY
	CURRENT TRANSFORMER	27/59	U/V & O/V RELAY
	POTENTIAL TRANSFORMER	67/67N	DIRECTTIONAL O/C & E/F RELAY
	CIRCUIT BREAKER	87	DIFFRENTIAL RELAY
V	VOLTMETER	46	NEUTRAL UNBALANCE RELAY
A	AMMETER	25	SYNC CHECK
TVM	TRIVECTOR METER		

NOTE; 1. REFER SPECIFICATION CLAUSE 11.0 FOR FUNCTIONAL DETAILSOF PROTECTION RELAYS.
2. TVM IS NOT IN SUPPLIER'S SCOPE.

DRAWN	AH/AM	TITLE:–	BSES
CHECKED	SG/AS	TYPICAL 66KV CAPACITOR BANK FEEDER SLD	SPEC No – BSES–TS–86–CRP–RO
APPD.	GS/GN		
DATE	03.06.22		DWG No.:–SLD–CRP–66KV–04
SCALE	NTS		

ANNEXURE–D5



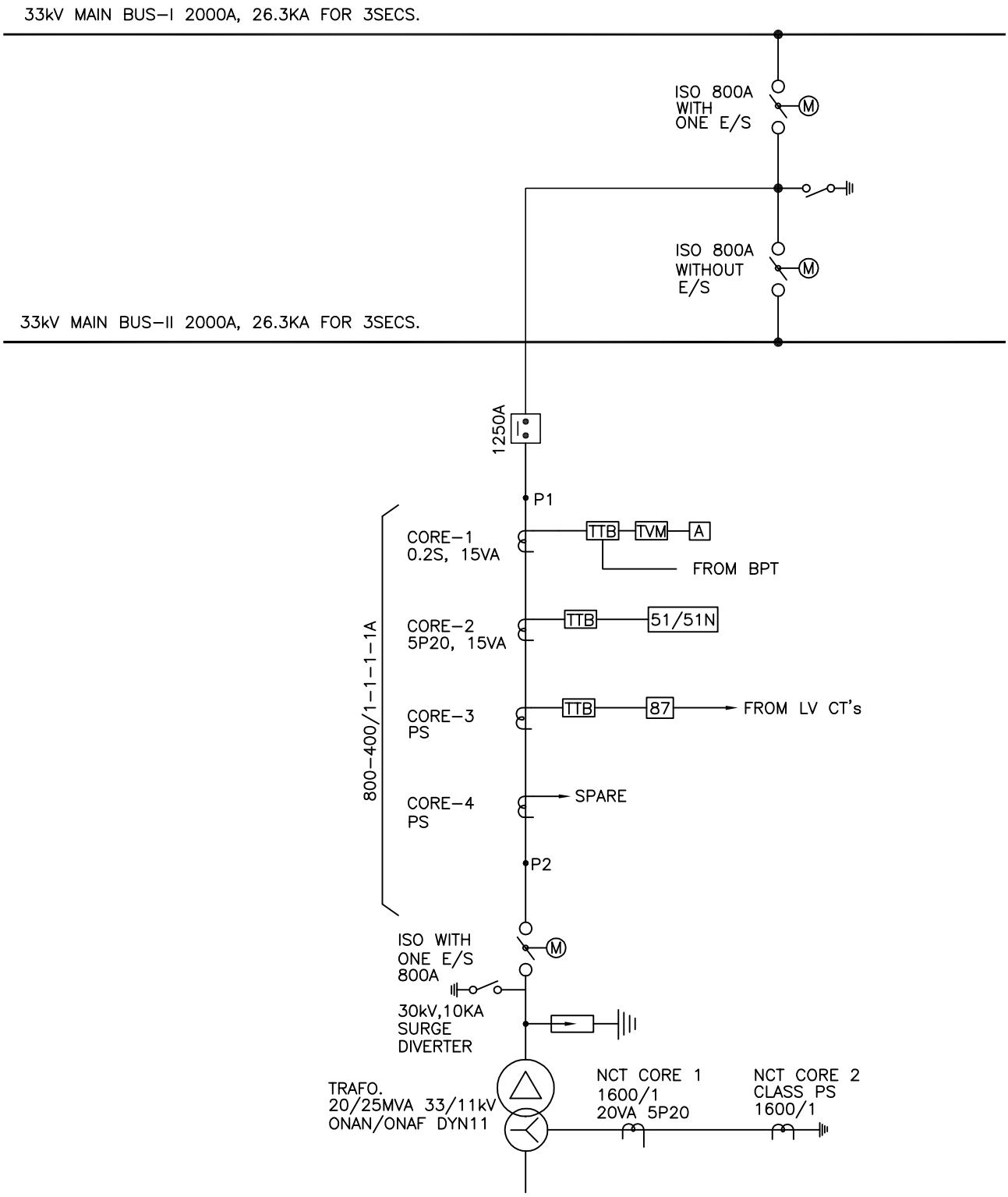
LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MOTORISED ISOLATOR WITH ONE E/S	TTB	TEST TERMINAL BLOCK
	MOTORISED ISOLATOR WITH DOUBLE E/S	51/51N	O/C & E/F RELAY
	SURGE DIVERTER	21	DISTANCE RELAY
	CURRENT TRANSFORMER	27/59	U/V & O/V RELAY
	POTENTIAL TRANSFORMER	67/67N	DIRECTIONAL O/C & E/F RELAY
	CIRCUIT BREAKER	87	DIFFRENTIAL RELAY
V	VOLTMETER	46	NEUTRAL UNBALANCE RELAY
A	AMMETER	25	SYNC CHECK
TVM	TRIVECTOR METER		

NOTE; 1. REFER SPECIFICATION CLAUSE 11.0 FOR FUNCTIONAL DETAILS OF PROTECTION RELAYS.
2. TVM IS NOT IN SUPPLIER'S SCOPE.
3. LINE DIFFERENTIAL OR DISTANCE RELAY AS PER CLAUSE 11.2.1 OF SPECIFICATION.

DRAWN	AH/AM	TITLE:– TYPICAL SLD FOR 33KV INCOMER/OUTGOING	BSES
CHECKED	SG/AS		
APPD.	GS/GN		SPEC No – BSES–TS–86–CRP–RO
DATE	03.06.22		DWG No.:–SLD–CRP–33KV–01
SCALE	NTS		

ANNEXURE–D6



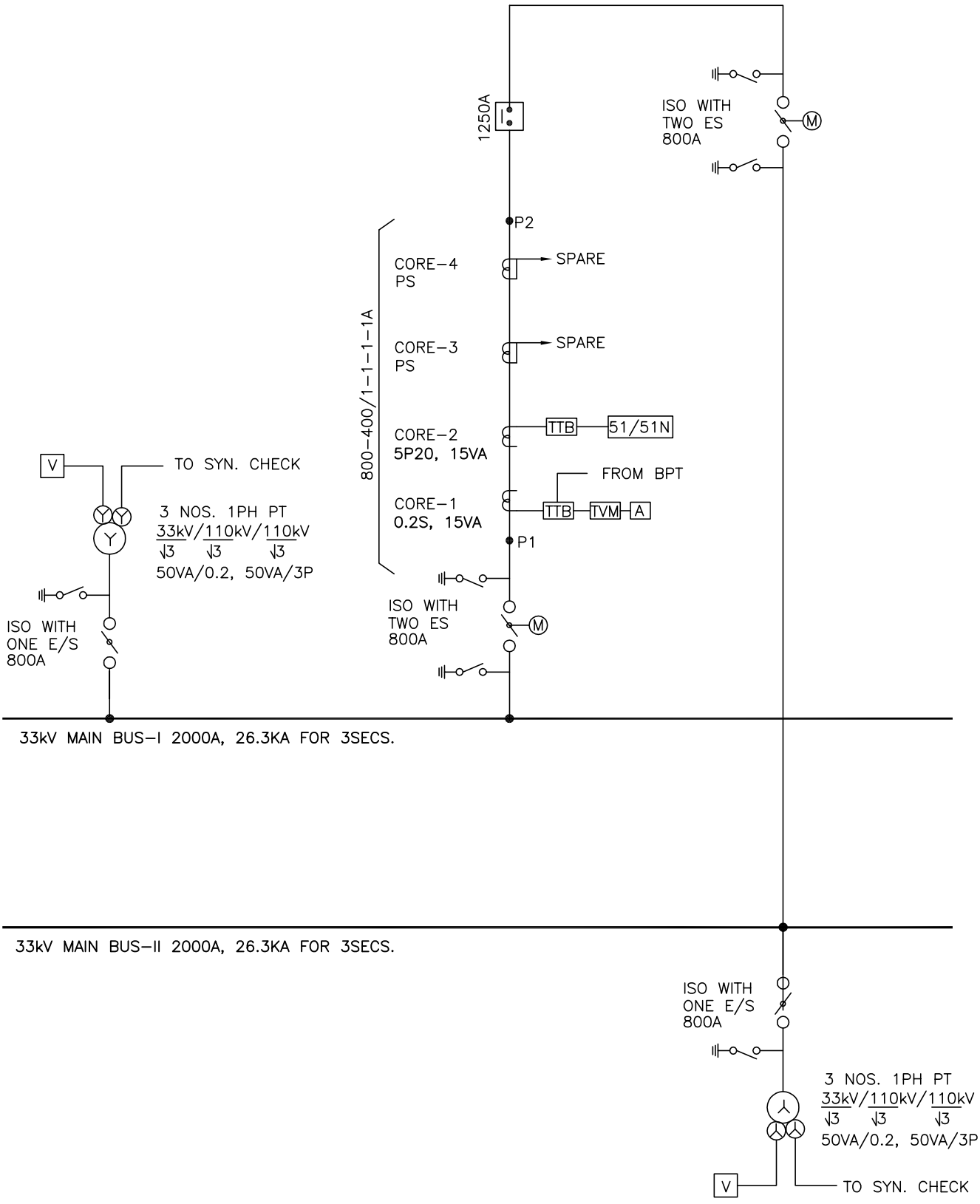
LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MOTORISED ISOLATOR WITH ONE E/S	TTB	TEST TERMINAL BLOCK
	MOTORISED ISOLATOR WITH DOUBLE E/S	51/51N	O/C & E/F RELAY
	SURGE DIVERTER	21	DISTANCE RELAY
	CURRENT TRANSFORMER	27/59	U/V & O/V RELAY
	POTENTIAL TRANSFORMER	67/67N	DIRECTIONAL O/C & E/F RELAY
	CIRCUIT BREAKER	87	DIFFRENTIAL RELAY
V	VOLTMETER	46	NEUTRAL UNBALANCE RELAY
A	AMMETER	25	SYNC CHECK
TVM	TRIVECTOR METER		

NOTE; 1. REFER SPECIFICATION CLAUSE 11.0 FOR FUNCTIONAL DETAILS OF PROTECTION RELAYS.
2. TVM IS NOT IN SUPPLIER'S SCOPE.

DRAWN	AH/AM	TITLE:– TYPICAL 33/11KV TRANSFORMER FEEDER SLD	BSES
CHECKED	SG/AS		
APPD.	GS/GN		SPEC No – BSES–TS–86–CRP–RO
DATE	03.06.22		DWG No.:–SLD–CRP–33KV–02
SCALE	NTS		

ANNEXURE–D7



LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MOTORISED ISOLATOR WITH ONE E/S	TTB	TEST TERMINAL BLOCK
	MOTORISED ISOLATOR WITH DOUBLE E/S	51/51N	O/C & E/F RELAY
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	CURRENT TRANSFORMER	27/59	U/V & O/V RELAY
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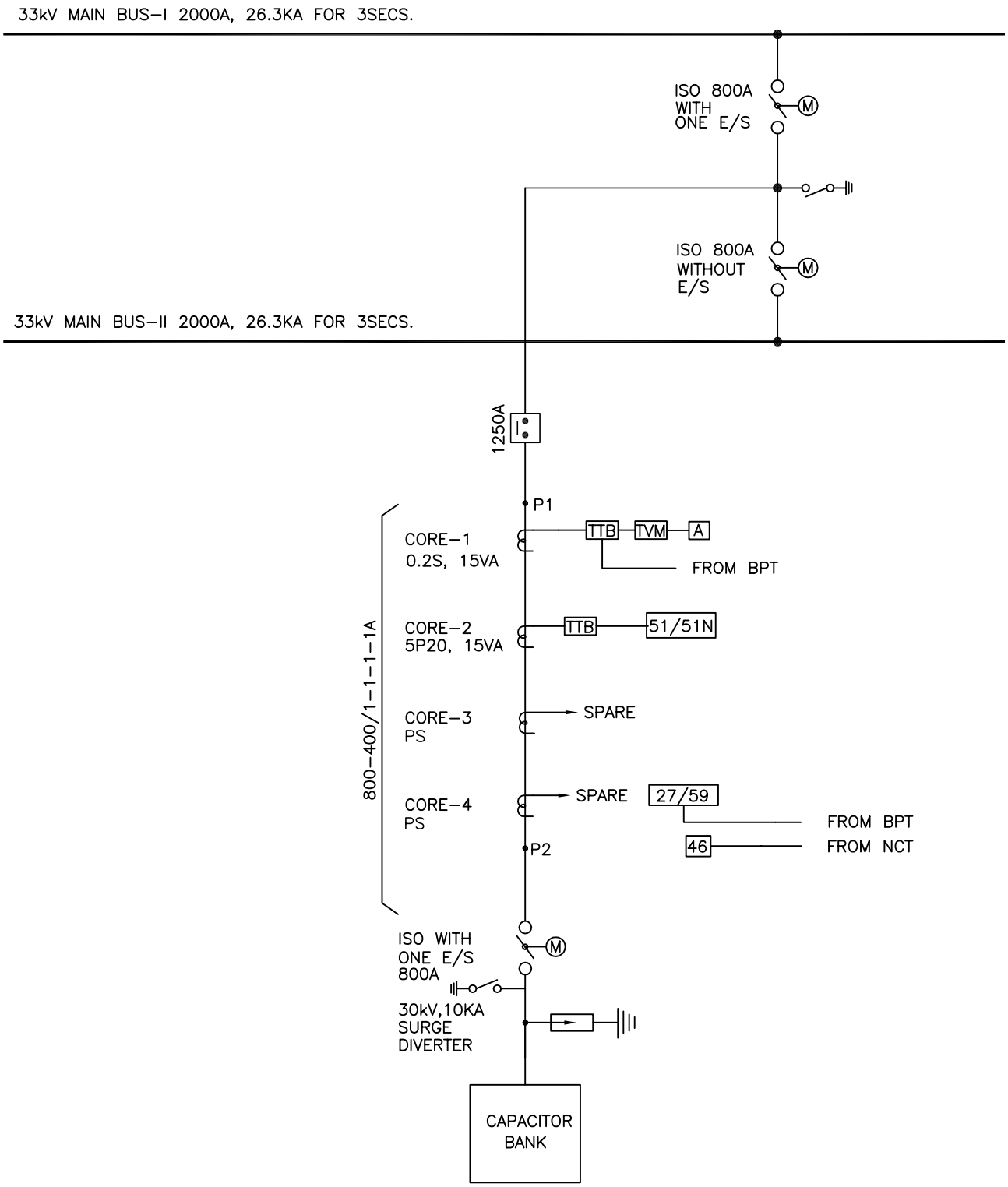
	CIRCUIT BREAKER	87	DIFFRENTIAL RELAY
V	VOLTMETER	46	NEUTRAL UNBALANCE RELAY
A	AMMETER	25	SYNC CHECK
TVM	TRIVECTOR METER		

NOTE; 1. REFER SPECIFICATION CLAUSE 11.0 FOR FUNCTIONAL DETAILS OF PROTECTION RELAYS.
2. TVM IS NOT IN SUPPLIER'S SCOPE.

DRAWN	AH/AM	TITLE:– TYPICAL 33KV BUSCOUPLER SLD	BSES
CHECKED	SG/AS		
APPD.	GS/GN		SPEC No – BSES–TS–86–CRP–R0
DATE	03.06.22		DWG No.:– SLD–CRP–33KV–03
SCALE	NTS		

ANNEXURE–D8



LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MOTORISED ISOLATOR WITH ONE E/S	TTB	TEST TERMINAL BLOCK
	MOTORISED ISOLATOR WITH DOUBLE E/S	51/51N	O/C & E/F RELAY
	SURGE DIVERTER	21	DISTANCE RELAY
	CURRENT TRANSFORMER	27/59	U/V & O/V RELAY
	POTENTIAL TRANSFORMER	67/67N	DIRECTTIONAL O/C & E/F RELAY
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A	AMMETER	25	SYNC CHECK
TVM	TRIVECTOR METER		

NOTE; 1. REFER SPECIFICATION CLAUSE 11.0 FOR FUNCTIONAL DETAILS OF PROTECTION RELAYS.
2. TVM IS NOT IN SUPPLIER'S SCOPE.

DRAWN	AH/AM	TITLE:– TYPICAL 33/11KV CAPACITOR BANK FEEDER SLD	BSES
CHECKED	SG/AS		
APPD.	GS/GN		SPEC No – BSES–TS–86–CRP–R0
DATE	03.06.22		DWG No.:–SLD–CRP–33KV–04
SCALE	NTS		

BSES

TECHNICAL SPECIFICATION OF BAY MARSHALLING KIOSK

Specification no – BSES-TS-42-BMK-R0

Rev:		0
Date:		22 Apr 2022
Pages		13
Prepared by	Jeena Borana	
	Alok Mandal	
Reviewed by	Srinivas Gopu	
	Abhinav Srivastava	
Approved by	Gaurav Sharma	
	Gopal Nariya	

INDEX

1.0 SCOPE OF SUPPLY

Design, manufacture, assembly, testing at stages of manufacture, final testing at manufacturer works on completely assembled bay marshalling Kiosk before dispatch, packing, delivery and submission of all documentation for the bay marshalling Kiosk.

2.0 CODES & STANDARDS

Materials, equipment and methods used in the manufacture of Bay Marshalling Kiosk shall conform to the latest edition of following standards:

IS 12063	Classification of degrees of protection provided by enclosure of electricalequipment
IS 5039	Distribution pillars for voltage not exceeding 1000V AC and 1200V DC
IS 2147	Degree of Protection provided by enclosures for low voltage switchgearand controlgear.
IS 5133 Part I	Boxes for enclosure of the electrical accessories: Steel and Cast ironboxes
IS 8828	Circuit breaker for overcurrent protection for household & similarinstallations.
IS 6005	Code of practice for phosphating iron and steel.
IS3202	Code of practice for climate proofing.
IS 2551	Danger Notice Plates
IS 4237	General requirement for switchgear & controlgear for voltage notexceeding 1000V AC & 1200V DC.
IS 8623	Low voltage switchgear & controlgear assemblies
	Indian Electricity Rules
	Indian Electricity Act

3.0 SERVICE CONDITIONS

3.1	Average grade atmosphere:	Heavily polluted, dry
3.2	Maximum altitude above sea level	1000 M
3.3	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
3.4	Minimum ambient air temperature	0 Deg C
3.5	Relative Humidity	100 % Max
3.6	Thermal Resistivity of Soil	150 Deg.C cm/W
3.7	Seismic Zone	4 as per IS 1893
3.8	Rainfall	750 mm concentrated in four months
3.9	Wind Pressure	195Kg/m2 up to 30M elevation as per IS 875-1975

4.0 DESIGN PARAMETERS

4.1	Type	Bay marshalling Kiosk shall be made out of sheet metal, suitable for Outdoor application, vertical self standing enclosure.
4.2	Enclosure	a) Made out of GI sheet (min 120 gsm) of not less than 2 mm thick at the side and Top. b) Degree of protection- IP 55
4.3	Design	BMK Shall be dust and vermin proof, suitable for humid, dusty and tropical atmosphere. Lifting lugs shall be provided to the top. It shall have doomed or sloping roof. Hinged type door shall be provided in front of enclosure. Door shall have handle and provision of padlocking arrangement.
4.4	Internals of marshalling Kiosk	
4.4.1	Terminal block	BMK shall have three distinct sets of Terminal block in vertical formation required for a) AC & DC Distribution up to 415V for AC and 220V for DC. b) For CT & PT connections c) For other potential free contacts.
4.4.2	Type of Terminal	a) AC and DC distribution terminals shall be non-disconnecting stud type. Refer figure-1 for terminal sizes. b) CT & PT terminals shall be disconnecting Stud type suitable for 6mm^2 copper cable. c) For other potential free contacts terminals shall be stud type suitable for 6 mm^2 copper cable.
4.4.3	Design	The terminal blocks shall be made of non-inflammable, molded resin / polyamide with integrally molded barriers, brass inserts & removable transparent covers. Each terminal shall be clearly marked with identification number or letters Each terminal shall have provision for insertion of banana plugs for testing. Marshalling Kiosk shall have followings: a) To receive 415V AC 3phase 4wire and distribution as per scheme in figure -1. b) To receive DC supply and distribution as per scheme in figure-1.

4.4.4	Distribution MCB	The MCB for AC and DC power supply shall be mounted in horizontal configuration at the bottom. For AC circuit MCB shall be 4Pole and 2Pole. For DC it shall be 2 Pole. Partition barrier shall be provided for identification of AC and DC
4.4.5	Wiring	Copper flexible 1.1Kv grade PVC insulated, FRLS grade. The wiring shall be neatly bunched, supported and should be readily accessible, PVC troughs shall be provided.
4.5	Cable Entry	Removable cable gland plate shall be provided at the bottom made out of not less than 2.5mm thick sheet. Proper PVC conduit shall be provided for dressing of wires up to the terminals.
4.6	Panel Illumination	A lamp with Door limit switch shall be provided for illumination of panel. A 5/15 power socket shall also be provided.
4.7	Heater	A heater with thermostat and Fuses shall be provided inside the panel.
4.8	Earthing	Two no's earthing terminals shall be provided at both side for earthing.
4.9	Painting	
4.9.1	Painting surface preparation	Powder coating with min thickness 85 microns and anti-corrosion coating at welded joints.
4.9.2	Painting external finish	692 as per IS 5 on external side and Glossy white inside enclosure.

5.0 FITTINGS AND ACCESSORIES

5.1	Rating and Diagram Plate	Required
5.1.1	Material	Anodized aluminum 16SWG
5.1.2	Background	Satin Silver
5.1.3	Letters, diagram & border	Black
5.1.4	Process	Etching
5.2	Name plate details	a) Equipment Name b) Company Name c) PO no. and date d) Sr. No. e) Year of manufacturing-mm/yy f) Guarantee Period

6.0 APPROVED MAKE OF COMPONENTS

6.1	Connectors	Connectwell, Elmex, Phoenix
6.2	Flexible wire	Finolex, Lapp Kabel
6.3	MCB	Schneider, L&T, Siemens, Legrand
6.4	Space heater with thermostat	Elcon, Girish

Note – Any other make of component to be approved by purchaser

7.0 QUALITY ASSURANCE

7.1	Vendor quality plan	To be submitted for purchaser approval.
7.2	Inspection point	To be mutually identified and agreed inquality plan

8.0 PROGRESS REPORTING

8.1	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, packing, dispatch, documentation programme.
8.2	Detailed Progress report	To be submitted to Purchaser once a monthcontaining a) Progress on material procurement b) Progress on fabrication (As applicable) c) Progress on assembly (As applicable) d) Progress on internal stage inspection e) Reason for any delay in total programme f) Details of test failures if any in manufacturing stages. g) Progress on final box up Constraints / Forward path

9.0 DRAWING, DATA & MANUALS

9.1	To be submitted along with bid	Seller has to submit: a) Tentative GA / cross sectional drawing of product showing all the views / sections b) Detailed reference list of customers already using the offered product during the last 5 years with particular emphasis on units of similar design and rating c) Completely filled GTP d) Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted e) Details of manufacturer's quality assurance standards and programme and ISO 9000 series or equivalent national certification f) Type test reports shall be submitted for the type, size & rating of product / equipment offered along with bid. In case the type test report for identical product is not available then type test report of nearby size /rating shall be submitted for review. They shall be considered valid for 5 years from date of test performed on product /equipment. g) Complete product catalogue and Manual along with the bid.
9.2	After award of contract, seller has to submit mentioned drawings for buyer's Approval (A) / Reference (R)	a) Programme for production and testing (A) b) Guaranteed Technical Particulars (A) c) Calculations to substantiate choice of electrical, structural, mechanical component size / ratings (A) d) Detailed dimensional drawing for all components, general arrangement drawing showing detailed component layout and detailed schematic and wiring drawings for all components. e) Terminal arrangement details etc (as applicable) (A) f) Drawing of major components (A) g) Rating and diagram plate (A) Detailed loading drawing to enable the buyer to design and construct foundations (as applicable) (R) h) Transport / Shipping dimensions with weights. etc (As applicable) (R) i) List of makes of all components (A) j) Detailed installation and commissioning instructions (R) k) Quality plan

9.3	Submittals required prior to dispatch	a) Inspection and test reports, carried out in manufacturer's works (R) b) Test certificates of all bought out items c) Operation and maintenance Instruction as wellas trouble shooting charts/ manuals
9.4	No of drgs./Documents required at different stages	As per Annexure A Scope of Supply

10.0 INSPECTION & TESTING

10.1	Inspection and Testing during manufacturing	
10.2	Sheet metal Box / Panel	a) Checking of dimensions as per approved drawing. b) Checking for thickness of sheet metal. c) Thickness of Paint as applicable
10.3	Connectors/MCB/Wire	Check for routine electrical test.
10.4	Routine tests	Following routine test shall be conducted on each BMK : a) Dimensional Checks b) Degree of protection for enclosure (paperinsertion test) c) Test for paint thickness. d) HV/IR tests e) Functional tests.
10.5	Type Tests	a) On cubicle of each rating and type b) IP Protection test.
		In case the product is never type tested earlier, seller has to conduct the type tests from CPRI/ERDA/ NABL accredited test labs at their own cost, before commencement of supply.
10.6	Acceptance test	Following routine test shall be conducted on each BMK a) Dimensional Checks b) Degree of protection for enclosure (paperinsertion test) c) Test for paint thickness. d) HV/IR tests e) Functional tests.

11.0 PACKING , SHIPPING, HANDLING AND STORAGE

11.1	Packing	
11.1.1	Packing protection	Against corrosion, dampness, heavy rains,breakage and vibration
11.1.2	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection and identification labels.
11.1.3	Packing identification label	In each packing case, following details are required : a) Individual serial number b) Purchaser's name c) PO number(along with SAP item code, ifany) & date d) Equipment Tag no. (if any) e) Destination f) Manufacturer/Supplier's name g) Address of manufacturer/supplier's / itsagent h) Description and quantity i) Country of origin j) Month and year of manufacturing k) Case measurements l) Gross and net weights in kilograms m) All necessary slinging and stackinginstructions.
11.2	Shipping	a) The bidder shall ascertain at an early dateand definitely before the commencement of manufacture, any transport limitations suchas weights, dimensions, road culverts, Overhead lines, free access etc. from the manufacturing plant to the project site; and furnish to the Purchaser confirmation that theproposed packages can be safely transported, as normal or oversize packages, up to theplant site. Any modifications required in theinfrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser. b) The seller shall be responsible for all transitdamage due to improper packing.
11.3	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

12.0 DEVIATIONS

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

Annexure – A - Guaranteed Technical Particulars

Sr No	Description	Data by purchaser	Data by Supplier
1.0	Location of equipment	Project specific to be filled up	
2.0	Name of manufacturer		
2.1	Address & contact details		
3.0	Type		
3.1	Manufacturer Model no		
4.0	Degree of protection of enclosure	IP55	
5.0	Thickness of sheet metal enclosure		
5.1	- Top & side sheet	2.0mm min.	
5.2	- Bottom sheet	2.5mm min.	
6.0	Internal lamp with door switch provided		
7.0	Rating of space heater with thermostat		
8.0	Rating of plug and socket	5/15 Ampere	
9.0	Terminal Blocks		
9.1	Make and type		
9.2	Rating		
9.3	Number of terminals provided	As per Fig 1	
9.4	Suitable for conductor size		
9.5	20% spare terminals provided for scheme furnished		
10.0	Miniature circuit breaker		
10.1	Make and type		
10.2	Rated voltage & frequency		

Sr No	Description	Data by purchaser	Data by Supplier
10.3	No. of poles		
10.4	Current rating		
	- Continuous at 50DEG C		
	- Short time for 1 sec.		
10.5	Breaking capacity		
	- Symmetrical		
	-Asymmetrical		
10.6	Type of blow out device		
10.7	Type of overload device		
10.8	Terminals suitable for cable size		
10.9	Whether provided with 2NO/2NC aux. Contacts		
11.0	Cables and Wire		
11.1	Voltage grade	1.1KV	
11.2	Conductor		
11.3	-Material	Copper	
11.4	-Size	10 & 6mm2	
12.0	Overall dimensions (depth, width & height)		
13.0	Details of earthing studs		

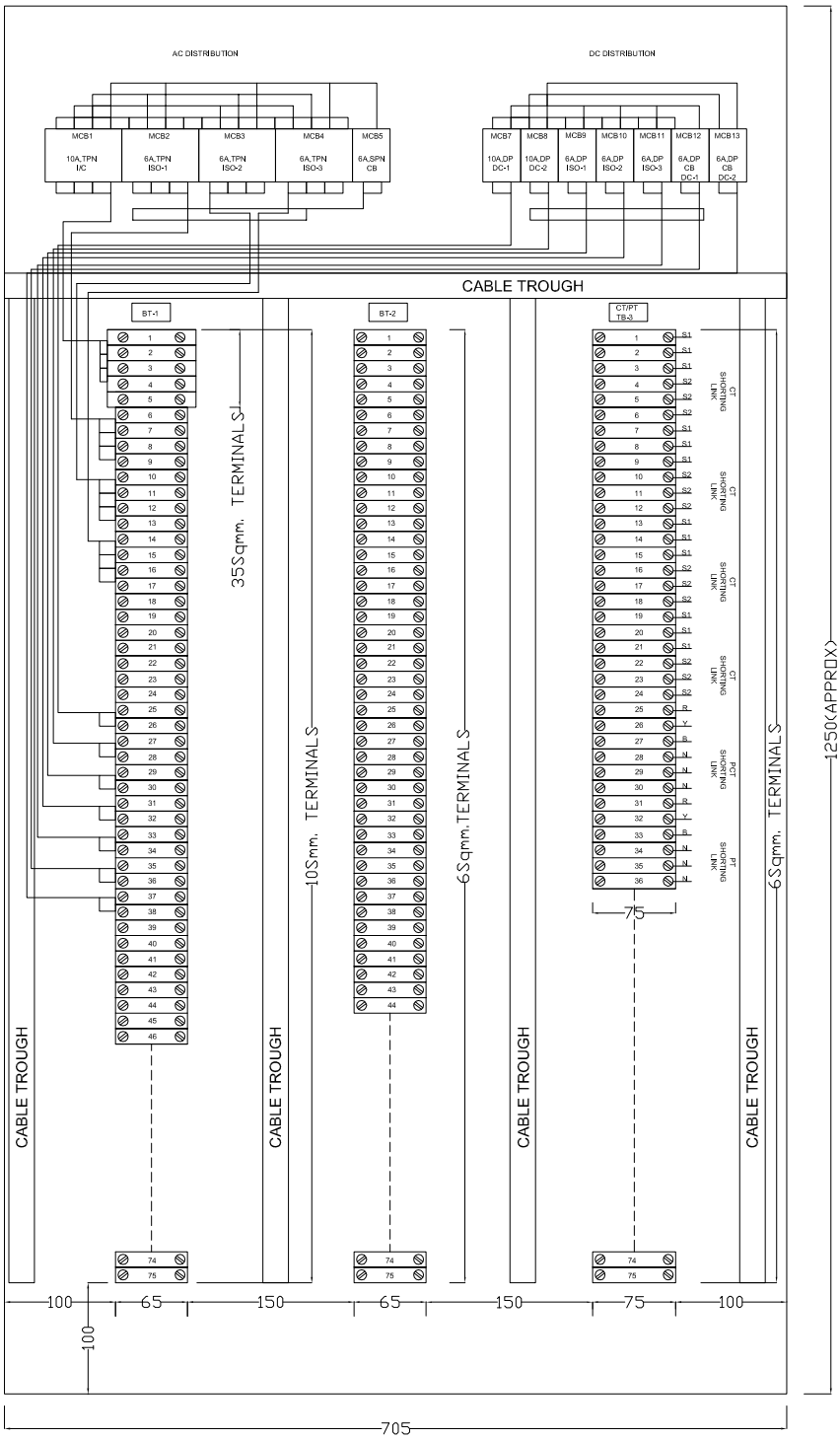
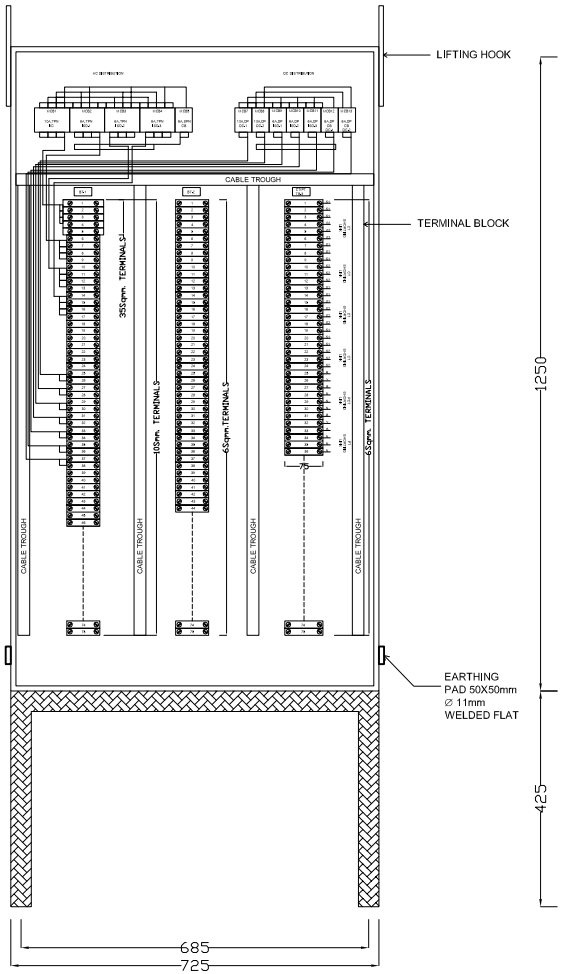


FIGURE-1-SCHEMATIC DIAGRAM

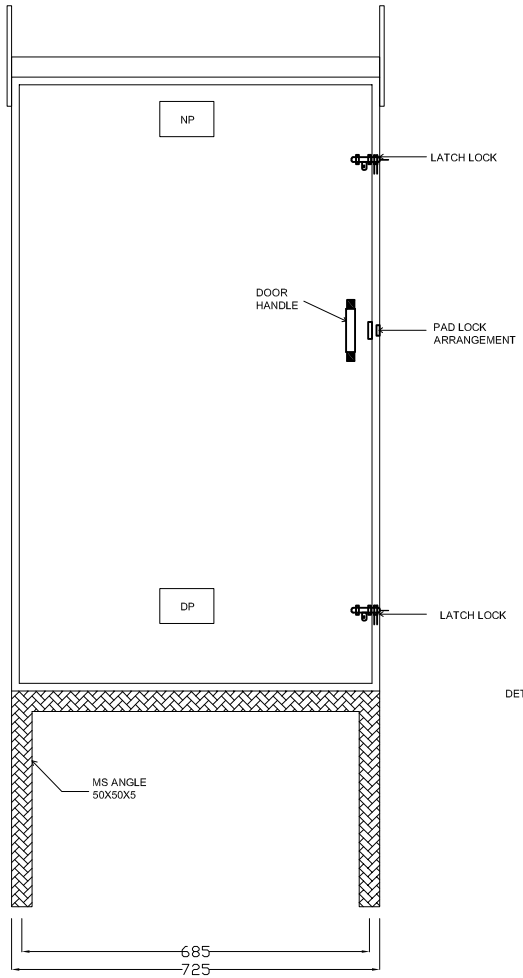
Note-

1. Terminal block TB-1 (75nos) ,TB-2 (75nos) ,shall be non disconnecting stud type.
2. Terminal block TB-3 (75nos) ,shall be disconnecting stud type.
3. Cable Trough shall be provided along the terminal blocks.
4. Busbar type links should be used for CT/PT star point formation . 6nos. spare links to be provided for shorting of spare core of CT.
5. All dimension are in mm.

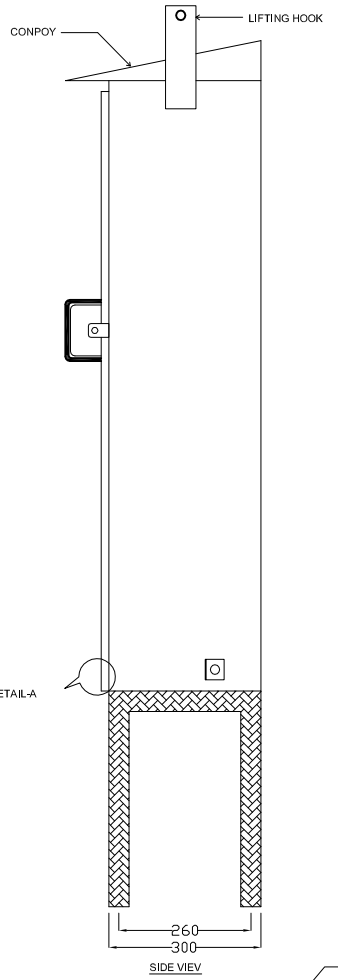
TITLE:-
SCHEMATIC DIAGRAM



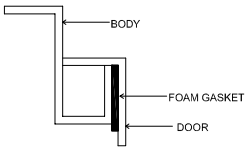
FRONT VIEV WITHOUT OUTER DOOR



FRONT VIEV WITH OUTER DOOR

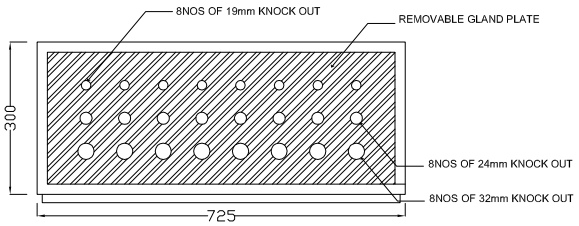


SIDE VIEV

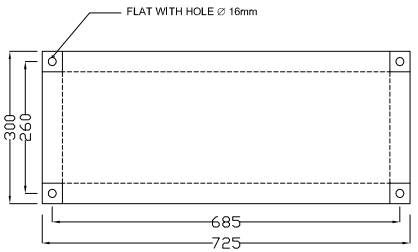


GASKET ARRANGEMENT FOR
OUTER DOOR

DETAIL-A



BOTTOM VIEV



FOUNDATION DETAIL

1. All dimension are in mm.
2. Degree of Protection IP-55 Outdoor type
3. Cable entry shall be from bottom
4. Fabrlcatlon shall be galvanlzed sheet of 120 GSM (mln) top and slde door 2.0mm and bottom sheet/gland Plate 2.5mm
5. Gasket materlal shall be EPDM/Foam type
6. Paint shade 692 as per IS:5, internal paint glossy white the thickness of powder coating shall be 85 microns (min.)
7. 1.1kV grade PVC Insulated frls copper flexlle wlre shall be provlded
8. Earthlng of gasketed jolnts shall be wlth 4sqmm CU wlre
9. Name plate and danger plate shall be made of 1.6mm thick AL plate
10. Busbar type links should be used for CT/PT star point formation. 6No's spare links to be provided for shorting of spare core of CT.

BSES
TITLE:-
BAY MARSHALLING KIOSK

Technical Specification

Of

Insulated Floor Coating

Specification no – BSES-TS-75-INFC-R0

Rev:		0
Pages:		1 of 7
Date:		06 May 2022
Prepared by	Abhishek Harsh	3267d7c3-82b5-46cb-b5a6-867ee7820a34
Reviewed by	Srinivas Gopu	5d32525e-ed3a-4f41-b1c7-b8a5e77d1519
Approved by	Gaurav Sharma	23dc2de2-95de-4472-99a7-dea873f472b6

INDEX

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

1 SCOPE

This specification covers the basic requirement, the testing and inspection, supply and installation/fixing of insulating paints on floors in front of the switchgear panels at BYPL/BRPL grid locations.

2 STANDARDS AND CODES

2.1.	IS 15652:2006	Specification of Insulating mats for electrical purposes
2.2.	CEA guidelines, 2010	Measures relating to safety and Electric supply

3 SERVICE CONDITION

3.1	Location	Indoor
3.2	Average grade atmosphere	Heavily polluted, Dry
3.3	Maximum altitude above sea level	1000M
3.4	Ambient air temperature	Highest 50Deg C Average 40Deg C
3.5	Minimum ambient air temperature	0 Deg C
3.6	Relative Humidity	100%
3.7	Rainfall	750mm concentrated in four months
3.8	Seismic Zone	IV

4 GENERAL REQUIREMENTS OF INSULATING PAINTS ON FLOORS

4.1	General Properties	a. The Insulating coating shall be self-levelling, solvent free, and have high breakdown voltage, loaded with special insulating additives. b. The material of the insulating floor shall be epoxy resin. c. It shall be resistant to chemicals and oils. d. It shall be tough, wear & weather resistant. e. It shall exhibit high build, high adhesion with smooth and glossy finish and slip resistant. f. It shall be easy to apply/install, clean and repair on floors.
4.2	Colour of the finished item	The insulating floors shall be light Grey in colour

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4.3	Class of the insulating floor to be used	For 11kV voltage : Class B For 33kV voltage : Class C
4.4	Thickness of the paint on floor	For 33kV voltage : 3 mm +/- 10% For 11kV : 2.5 mm +/- 10%
4.5	AC proof voltage	For 33kV : 36kV minimum For 11kV: 22 kV minimum
4.6	Dielectric strength	For 33kV: 65kV rms For 11kV: 45kV rms

5 TESTING AND INSPECTION

5.1	Routine and Acceptance tests in the factory	All the routine and acceptance tests shall be performed as per IS 15652. The purchaser reserves the right to witness the tests at the time of inspection.
5.2	Inspection at site	The purchaser reserves the right to verify the material at the time of applying the insulating floors at site. Following tests shall also be verified at site: 1. Dielectric strength 2. Ac proof voltage 3. Thickness
5.3	Type Test Reports	All the Type test reports of the material to be used as the insulating floors as per IS 15652 from CPRI/ERDA shall be submitted.

6 INSTALLATION

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

6.1	Application of insulating paints	a. The insulating paint shall be applied in accordance with manufacturer's installation procedure. b. The purchaser may witness the painting process.

7 INSPECTION AND TESTING

7.1	Type test	Equipment should be of type tested quality only, type test certificate to be submitted along with offer. If the manufacturer's lab is accredited by govt. / authorized body then it shall be acceptable for type testing.
7.2	Acceptance & Routine tests	As per relevant Indian standard

8 PACKING, SHIPPING, HANDLING AND SITE SUPPORT

8.1	Packing Protection	The packing shall be fit to withstand rough handling during transit and storage at destination. The test set should be properly protected against corrosion, dampness & damage.
8.2	Packing for accessories and spares	Robust non-returnable packing case with all the above protection & identification Label. The bidder should get the packing list approved before dispatching the material.
8.3	Packing Identification Label	On each packing case, following details are required:
8.3.1	Individual serial number	
8.3.2	Purchaser's name	
8.3.3	PO number (along with SAP item code, if any) & date	
8.3.4	Equipment Tag no. (if any)	
8.3.5	Destination	
8.3.6	Manufacturer / Supplier's name	
8.3.7	Address of Manufacturer / Supplier / it's agent	
8.3.8	Description	
8.3.9	Country of origin	

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8.3.10	Month & year of Manufacturing	
8.3.11	Case measurements	
8.3.12	Gross and net weight	
8.3.13	All necessary slinging and stacking instructions	
8.4	Shipping	The seller shall be responsible for all transit damage due to improper packing.
8.5	Handling and Storage	Manufacturer instruction shall be followed.
8.6	Detail handling & storage instruction sheet / manual to be furnished before commencement of supply.	

9 DEVIATIONS

9.1	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

10 DOCUMENT SUBMISSION

Drawing submission shall be as per the matrix given below. All documents/ drawing shall be provided on A3/A4 sheet in box file with separators for each section. Also provide USB containing pdf with bid for soft copy. Language of the documents shall be English only. Deficient/ improper document/ drawing submission may liable for rejection

S. No	Head	Bid	Drawing Approval	Pre Dispatch	Pre Closure
15.1	Contact Person Name, Email ID and Mobile Number	Required			
15.2	Deviation Sheet	Required	Required		
15.3	Type Test	Required			
15.5	Manufacturer's quality assurance plan and certification for quality standards		Required		
15.6	Datasheet		Required		

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15.7	Floor Layout		Required		
15.13	GTP	Required	Required		
15.14	QAP		Required		
15.15	BOQ		Required		
15.19	Make of all Component as per specification		Required		
15.20	Inspection Report			Required	
15.21	As manufacturing Drawings			Required	
15.22	Operation and Maintenance Manual			Required	Required
15.24	As built Drawings				Required
15.25	Test Report				Required

11 GUARANTEED TECHNICAL PARTICULARS

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

DocUUID : 0741b82a-0e63-45fd-a24f-3f04776609e6

TECHNICAL SPECIFICATION

FOR

SCADA NETWORK & INTEGRATION

PREPARED BY	APPROVED BY	REV	02
		DATE	17th Jan 2023
RK	AV	PAGE	1 OF 15

INDEX

1.0 SCOPE

A. This specification is intended to cover the supply, erection, testing and commissioning of SCADA Network and Integration associated hardware/software (like protocol converters), cables, accessories and other material required for interfacing of all electrical equipments with existing ABB RTU560 for efficient and trouble free operation.

A.1. ABB RTU panel is multi processor CMR02 based having required nos. of co processor and main processor and having redundant power supply. Main processor is having Ethernet ports and serial ports. Ethernet port of main processor is connected to LAN Switch (to be provided by BSES) for communication with Master Control Centre on IEC 104 Protocol.

A.2. The co processors are having Ethernet ports which are responsible to communicate to all numerical relays and Digital RTCC on IEC 61850 protocol.

A.3. The co processors are having serial ports which are responsible to communicate to all multifunction meters (MFMs) and battery charger on Modbus protocol through RS485 network.

A.4. The main processors and co processors are having the licenses of IEC61850, MODBUS RTU MASTER & PLC, Archive, HMI, IEC 103 and IEC 104.

B. The devices i.e. Numerical relays, digital RTCC, MFMs, battery charger etc. on serial and LAN should have redundant media and redundant co processor connectivity.

C. This specification shall be used in conjunction with all specifications, data sheets, single line diagrams, and other drawings attached to the specification / purchase requisition.

2.0 SCADA NETWORK

2.1	INFRASTRUCTURE	i. All numerical relays & transformer monitoring units shall be connected to RTU in parallel redundancy protocol (PRP). ii. The communication shall be made in 1+1 mode, including the links between numerical relays & TMUs to switch and up to RTU, such that failure of one set of communication shall not affect the normal operation of system. However it shall be alarmed in RTU. iii. Data exchange is to be realized on dual star Bus topology using IEC 61850 protocol with a redundant managed switched on Ethernet communication infrastructure. iv. MFMs shall be connected to RTU through RS485 network with SPD so loop shall be prepared in daisy chain fashion. v. Devices connected to single loop shall not be more than 10 IEDs.

		vi. Network architecture shall be approved by BYPL SCADA team.
2.2	SCOPE OF WORK	i. Laying and termination of cat 6 cables from CRP switch to RTU Switch shall be done in suitable size of PVC Pipe. ii. Laying and termination of RS 485 cables shall be done in PVC Pipe of minimum 2 inch. iii. Laying and termination of FO patch cord from IEDs to CRP LAN Switch through suitable size PVC conduit.
2.3	SCOPE OF SUPPLY	i. All the hardware required to extend the relay signals to the RTU shall be supplied along with the switchboards. ii. Aux supply of these hardware devices shall be same as grid control voltage having wide range (-20% to +20%). iii. All communication hardware or protocol converters required for compatibility with existing RTU system shall be in bidder's scope.
2.3.1	Ethernet switches	The IEC 61850 compliant Managed Ethernet switch shall meet the demand of power system automation systems (IEC 61850-3, IEEE 1613 compliance). i. Ethernet switch shall be layer 2 industrial grade. ii. Ethernet switch shall be modular with SFP for copper and LC multimode fiber port. iii. Ethernet switch port shall be approve by engineering in charge of SCADA. iv. Ethernet switch shall be 19" rack mounted. v. Ethernet switch shall operate at grid supply voltage with range +20% to -20% VDC. vi. Operating Temperature: -40°C to +85°C. vii. All port shall be user configurable with minimum configuration of 100Mbps. viii. Communication type: Fiber Optics media and LC Connector compatible with IEDs supplied with CRP, As Per Site and Ethernet copper CAT6 OR above cable. Further approval at the time of final engineering approval. ix. LED indicators on all ports shall be blinking with data transfer. x. The switch should have a diagnostic/ error/ warning LED.

		xi. It should support remote user setting configuration. xii. It should own separate maintenance/ console port. xiii. Latency shall be not more than 10ms. xiv. Should be KEMA, CE and FCC Certified. xv. Switch should be extendable for future expansion. xvi. Minimum 20% spares of utilized hardware and accessories to be provided by the supplier/ BA. xvii. On-site warranty for the switch must be 5 years. The warranty certificate is required to be submitted by the supplier/ BA to BYPL at the time of SAT. xviii. Shall be suitably mounted in CRP/switchgear panel. xix. Ethernet Switch shall have required nos. of ports (having RJ45 Ports / FO Ports).Minimum 20% spare ports shall be provided. Final approval at the time of detail engineering. xx. Power Supply of EFS shall be Dual redundant with pluggable terminal block. xxi. Shall have Environmental conditions compliance as per • IEC60068-2-1 COLD TEMPERATURE • IEC60068-2-2 DRY HEAT • IEC60068-2-30 HUMIDITY • IEC60068-21-1 VIBRATION • IEC60068-21-2 SHOCK xxii. Shall have Features: • Management through Web-based HTTPS, Telnet, CLI • SNMP supported • Remote Monitoring with RBAC • Diagnostics with logging and alarms • Console ports xxiii. Shall have Product conformity • acc. to IEEE 802.3-10BaseT Yes • acc. to IEEE 802.3u-100BaseTX Yes • acc. to IEEE 802.3u-100BaseFX Yes • acc. to IEEE 802.3ab-1000BaseT Yes • acc.toIEEE802.3ad-Link Aggregation Yes • acc. to IEEE 802.3x-Flow Control Yes • acc. to IEEE 802.1d-MAC Bridges Yes

		• acc. to IEEE 802.1d-STP Yes • acc. to IEEE 802.1p-class of service Yes • acc. to IEEE 802.1Q-VLAN tagging Yes • acc. to IEEE 802.1Q-2005 (formerly IEEE 802.1s) MSTP Yes • acc. to IEEE 802.1w-RRS Yes • acc. to IEEE 802.1x-port based Network Access Control xxiv. Shall have Mode Store and Forward xxv. Shall have Protection class IP4X,Conformal Coating,IPV6 xxvi. Shall have Authorized Repair center of original Ethernet switch manufacture in India. xxvii. Shall have Uplink Rate 1 GBPS and Downlink Rate 100 MBPS BYPL approved Makes Make 1 Ruggedcom 2 Hirschmann The specified makes are to be strictly adhered to and no change will be considered hereto.
2.3.2	Interface between Numerical Relay and switch	LC multimode duplex fibre optic patch cords connecting the numerical relay to switch shall be supplied by the bidder.. Make- Preston or equivalent
2.3.3	Interface between RTU and Ethernet switch	CAT 6 STP Cable shall be in bidder scope. Make- D-link, Belden or equivalent
2.3.4	Interface between MFM and RTU	RS485 Belden class cable shall be provided by bidder. Make- Belden or equivalent
2.3.5	Communication hardware	All hardware like LAN Switch, FO cables, protocol converters required for interfacing IEDs like protection relays, multifunction meters, transformer monitoring relays, battery charger controllers etc. to RTU should be included in scope of supply.

3.0 SCADA INTEGRATION

3.1	INFRASTRUCTURE	Numerical relays should be IEC 61850 compatible having dual fibre PRP optic ports. Through these ports relays shall be connected to CRP switches that further extended to existing RTU system through CAT6 LAN cable.
3.2	SCOPE OF WORK	i. Configuration of IEDs (primary, backup) and multifunction meters for SCADA signals as per Annexure 1: Signals related with 11KV panels and Annexure 2: Signals Related with MFM to communication the same in existing RTU 560A Co Processor CMR02. ii. For communication configuration and troubleshooting of Relays and MFM, required software, ICD file (IED configuration description file), SCD file (substation configuration description file), communication cables and documents to be handed over to team SCADA BYPL. iii. Providing protocol mapping/node details for signals listed in Annexure 1: Signals related with 11KV panels and Annexure 2: Signals Related with MFM and communication configuration details for RTU configuration. iv. Simulation of all configured signals (Annexure 1: Signals related with 11KV panels and Annexure 2: Signals Related with MFM) over LAN on IEC 61850 and over RS 485 on modbus on separate terminal with same configuration settings. v. Testing & commissioning of Numerical relays, and Multifunction meters for all related signals upto RTU. vi. Testing of Indications, Command, Interlocks as per scheme, Relay soft interlock testing from Relay HMI as well as simulation of SCADA command through configured output of Relay. vii. Downloading of Disturbance records and uploading/downloading of configuration file to and from IEDs facility from remote through switches at pre decided IPs shall be provided. viii. Demonstration of operational compatibility with SCADA. ix. Point to Point testing all signals to BYPL SCADA at MCC and BCC.

3.3	SCOPE OF SUPPLY	
3.3.1	Configuration Software and Tools	All software and configuration tools required for configuration of SCADA Network should be included in scope of supply.

4.0 SPARES

4.1		i. Bidder shall submit list of recommended spares for BSES BYPL SCADA approval. ii. Recommended minimum 20% spares of supplied SCADA accessories for SCADA interface to be supplied by bidder. Price for spares shall be included in CRP package. All spares shall be tested in our premises

5.0 DOCUMENTATION

5.1	Documents for approval	i. The bidder shall ensure that all necessary drawings, write-up, information, etc required to fully describe the equipment are to be submitted for approval. ii. The manual shall clearly indicate in English the installation and connection method. Check up, maintenance and calibration method shall also be provided in the manuals.

6.0 TRAINING

5.1	Training at site	Training to BYPL SCADA's engineers at site by domain expert (two day training- one day in classroom and one day on site) with hands on.

7.0 DEVIATIONS

6.1	Deviation	Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP/Drawing and a description of the alternative offer. In absence of such a statement, it will be assumed that the bidder complies fully with this specification. No deviation will be acceptable post order.

Annexure 1 (Signal List- 11kV)

A. 11kV Outgoing feeders- IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker ON	✓		DPI
2.	Breaker OFF			SPI
3.	Trip Ckt Healthy	✓		SPI
4.	Spring Charge	✓		SPI
5.	Breaker in Service	✓		SPI
6.	Breaker in Test	✓		SPI
7.	Auto Trip (86) Operated	✓		SPI
8.	Panel DC Fail	✓		SPI
9.	L/R switch in SCADA	✓		SPI
10.	Relay Int Fault	✓		SPI
11.	Over Current Operated	✓		SPI
12.	Earth Fault Operated	✓		SPI
13.	BKR Close COMMAND		✓	DCO
14.	BKR Open COMMAND			
15.	Auto Trip (86) relay reset from Remote		✓	SCO
16.	3Phase R, Y, B- Current & Voltage, Active Power, Reactive Power, Power factor, Max. Demand, Neu. Current	✓		AI/ MV
17.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose	✓		AI/MV

Note: Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel

B. 11kV Incomers: IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		DPI
2.	Breaker OFF			
3.	Trip Ckt Healthy	✓		SPI
4.	Spring Charge	✓		SPI
5.	Breaker in Service	✓		SPI
6.	Breaker in Test	✓		SPI
7.	Auto trp (86) Operated	✓		SPI
8.	VT fuse Blown- Metering	✓		SPI
9.	VT fuse Blown- Protection	✓		SPI
10.	Panel DC Fail	✓		SPI
11.	L/R Switch in SCADA	✓		SPI
12.	Relay Int Fault	✓		SPI
13.	Over Current Operated (All Stages)	✓		SPI
14.	Earth Fault Operated (All Stages)	✓		SPI
15.	Under Voltage Prot. Operated	✓		SPI
16.	Over Voltage Prot. Operated	✓		
17.	REF Operated	✓		SPI
18.	BKR Close COMMAND		✓	DCO
19.	BKR Open COMMAND			
20.	Auto trip (86) relay reset from Remote		✓	SCO
21.	3Phase R, Y, B- Current & Voltage, Active Power, Reactive Power, Power factor, Max. Demand, Neu. Current	✓		AI/ MV
22.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose	✓		AI/MV

Note: Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel

C. 11kV Bus Coupler: IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		DPI
2.	Breaker OFF			
3.	Trip Ckt Healthy	✓		SPI
4.	Spring Charge	✓		SPI
5.	Breaker in Service	✓		SPI
6.	Breaker in Test			SPI
7.	Auto trip (86) Operated	✓		SPI
8.	Panel DC Fail	✓		SPI
9.	L/R Switch in SCADA			SPI
10.	Relay Int. Fault	✓		SPI
11.	PT MCB- Metering operated	✓		SPI
12.	PT MCB- Protection operated	✓		SPI
13.	Over Current Operated	✓		SPI
14.	Earth Fault Operated	✓		SPI
15.	BKR Close COMMAND		✓	DCO
16.	BKR Open COMMAND			
17.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance Records, Fault Graphs for Remote diagnosis purpose	✓		AI/MV

Note: Signals like Panel DC Fail and Relay Int Fault to be taken from adjacent panel

D. 11Kv Capacitors: IEC 61850 Protocol

S.No.	Signal List	DI/ AI soft through N.Relay/ BCU	DO soft through N.Relay/ BCU	Signal Type
1.	Breaker On	✓		DPI
2.	Breaker OFF			
3.	Bank ISO ON	✓		DPI
4.	Bank ISO OFF			
5.	Trip Ckt Healthy	✓		SPI
6.	Spring Charge	✓		SPI
7.	Breaker in Service	✓		SPI
8.	Breaker in Test	✓		SPI
9.	Master Trip (86) Operated	✓		SPI
10.	Bus PT fuse Blown-Metering	✓		SPI
11.	Bus PT fuse Blown-Protection	✓		SPI
12.	Panel DC Fail	✓		SPI
13.	L/R Switch in SCADA	✓		SPI
14.	Over Current Operated	✓		SPI
15.	Earth Fault Operated	✓		SPI
16.	Under Volt. Prot. Operated	✓		SPI
17.	Over Volt. Prot. Operated	✓		SPI
18.	Neg. Phase sequence Operated	✓		SPI
19.	Timer Relay operated/ Normal	✓		DPI
20.	Relay Int. Fault	✓		SPI
21.	BKR Close COMMAND		✓	DCO
22.	BKR Open COMMAND			
23.	BANK ISO OPN		✓	DCO
24.	BANK ISO CLS			
25.	Master trip (86) reset from remote		✓	SCO
26.	3phase R, Y, B- Curr & Volt, React. Pow, Neu. Curr	✓		AI/ MV
27.	Fault current and phase indication of faulty phase viz. R, Y, B, Earth, Unbalance (O/C & E/F Relay), Disturbance	✓		AIMV

	Records, Fault Graphs for Remote diagnosis purpose			

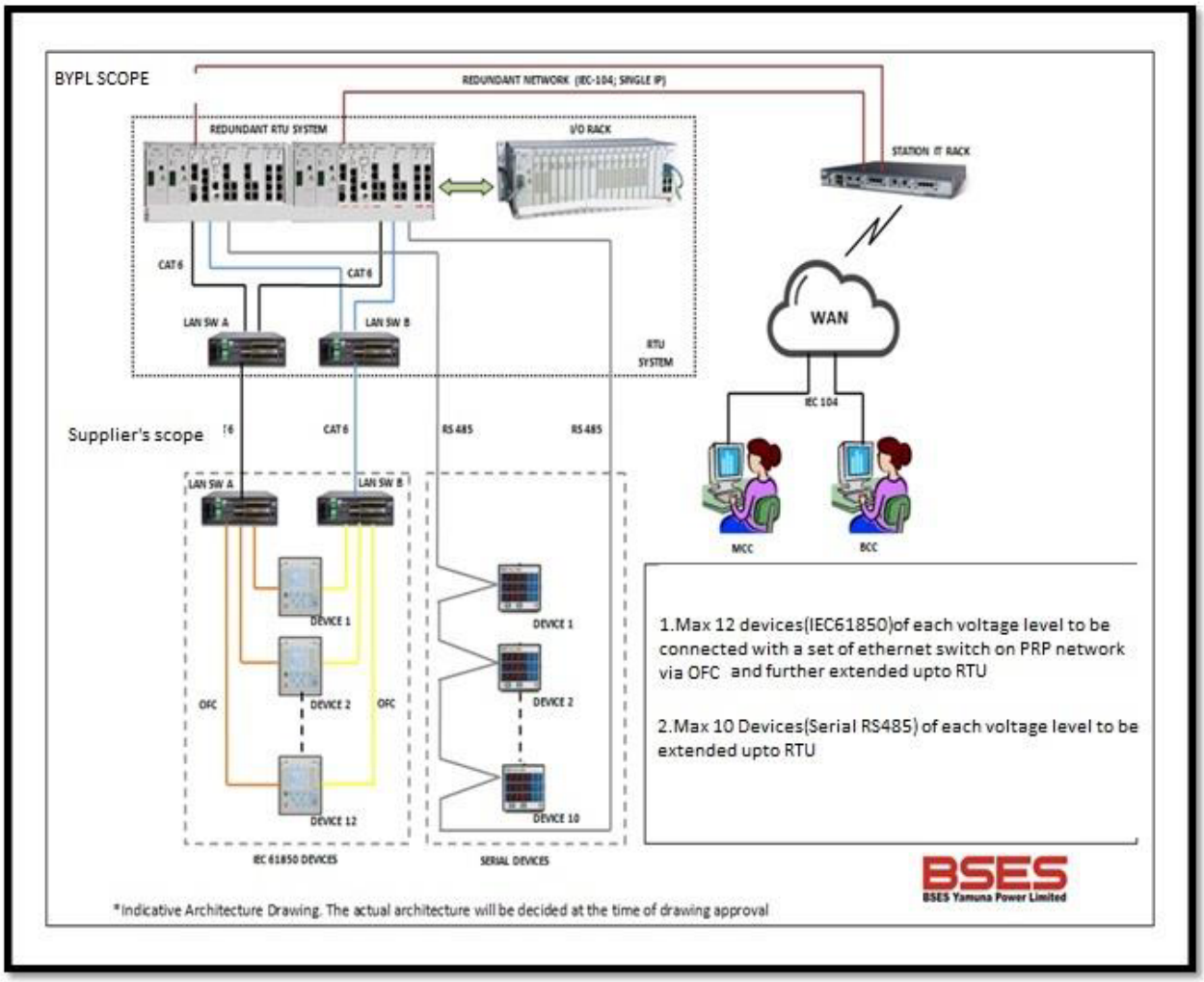
Annexure 2: Signals Related with MFM

Sr. No.	Signal Detail	Type of Signal on Modbus
	Measurement Signals	
1	Active Power	Measured Float
2	Current Bph	Measured Float
3	Current Rph	Measured Float
4	Current Yph	Measured Float
5	Frequency	Measured Float
6	Power Factor	Measured Float
7	Reactive Power	Measured Float
8	Voltage BR	Measured Float
9	Voltage RY	Measured Float
10	Voltage YB	Measured Float
11	Neutral Current	Measured Float
12	THD	Measured Float
13	Max Demand	Measured Float
14	Apparent power	Measured Float

(This is the indicative IO list, however the signal list may vary during the engineering time)

Annexure 4:

SCADA Network Architecture



Annexure 5: (List of Abbreviations)

1. SCADA: Supervisory Control and Data Acquisition
2. RTU: Remote Terminal Unit
3. C&R: Control and Relay
4. MFM: Multi Function Meter
5. BYPL: BSES Yamuna Power Ltd.
6. MCC: Master Control Center
7. BCC: Business Continuity Center
8. IED: Intelligent Electronic Devices
9. IEC: International Electrotechnical Commisssion
10. KEMA: Keuring van Elektrotechnische Materialen te Arnhem
11. CE: Conformité Européene
12. FCC: Federal Communications Commission
13. PRP: Parallel Redundancy Protocol
14. LAN: Local Area Network
15. NIFPS: Nitrogen Injection Fire Protection System
16. APFC: Automatic Power factor Controller
17. HMI: Human Machine Interface
18. PVC: Polyvinyl Chloride
19. OFC: Optical Fiber Cable
20. MV: Measured Value
21. SPD: Surge Protection Device
22. DCO: Double Command Input
23. DPI: Double Point Indication
24. MV: Measured Value
25. SCO: Single Command Input
26. SPI: Single Point Indication