West Bengal State Electricity Distribution Company Limited

(A Govt. Of West Bengal Enterprise)

TECHNICAL SPECIFICATION

FOR

Control & Relay Panel for 33 kV Feeder with SCADA compatible Directional O/C and E/F protection and 33/11 kV Transformer with SCADA compatible Differential Protection

FOR

Various 33/11 kV Substations in West Bengal

P&E Distn. | CE, Distn. | CE, IT&C | CE, CCD | CE, P&CD | CE , DTD | ACE, DTD | ACE, P&CD | ACE, P&CD

ACE, P&E Distn | ACE,Communication | ACE, Project-III | ACE,P&E Distn. | SE, P&E Distn. | SE,P&CD | DE,DTD, | SE,P&CD

1.0 SCOPE:

This specification covers design, manufacture, assembly, testing before supply, inspection, packing and delivery and other basic technical requirements in respect of control and relay panels for 33 kV feeders with Directional protection, and 33/11kV Power Transformers with differential protection to be installed at various 33/11 kV sub-stations in West Bengal. The equipment to be supplied against this specification is required for vital installations where continuity of service is very important. The design, materials and manufacture of the equipment shall, therefore, be of the highest order to ensure continuous and trouble-free service over the years. The Bidder has to design the Schematics for protection and Control of all equipments including monitoring indications, visual and audible alarm, and interlocking schemes among different equipment. Any other requirement which are not specifically covered here but which are necessary for successful commissioning of the Sub stations are also within the scope of the Contract.

The equipment manufactured should conform to the relevant standards and of highest quality of engineering design and workmanship. The equipment manufactured shall ensure satisfactory and reliable performance throughout the service life. The Schedule of requirement of the Panel is furnished separately in details.

2.0 SERVICE CONDITIONS:

2.1 **System particulars:**

Nominal system voltage	33 kV & 11 kV
Corresponding highest system voltage	36 kV & 12 kV
Frequency	50 Hz±3%
Number of phases	3
Neutral earthing	33 kV Grounded through Earthing Transformer 11 V solidly earthed

2.2 Equipment supplied against the specification shall be suitable for satisfactory operation under the following tropical conditions:-

Max. ambient air temperature	60 ° C
Max. relative humidity	100 %
Max. annual rainfall	1450 mm
Max. wind pressure	150 kg/sq.m.
Max. altitude above mean sea level	1500 mtrs.
Isoceraunic level	50
Reference Ambient Temperature for temperature rise	50 deg C
Climatic Condition	Moderately hot and humid tropical climate conducive to rust and fungus growth

2.3 The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

2.4 Auxiliary supplies available at the various sub-stations are as follows:-

2.4.1. Rating:

i.	A. C. Supply	230 volts, with ± 10% variation, Frequency 50Hz with ±3%
ii	D.C. Supply	30 V DC. DC system is 2(two) wire with necessary earth fault annunciation scheme. DC supply shall be normally fed from Battery charger. In case of failure of AC supply to Battery Charger, DC supply voltage will be available from Lead Acid Battery.

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2.5 Unless otherwise specified all equipment and material shall conform to the latest IS applicable standards. Equipment complying with other internationally recognized standards will also be considered if it ensures performance equivalent or superior to Indian standards. In the event of supply of equipment conforming to any international\internationally recognized standards other than the standard listed below, the salient features of comparison shall be brought out and furnished along with the bid. One copy of such standard specification in English language shall be enclosed with the tender.

2.6 The equipment provided shall also comply with the latest revisions of Indian Electricity act and Indian Electricity rules and any other applicable statutory provisions, rules and regulations.

2.7 All equipment provided under the specification shall generally conform to the latest issue of the following :-

a)	IS 12063/1987	Degree of Protection provided for enclosure of electrical equipment.
b)	IS 5/2004	Colour for ready mixed paints & enamels.
c)	IS 3231 / 1986 & 1987	Electrical relays for power system protection
d)	IEC 60255	Numerical biased protection relay
e)	IS 8686/1977	Static Protective Relays
f)	IS 1248/2003	Indicating instruments
g)	IS 14697/1999	HT Static Tri vector TOD Energy meter
h)	IS 6875 amended up to date	Control switches
i)	IS 4794/1968 & 1986	Push buttons
j)	IEC 337 &337-1	Control Switches (LV Switching devices for control and auxiliary circuit)
k)	IEC:60185	Current Transformers
l)	IEC:60186	Voltage Transformer
m)	IS 375	Marking and arrangement for Switchgear Bus
n)	IS:5578/1984	Marking of insulated conductors.

CT, PT Ratio and Transformer Details:-

CIRCUIT	33kV CT RATIO/CLASS
33kV Feeder	400-200/1-1 A 0.5,5P20
33kV side of 33/11kV transformer	200-100/1- 1-1A, 0.5/5P20/PS
11kV side CT for Transformer	600-400/1-1-1A, 0.5/5P20/PS at phase side (Indoor Panel)
11kV transformer Bushing CT for REF	600/1A, PS for 10 MVA 33/11kV transformers for both Phases & neutral. 400/1A, PS for 6.3 MVA 33/11kV transformer for both phases and neutral.
33 kV PT	33 kV, single phase, Electromagnetic type
PT Ratio/Class	33kV/√3, 110V/√3-110V/√3 ,0.5/3P
Transformer details	33/11kV,6.3/10 MVA, Dyn11

3.0 CONSTRUCTIONAL DETAILS:

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3.1. CONTROL AND RELAY PANEL

The Control and Relay Panel shall be of Simplex type and the access door shall be provided at the back of each Panel where no instruments or relays shall be mounted. The indicating and signaling devices and relays etc. shall be mounted on the front side and the auxiliaries which shall be inside the Panel. The access door shall be at the back side and of double door type of height 1900 mm.

In front of Panel where relays and instruments are to be mounted shall be stretcher leveled steel plate 3 mm. thick and side panel, doors and top covers shall be of 2mm. thick steel plate. Light sections of structural steel shall be used for panel frame.

The individual panel shall be 2250 mm. in height with 100 mm Channel base, 610 mm. in depth and of suitable width limited to 850 mm to accommodate the equipment at a suitable height, suitable gaps to facilitate easy workability as specified hereafter. Individual piece of Channel base of C&R Panel is to be provided to obtain the flexibility of inter-changing the Panel, if any.

The complete panel shall incorporate all necessary instruments, meters, relays, auxiliary relays, control switches, indicating lamps, mimic, annunciator, audible alarms, horizontal and vertical wiring trough, wiring supports, interior lighting system, terminal blocks , fuses and links etc.

3.2. Constructional features

a) The Control and Relay Panel frame shall be suitable for erection of flush concrete floor and secured to it by means of evenly spaced grout bolt projecting through the base channels from members of the frame.

b) The manufacturer shall ensure that the equipment specified and such unspecified complementary equipment required for completeness of protection/control scheme be properly accommodated in the panels without congestion and if necessary to provide panels with larger width. No price increase at a later date on this account shall be allowed.

c) Panels shall be completely metal enclosed and shall be dust, moisture and vermin proof for tropical use. The enclosure shall provide a degree of protection not less than IP-41 in accordance with IS-2147. Type test report in this respect shall be furnished with offer.

d) Panels shall be free standing, floor mounting type and shall comprise structural frames enclosed completely with specially selected smooth finished, cold rolled sheet steel of thickness not less than 3 mm for weight bearing members of panels such as base frame, front sheets and door frames and not less than 2mm for sides, door, top & bottom portions. There shall be sufficient reinforcement to provide level surfaces, resistance to vibration and rigidity during transportation and installation.

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

f) All holes and extension windows in the Panel shall be blanked and access doors shall be lined with compressible liners at the edges. The WBSEDCL will shut off the bottom crevices with cream cement, the Cable Entry holes with weak concrete and the cable trench with present R.C. Slabs or checker plate. All control and supply cables will be laid in a distribution trench running under the panel. The Cable will branch off into each cubicle through entry holes in the concrete floor opening in the bottom cubicles. Necessary Drawings for concrete floor and trench shall be supplied by the manufacturer to enable the WBSEDCL to construct the foundation floor for these panels. The drawings shall show details of the distributing trench, cable entry holes, glands and positions of grouting bolts. The WBSEDCL will prepare foundation with pocket for grouting bolts. The

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manufacturer shall supply channel base, suitable grouting bolts, lock nut and washers.

g) Control Cable entries to the panel shall be from the bottom. Bottom plates of the panels shall be fitted with detachable gland plates to allow cable entries from the bottom. Gland plates shall be suitable for fixing the cable glands at an elevated height of at least 100 mm above the ground level. Terminal Connectors and Test terminal blocks for cables shall be fixed at an elevated height of at least 200 mm above the Bottom plate. Side blocks cut out to be arranged at the top of both sides of panel for inter panel bus wires. Dimensions of the cut out will be 300 mm X 50 mm, 255 mm from the top.

3.2.1. General:

a) Materials shall be new; the best quality of their respective kinds and such as are usual and suitable for work of like character. All materials shall comply with the latest issues of the specified standard unless otherwise specified or permitted by WBSEDCL.

b) Workmanship shall be of the highest class throughout to ensure reliable and vibrations free operations. The design, dimensions and materials of all parts shall be such that the stresses to which they may be subjected shall not cause distortion, undue wear, or damage under the most severe conditions encountered in service.

c) All parts shall conform to the dimensions shown and shall be built in accordance with approved drawings. All joints, datum surfaces and meeting components shall be machined and all castings shall be spot faced for nuts. All machined finishes shall be shown on the drawings. All screw, bolts, studs and nuts and threads for pipe shall conform to the latest standards of the International Organization for Standardization covering these components and shall all conform to the standards for metric sizes.

d) All materials and works that have cracks, flaws or other defects or inferior workmanship will be rejected by WBSEDCL.

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

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

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

4.0 MOUNTING:

a) All equipment on and inside the panels shall be mounted and completely wired to the terminal blocks ready for external connection.
b) Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent devices and are readily accessible without use of special tools. Terminal marking shall be clearly visible and of permanent nature.
c) The manufacturer shall carry out cut-out, mounting and wiring of the bought out items which are to be mounted in the panel in accordance with the corresponding equipment manufacturer's drawings.
d) The centre line of switches, push buttons and indicating lamps shall be not less than 750 mm from the bottom of the panel. The centre line of relays and meters and recorders shall be not less than 450 mm from the bottom of the panel.
e) The centre lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Likewise the top of all meters, relays and recorders etc. shall be in one line.
f) The location of the switches shall be within working height from the floor level for easy and comfortable operation.

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g) No equipment shall be mounted on the doors.
h) All the equipment connections and cabling shall be designed and arranged to minimise the risk of fire and damage.

5.0 WIRING

5.1. All wiring shall be carried out with 1100/750 volts grade single core, multistrand flexible tinned copper wires with PVC insulation which has provided its utility in tropical region against hot and moist climate and vermin (Misc. white ant and cockroaches etc.) Rubber insulated wiring will not be accepted. Wire numberings and colour code for wiring shall be as per IS: 5578/1984. The wiring should be encased in suitable width PVC casing. The wiring diagram for various schematics shall be made on thick and laminated durable white paper in permanent black ink and same should be pasted on the inside surface of the door. The PVC insulation shall be of FRLS category, flame vermin & rodent proof.

5.2. The sizes of wiring in different circuit shall not be less than these specified below:

TABLE-I

Circuit	Permissible size of wire
Metering and Relaying Circuits connected Current Transformer including earthing	2.5 mm^2
Potential Circuits for metering and Relaying, Control, Visual Audible Alarms and Signalling Circuit	1.5 mm^2

The following colour schemes shall be used for the Wiring:

TABLE – II

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

5.3.

a) All internal wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters & trough shall be used for this purpose.

b) Longitudinal troughs extending throughout the full length of the panel shall be used for inter panel wiring. Inter connections to adjacent panels shall be brought out to a separate set of terminal blocks wires. All bus wiring for inter panel connection shall preferably be provided near the top of the panels running throughout the entire length of the panels.

c) Wiring connected to the space heaters in the cubicles shall have porcelain beaded insulation over a safe length from the heater terminals.

d) Wire termination shall be made with solder less crimping type and tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided to all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected for any purpose. Termination shall be such that no strand of a conductor shall left loose or overhanging. Conductor termination shall be secured to the holding nuts/screws, terminal blocks etc. with washers interposed between the terminals/holding nuts/screw heads. The terminals shall be so connected that no conductor ferrule code gets masked due to overlay of conductors.

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e) All spare contacts of relays shall be wired up to terminal blocks.
f) Each wire shall be continuous from end to end and shall not have any joint within itself individually.
g) Wires shall be connected only at the connection terminals or studs of the terminal blocks, meters, relays, instruments and other panel devices. Terminal Ends of all wires shall be provided with numbered Ferrules. At point of inter-connection where a change of number is necessary, duplicate Ferrules shall be provided with the appropriate numbers on the changing end.
h) At the terminal connection, washers shall be interposed between terminals, wire terminals and the holding nuts. All holding nuts shall be secured by locking nuts. The connection stud shall project at least 6 mm from the lock nut surface. Wire ends shall be so connected at the terminal studs that no wire terminal numbered ferrule gets masked due to succeeding connections. All wires shall be suitable for bending to meet the terminal stud at right angles with the stud axis, and they shall not be skewed.
i) All studs, nuts, bolt's screws etc. shall be threaded according to the British Standard practice unless WBSEDCL's prior approval to any other practice of threading is obtained.

6.0 TERMINAL BLOCK CONNECTION:

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

The terminal connector/blocks shall be disconnecting type terminal connectors for PT and same with automatic shorting of C.T. secondary terminals shall be provided in CT secondary circuit. All other terminal connectors shall be Non-disconnecting type. Terminal should be shock protected in single moulded piece. Terminal block should have screw locking design to prevent loosening of conductor. Provision shall be made on each pillar, for holding 10% extra connection (5% incoming + 5% outgoing).
At least 20% spare terminals for each type shall be provided. All terminals shall be provided with ferrules indelibly marked or numbered and identification shall correspond to the designations on the relevant wiring diagrams. The terminals shall be rated for adequate capacity which shall not be less than 10 Amps for control circuit. For power circuit it shall not be less than 15 Amps.

7.0 SPACE FOR CONTROL CABLES AND CABLE GLANDS:

Sufficient space for receiving the Control Cables inside the Panel at the bottom of the cubicles and mounting arrangement for the terminal cable glands shall be provided. Removable type separate cable entry plate (may be two) shall be fixed with bottom plate. The specification does not cover supply of control cables and cable glands for which the WBSEDCL will make separate arrangement.

8.0 SPACE HEATERS:

240 V, 50 Hz Tubular Space Heaters suitable for connection to the Single Phase A.C. Supply complete with On-Off Switches located at convenient position shall be provided at the bottom of the Panel to prevent condensation of moisture. The Watt loss per Unit surface of heater shall be low enough to keep surface temperature well below sensible heat. A thermostat control unit with variable temperature shall be installed to control the heater. The 240 V AC supply for the heater shall be controlled by a suitably rated single pole miniature circuit breaker compartment to be mounted on an insulator. One AC Ammeter with 0-1.0 Amp range shall be provided in series with the heater to monitor the current drawal of the Heater.

9.0 DISTRIBUTION AND CONTROL OF AUX. POWER CIRCUIT

9.1 D.C. CIRCUIT

There shall be only one 30V D.C. for the entire Control and Relay Panel fed from a D.C. Distribution Panel. A continuous D.C. Bus shall be provided in the Control and Relay Panel and D.C. supply for control, protection, indication and supervision of circuit breaker and other equipment shall be teed off from D.C. bus through a set of 20 Amp rated H.R.C. Fuse on positive and negative side. D.C. supply to be teed off shall be distributed within the Panel as below:

(a) Control DC scheme both positive and negative side with 16 Amp fuse
(b) Close/Trip Ckt 1 and Trip Ckt 2 without fuse; closing circuit with 10A fuse.

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(c) Indication Circuit through a set of 6 Amp. HRC Fuse both at +ve and –ve side
(d) Protective relay circuits through 6A fuse both at +ve and –ve side
(e) Annunciation ckt with 6Amp fuse on both at +ve and –ve side
(f) DC Emergency Lamp with 6Amp fuse both at +ve and –ve side

Three nos. of D.C. operated no-volt auxiliary relay(self reset type) provided with hand reset type flag with inscription – 'Main D.C. Fail' , 'Control DC fail' & 'Protection DC fail' with 4NO+4NC (including one NC type coil cut off contact) contacts in each relay. 2 NC contact for 'DC fail' alarm and Indication, 1NO wired upto SCADA TB and 1NO wired upto spare TB.

One Push button having N/C Contact used in Series with the above relay for 'D.C. Fall Test' purpose.

9.2 A.C. CIRCUITS

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

9.3 P.T. SECONDARY CIRCUIT

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

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

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

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

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

e) PT selector switch PT -1/2 Stayput Type, 2 Position type, 16 Ways, minimum 16A shall be provided in each panel,

f) One no. at least 4-pole 30V D.C. Contact Multiplier for secondary P.T. circuit that to be connected in energy meter shall have to be provided in respect of Feeder Control Panel only.

9.4 FUSE AND LINK

Fuses shall be of cartridge type. Carrier and base for the fuse and links for all D.C. and A.C. Circuits shall have imprint of rating, voltage and circuit designation.

9.5 MIMIC DIAGRAMS

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

b) Colour scheme for mimic diagram as follows:-

kV Class	Colour	Shade Index as per ISS
33 kV	Brilliant green	221
11 kV	Air Craft blue	108
400/230 V	Black	309

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Earth	White	-
110 V	Canary yellow	-

c) In 33 kV simplex type C&R panels, Symbol marking for the position indication of isolators, earth switches etc, ON/OFF indication for Circuit breaker, PT supply indication, CB spring charge, auto trip, trip ckt healthy etc. shall be mounted along the mimic diagram at appropriate location. Non-Discrepancy type control switch for the C.B. shall be mounted within the mimic, indicating the C.B. ON/OFF status.

10.0 LABELING

All front mounted as well as internally mounted items including MCBs shall be provided with individual identification labels. Labels shall be mounted directly below the respective equipment and shall clearly indicate the equipment designation. Labelling shall be on aluminium anodised plates of 1 mm thickness, letters are to be properly engraved.

11.0 EARTH BUS

Each panel shall be provided with continuous earth bus of size 25 x 6 mm (min) each. The earth bus shall be of tinned plated copper, and all metallic cases of relays, instruments etc. shall be connected to this earth bus independently for their effective earthing. The wire used for earth connections shall have green insulation.

12.0 CIRCUIT BREAKER CONTROL SWITCH

12.1. PISTOL GRIP TYPE Non- discrepancy T-N-C spring return type switch shall be provided for remote operation of circuit breaker to ensure that manual pumping of closing solenoid not possible. The switch shall be mounted in the mimic diagram itself such that the stay-put ('N') position will render the continuity of the mimic. One green LED for 'breaker open' indication and one red LED for 'breaker closed' indication shall also be provided adjacent to the T-N-C switch.

12.2. Switches should have finger touch proof terminals. For the convenience of maintenance, screw driver guide should be from top/bottom of the switch and not from the side. Terminal wire should be inserted from the side of the switch terminal.

12.3. Terminal screws must be captive to avoid misplace during maintenance.

12.4. Switch shall be with 48 mm x 48 mm escutcheon plate marked with Trip & Close.

12.5. Trip-neutral-close, with pistol grip handle must be pushed in to spring return to either trip or close position from Neutral position for safety and not just turn to trip.

12.6. One contact to close in each position of Trip and Close. Contact rating shall be 12 A at 30 V DC.

12.7. One spare contact is required in off & on position.

13.0 LOCAL/REMOTE(SCADA) SWITCH

Local/Remote Switch, 2 Position Type, loackable, Stayput type, 10 ways , 25 Amp

14.0 INDICATING LAMPS

L.E.D. Type Indicating Lamps shall be provided on the Control Panel to indicate the following:

Sl. No.	Functions	Quantity	Colour of Lamp
1	C.B. Spring charged indication	1 No.	Blue
2	C.B. trip Coil/Circuit healthy indication	2 Nos.	White
3	C.B. Auto tripped indication	1 No.	Amber
4	Panel D.C. Fail indication	1 No.	Amber
5	P.T. Supply indicating Lamp	2 sets	Red/Yellow/Blue

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6	C.B. –ON indication	1 No.	Red
7	C.B. –OFF indication	1 No.	Green

All the lamps shall be connected to the auxiliary D.C. supply of the Sub-Station except Sl. No. (4) & Sl. No. (5) which should be connected to the auxiliary A.C. supply and P.T. Secondary supply respectively. The Lamp shall be suitable for Panel purpose and shall be Low Watt consumption. All indicators shall have bright LEDs having long life. Conventional bulbs are not acceptable. The indicating LEDs with resistors shall withstand 120% of rated voltage on a continuous basis. However, the specification of indicating lamps may likely to be changed/ modified as per requirement of WBSEDCL.

15.0 CONTACT MULTIPLIER

230 Volts, Single Phase, 50 Hz A.C. or 30V DC Supply operated Contact Multiplier to be provided, if required as per scheme and will be finalized during drawing/GTP approval stage.

16.0 TERMINAL BLOCK / TTB

1. Terminal Blocks for incoming A.C and D.C. Circuit and C.T., P.T. & SCADA Circuit should be located on the left hand side and Transformer supervision, breaker control and spare in right hand side of the wall of the Panel seen from back side respectively.
2. 3-Phase, 4-Wire Link type Test Terminal Block having sealing provision shall be provided in Metering Circuit of each Panel.

17.0 SAFETY EARTHING

1. Earthing of metallic parts or metallic bodies of the equipment on the Panel shall be done with soft drawn single conductor bare Copper Tail connections shall have minimum area of 16 sq, mm. and the main earthing connection 60 sq.mm. These wires shall be connected by suitable terminals and clamps junction. Soldered connections shall not be employed.
2. The neutral point of star connected LV winding of instrument transformers and one corner of the open delta connected LV side of instrument transformers shall be similarly earthed by tail connected with main earth wire of Panel Earthing System. Multiple earthing of any instrument transformer circuit shall be avoided.

18.0 PANEL LIGHTING

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

19.0 ANNUNCIATOR

A. ELECTRONIC ANNUNCIATOR

1. Suitable Multi-way Microprocessor based electronic Annunciator for the visual and audible alarm on the control panel using bright LEDs shall be provided in each panel to indicate over current and earth fault protection operated. In addition to above, each electronic annunciator of Transformer Control Panel shall

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have provision to indicate Transformer trouble trip/alarm function operated. Also one window of the Annunciator shall have to be used for Non-Trip A.C. Fail Alarm Indication and one window for Trip Circuit unhealthy indication. Each Electronic Annunciator shall have provision for connection with accept/reset/lamp test/mute Push buttons for proper functions. Electronic annunciator shall have provision for connection with Electronic Buzzer/Electronic Bell for Trip & Non-Trip Audio Alarm of common annunciation scheme. Electronic Annunciation shall have provision for flashing illuminating display with inscription for operation of respective Protection Relay. The Micro-Processor based Electronic Annunciator should have separate coloured windows for Trip & Non-Trip Annunciation for easy detection.

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

3. Electronic Annunciator shall have first Fault Indication Facilities & System Watch Dog
4. Annunciator facia plate shall be engraved in black lettering with respective alarm inscription as specified. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall be about 5 mm. The inscriptions shall be visible only when the respective facia LED will glow.
5. Annunciator facia units shall be suitable for flush mounting on panels. Replacement of individual facia inscription plate and LED shall be possible from front of the panel.
6. Unless otherwise specified, one alarm buzzer meant for non-trip alarms and one bell meant for trip alarms shall be provided in each control panel (mounted inside).
7. Each annunciator shall be provided with 'Accept', 'Reset' and 'Test' push buttons, in addition to external PB.
8. Special precaution shall be taken by the manufacturer to ensure that spurious alarm conditions do not appear due to influence of external magnetic fields on the annunciator wiring and switching disturbances from the neighbouring circuits within the panels.
9. In case 'RESET' push button is pressed before abnormality is cleared, the LEDs shall continue to glow steadily and shall go out only when normal condition is restored.
10. Any new annunciation appearing after the operation of 'Accept' for previous annunciation, shall provide a fresh audible alarm with accompanied visual alarm, even if the process of "acknowledging" or "resetting" of previous alarm is going on or is yet to be carried out.

Provision for testing healthiness of visual and audible alarm circuits of annunciator shall be available.

16 Window Annunciation Scheme for individually controlled Transformer Panel to indicate following functions:-		
i)	Differential protection(87) operated	1 no.
ii)	Non-directional protection (O/C+E/F) operated	1 no.
iii)	Oil Temp./Winding Temp/MOG Alarm for transformer	1 no.
iv)	Oil Temp./Winding Temp Trip for transformer	1 no.
v)	REF 64R(HV side) tripped	1 no.
vi)	REF 164R(LV side) tripped	1 no.
vii)	Buchholz Alarm for transformer	1 no.
viii)	Buchholz Trip for transformer	1 no.
ix)	OLTC Buchholz/ Main Tank PRV Trip for transformer	1 no.
x)	AC fail	1 no.
xi)	Trip Circuit/Coil 1or Trip Circuit/Coil 2 Unhealthy	1 no.
xii)	Non-directional O/C & E/F Relay Trouble	1 no.
xiii)	Differential relay trouble	1 no.

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

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xiv)	Spare	1 no.
xv)	Spare	1 no.
xvi)	Spare	1 no.
Mounting		**Flush**
No. of facia windows		16
Supply voltage		30 V DC
No. of LEDs per window		2 (Min)
Lettering on facia plate		Properly engraved

12 Window Annunciation Scheme for Parallel Feeders to indicate following functions:-		
i)	Directional O/C operated	1 no.
ii)	Directional E/F operated	1 no.
iii)	Panel DC Fail	1 no.
iv)	Trip Circuit/Coil 2 Unhealthy	1 no.
v)	Panel AC fail	1 no.
vi)	Trip Circuit/Coil 1 Unhealthy	1 no.
vii)	Directional O/C & E/F Relay Trouble	1 no.
viii)	PT MCB Tripped	1 no.
ix)	Spare	1 no.
x)	Spare	1 no.
xi)	Spare	1 no.
xii)	Spare	1 no.
Mounting		**Flush**
No. of facia windows		12
Supply voltage		30 V DC
No. of LEDs per window		2 (Min)
Lettering on facia plate		Properly engraved

B. PANEL D.C. FAIL ALARM SCHEME

Control & Relay Panel shall have a common — 'Panel D.C. Fail' Alarm Scheme operated by 230 V Single phase A.C. Aux. Supply for audible as well as visual alarm in case of failure of D.C. incoming supply to the Panel. Another Single Element Relay without Flag and 1 no. self-reset type N/O & 1 no. N/C contact having inscription — 'Panel D.C. fail alarm accept Relay' shall be provided. Besides above, 1 no. Indicating Lamp, 1 no. A.C. Operated Electric Hooter and 2 nos. Push Button, one having 1 no. N/C contact, the other having 1 no. N/O contact shall also be provided for successful operation of the scheme. All auxiliary relays required to render Annunciation System operative and shall be considered to be within the scope of the tender.

AC fail, DC fail scheme shall be operated by relay not contactor.

20.0 INDICATING INSTRUMENT AND METERS

a. All instruments shall be flush mounted, back connected type and provided with dust tight cases for tropical use with dull black enamel finish. All fixing screws, nuts and threaded parts shall be designed to Indian Standards.

b. All instruments shall be of class 0.5 type. The calibration of the instruments shall function satisfactorily when mounted on steel panels or alternatively magnetically shielded instruments shall be used.

Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

c. Instruments shall be capable of indicating freely when operated continuously at any temperature from 0 to 50 degree C.

d. All circuits of instruments shall be capable of withstanding applied load of 20% greater than the rated capacity for a period of eight hours.

e. The instruments shall be capable of withstanding the effect of shock vibration and a di-electric test of 2000 Volts r.m.s. to ground for one minute as per relevant ISS.

20.1. Ammeters:

All ammeters shall be provided with direct reading scale. Full Scale Value of the Ammeters shall be 100% of the nominal current of maximum C.T. ratio. The ammeters shall be connected to measuring C.T. Core. Ammeters shall be suitable for R.Y.B. Phase measurements. However, the ammeters to be supplied shall be "DIGITAL" type. The auxiliary power of the ammeters should be 230V AC.

20.2. Voltmeters

Volt Meter shall be provided with direct reading scale. The maximum value of the volt-scale be 15% in excess of the normal Circuit Voltage. The rated voltage of the Volt Meter shall be 110V A.C. However, the voltmeters to be supplied shall be "DIGITAL" type. The auxiliary power of the voltmeters should be 230V AC.

20.2.1. Voltmeter Selector Switch

One Voltmeter selector switch having 7 position 6 way stay-put type shall be provided.

20.2.2. PT Selector Switch

One PT selector switch, 2 position, stayput type shall be provided.

20.3. Energy Meters

Tariff Metering Equipments

(a)Three element Tri-vector Meters **shall be supplied by the WBSEDCL**. But Panel Wiring for the Meters along with Test Terminal Block and space for the Tri-vector Meters are to be provided for the Panels.

21.0 NAME OF IDENTITY PLATES

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

b) 3mm thick and 25mmX150mm brass or plastic plates bearing suitable identification marks shall be fixed under the terminal wiring at the test blocks, at the fuse blocks and at the cable terminals. Similar plates shall be fixed on the exterior of the panel in appropriate places to indicate function of control switches, push button etc. such as isolator control switch, breaker control switch, DC fail test, accept reset etc. Suitable identification marks shall be provided for individual casing part of the relays and other equipment. Plates should be screwed and riveted to the Panel.

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

d) Schematic Diagram of CT, PT, CB circuitry & AC, DC Ckt, Indication and Annunciation Ckt along with protection circuitry giving the terminal nos. and Bus wire details shall be printed in laminated durable stickers and pasted inside the panel Door page wise of the respective panel.

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

i) Manufacturer's name
ii) P.O. no. and date
iii) Drg. Ref. No. pertaining to the panel.

22.0 PAINTING

Panel painting shall be done by the modern process of painting. All unfurnished surface of the steel panel and frame

P&E Distn. | CE, Distn. | CE, IT&C | CE, CCD | CE, P&CD | CE , DTD | ACE, DTD | ACE, P&CD | ACE, P&CD

ACE, P&E Distn | ACE,Communication | ACE, Project-III | ACE,P&E Distn. | SE, P&E Distn. | SE,P&CD | DE,DTD, | SE,P&CD

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

Details of Painting:-

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

23.0 RELAYS:

A. GENERAL REQUIREMENT

The main protective relays SCADA Compatible Numerical Differential Relay, Numerical Directional/Non Directional O/C & E/F Relays shall be of panel manufacturer's own make. However, multinational company manufacturing panel in India may import required/desired relays from their foreign counterpart with same brand name at their own risk, cost and responsibility without hampering the stipulated delivery schedule as stated in the tender notification.

Credential for offered relays shall also to be furnished along with C&R panel in tender documents as pre-requisites of tender.

All numerical relays shall be provided with 'Relay Failure Annunciation contact'.

Live demonstration of any offered relay has to be arranged by the party at the laboratory of Distribution Testing Department of WBSEDCL, if felt necessary by WBSEDCL before finalizing the Bid.

B. SCADA COMPATIBLE NUMERICAL DIRECTIONAL/NON DIRECTIONAL O/C & E/F RELAYS & DIFFERENTIAL RELAYS

The primary requirements of the relays are to protect the respective single circuit or double circuit feeders and 33/11kV Power Transformers in the event of fault. The Directional/Non Directional E/F relays shall provide suitable sensitivity for limited earth fault current.

The relay should be suitable for substation automation, primary circuit breaker operation through SCADA from remote control room.

THE DETAILED SPECIFICATION OF Non-Directional O/C and E/F RELAY IS AS PER ANNEXURE-A OF SPECIFICATION

THE DETAILED SPECIFICATION OF Directional O/C and E/F RELAY IS AS PER ANNEXURE-B OF SPECIFICATION

THE DETAILED SPECIFICATION OF DIFFERENTIAL RELAY IS AS PER ANNEXURE-C OF SPECIFICATION

C. OTHER PROTECTIVE RELAYS

- REF relay etc. may be of static type.
- REF, Master Trip & other Auxiliary relays (other than the Numerical relays with IEC 61850 communication protocol) not previously supplied to WBSEDCL but having the Technical features as per technical specification may also be acceptable provided the performance certificate of those relays in any other power utility for a period not less than 01(One) year.

D. OTHER PARTICULARS RELATED TO ALL RELAYS

1. All shall conform to the requirement of IS: 3231 / IEC 255 and shall be suitable for operation within a temperature range 0ºC to 55ºC and 95% relative humidity. Relays shall be suitable for flush / semi flush mounting on the panel with connections from the rear, protected with dust tight cases for tropical use

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE, DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

and with transparent cover removable from the front.

2. All A.C. relays shall be suitable for operation at 50Hz. The current coils shall be rated for a continuous current of 1 amp and the voltage coil for 230V normal. The contacts of the relays shall be properly designed to prevent or minimise damage due to arcs which have to be broken successfully against 30V +/- 10% volt DC. When open, the contacts shall withstand a voltage of 115% of the normal circuit voltage. The relays shall be designed for satisfactory operation between 70% to 110% of rated D.C. voltage of the sub-station. The voltage operated relays shall have adequate thermal capacity for continuous operation.
3. Timers shall be of static type. Pneumatic timers are not acceptable. The separate timer will not be applicable. The timer shall have built in feature in the Numerical relays of the both types of C&R panels as mentioned in the specifications.
4. The Relays shall preferably be provided with suitable Seal-in-Devices. Relays should be immune to all types of external influences like Electro static, Electromagnetic, Radio interference, shock etc.
5. All the numerical relay should have provision for setting all the features available in the relay and viewing those setting as well as different other parameters through both built in display unit as well as through PC. All numerical relays shall have self monitoring feature with watch dog contact. The supply of relay should be inclusive of necessary licensed software and hardware for interfacing with a PC, to be supplied by the bidder.

E. PROTECTION SCHEMES

E-1 PROTECTION SCHEMES FOR 33 kV LINE PROTECTION

DIRECTIONAL PROTECTION

Directional O/C & Directional Instantaneous E/F Relays shall be required for 33 kV feeders as specified in the schedule of requirement. Each Feeder shall be provided with 3 elements IDMT Voltage polarized O/C Relays and single element voltage polarized E/F Relay. The O/C Relays shall be IDMT type with high set element. The E/F Relay shall have directional sensitive E/F setting having wide range of setting (1-40%) & wide range of definite time setting range minimum. 0.1 to 10 Sec. The relay shall also have instantaneous unit. The relay shall have necessary P.T. fuse failure monitoring scheme. **The Directional O/C & E/F Relay should have the Site-selectable provision for operating in both Directional & Non-directional mode depending on site requirement.**

Characteristics:-

O/C Element: IDMT with High Set Unit	**Current Settings & Operating time**	IDMT-50-200%, 0-3 sec, Inst.-500-2000%or 400-1600%
MTA	Selectable MTA for Directional Relay should cover 1st quadrant in a non-effectively grounded system	
Polarized P.T. Voltage	110 V A.C.	
E/F Element		
Current Setting	1-40% (minimum.) in very small steps	
Operating Time of Relay	Instantaneous	
Operating Time of Timer	0.1 to 10 Sec in very small steps	
MTA	Selectable MTA for Directional Relay should cover 1st quadrant in a non-effectively grounded system	
Open Delta P.T. Voltage	63.5 V A.C.	

The numerical directional relay shall have in-built feature for derivation of zero sequence voltage internally. If separate IVT is required for derivation of zero sequence voltage for directional earth fault element, the particulars shall be as per following Technical Parameters:-

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

1	Insulation Level	1.1kV
2	Over Voltage Factor	1.2 Cont./1.9 for 8 Hrs.
3	Transformation Ratio	110 V/√3 / 110/√3
4	VA Burden/Phase	7.5
5	Accuracy Class	3P
6	No. of Phase	Single
7	Type	Epoxy Cast Resin Indoor Single Phase Voltage Transformer
8	Formation	3 nos. Single Phase P.T. shall be connected in primary as Star and Secondary as Open Delta with neutral of Primary and one end of Open Delta earthed.

E-2 PROTECTION OF 33 kV INDIVIDUAL TRANSFORMERS

For protection of H.V. Side of the Transformers, following main protective relays are required

i) Numerical O/C protection.
ii) 2 sets Restricted E/F Relay shall be provided for HV and LV side of individual control transformer panel.
iii) Differential Relay shall be provided for transformer protection.

Differential Relay shall be-

a) Provided at 33kV panel of the transformers to be protected. It shall be numerical adjustable/variable percentage biased type differential relay.
Necessary software, cables, connectors and other accessories as required for download, analyze data etc. shall be within the scope of successful bidder.

b) The relay shall be very fast in operation with an operating time less than 40 millisecond at 5 times setting.

c) The relays shall be inherently stable for external through fault conditions without affecting the speed of operation for internal faults.

d) The relay shall have either a built in facility of ratio and phase angle correction or necessary interposing Auxiliary current transformers of universal type, shall be provided in the respective panel.

e) The relay shall be provided with 2nd harmonic restraint or any other inrush proof feature to prevent operation due to magnetizing in rush current when the transformer is charged either from HV or LV side. But this shall not affect the speed of operation for internal fault.

f) It shall be provided with 5th harmonic restraint features to prevent operation due to possible over excitation of the transformer. This shall also not affect the speed of operation for internal fault.

g) The relay shall have adjustable bias setting range 20% to 50% and adjustable operating setting range of 10% to 50% at zero bias.

h) It shall have three instantaneous high set over current units for clearing heavy internal fault.

i) The relay shall be with 2-bias winding.

j) The relay shall be such that there will not be any necessity of changing the setting of the relay whenever the transformer taps are changed from +5% to-15%.

k) Differential relay shall have facility for setting, parameterization, downloading the storage data, data captured by disturbance recorder etc. locally through PC. The necessary Windows based licensed software for establishing the facility to be considered in the scope of the supply by the Bidder.

l) The relay shall have disturbance recording (with time stamping) function with suitable no. of analog and digital channels, Memory size and number of disturbances stored in the relay shall be clearly indicated in the offer. No. of site selectable BI, BO and watchdog contact details, communication port details (front, rear) along with necessary hardware and software details shall be furnished with the Bid documents.

E-3 RESTRICTED EARTH FAULT PROTECTION

The above protection shall be provided for 33/11 kV transformers at HV and LV side. The Relay shall be:

a) Single pole type.

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E, P&E, Distn ACE,Communication ACE, Project ACE, P&C Distn SE, P&E Distn SE, P&CD DE, DTD, SE, P&CD

b) Current/voltage operated high impedance type with a suitable setting to cover the maximum portion of transformer winding. Necessary calculation to prove the above winding coverage shall be furnished along with the tender.

c) Tuned to the system frequency.

d) Have suitable nonlinear resistor to limit the peak voltage and stabilizing resistance.

e) Operating time shall be less than 40 ms.

f) Shall be standalone type.

g) Have suitable stabilizing resistor to prevent mal operation during external faults if necessary.

E-4 A set of D.C. Voltage Operated Aux. Relays with 4NO self-reset contacts, hand reset flag having continuous current rating coil for the following transformer internal trouble/fault

(a) Buchholz Alarm
(b) Buchholz Trip
(c) Winding Temp. Trip & winding temp. alarm
(d) Oil Temp trip & Oil Temp. Alarm
(e) Low Oil Level Alarm
(f) Pressure Release Device Trip
(g) OSR for OLTC trip
(h) Pressure Release Device of OLTC Trip

E-5 AUXILIARY RELAYS, TRIP RELAYS and TRIP COIL/ CIRCUIT SUPERVISION RELAYS

Trip Circuit Supervision Relays - All Panels should be provided with D.C. Voltage operated Trip Circuit Supervision Relay having provisions for pre & post close supervision of Trip Circuit with set of self-reset contacts provided for Trip Circuit Healthy Indication and Trip Circuit unhealthy indication& Alarm in respect of Trip Coil/circuits of respective Breakers.

Tripping Relays- All Panels should be provided with D.C. Voltage operated High Speed Tripping Relays having electrical reset contacts capable to make, carry and break trip coil current. Sets of Trip Contacts shall be provided for Inter-tripping function of corresponding 11 kV Incoming Switchgear and closing blocking function of 33 kV & 11 kV Breakers in respect of Transformer Control Panels. Each set of trip relay shall have minimum two nos. NO and 1No. NC contact as SPARES. The operating time of master trip relay shall be less than 40 ms and electrical reset type with electrical reset contacts and hand-reset flag.

E-6 TRIP CIRCUIT/COIL SUPERVISION SCHEME :

Trip circuit supervision scheme shall be such that testing of trip circuit healthiness is possible irrespective of whether the C. B. is in the closed or open position. The Trip Circuit Healthy LED should glow continuously in CB 'ON' Position and on demand in C.B. 'OFF" position. The rating of dropping resistance in series with Trip Circuit Healthy LED shall be such that the Trip Coil should not get damaged because of continuous current flowing through it. Trip Circuit Supervision relays shall be stand alone type. These relays may be numerical or Static type.

E-7 Principal requirements of protective relays, metering equipments, auxiliary relays etc. are as follows:

E-7-1 Ammeter:

Each circuit one ammeter shall be provided with the following:

Mounting	Flush
Size	96 x 48 mm. case
Response Time	1 second
Operating Temperature	Up to 55°C
Dielectric Strength	2 kV RMS for 1 minute
Auxiliary Supply	230 volt A.C, 50 Hz
Operating Current	1 A from CT Secondary.
Type	Panel Mounting with $3^1/_2$ Digital Display.

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ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

E-7-2 Volt Meter :-

Mounting	Flush
Size	96 x 48 mm. Case
Response Time	1 second
Operating Temperature	Up to 55°C
Dielectric Strength	2 kV RMS for 1 minute
Auxiliary Supply	230 V A.C., 50 Hz
Frequency	50 Hz
Operating Voltage	110 V from PT Secondary.
Type	Panel Mounting with $3^1/_2$ Digital Display.

E-7-3 Buzzer

One DC buzzer shall be provided in the panel for non-trip alarm. One DC Bell shall be provided for Trip alarm and one AC Bell for Panel DC fail alarm.

E-7-4 High speed tripping relay electrically resettable type confirming to IS – 3231

Aux. voltage	30 V D.C
Coil rating	30V D.C., voltage band for satisfactory operation : 50 to 120% of rated voltage
Operating Time	40 m. seconds nominal at rated voltage
Burden of relay coil watts (Max)	Low burden 40 Watt at rated voltage
Operating temp	-10 deg C to 55 deg C.
Type and Operational indication	**Electrical Reset type** and Mechanical red colour Flag Indication
Contact Configuration	6 NO + 4 NC combination Electrical reset contacts and hand-reset flag

Contact ratings:

Make and carry	A.C. 1250 VA with max 5 amp & 660 Volts D.C. 1250 W dc with max 5 amp & 660 Volts
Make and carry for 3 sec.	A.C. 7500 VA with max 30 amp & 660 Volts D.C. 7500 W dc with max 30 amp & 660 Volts
Break	A.C. 1250 VA with max 5 amp & 660 Volts D.C. – 100 W resistive 50 watt inductive with max 5 amp & 660 Volts
Insulation	2 kV RMS, 50Hz for 1 min. 2.5 kV/1 sec between all terminals & case as per IS 3231. 1 kV RMS, 50Hz for 1 min. across open contact
Type of mounting	Flush

E-7-5 Non-Directional O/C & E/F Relay as per ANNEXURE-A
E-7-6 Directional O/C & E/F Relay as per ANNEXURE-B
E-7-7 Numerical based differential protection relay as per ANNEXURE-C

24.0 GUARANTEE:

The panels shall be delivered to the various consignees of the WBSEDCL and shall be suitably packed to avoid damages during transit. The Relays and Meters for each panel are to be delivered to the same consignee in a separate suitably packed crate in order to avoid any damage during transit. Packing of those items requires adequate care to avoid any

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possibility of ingress of rain water or seepage of water inside during transportation and subsequent storing at WBSEDCL store.

The C&R Panel with relays with all integral parts of the Equipment will be guaranteed for the period of five years from the date of last despach.

In the event of any defect in the Equipment, relay, any integral part of the Equipment arising out of faulty design, materials, workmanship within the above period, the supplier shall guarantee to replace or repair to the satisfaction of WBSEDCL.

If the supplier fails to do so, within one month of receipt of intimation, WBSEDCL reserves the right to effect repair or replacement by any other agency and recover charges for repair or replacement from the supplier.

25.0 TESTS:

25.1. TYPE TEST :

25.1.1. The Bidder should submit the Type test report including functional test for all the protective relays and C&R panels carried out within five years from the due date of submission of tender from CPRI/NABL accredited Laboratory/ Govt. Recognized test house or Laboratory on the tendered Items as per relevant Standard & Tender Specification with the Bid failing which the Bid may not be considered. The Type tests for Numerical Relays is to be submitted as specified in Clause No. 27 of Annexure-A & B & C of Relays specification.

25.1.2. **Test at Factory:**

The following Tests shall be carried out and 6 copies of Test certificates shall be submitted for approval. The Equipments shall only be dispatched after approval of the test certificates.

1. Checking of wiring of circuits and the continuity.
2. One minute applied voltage test. All Equipment on panel and small wiring shall be tested for withstand voltage of 2000Volts to earth & between different voltage circuits.
3. Insulation resistance of the complete wiring, circuit by circuit with all equipments mounted on the Board before and after H.V. test mentioned under 2 above.
4. Routine tests according to relevant National standard are on the Instruments, relays & other devices.

26.0 INSPECTION:

26.1. Acceptance test at manufacturer's works in presence of purchaser's representatives shall be carried out. The supplier shall give at least 15 days notice of the date when the tests are to be carried out. Purchasers shall give the right to select any quantity of the item wise offered lot for testing, offered for inspection and in the event of failure in test(s), the purchaser shall have the right to reject the offered equipments.

26.2. All relays, meters & annunciators provided in the control & relay panels are to be accepted only after successful hundred percent performance testing at testing department of WBSEDCL.

26.3. The inspection may be carried out by the WBSEDCL at any stage of manufacturing. The successful Bidder shall grant free access to the WBSEDCL's representative/s at a reasonable notice when the work is in progress. Inspection and acceptance of any equipment under this specification by the WBSEDCL, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

26.4. The manufacturer shall keep the WBSEDCL informed in advance, about the manufacturing programme so that arrangement can be made from stage inspection.

26.5. The WBSEDCL reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The supplier shall keep the WBSEDCL informed, in advance, about such testing programme.

27.0 TENDER DRAWING & LITERATURE:

Triplicate copies of the following drawings and literature shall be submitted along with the Tenders:-

a) Principal dimension details of each unit cubicles, complete assembly of panel and proposed arrangement of the Panel in a Control Room.
b) Front and rear views of the Panel with instrument and device positions marked.
c) Illustrative, descriptive literature, General Technical Data & Specification of Devices.
d) Make, type, particulars, literatures of each and every relay (protective & auxiliary), meters, annunciators, switches, lamps, TBs, TTBs etc. in line with tender specification.

28.0 CONTRACT DRAWINGS & LITERATURE

In the event of an order materializing, the Supplier also submit four prints of each drawing for approval of the WBSEDCL along with 2 sets of literature as mentioned in the spec.

The Contract drawings shall cover the followings:-

(a) Details of construction and dimensions of a cubicle and of the complete Panel.

(b) Template for foundation and details of Cable Trench and Cable Entry Holes in the Foundation Platform.

(c) Elementary diagrams of all controls, metering, protection annunciation and other circuits. All devices shall be numbered according to ASA or international usage, which shall be separately coded.

(d) Cabling and wiring diagram of the cubicles and inter-connections between them. Ferrule numbers, device number and grouping for cable take off shall be distinctly shown.

(e) Dimensional outline drilling diagram and special mounting arrangement if any, of such type of various devices on the Panel.

(f) Inter-connection diagram between Control Panel and C.B. power and instrument transformer etc.

(g) Wiring Schedule for Control & Relay Panel.

(h) Internal wiring diagram of all devices and elementary wiring diagram of relays where internal wiring is in triplicate. Construction details of switches, terminal blocks and test blocks etc.

(i) After approval, 10 sets of the final contract drawing for each set of Control & Relay Panels are to be supplied by the Bidder. One set reproducible tracing of the above drawings in soft format shall also be supplied.

In the event of contract being awarded, 4 copies of the following literatures shall be supplied along with the drawings as mentioned:-

(a)Literature describing construction, operation, adjustment and rating specifications of all the protective and auxiliary relays, recording instruments, metering instruments and control switches.

(b)Literature giving rating data, details and adjustments for calibration of the indicating instruments.

(c) Calibration instruments for the metering instruments.

(d) List of spare parts, identification number of renewable parts of relays, instruments and switches etc. with the help of which the WBSEDCL will be able to procure spare parts from the bidder at any subsequent time.

(e)It is desired that the complete schematic drawing is provided on a permanently laminated/engraved plate of suitable thickness which has to be bolted/riveted at the four corners on the inside face of rear door. In addition, one more plate of similar type and dimension shall be provided on the outside of the rear door providing guidelines and instructions for operation. The guidelines and schematic to be provided on the plates shall be as per approved drawings.

29.0 DOCUMENTS TO BE SUBMITTED ALONGWITH THE OFFER:

The bidder shall invariably submit the following documents failing which the offers are liable for rejection:-

29.1. Bill of Material (schedule-IA/IB).

29.2. Drawings, Literatures & Catalogues of the Equipment including all type of Relays as per Clause No. 26 of the Technical Specification.

CE Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn SE,P&CD DE,DTD SE,P&CD

29.3. List of testing equipment available with the Bidder.

29.4. GUARANTEED TECHNICAL PARTICULARS:

(i) Schedule-II -- GTP for C&R Panel

(ii) Schedule-III—GTP for Non Directional O/C & E/F Relay

(iii)Schedule-IV—GTP for Directional O/C & E/F Relay

(iv)Schedule-V—GTP for Master Trip Relay

(v) Schedule- VI – GTP for Differential Protection Relay

29.5. Undertakings from relay manufacturer (Schedule-VII)

29.6. Type Test report as per Clause No. 24 of the Technical Specification

30.0 QUALITY ASSURANCE PLAN

Immediately on receipt of the order you shall have to submit a "Quality Assurance Plan" indicating the specific quality control procedure and practices adopted in the major activities of production to ensure its standard.

31.0 Bus Configuration and Bill of material

31.1. 33/11kV delta star individual control transformer panel having HV side control and protection. Single main bus with bus section isolator scheme

2 nos.	Circuit label engraved suitably at front and inner side
1 no.	Section of painted and overlaid mimic diagram
1 no.	Circuit breaker control switch.
1 no	Local/Remote switch
6 nos.	Indicating lamps for circuit breaker ON/OFF, spring charged, trip circuit 1 & 2 healthy and auto trip indication.
3+3 nos.	PT supply Indicating lamps, red-yellow-blue for each PT.
2 nos.	Trip circuit supervision relay to supervise the TC 1 & 2 both under pre close and post close condition.
3 nos.	96 mm x 48 mm digital ammeter.
1 no.	Digital volt meter of 96 mm x 48 mm
1 no	Voltmeter selector switch, 7-position, RY-YB-BR-OFF-RN-YN-BN.
1 no.	Suitable space and wiring for non-tariff TVM for energy management.
1 set	Three phase 4 wire test terminal block for above.
1 no	Auxiliary relay with test push button for panel DC supervision relay.
16 way	Fascia window type annunciator complete with accept reset and test PB but without audible bell.
1 no	Three Element, IDMTL, non-directional over current relay with setting range 50% - 200% for IDMTL units and 500% - 2000% for high set unit.
2 nos	Restricted Earth Fault Relay current operated having setting range 10% to 40% both for HV & LV side of the Transformer.
1 no	Electrical Reset type high speed master tripping relay with contacts as required.

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

1 set	Biased Transformer differential relay.
1 no.	PT selector switch, two position PT-1/PT-2 switch, stay put type (16 A)
1 no.	Space heater with On/OFF switch and thermostat.
1 no.	Two element DC operated auxiliary relay having self reset type contact with hand reset operating flag for transformer Buchholz trip and Buchholz alarm function. Each element with 4NO Contact. Coil should be continuously current rated without cut-off contact.
1 no.	Two element DC operated auxiliary relay having self reset type contact with hand reset operating flag for transformer winding temp. trip and alarm function. Each element with 4NO Contact. Coil should be continuously current rated without cut-off contact.
1 no.	Two element DC operated auxiliary relay having self reset type contact with hand reset operating flag for transformer Low Oil Level (Main Tank) and OSR (OLTC) trip function. Each element with 4NO Contact. Coil should be continuously current rated without cut-off contact.
1 no.	Two element DC operated auxiliary relay having self reset type contact with hand reset operating flag for transformer Oil Temp. Trip and alarm function. Each element with 4NO Contact. Coil should be continuously current rated without cut-off contact.
1 no.	Two element DC operated auxiliary relay having self reset type contact with hand reset operating flag for transformer Main tank PRV trip and OLTC PRV Trip function. Each element with 4NO Contact. Coil should be continuously current rated without cut-off contact.
1 no	Two element DC operated auxiliary relay having self reset type contact with hand reset operating flag for OLTC Buchholz trip and spare. Each element with 4NO Contact. Coil should be continuously current rated without cut-off contact.
1 set	Audible bell and hooter for trip and non-trip fascia annunciation.
1 no	AC operated single element, auxiliary relay having only self reset contacts and with reverse flag for incoming AC supply supervision with test push button.
1 no	DC operated, two element, auxiliary relay having only self reset contact and with reverse flag for incoming DC and alarm bus DC fail supervision.
2 nos.	Test push button for above.
1 no	Single element AC operated auxiliary relay having self reset contact only for incoming DC and alarm bus DC fail alarm cancellation.
1 no	Push button for incoming DC and alarm bus DC fail alarm accept.
1 no	Indicating lamp for incoming DC and Alarm bus DC fail indication.
1 no	AC operated buzzer for incoming DC and Alarm bus DC fail audible alarm.
1 no.	DC operated emergency lamp with switch.
1 no.	Cubicle illumination lamp operated from door switch.
1 no.	15A, 3 phase plug & socket with switch.
1 set	Panel accessories as necessary.
1 set	Other equipment, relays etc. as required to fulfill the scheme Requirement.
2 nos.	Non Linear resistors and Stabilizing resistors for REF relays on both HV & LV sides of transformers.

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

31.2. 33kV Line Control C&R Panel with Directional O/C & E/F protection. Single main bus with bus section isolator scheme

2 no.	Circuit label engraved suitably at front and inner side
1 no.	Section of painted and overlaid mimic diagram
1 no.	Circuit breaker control switch.
1 no.	Local/Remote switch
6 nos.	Indicating lamps for circuit breaker ON/OFF, spring charged, trip circuit 1 & 2 healthy and auto trip indication.
3+3 nos.	PT supply Indicating lamps, red-yellow-blue for each PT.
2 nos.	Trip circuit supervision relay to supervise the TC 1 & 2 both under pre close and post close condition.
3 nos.	ammeter of 96 mm x 48 mm.
1 no.	Voltmeter of 96 mm x 48 mm.
1 no.	Voltmeter selector switch, 7-position, RY-YB-BR-OFF-RN-YN-BN.
1 no.	Suitable space and wiring for non-tariff TVM for energy management.
1 no.	Three phase 4 wire test terminal block for above.
1 no.	Auxiliary relay with test push button for panel DC supervision relay.
12 way	Fascia window type annunciator complete with accept reset and test PB but without audible bell.
1 no	Triple pole, IDMTL, non-dir- over current relay as per clause 23
1 no.	Single pole definite time sensitive E/F relay current operated having wide setting range for single circuit line.
1 no	Triple pole, IDMTL, directional over current relay with setting range 50% - 200% for IDMTL units and instantaneous high set unit -500% - 2000% applicable for parallel line feeder as per schedule
1 no	Single pole directional definite time sensitive E/F relay current operated having wide setting range for single circuit line. NECESSARY IPTs ARE WITHIN THE SCOPE OF BIDDER
1 no.	High speed master tripping relay with contacts as required with lock out and coil supervision scheme complete.
1 no.	PT selector switch, two position PT-1/PT-2 switch, stay put type (16 A)
1 no.	Space heater with On/OFF switch and thermostat.
1 set	Audible bell and hooter for trip and non-trip fascia annunciation.
1 no	AC operated single element, auxiliary relay having only self reset contacts and with reverse flag for incoming AC supply supervision with test push button.
1 no	DC operated, two element, auxiliary relay having only self reset contact and with reverse flag for incoming DC and alarm bus DC fail supervision.
2 nos.	Test push button for above.
1 no	Single element AC operated auxiliary relay having self reset contact only for incoming DC and alarm bus DC fail alarm cancellation.
1 no	Push button for incoming DC and alarm bus DC fail alarm accept.
1 no	Indicating lamp for incoming DC and Alarm bus DC fail indication.
1 no	AC operated buzzer for incoming DC and Alarm bus DC fail audible alarm.
1 no.	DC operated emergency lamp with switch.

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

1 no.	Cubicle illumination lamp operated from door switch.
1 no.	15A, 3 phase plug & socket with switch.
1 set	Panel accessories as necessary.
1 set	Other equipment, relays etc. as required to fulfill the scheme Requirement.

Annexure – D

Standard Make of Relay and Fitments

1.	**Relays**	**Schneider, ABB, Siemens, Alstom, CGL and other reputed relay Manufacturers fulfilling Relay specification as per ANNEXURE-A, ANNEXURE-B & ANNEXURE-C and general requirement as per Clause No.22 of the Technical Specification.**
2.	**Breaker Control Switch/ Local-Remote switch**	**Kaycee/Recom/Switron**
3.	**Ammeter/Voltmeter Selector switch**	**Kaycee/ Recom**
4.	**Static Ammeter/ voltmeter**	**AE/RISHAV/Secure**
5.	**Push Buttons**	**Vaishno/Teknic/Lumen/STS**
6.	**Indicating Lamps with lenses**	**Vaishno/Teknic/Lumen/STS/SWITRON**
7.	**Panel wiring**	**Finolex/Havvels/ KEI/ R. R. KAbles**
8.	**Hooter/Buzzer/Bell**	**Vaishno/STS/JVS/Bharani**
9.	**Annunciator**	**MINILEC/ALAN/ INSTALARM/EAPL**

Annexure-E

Legend of Devices associated with 33kV C & R Panel

Symbol Reference	Description	Particulars
A1-A2-A3, Ah	Ammeter	As specified
V	Voltmeter	As specified
VS	Manual Voltmeter Selector Switch	As specified
EM	Tri-Vector Meter	As specified
CS	Control switch T-A/T-N-A/C-C spring return type	As specified
L/R	Local/Remote switch	As specified
IL-R	CB 'ON' Indication Red lamp	As specified
IL-G	CB 'OFF' Indication Green lamp	As specified
IL-W	'Trip /Close signal received from Remote Indication white lamp	As specified
IL-B	"Spring charged" Indication Blue lamp	As specified
IL-A	CB " Auto trip" Indication Amber lamp	As specified

PB	Push Button	As specified
ANN	DC operated electric Buzzer and Microprocessor based Electronic annunciator with built in watch dog and first fault indication facility. The annunciator shall have provision for trip and non trip alarm functions and Accept/Test/Reset/Mute Push buttons	As specified
H,HS,TH	Heater, Heater Switch, Thermostat	As specified
FS	Fuse	As specified
LK	Link	As specified
MCB1	MCB 2 pole 32 A for DC supply	As specified
MCB2	MCB 2 pole 16 A for AC supply	As specified
MCB3	MCB 2 pole for spring charging motor supply	As specified
MVS	Manual PT selector switch	As specified
IR-I	Remote inter tripping contact from 33 kV Transformer Control and relay Panel	As specified
TC	Tripping Coil	As specified
CC	Closing Coil	As specified
86	Tripping Relay for Tripping function	As specified
52	Vacuum Circuit breaker	As specified
52a,52b	NO and NC contacts of Breaker Auxiliary switch respectively	As specified
PT	Potential Transformer	As specified
CT	Current Transformer	As specified
TTB	Test Terminal Block	As specified
51/50 R-Y-B-N	O/C and E/F protection	As specified
67 R-Y-B-N	Directional O/C and E/F protection	As specified
64	Restricted Earth Fault Protection	As specified
87	Differential Protection	As specified

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

SCHEDULE-I A

(To be submitted, duly filled in, along with the offer)

Bill of materials for 33 kV feeder C&R panels

Sl. No.	Description	Quantity	Make, Type etc.
1	Circuit label	1 No.	
2	Mimic section(Brilliant green paint to shade No.221 of IS 5 to be used)	1 No.	
3	T-N-C type control switch for circuit breaker.	1 No.	
4	Indicating LEDs for Spring charge indication(Blue) Trip circuit healthy indication(white) one each for Trip ckt 1 and Trip Ckt 2 Breaker 'ON' indication(Red) Breaker 'OFF' indication(Green)	 1 No. 2 Nos. 1 No. 1 No.	
5	Push button for Alarm Accept/Reset/Test/Mute	4 Nos.	
6	Numerical Directional IDMT over current and earth fault relay with high set instantaneous trip feature	1 No.	
7	High speed Master tripping relay (Electrically resettable)	1 No.	
8	12 window annunciation scheme with accept, reset and LED test push button with self resetting audible alarm.	1 Set	
9	TTB for HT Static TOD Tri-vector Energy meter.	1 No.	
10	Digital Ammeter (96 mm x 48 mm.)	3 Nos.	
11	Digital Voltmeter (96 mm x 48 mm.)& selector switch.	1 Set	
12	Local / Remote switch	1 No.	
	Internally mounted		
1	Space heater and control switch	1 Set	
2	Cubical illumination lamp and door switch	1 Set	
3	Power Plug, socket and control switch	1 set	
4	Alarm bell for trip & non-trip	3 Nos.	
5	MCBs	As required	
6	Fuse and Links	As required	
7	Control wire	As required	

&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE, DTD ACE, DTD ACE, P&CD ACE, P&CD

CE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

SCHEDULE-I B

Bill of materials for 33/11kV Transformer C&R panels with differential protection

Sl. No	Description	Quantity	Make,Type etc.
1	Circuit label	1 No.	
2	Mimic section (Brilliant green paint to shade No. 221 of IS 5 to be used)	1 Set	
3	T-N-C type control switch for circuit breaker.	1 Nos.	
4	Indicating LEDs for Spring charge indication(blue) Trip circuit healthy indication(white)) one each for Trip ckt 1 and Trip Ckt 2 Breaker 'ON' indication(Red) Breaker 'OFF' indication(Green)	 1 Nos. 2 Nos. 1 Nos. 1 Nos.	
5	Push button for Alarm accept/Reset/Test/Mute	4 Nos.	
6	Numerical non-directional IDMT over current and earth fault relay with high set instantaneous trip feature	1 Nos.	
7	High speed master tripping relay (electrically resettable)	1 No.	
8	TTB for HT Static TOD Tri-vector Energy meter.	1 No.	
9	Digital Ammeter (96 mm x 48 mm.)	3 Nos.	
10	Digital Voltmeter (96 mm x 48 mm.) & selector switch.	1 Sets	
11	Transformer differential numerical relay	1 No.	
12	16 window annunciation scheme with accept, reset and LED test push button with self resetting audible alarm.	1 No.	
13	Auxiliary relay for main tank Buchholz Alarm/trip (2-element)	1 Set	
14	Aux. relay for winding temp Alarm/trip (2-element)	1 Set	
15	Aux. relay for OLTC Buchholz Alarm/trip (2-element)	1 Set	
16	Aux. relay for low oil level alarm(Main Tank) & OSR(OLTC) Trip (2-element)	1 Set	
17	Aux. relay for oil temp alarm/trip (2-element)	1 Set	
18	Aux. relay for Main tank PRV & OLTC PRV Trip (2-element)	1 Set	
19	Restricted Earth Fault Relay as per specification (stand alone type) for HV & LV side of transformer	2 Nos.	
	Internally mounted		
1	Space heater and control switch	1 No.	
2	Cubicle illumination lamp with door switch.	1 No.	
3	Power plug with control switch	1 No.	
4	Alarm bell for trip & non-trip	3 Nos.	
5	MCB	As required	
6	Fuse and Links	As required	
7	Control wire	As required	

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE.Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

SCHEDULE - II

DETAILS OF RELAYS, METERS, EQUIPMENT& DEVICES AS OFFERED IN SCHEDULE OF 33 kV SIMPLEX TYPE CONTROL AND RELAYS PANEL – TO BE FILLED UP BY THE BIDDERS ALONGWITH SUBMISSION OF SUPPORTING DOCUMENTS

Sl. No.	Description	Make And Country Of Manufacture	Type (Catalogue to be enclosed)	Brief Description, with CT/PT details, contact configuration, Input/ Output details, characteristics, range, suitability etc. for clear perspective.
A	**SURFACE MOUNTING DEVICES**			
1	Circuit Level			
2	Mimic Diagram			
3	Circuit Breaker Control Switch Spring return lost motion type. Breaker Control Switch, 3 Position, Spring Return to Neutral, 8 Ways, 25 Amp.			
4	Ammeter 96 mm X 48 mm for C.T. Secondary rated Current 1A Scale 0-100/0-200A Scale 0-200A / 0-400A			
5	Voltmeter 96 mm X 48 mm for P.T. Secondary 110 VAC (L/L) Scale 0-40 kV			
6	Voltmeter Selector Switch 6 way & off position having break before make contact			
7	Test Terminal block suitable for 3 phase 4 wire system with wire rear connecting studs having provision of sealing arrangement			
8	Multi way micro processor based Electronic Annunciator with building- system watchdog first fault indications and red & yellow coloured windows with inscription for Trip & Non Trip Alarm functions			
9	Indicating Lamps LED type 63.5 VAC for P.T. Supply indication with RED/YELLOW/ BLUE Colours			
10	Indicating Lamp LED type 230 VAC for Panel D.C. Fail Common Indication			
11	Indicating Lamp LED type 30 VDC for CB ON/OFF, Auto trip, Spring Charge, Trip Circuit Healthy Indication with RED/GREEN/AMBER/BLUE/WHITE Colours respectively			
12	Push Button for Panel DC fail test			

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE, DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Description	Make And Country Of Manufacture	Type (Catalogue to be enclosed)	Brief Description, with CT/PT details, contact configuration, Input/ Output details, characteristics, range, suitability etc. for clear perspective.
13	Push Button for including AC fail test			
14	Push Button for non trip Panel DC fail Alarm Accept			
15	Push Button for Annunciator Alarm Test / Mute/Accept/Reset			
16	3 Element normal IDMTL over current Relay with instantaneous high set unit			
17	Single Element Instantaneous sensitive Earth Fault Relay with Timer			
18	Triple Pole Directional Voltage polarized Over Current Relay with Directional High Set Unit on all Element			
19	Single Pole Directional Voltage polarized Instantaneous sensitive E/F Relay with timer			
20	Hi balance Instantaneous Restricted Earth Fault Circulatory Current Fault Relay (a) HV side of Power Trf. (b) LV side of Power Trf.			
21	Single Element High Speed Tripping Relay with electrically reset Contact & H/R flag/indication with required numbers of contacts			
22	Two Element 30 V DC Voltage Actuated Auxiliary Relay with SR Contacts & HR/LED Flag/indication for Transformer Internal Trouble functions			
23	Single Element 30V DC Voltage Actuated Auxiliary Relay with self Reset Contact & Reverse Flag indication for Panel DC Supply fail function			
24	Single Element 230V AC Voltage Actuated Auxiliary Relay with self Reset Contacts & Reverse Flag indication for incoming AC Supply fail function			
25	30 V DC Voltage operated Relay for Trip Circuit supervision purpose with self reset contact			

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD.

ACE, P&E Distn ACE.Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Description	Make And Country Of Manufacture	Type (Catalogue to be enclosed)	Brief Description, with CT/PT details, contact configuration, Input/ Output details, characteristics, range, suitability etc. for clear perspective.
26	Single Element 230V AC Voltage Actuated Auxiliary Relay with self Reset Contacts without Flag indication for panel DC fail Alarm, Accept			
27	Additional Involvement of Single Element 30V DC Voltage Actuated Auxiliary Relay			
28	Extra Involvement of Auxiliary Relay for not having sufficient contacts to achieve required functions			
29	Space & wiring for housing purchaser's projection mounting type Energy meter(not within the scope of bidder			
30	Common Electronic DC bell/Buzzer Trip & Non-Trip Alarm functions			
31	Common Electronic AC Ball for Panel DC fail Alarm functions			
32	Biased differential relay for Trf. Control & Relay Panel			
B	**Inside Mounting Devices**			
1	230V AC Cubicle illuminating lamp with door operated Switch/Toggle Switch			
2	30V DC Emergency Lamp with Toggle Switch			
3	230C AC 60W space heater with thermostat & Toggle Switch			
4	16A Double V AC Combined 2/3 pin plug and socket with Switch			
5	16A Double Pole MCB for Incoming AC Supply			
6	Fuse			
7	Links			
8	Terminals			
9	Panel wires			
10	Earthing Arrangement			
C	**Panel Make**			
1	Panel Height			
2	Panel Width			
3	Panel Depth			

Note: All surface mounting devices excepting Energy meter, TTB & Bells are flush mounting type As per Schedule requirement.

&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

CE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Schedule-III

GTP for Numerical Non-Directional O/C & E/F Relay

Sl. No.	Feature and Function	Supplier's details
1.1	Make, Type, Model No and Version No and Ordering Code	
1.2	Conformance to i. IEC255-4	
	ii. IEC 61850	
1.3	No. of CT inputs for O/C and E/F Protection	
1.4	Type test report submitted(y/n)	
1.5	Relay shall be of Numeric Design	
1.6	Relay designed for line protection and Control	
1.7	Size of Relay LCD screen	
1.8	Relay is equipped with CB close and open key/push buttons	
1.9	Relay has following protection functions: a. Three phase over current b. Earth fault c. Thermal overload function d. Broken conductor protection function e. Circuit Breaker Maintenance function	
2.	a. One time delayed element and two high set elements b. Setting range and step for IDMT element for both current and Time Multiplier Setting	
	c. Selectable Current/Time Curve for IDMT element	
	d. Setting range and step for high set elements for both current and time delay	
3.	Sampling rate and frequency of analog signal	
4.	Whether remote controllable from SCADA	
5.	a. No. of Digital Inputs b. Voltage rating of Digital Inputs c. Provision of testing without current injection	
6.	Supervision for CB open and Closed status	
7.	No. of programmable LEDs and no. of Latched LEDs	
8.	Analog Measurement and display supported	
9.	Fault Record storage capacity	
10.	Event storage capacity	
11.	Disturbance record storage capacity	
12.	MMI with keypad and LCD provided	
13.	Rated DC Supply and tolerance	
14.	Rating of PT secondary	
15.	Rated frequency	
16.	a. Operating ambient temperature & humidity	

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

	b. Withstanding capability of Electromagnetic Interference as per relevant part of IEC 61850	
17.	Mounting	
18.	Watchdog	
19.	a. Nominal Feeder current	
	b. CT Ratio setting	
	c. Earth fault current with time delay IEC Curves, 2nd stage for instantaneous trip(less than 50 ms)	
	d. High set with delay	
	e. IEC Curves for all O/C and E/F have user selectable?	
20.	a. No. of Digital Output Contacts	
	b. Contact rating	
21.	Mode of Time Synchronization	
22.	Type of Lugs and terminators	
23.	MTBF	
24.	Lifespan	
25.	Compliance to Type Test	
26.	Communication Port a. Rear port- details b. Front port-details	
27.	Whether Communication Ports are native to the Relay	
28.	Protocol supported for Rear Port	
29.	Protocol supported for Front port	
30.	Start and trip output contacts are freely programmable	
31.	Cable for connection of Relay to laptop(USB port) along with converter and power supply if required for relay local setting	
32.	Basic application software for setting change, parameterisation	
33.	CD with software(licensed) to download disturbance recorder, event log and evaluation of those records	
34.	Graphical configuration tool for I/P, O/P and functional building block for protection and control	
35.	Any other software required for integration with SCADA.	

E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

E, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Schedule-IV

GTP for Numerical Directional O/C & E/F Relay

Sl. No.	Feature and Function	Supplier's details
1.1	Make, Type, Model No and Version No and Ordering Code	
1.2	Conformance to i. IEC255-4	
	ii. IEC 61850	
1.3 (a)	No. of CT inputs for O/C and E/F Protection - 5/1 Amp(site selectable)	
1.3 (b)	No. of PT Input - rated 110 Volt (L-L)	
1.3(c)	The relay should be able to internally derive the "Zero Sequence Voltage"	
1.4	Type test report submitted(y/n)	
1.5	Relay shall be of Numeric Design	
1.6	Relay designed for Feeder protection and Control	
1.7	Size of Relay LCD screen	
1.8	Relay is equipped with CB close and open key/push buttons	
Sl. No.	**Feature and Function**	**Supplier's details**
1.9	Relay has following Site – Selectable protection functions: a. Three phase Directional & Non – Directional over current b. Directional & Non – Directional Earth fault c. Thermal overload function d. Broken conductor protection function e. Circuit Breaker Failure Protection & Maintenance function f. The relay should have built in single & three Phase "VTFF" and have internal feature to operate as a Non – Directional relay in the event of "VTFF"	
2.	a. Directional Characteristic Angle setting range & resolution. b. One time delayed element and two high set elements c. Setting range and step for IDMT element for both current and Time Multiplier Setting	

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

	d. Selectable Current/Time Curve for IDMT element e. Setting range and step for high set elements for both current and time delay	
3.	Sampling rate and frequency of analog signal	
4.	Whether remote controllable from SCADA	
5.	a. No. of Digital Inputs b. Voltage rating of Digital Inputs c. Provision of testing without current injection	
6.	Supervision for CB open and Closed status	
7.	No. of programmable LEDs and no. of Latched LEDs	
8.	Analog Measurement and display supported	
9.	Fault Record storage capacity	
10.	Event storage capacity	
11.	Disturbance record storage capacity	
12.	MMI with keypad and LCD provided	
13.	Rated DC Supply and tolerance	
14.	Rating of CT/PT secondary	
15.	Rated frequency	
16.	Operating ambient temperature & humidity	
	b. Withstanding capability of Electromagnetic Interference as per relevant part of IEC 61850	
17.	Mounting	
18.	Watchdog	
19.	a. Nominal Feeder current	
	b. CT Ratio setting	
	c. Earth fault current with time delay IEC Curves, 2nd stage for instantaneous trip(less than 50 ms)	
	d. High set with delay	
	e. IEC Curves for all O/C and E/F have user selectable?	
20.	a. No. of Digital Output Contacts	
	b. Contact rating	
21.	Mode of Time Synch.	
22.	Type of Lugs and terminator	
23.	MTBF	
24.	Lifespan	
25.	Compliance to Type Test	
26.	Communication Port a. Rear port- details	

&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

CE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE.DTD, SE,P&CD

	b. Front port-details	
27.	Whether Communication Ports are native to the Relay	
28.	Protocol supported for Rear Port	
29.	Protocol supported for Front port	
30.	Start and trip output contacts are freely programmable	
31.	Cable for connection of Relay to laptop(USB port) along with converter and power supply if required for relay local setting	
32.	Basic application software for setting change, parameterization	
33.	CD with software(licensed) to download disturbance recorder, event log and evaluation of those records	
34.	Graphical configuration tool for I/P, O/P and functional building block for protection and control	
35.	Any other software required for integration with SCADA.	
36.	Provision for Time Stamping of all fault & event recorder.	

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Schedule-V

GTP for Master Trip Relay

Sl. No.	Description	Bidder's Response
1.	Manufacturer Name	
2.	Type and designation	
3.	Electrical reset	
4.	Mounting	
5.	High Burden relay	
6.	Operating Time	
7.	Rated DC supply and tolerance	
8.	No. of NO Contact	
9.	No. of NC Contact	

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Schedule-VI

GTP for Numerical Based Differential Relay

Sl. No.	Feature and Function	Supplier's details
1.1	Make, Type, Model No and Version No and Ordering Code	
1.2	Conformance to i. IEC255-4	
	ii. IEC 61850	
1.3	a. No. of CT inputs for differential Protection	
	b. C.T. secondary current	
	c. Adjustable bias setting	
	d. Operation philosophy	
	e. Whether Programmable HV/LV CT ratio of T/F & vector group provided	
1.4	Type test report submitted(y/n)	
1.5	Relay shall be of Numeric Design	
1.6	Relay designed for Transformer differential protection and Control	
1.7	Size of Relay LCD screen	
1.8	Relay is equipped with CB close and open key/push buttons	
1.9	Relay has following protection functions: a. Inbuilt REF protection b. Inbuilt HV & LV side over current & earth fault protection provided c. Thermal overload function d. Circuit Breaker Maintenance function e. Circuit Breaker failure protection.	
2.0	Harmonic restrain feature	
2.1	a. Percentage bias setting	
	b. Differential operating current	
	c. Through fault stabilization features	
2.2	a. Nos. of time delayed element and high set elements for O/C & E/F protection b. Setting range and step for IDMT element for both current and Time Multiplier Setting	
	c. Selectable Current/Time Curve for IDMT element	
	d. Setting range and step for high set elements for both current and time delay	
3.	Sampling rate and frequency of analog signal	
4.	Whether remote controllable from SCADA	

, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

5.	a. No. of Digital Inputs b. Voltage rating of Digital Inputs c. Provision of testing without current injection	
6.	Supervision for CB open and Closed status	
7.	No. of programmable LEDs and no. of Latched LEDs	
8.	Analog Measurement and display supported	
9.	Fault Record storage capacity	
10.	Event storage capacity	
11.	Disturbance record storage capacity	
12.	MMI with keypad and LCD provided	
13.	Rated DC Supply and tolerance	
14.	Rating of CT secondary	
15.	Rated frequency	
16.	a. Operating ambient temperature & humidity	
	b. Withstanding capability of Electromagnetic Interference as per relevant part of IEC 61850	
17.	Mounting	
18.	Watchdog	
19.	a. Nominal Feeder current	
	b. CT Ratio setting	
	c.Operating characteristics of the differential protection	
	d. Earth fault current with time delay IEC Curves, 2nd stage for instantaneous trip(less than 50 ms)	
	e. High set with delay	
	f. IEC Curves for all O/C and E/F have user selectable?	
20.	a. No. of Digital Output Contacts	
	b. Contact rating	
21.	Mode of Time Synchronization	
22.	Type of Lugs and terminators	
23.	MTBF	
24.	Lifespan	
25.	Compliance to Type Test	
26.	Communication Port a. Rear port- details b. Front port-details	
27.	Whether Communication Ports are native to the Relay	
28.	Protocol supported for Rear Port	
29.	Protocol supported for Front port	
30.	Start and trip output contacts are freely programmable	
31.	Cable for connection of Relay to	

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

	laptop(USB port) along with converter and power supply if required for relay local setting	
32.	Basic application software for setting change, parameterisation	
33.	CD with software(licensed) to download disturbance recorder, event log and evaluation of those records	
34.	Graphical configuration tool for I/P, O/P and functional building block for protection and control	
35.	Any other software required for integration with SCADA.	

Date :

Signature:
Name:
Designation:
Company Seal:

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

ANNEXURE-A

Technical specification for IEC 61850 compliant non- Directional O/C and E/F Relay

Sl. No.	Feature and Function	Technical requirement
1.	Purpose and application	It is intended to automate the Switchgears specified in the scope of supply and use Communicable Numeric relays for Protection, Control, Metering and Status monitoring. This specification is based on the understanding that an integrated Automation System along with protections shall be provided and same shall have provisions for Integration with SCADA system. All the feeders shall be remote controlled from WBSEDCL's SCADA and from the local console of the numerical relays. Numerical multifunctional combined Microprocessor based Feeder protection and management relay to protect the 33kV Feeder from all electrical and other faults along with reporting system, Disturbance record for fault analysis. Bidder should comply with any especial requirement or feature asked for retrofitting the relays. Relay should be IEC 61850 compliant. Relay should have 4 CT input for O/C and E/F protection. There should be option for derivation of E/F internally.
2.	Main Protection Feature	1. Relay should have minimum two group of setting. Setting group changeover required from digital status input. 2. Electrical over load protection with selectable IEC curves with two stage, first stage to be used as Definite Time / IDMT and second stage to be used as high set for short circuit protection. 3. Earth fault protection in two stages with IEC characteristics. First stage to be used as IDMT/Definite Time and second stage to be used as instantaneous elements. Earth fault element should be suitable for both CBCT and residual type CT connection. 4. Negative phase sequence Protection with IEC Curves. 5. CB Fail Protection & time settable as per user. 6. The relay should be immune to DC switching while carrying current i.e. no spurious trip should be generated if relay DC is made On and Off. 7. The relay should conform to the IEC255-4 or BS 142 for Inverse time characteristics. 8. The relay should have features to monitor for broken conductor and CB opening time.
3.	Processor feature	Relay shall be completely Numerical with protective elements having software algorithm based on sampling of Analog inputs. Sampling Rate of Analog Signal: The sampling rate should be 1000 Hz for 50 Hz signal or better for each analog channel. Hardware based measurements shall not be acceptable.
4.	Operational Philosophy	The operation of Relay shall be possible both locally from the Switchgear and remote & Local Work station. The local position shall be displayed in remote / local workstation and remote operation shall be blocked if the switch is in Local. Clear control priorities shall prevent initiation of operation of a single switch at the same time from more than one of the various control levels and there shall be interlocks among various control levels. The priority shall always be with the lowest enabled control level. Relay accuracy shall not be affected by system frequency fluctuation.
5.	Status/Optical Inputs/Digital inputs	1. Minimum 7 number status inputs are required 2. All status inputs should be 30 V DC

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		3. Setting group is required to be changed with any Digital input status. 4. Trip circuit supervision with DI status 5. The digital inputs shall be acquired by exception with 1ms resolution. Contact bouncing in digital inputs shall not be assumed as change of state. 6. Relay should have comprehensive self diagnostic feature with remote indication of relay failure and alarm shall be generated without tripping of circuit 7. Provision of Testing output relays without any current injection. 8. No. of programmable LEDs - at least 4 nos. with latching option.
6.	Main measuring and reporting feature	All measurements should be in primary quantities. Minimum following displays are required in alpha numeric:- 1. Three phase (Positive sequence) current 2. Neutral(zero sequence) current 3. All the trips should have clear indication on the relay terminals 4. Resetting should be selectable as hand reset or auto reset. 5. The default relay LCD shall be user defined to display primary circuit loading.
7.	Memory and Recording Feature	1. The relay setting and programming should be stored in EEPROM so that during Aux. Power failure the said data is not lost. 2. Relay should have event log, trip log and DR record. All logs should go in to history. 3. All tripping of relay should initiate DR in auto without extra binary input. Triggering of DR with binary input should be user configurable. 4. The last 2 fault DR records should be in flash memory and DR will not erase in case of DC supply fail for more than 2 days. 5. Should be able to record at least 5 Oscillographic disturbances and 5 fault records and 250 event records. 6. Minimum Four no. of latest trip log with cause of trip should be stored in memory along with date and time stamping. The memory should not be lost with the switching off of DC. 7. The relay should have fault-recording feature with current waveform and Digital Input status. The fault waveform should consist of minimum four current waveforms of three phase current and zero sequence current and DI status. Triggering time for Pre and Post should have user selectable. This record should be in flash memory for minimum 7(seven) days even after switching off the DC supply. 8. The fault should be date and time stamped. 9. Communication protocol IEC 61850.
8.	Auxiliary Supply	30V to - 25% to + 10%, 2 wire unearthed system. Necessary software shall be in-built for proper shutdown and restart in case of power failure. Auxiliary supply burden will be around 20Watt.
9.	Rated CT/PT secondary	5/1 Amp(User selectable) , CTs used to be protection class
10.	Rated frequency	50 HZ +/- 5%
11.	Ambient condition	1. Operating ambient temperature upto 55 Deg C 2. Operating Humidity upto 100 % 3. Relay shall meet the requirement for withstanding electromagnetic interference according to relevant parts of IEC 61850. Failure of single component within the equipment shall neither cause unwanted operation nor lead to a complete system breakdown.

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
12.	Module and Mounting	1. Relay should be flush mounted type 2. If module is drawout type then it should have CT shorting facility of make before break type. 3. Mounting in switchgears located in non AC rooms. 4. Galvanic isolation between field connection and relay hardware should be there.
13.	Watchdog and self monitoring	The relay should have facility to monitor the healthiness of its circuits and components by own monitoring system. In case of any problems, the alarm should be generated by one of the output contacts. The alarm as soft signal to be sent to SCADA system as well. Necessary support documentation explaining the self diagnostic feature shall be furnished Watch dog contact shall be provided in addition to required 7BI and 7 BO.
14.	Settings	Approximate settings possible should be as follows:- 1. Nominal Feeder current 2% to 110 % 2. CT Ratio setting 10-1000(approx.) 3. Earth fault current 5 to 40% with time delay IEC Curves, 2nd stage for instantaneous trip(less than 50 ms) 4. Over current trip- 50% to 200% of 1/5 Amp with time delay as per IEC Curves. 5. High set with delay 200% to 2000% 6. IEC Curves for all O/C and E/F have user selectable.
15.	Output Relays	Minimum 7 number output relays are required out of which 1. One potential free change over contact should be provided for start inhibit of relay. 2. All o/p contact should be freely programmable. 3. Rating of trip contacts:- a) Contact durability>10K operation b) 15 Amp make and carry for 3 sec for trip contact c) Make and carry for trip contacts L/R<=40ms Rating of Alarm contacts:- a) 8 Amp make and carry continuously for 5 sec. Testing of Output relays through keypad on relay fascia and relay HMI software. Output relay dwell time shall be user programmable or fixed at 100ms.
16.	Relay software and Man Machine Interface	1. The relay should have native IEC 61850 Communication Protocol. 2. Should have password protected key padlock. 3. Necessary software for relay setting, retrieving DR, event log, trip log should be supplied by the Bidder. Necessary License is to be issued for WBSEDCL, if required. 4. Bidder has to supply communication hardware for relay setting, DR downloading from front port. This device should be compatible to USB/Ethernet port. 5. It shall be possible to transfer the data stored in the DFR to computer on IEEE/COMTRADE format. The data format shall be compatible for dynamic protection relay testing on relay test kit. COMTRADE data viewing software to be provided. 6. Multiuser/Corporate license for installation on minimum 7 nos. of PCs.
17.	Date and time	Date and Time stamping with faults and record. The clock should be powered from internal cell and should not required setting after every DC switching. The internal cell life minimum 5 years. Time synchronization by IRIG-B or SNTP. For time synchronization through SNTP is to be provided from clock signal coming

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		from RTU. In case of IRIG-B, time synchronization will be done with GPS clock signal from GPS receiver located at substation.
18.	Lugs and terminators	All CT and PT terminals shall be provided as fixed (screwed) type terminals on the relay to avoid any hazard due to loose connection leading to CT opening or any other loose connection. Necessary amount of lugs should be supplied along with each relay for CT connection and control wiring. All CT terminals should be capable to connect with ring socket.
19.	Manuals, Drawings and Literature	1. The relays should be supplied with manuals with all technical and operating instructions. 2. All the internal drawings indicating the logics and block diagram details explaining principle of operation should be given at the time of supply. 3. Mapping details shall be submitted in IEC format.
20.	Standard documentation per Relay, according to IEC 61850	1. MICS document (model implementation conformance statement) 2. PICS(protocol implementation conformance statement 3. Conformance Test certificate from KEMA/CPRI. 4. PIXIT document All the above mentioned certificates shall be submitted along with Techno-commercial Bid. 5. ICD file 6. SCD file
21.	Extendibility in Future	The Bidder shall provide all necessary software tools along with source codes to perform addition of bays in future and complete integration with SCADA by the User. These software tools shall be able to configure relay, add analog variable, alarm list, event list, modify interlocking logics etc. for additional bays/equipments which shall be added in future.
22.	Lifespan	The supplier should mention following:- 1. Product maturity: The Bidder should mention the time period for which the product is in the market 2. Expected production life 3. Hardware/Firmware change notification process. Upgrades to be provided free of cost within the Guarantee period/5 years whichever is later, if needed. 4. Lifespan of standard tools and processes for relay configuration, querying and integration.
23.	Standards	The relay should conform to the IEC255-5 or equivalent BS / ANSI for following:- 1. Overload withstand test 2. Dielectric withstand: 2kV in common, 1 kV in differential mode 3. Impulse Voltage: 5kV in common, 1kV in differential mode 4. Insulation resistance>100 M-ohm. 5. Vibration: Shock and bump and Seismic 6. Storing and transportation 7. Radio Interference: IEC 61000 for high frequency disturbance, Transient disturbance, Electrostatic discharge 8. KEMA Certification for the particular model offered with respect to IEC61850 Protocol.
24.	Communication Port	1. Two nos. IEC 61850 (Edition-2) protocol compliant 100 MBPS Ethernet RJ45/F.O ports having selectable HSR (High Availability Seamless Redundancy) and PRP (Parallel Redundancy Protocol) Protocol compliance for communication with SCADA system through two managed Ethernet

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		Switches operating in redundant mode. The communication shall be made in 1+1 mode between individual IED to Switch, such that failure of one set of LAN shall not affect the normal operation of SCADA. However, it shall be alarmed in SCADA. The relay rear ports should accommodate both daisy chain and star bus tropology for SCADA integration. 2. Functioning of Relay shall not hamper to fault occurring any interconnected relay. 3. One Front port Ethernet RJ45/USB 2.0 for relay parameterization and configuration etc. with the help of PC. In case RS-232 port offered, suitable interfacing cable with one end having RS 232 port and other end USB 2.0 to be provided to connect with PC free of cost. 4. Relay should generate GOOSE message as per IEC 61850 standard for interlocking and also ensure interoperability with third party relays.
25.	Name Plate and marking	Each IED shall be clearly marked with manufacturer's Name, type, serial no. and electrical rating data. Name plates shall be made of anodized aluminium with white engraving on black surface.
26.	Performance Guarantee	Relays will be guaranteed for the period of five years from the date of last dispach. Any problem in the said period should be attended free of charge inclusive of repair/replacement of relays/ component (both H/W, S/W).
27.	Type Test	• Dielectric Withstand Test—IEC 60255-5 • High Voltage Impulse Test, class III --- IEC 60255-5(5kV peak, 1.2/50 micro Sec;3 Positive and 3 negative shots at interval of 5 Sec.) • DC Supply Interruption ---- IEC 60255-11 • AC Ripple on DC supply ---- IEC 60255-11 • Voltage Dips and Short Interruptions --- IEC 61000-4-11 • High frequency Disturbance ---- IEC 60255-22-1, Class III • Fast Transient Disturbance ---- IEC 60255-22-4, Class-IV • Surge withstand capability ---- IEEE/ANSI C 37.90.1(1989) • Degree of Protection • Electromagnetic compatibility • Mechanical stress/vibration test • Temperature withstand Type test reports for the above tests shall be submitted for the approval of WBSEDCL along with Tender, failing which the bid may not be considered. Wherever the above mentioned standards and IEC 61850 overlap, the latter will prevail.
28.	Credential as pre-requisite of Tender	Qualifying Requirement:- 1. Copies of performance certificate for two years successful operation as on the due date of bid opening for the offered relay in respect to implementation of IEC 61850 protocols to any SCADA/substation automation system from reputed Power Sector Utility in India shall have to be furnished along with the Bid. Copies of Purchase Orders and corresponding Delivery Challans /Stores Receipt vouchers/ Excise Duty Invoice, etc., i.e. Proof of Execution of the Purchase Orders. OR

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		Successful testing and operation of minimum one year in WBSEB/WBSEDCL/WBSETCL network. 2. Documentary evidence for being manufacturers like registration Certificate issued by SSI/NSIC/Directorate of Industries/DGS&D, etc. for Qualifying requirement. 3. The bidder should have testing facilities of all functional tests or should have arrangement of all functional tests at government approved testing laboratories. **Inter-operability test:-** After fulfilment of the above Q.R., inter-operability test of the offered relay (other than Make & Model used in WBSEDCL) with the existing relay in WBSEDCL Network will be tested in WBSEDCL Distribution Testing Department, WBSEDCL for which due intimation for supply of sampled of offered relay will be given to the Bidder. The Bidder needs to submit the said relay to Distribution Testing Department, WBSEDCL within one week from the said intimation. The offered relay will only be accepted after fulfilment of above Q.R. & successful inter-operability test at WBSEDCL system.

Checklist for Bill of Material for supply

Sl. No.	Material	
1.	Relay (Model No.)	Qty as per Tender
2.	Lugs suitable for current and control, wiring	Qty as per Tender X Number of TBs in relay + 20% extra.
3.	Cable for connection of Relay to laptop(USB port). Along with converter and power supply if required for relay local setting	10 set
4.	Manual, Hard copy in good quality paper properly bounded	10 set
5.	Copy of Type Test certificate along with manual	With offer
6.	Basic application software for setting change,	10 nos.
7.	CD with software(licensed) to download disturbance recorder, event log and evaluation of those records	10 nos.
8.	Graphical configuration tool for I/P, O/P and functional building block for protection	10 nos.
9.	Any other software required for integration with SCADA.	10 nos.

N.B. All the above tools/ Software should be compatible to WINDOWS XP/WINDOWS NT/WINDOWS 7 Operating System.

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

ANNEXURE-B

Technical specification for IEC 61850 compliant Directional O/C and E/F Relay

Sl. No.	Feature and Function	Technical requirement
1.	Purpose and application	It is intended to automate the Switchgears specified in the scope of supply and use Communicable Numeric relays for Protection, Control, Metering and Status monitoring. This specification is based on the understanding that an integrated Automation System along with protections shall be provided and same shall have provisions for Integration with SCADA system. All the feeders shall be remote controlled from WBSEDCL's SCADA and from the local console of the numerical relays. Numerical multifunctional combined Microprocessor based Feeder protection and management relay to protect the 33 kV Feeder from all electrical and other faults along with reporting system, Disturbance record for fault analysis. Bidder should comply with any especial requirement or feature asked for retrofitting the relays. Relay should be IEC 61850 compliant. Relay should have 4 CT input, 3 input for O/C and residual E/F protection will be derived internally. One CT input may be used for unbalanced current protection. Relay should have 4 voltage input, 3 input for VT element for directional O/C protection with internally derived residual voltage for E/F protection. Another VT input will be used for residual voltage protection. Relay should have two stage over voltage and under voltage protection. **The Directional O/C & E/F Relay should have the Site-selectable provision for operating in both Directional & Non-directional mode depending on site requirement.**
2.	Main Protection Feature for directional O/C & E/F relay.	1. Electrical over load protection with selectable IEC curves with two stage, first stage to be used as Definite Time / IDMT and second stage to be used as high set for short circuit protection. 2. Earth fault protection in two stages with IEC characteristics. First stage to be used as IDMT/Definite Time and second stage to be used as instantaneous elements. Earth fault element should be suitable for both CBCT and residual type CT connection. 3. Negative phase sequence Protection with IEC Curves. 4. CB Fail Protection & time settable as per user. 5. The relay should be immune to DC switching while carrying current i.e. no spurious trip should be generated if relay DC is made On and Off 6. The relay should conform to the IEC255-4 or BS 142 for Inverse time characteristics. 7. VT fuse fail detection on NPS current/NPS Voltage or zero sequence current/voltage based logic and blocking of under voltage protection by VT fuse fail detection. 8. Three phase VT fuses fail detection on current based logic. 9. The relay should have features to monitor for broken conductor and CB opening time. 10. The relay shall be designed for application in WBSEDCL's distribution network where the system is non-effecively earthed through earthing transformer emanating at 33kV bus of 132/33 kV

E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

E, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		substation. 11. Relay should have minimum two group of setting. Setting group changeover required from digital status input.
3.	Processor feature	Relay shall be completely Numerical with protective elements having software algorithm based on sampling of analog inputs. Sampling Rate of Analog Signal: The sampling rate should be 1000 Hz for 50 Hz signal or better for each analog channel. Hardware based measurements shall not be acceptable.
4.	Operational Philosophy	The operation of Relay shall be possible from both locally from the Switchgear and remote and Local Work station. The local position shall be displayed in remote / local workstation and remote operation shall be blocked if the switch is in Local. Clear control priorities shall prevent initiation of operation of a single switch at the same time from more than one of the various control levels and there shall be interlocks among various control levels. The priority shall always be with the lowest enabled control level. Relay accuracy shall not be affected by system frequency fluctuation.
5.	Status/Optical Inputs/Digital inputs	1. Minimum 7 number status inputs are required 2. All status inputs should be 30 V DC 3. Setting group is required to be changed with any Digital input status. 4. Trip circuit supervision with DI status 5. The digital inputs shall be acquired by exception with 1ms resolution. Contact bouncing in digital inputs shall not be assumed as change of state. 6. Relay should have comprehensive self diagnostic feature with remote indication of relay failure and alarm shall be generated without tripping of circuit 7. Provision of Testing output relays without any current injection. 8. No. of programmable LEDs- at least 4 nos. with latching option.
6.	Main measuring and reporting feature	All measurements should be in primary quantities. Minimum following displays are required in alpha numeric:- 1. Three phase (Positive sequence) current, Three phase voltage 2. Neutral (zero sequence) current, MW, MVAR, Frequency, Pf, MVA etc. 3. All the trips should have clear indication on the relay terminals 4. Resetting should be selectable as hand reset or auto reset.
7.	Memory and Recording Feature	1. The relay setting and programming should be stored in EEPROM so that during Aux. Power failure the said data is not lost. 2. Relay should have event log, trip log and DR record. All logs should go in to history. 3. All tripping of relay should initiate DR in auto without extra binary input. Triggering of DR with binary input should be user configurable. 4. The last 2 fault DR records should be in flash memory and DR will not erase in case of DC supply fail for more than 2 days. 5. Should be able to record at least 5 Oscillographic disturbances and 5 fault records and 250 event records. 6. Minimum Four no. of latest trip log with cause of trip should be

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		stored in memory along with date and time stamping. The memory should not be lost with the switching off of DC. 7. The relay should have fault-recording feature with current waveform and Digital Input status. The fault waveform should consist of minimum four current waveforms of three phase current and zero sequence current and DI status. Triggering time for Pre and Post should have user selectable. This record should be in flash memory for minimum 7 days even after switching off the DC supply. 8. The fault should be date and time stamped. 9. Communication protocol IEC 61850.
8.	Auxiliary Supply	30 V to - 25% to + 10%, 2 wire unearthed system. Necessary software shall be in-built for proper shutdown and restart in case of power failure. Auxiliary supply burden will be around 20Watt.
9.	Rated CT/PT secondary	5/1 Amp(site selectable) , CTs used to be protection class. 3PT input rated 110 Volt (L-L)
10.	Rated frequency	50 HZ +/- 5%
11.	Ambient condition	1. Operating ambient temperature up to 55 Deg C 2. Operating Humidity up to 100 % 3. Relay shall meet the requirement for withstanding electromagnetic interference according to relevant parts of IEC 61850. Failure of single component within the equipment shall neither cause unwanted operation nor lead to a complete system breakdown.
12.	Module and Mounting	1. Relay should be flush mounted type 2. If module is draw out type then it should have CT shorting facility of make before break type. 3. Mounting in switchgears located in non AC rooms. 4. Galvanic isolation between field connection and relay hardware should be there.
13.	Watchdog and self monitoring	The relay should have facility to monitor the healthiness of its circuits and components by own monitoring system. In case of any problems, the alarm should be generated by one of the output contacts. The alarm as soft signal to be sent to SCADA system as well. Necessary support documentation explaining the self diagnostic feature shall be furnished. Watch dog contact shall be provided in addition to required 7BI and 7 BO.
14.	Settings	Approximate settings possible should be as follows:- 1. Nominal Feeder current 2% to 110 % 2. CT Ratio setting 10-1000(approx.) 3. Earth fault current 5 to 40% with time delay IEC Curves, 2nd stage for instantaneous trip(less than 50 ms) 4. Over current trip- 50% to 200% of 1/5 Amp with time delays as per IEC Curves. 5. High set with delay 200% to 2000% 6. IEC Curves for all O/C and E/F have user selectable. 7. Selectable MTA for Directional features for O/C relay should cover 1st quadrant for effectively grounded system/ impedance grounded system/solid grounded system.

CE Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

CE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
15.	Output Relays	Minimum 7 number output relays are required out of which 1. One potential free change over contact should be provided for start inhibit of relay. 2. All o/p contact should be freely programmable. 3. Rating of trip contacts:- a) Contact durability>10K operation b) 15 Amp make and carry for 3 sec for trip contact c) Make and carry for trip contacts L/R<=40ms Rating of Alarm contacts:- d) 8 Amp make and carry continuously for 5 sec. Testing of Output relays through keypad on relay fascia and relay HMI software. Output relay dwell time shall be user programmable or fixed at 100ms.
16.	**Relay software and Man Machine Interface**	1. The relay should have native IEC 61850 Communication Protocol. 2. Should have password protected key padlock. 3. Necessary software for relay setting, retrieving DR, event log, trip log, and downloading waveform should be supplied by the Bidder. Necessary Licensed is to be issued for WBSEDCL, if required. 4. Bidder has to supply communication hardware for relay setting, DR downloading from front port. This device should be compatible to USB/Ethernet port. 5. It shall be possible to transfer the data stored in the DFR to computer on IEEE/COMTRADE format. The data format shall be compatible for dynamic protection relay testing on relay test kit. COMTRADE Data viewer software is to be provided. 6. Multiuser/Corporate license for installation on minimum 7 nos. of PCs.
17.	**Date and time**	Date and Time stamping with faults and record. The clock should be powered from internal cell and should not required setting after every DC switching. The internal cell life minimum 5 years. Time synchronization by IRIG-B or SNTP. For time synchronization through SNTP is to be provided from clock signal coming from RTU. In case of IRIG-B, time synchronization will be done with GPS clock signal from GPS receiver located at substation.
18.	**Lugs and terminators**	All CT and PT terminals shall be provided as fixed (screwed) type terminals on the relay to avoid any hazard due to loose connection leading to CT opening or any other loose connection. Necessary amount of lugs should be supplied along with each relay for CT connection and control wiring. All CT terminals should be capable to connect with ring socket.
19.	**Manuals, Drawings and Literature**	1. The relays should be supplied with manuals with all technical and operating instructions. 2. All the internal drawings indicating the logics and block diagram details explaining principle of operation should be given at the time of supply. 3. Mapping details shall be submitted in IEC format.
20.	**Standard documentation per Relay, according to IEC 61850**	1. ICS document (model implementation conformance statement) 2. PICS(protocol implementation conformance statement

SE, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		3. Conformance Test certificate from KEMA/CPRI. 4. PIXIT document All the above mentioned certificates shall be submitted along with Techno-commercial Bid. 5. ICD file 6. SCD file
21.	**Extendibility in Future**	The Bidder shall provide all necessary software tools along with source codes to perform addition of bays in future and complete integration with SCADA by the User. These software tools shall be able to configure relay, add analog variable, alarm list, event list, modify interlocking logics etc. for additional bays/ equipments which shall be added in future.
22.	**Lifespan**	The supplier should mention following:- 1. Product maturity: The Bidder should mention the time period for which the product is in the market 2. Expected production life 3. Hardware/Firmware change notification process. Upgrades to be provided free of cost within the Guarantee period/5 years whichever is later, if needed. 4. Lifespan of standard tools and processes for relay configuration, querying and integration.
23.	**Standards**	The relay should conform to the IEC255-5 or equivalent BS / ANSI for following:- 1. Overload withstand test 2. Dielectric withstand: 2kV in common, 1 kV in differential mode 3. Impulse Voltage: 5kV in common, 1kV in differential mode 4. Insulation resistance>100 M ohm 5. Vibration: Shock and bump and Seismic 6. Storing and transportation 7. Radio Interference: IEC 61000 for high frequency disturbance, Transient disturbance, Electrostatic discharge 8. KEMA/CPRI Certification for the particular model offered with respect to IEC61850 Protocol

&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

CE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
24.	**Communication Port**	1. Two nos. IEC 61850 (Edition-2) protocol compliant 100 MBPS Ethernet RJ45/F.O ports having selectable HSR (High Availability Seamless Redundancy) and PRP (Parallel Redundancy Protocol) Protocol compliance for communication with SCADA system through two managed Ethernet Switches operating in redundant mode. The communication shall be made in 1+1 mode between individual IED to Switch, such that failure of one set of LAN shall not affect the normal operation of SCADA. However, it shall be alarmed in SCADA. The relay rear ports should accommodate both daisy chain and star bus tropology for SCADA integration. 2. Functioning of Relay shall not hamper to fault occurring any interconnected relay. 3. One Front port Ethernet RJ45/USB 2.0 for relay parameterization and configuration etc. with the help of PC. In case RS-232 port offered, suitable interfacing cable with one end having RS 232 port and other end USB 2.0 to be provided to connect with PC free of cost. 4. Relay should generate GOOSE message as per IEC 61850 standard for interlocking and also ensure interoperability with third party relays.
25.	**Name Plate and marking**	Each IED shall be clearly marked with manufacturer's Name, type, serial no. and electrical rating data. Name plates shall be made of anodized aluminium with white engraving on black surface.
26.	**Performance Guarantee**	Relays will be guaranteed for the period of five years from the date of last dispach. Any problem in the said period should be attended free of charge inclusive of repair/replacement of relays/ component (both H/W, S/W).
27.	**Type Test**	• Dielectric Withstand Test—IEC 60255-5 • High Voltage Impulse Test, class III --- IEC 60255-5(5kV peak, 1.2/50 micro Sec;3 Positive and 3 negative shots at interval of 5 Sec.) • DC Supply Interruption ---- IEC 60255-11 • AC Ripple on DC supply ---- IEC 60255-11 • Voltage Dips and Short Interruptions --- IEC 61000-4-11 • High frequency Disturbance ---- IEC 60255-22-1, Class III • Fast Transient Disturbance ---- IEC 60255-22-4, Class-IV • Surge withstand capability ---- IEEE/ANSI C 37.90.1(1989) • Degree of Protection • Electromagnetic compatibility • Mechanical stress/vibration test • Temperature withstand Type test reports for the above tests shall be submitted for the approval of WBSEDCL along with Tender. Wherever the above mentioned standards and IEC 61850 overlap, the latter will prevail.
28.	Credential as pre-requisite of Tender	1. Copies of performance certificate for two years successful operation as on the due date of bid opening for the offered relay in respect to implementation of IEC 61850 protocol to any SCADA/substation automation system from reputed Power Sector Utility in India shall

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		have to be furnished along with the Bid. Copies of Purchase Orders and corresponding Delivery Challans /Stores Receipt vouchers/ Excise Duty Invoice, etc., i.e. Proof of Execution of the Purchase Orders. OR Successful testing and operation of minimum one year in WBSEB/WBSEDCL/WBSETCL network.. 2. Documentary evidence for being manufacturers like registration Certificate issued by SSI/NSIC/Directorate of Industries/DGS&D, etc. for Qualifying requirement. 3. The bidder should have testing facilities of all functional tests or should have arrangement of all functional tests at government approved testing laboratories. **Inter-operability test:-** After fulfilment of the above Q.R. inter-operability test of the offered relay (other than Make & Model used in WBSEDCL) with the existing relay in WBSEDCL Network will be tested in WBSEDCL Distribution Testing Department, WBSEDCL for which due intimation for supply of sampled of offered relay will be given to the Bidder. The Bidder needs to submit the said relay to Distribution Testing Department, WBSEDCL within one week from the said intimation. The offered relay will only be accepted after fulfilment of above Q.R. &successful inter-operability test at WBSEDCL system.

Checklist for Bill of Material for supply

Sl. No.	Material	
1.	Relay (Model No.)	Qty as per Tender
2.	Lugs suitable for current and control, wiring	Qty as per Tender X Number of TBs in relay + 20% extra.
3.	Cable for connection of Relay to laptop(USB port). Along with converter and power supply if required for relay local setting	10 set
4.	Manual, Hard copy in good quality paper properly bounded	10 set
5.	Copy of Type Test certificate along with manual	With offer
6.	Basic application software for setting change,	10 nos.
7.	CD with software(licensed) to download disturbance recorder, event log and evaluation of those records	10 nos.
8.	Graphical configuration tool for I/P, O/P and functional building block for protection	10 nos.
9.	Any other software required for integration with SCADA.	10 nos.

N.B All the above tools/ Software should be compatible to WINDOWS XP/WINDOWS NT/WINDOWS 7 Operating System.

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

ANNEXURE-C

Technical specification for IEC 61850 compliant Differential Relay

The offered item should meet minimum following requirements:-

Sl. No.	Feature and Function	Technical requirement
1.	Purpose and application	It is intended to automate the Switchgears specified in the scope of supply and use Communicable Numeric relays for Protection, Control, Metering and Status monitoring. This specification is based on the understanding that an integrated Automation System along with protections shall be provided and same shall have provisions for Integration with SCADA system. All the feeders shall be remote controlled from Employer's SCADA and from the local console of the numerical relays. Numerical multifunctional combined Microprocessor based Transformer protection and management relay to protect the 33/11 kV Transformer from all electrical and other faults along with reporting system, Disturbance record for fault analysis. Bidder should comply with any especial requirement or feature asked for retrofitting the relays. Relay should be IEC 61850 compliant. Relay should have 4 current input each for HV and LV side for differential protection of two winding transformer. However in total 7 current inputs may also be acceptable.
2.	Main Protection Feature	1. Relay should have minimum two group of setting. Setting group changeover required from digital status input. 2. Relay should be suitable for differential protection of two winding transformers above 6.3MVA, 33/11kV. 3. Relay should have 2nd and 5th harmonic blocking feature and unrestrained High Set current tripping feature. 4. Relay may have backup O/C and E/F feature with IDMTL/Definite Time. There should be option for derivation of E/F internally. 5. CB Fail Protection & time settable as per user. 6. The relay should be immune to DC switching while carrying current i.e. no spurious trip should be generated if relay DC is made ON and OFF. 7. The relay should conform to the IEC255-4 or BS 142 for Inverse time characteristics.
3.	Processor feature	Relay shall be completely Numerical with protective elements having software algorithm based on sampling of analog inputs. Sampling Rate of Analog Signal: The sampling rate should be 1000 Hz for 50 Hz signal. Hardware based measurements shall not be acceptable.
4.	Operational Philosophy	The operation of Relay shall be possible from both locally from the Switchgear and remote and Local Work station. The local position shall be displayed in remote / local workstation and remote operation shall be blocked if the switch is in Local. Clear control priorities shall prevent initiation of operation of a single switch at the same time from more than one of the various control levels and there shall be interlocks among various control levels. The priority shall always be with the lowest enabled control level.
5.	Status/Optical Inputs/Digital inputs	1. Minimum 7 numbers status inputs are required 2. All status inputs should be 30 V DC

Sl. No.	Feature and Function	Technical requirement
		3. Setting group is required to be changed with any Digital input status. 4. Trip circuit supervision with DI status 5. The digital inputs shall be acquired by exception with 1ms resolution. Contact bouncing in digital inputs shall not be assumed as change of state. 6. Relay should have comprehensive self diagnostic feature with remote indication of relay failure and alarm shall be generated without tripping of circuit 7. Provision of Testing output relays without any current injection. 8. No. of programmable LEDs- at least 4 nos. with site - selectable latching option.
6.	Main measuring and reporting feature	All measurements should be in primary quantities. Minimum following displays are required in alpha numeric:- 1. Three phase (Positive sequence) current and Phase angle (Both HV and LV side) 2. Neutral(zero sequence) current, 3. All the trips should have clear indication on the relay terminals. 4. Resetting should be selectable as hand reset or auto reset.
7.	Memory and Recording Feature	1. The relay setting and programming should be stored in EEPROM so that during Aux. Power failure the said data is not lost. 2. Relay should have event log, trip log and DR record. All logs should go in to history. 3. All tripping of relay should initiate DR in auto without extra binary input. Triggering of DR with binary input should be user configurable. 4. The last 2 fault DR records should be in flash memory and DR will not erase in case of DC supply fail for more than 2 days. 5. Minimum Four no. of latest trip log with cause of trip should be stored in memory alone with date and time stamping. The memory should not be lost with the switching off of DC. 6. The relay should have fault-recording feature with current waveform and Digital Input status. The fault waveform should consist of minimum four current waveforms of three phase current and zero sequence current and DI status. Triggering time for Pre and Post should have user selectable. This record should be in flash memory for minimum 7 days even after switching off the DC supply. 7. The fault should be date and time stamped. 8. Communication protocol IEC 61850.
8.	Auxiliary Supply	30 V with variation of - 25% to + 10%, 2 wire unearthed system
9.	Rated CT secondary	5/1 Amp (site selectable), CTs used to be protection class.
10.	Rated frequency	50 HZ +/- 5%
11.	Ambient condition	1. Operating ambient temperature up to 55 Deg C 2. Operating Humidity up to 100 % 3. Relay shall meet the requirement for withstanding electromagnetic interference according to relevant parts of IEC 61850. Failure of single component within the equipment shall neither cause unwanted operation nor lead to a complete system breakdown.
12.	Module and Mounting	1. Relay should be flush mounted type 2.If module is draw out type then it should have CT shorting facility of

Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&CD

P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		make before break type. 3. Mounting in switchgears located in non AC rooms.
13.	Watchdog and self monitoring	The relay should have facility to monitor the healthiness of its circuits and components by own monitoring system. In case of any problems, the alarm should be generated by one of the output contacts. The alarm as soft signal to be sent to SCADA system as well. Necessary support documentation explaining the self diagnostic feature shall be furnished.
14.	Settings	Approximate settings possible should be as follows:- 1. Nominal Feeder current 2% to 110 % 2. CT Ratio setting 10-1000(approx.) 3. Relay should have amplitude matching features by means of reference power common to all winding. 4. Relay should have site selectable suitable for all available vector groups. It will automatically taken care of zero sequence filtering of relay currents depending on relevant chosen vector group. 5. The bias operating characteristics of the relay shall have at least two knees and site selectable highest tripping facility (8 to 15 times of Relay basic current). Relay should have site selectable percentage bias setting from 20% to 45%. The differential operating current of the relay shall have site selectable range from 10% to 40%. 6. Relay shall have through fault stabilization features up to at least 10 times of relay basic current in the event of through fault. 7. Relay should have 2nd harmonic restraint features in order to bring stabilization under inrush condition. The percentage 2nd harmonic restraint features shall have site selectable setting range from 15% to 40%. 8. The relay shall have over fluxing restraint features based on site selectable ratio of 5th harmonic to fundamental current. The relay shall have also facility to activate/ deactivate the above features in site.
15.	Output Relays	Minimum 8 number output relays are required out of which 1. One potential free change over contact should be provided for start inhibit of relay. 2. All o/p contact should be freely programmable. 3.Rating of trip contacts:- a) Contact durability>10K operation b) 15 Amp make and carry for 3 sec for trip contact c) Make and carry for trip contacts L/R<=40ms Rating of Alarm contacts:- a) 5 Amp make and carry continuously for 5 sec.

P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&C

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&C

Sl. No.	Feature and Function	Technical requirement
16.	**Relay software and Man Machine Interface**	1. The relay should have native IEC 61850 Communication Protocol. 2. Should have password protected key padlock. 3. Necessary software for relay setting, retrieving DR, event log, trip log, downloading waveform should be supplied by the Bidder. Necessary Licensed is to be issued for WBSEDCL, if required. 4. Bidder has to supply communication hardware for relay setting, DR downloading from front port. This device should be compatible to USB/Ethernet port. 5. It shall be possible to transfer the data stored in the DFR to computer on IEEE/COMTRADE format. The data format shall be compatible for dynamic protection relay testing on relay test kit. 6. Should be able to record at least 5 Oscillographic disturbances and 5 fault records and 250 event records.
17.	**Date and time**	Date and Time stamping with faults and record. The clock should be powered from internal cell and should not required setting after every DC switching. The internal cell life minimum 5 years. Time synchronization by IRIG-B or SNTP.
18.	**Lugs and terminators**	All CT terminals shall be provided as fixed (screwed) type terminals on the relay to avoid any other any hazard due to loose connection leading to CT opening or any other loose connection. Necessary amount of lugs should be supplied along with each relay for CT connection and control wiring. All CT terminals should be capable to connect with ring socket.
19.	**Manuals, Drawings and Literature**	1. The relays should be supplied with manuals with all technical and operating instructions. 2. All the internal drawings indicating the logics and block diagram details explaining principle of operation should be given at the time of supply. 3. Mapping details of all the details shall be submitted in IEC format.
20.	**Standard documentation per Relay, according to IEC 61850**	1. MICS document (model implementation conformance statement) 2. PICS(protocol implementation conformance statement 3. Conformance Test certificate by KEMA/CPRI All the above mentioned Certificates shall be submitted along with the Techno-commercial Bid 4. ICD file 5. SCD file
21.	**Extendibility in Future**	The Bidder shall provide all necessary software tools along with source codes to perform addition of bays in future and complete integration with SCADA by the User. These software tools shall be able to configure relay, add analog variable, alarm list, event list, modify interlocking logics etc. for additional bays/equipment which shall be added in future.
22.	**Lifespan**	The supplier should mention following:- 1. Product maturity: The Bidder should mention the time period for which the product is in the market 2. Expected production life 3. Hardware/Firmware change notification process. Upgrades to be provided free of cost within the warranty period/5 years, if needed. 4. Lifespan of standard tools and processes for relay configuration, querying and integration
23.	**Standards**	The relay should conform to the IEC255-5 or equivalent BS / ANSI for following:-

Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE, DTD ACE, DTD ACE, P&CD ACE, P&CD

P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

Sl. No.	Feature and Function	Technical requirement
		1. Overload withstand test 2. Dielectric withstand: 2kV in common, 1 kV in differential mode 3. Impulse Voltage: 5kV in common, 1kV in differential mode 4. Insulation resistance>100 M-ohm 5. Vibration: Shock and bump and Seismic 6. Storing and transportation 7. Radio Interference: IEC 61000 for high frequency disturbance, Transient disturbance, Electrostatic discharge 8. KEMA Certification for the particular model offered with respect to IEC61850 Protocol.
24.	**Communication Port**	1. Two nos. IEC 61850 (Edition-2) protocol compliant 100 MBPS Ethernet RJ45/F.O ports having selectable HSR (High Availability Seamless Redundancy) and PRP (Parallel Redundancy Protocol) Protocol compliance for communication with SCADA system through two managed Ethernet Switches operating in redundant mode. The communication shall be made in 1+1 mode between individual IED to Switch, such that failure of one set of LAN shall not affect the normal operation of SCADA. However, it shall be alarmed in SCADA. The relay rear ports should accommodate both daisy chain and star bus tropology for SCADA integration. 2. Functioning of Relay shall not hamper to fault occurring any interconnected relay. 3. One Front port Ethernet RJ45/USB 2.0 for relay parameterization and configuration etc. with the help of PC. 4. Relay should generate GOOSE message as per IEC 61850 standard for interlocking and also ensure interoperability with third party relays.
25.	Name Plate and marking	Each IED shall be clearly marked with manufacturer's Name, type, serial no. and electrical rating data. Name plates shall be made of anodized aluminium with white engraving on black surface.
26.	**Performance Guarantee**	Relays will be guaranteed for the period of five years from the date of last dispach. Any problem in the said period should be attended free of charge inclusive of repair/replacement of relays/ component (both H/W, S/W).
27.	**Type Test**	**As per T/S of Directional O/C & E/F Relay Specification**
28.	Credential as pre-requisite of Tender	1. Copies of performance certificate for two years successful operation as on the due date of bid opening for the offered relay in respect to implementation of IEC 61850 protocol to any SCADA/substation automation system from reputed Power Sector Utility in India shall have to be furnished along with the Bid. Copies of Purchase Orders and corresponding Delivery Challans /Stores Receipt vouchers/ Excise Duty Invoice, etc., i.e. Proof of Execution of the Purchase Orders. OR Successful testing and operation of minimum one year in WBSEB/WBSEDCL/WBSETCL network.. 2. Documentary evidence for being manufacturers like registration Certificate issued by SSI/NSIC/Directorate of Industries/DGS&D, etc. for Qualifying requirement. 3. The bidder should have testing facilities of all functional tests or should

E, P&E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE , DTD ACE, DTD ACE, P&CD ACE, P&C

ACE, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD. SE,P&CI

Sl. No.	Feature and Function	Technical requirement
		have arrangement of all functional tests at government approved testing laboratories. **Inter-operability test:-** After fulfilment of the above Q.R. inter-operability test of the offered relay (other than Make & Model used in WBSEDCL) with the existing relay in WBSEDCL Network will be tested in WBSEDCL Distribution Testing Department, WBSEDCL for which due intimation for supply of sampled of offered relay will be given to the Bidder. The Bidder needs to submit the said relay to Distribution Testing Department, WBSEDCL within one week from the said intimation. The offered relay will only be accepted after fulfilment of above Q.R. & successful inter-operability test at WBSEDCL system.

Checklist for Bill of Material for supply

Sl. No.	Material	
1.	Relay (Model No.)	Qty as per Tender
2.	Lugs suitable for current and control, wiring	Qty as per Tender X Number of TBs in relay + 20% extra.
3.	Cable for connection of Relay to laptop (USB port). Along with converter and power supply if required for relay local setting	10 set
4.	Manual, Hard copy in good quality paper properly bounded	10 set
5.	Copy of Type Test certificate along with manual	With offer
6.	Basic application software for setting change,	10 nos.
7.	CD with software(licensed) to download disturbance recorder, event logger collection and evaluation of those records	10 nos.
8.	Graphical configuration tool for I/P, O/P and functional building block for protection	10 nos.
9.	Any other software, if required for integration with SCADA	10 nos.

N.B All the above tools/ Software should be compatible to WINDOWS XP/WINDOWS NT/WINDOWS 7 and other WINDOWS latest version Operating System.

E Distn. CE, Distn. CE, IT&C CE, CCD CE, P&CD CE, DTD ACE, DTD ACE, P&CD ACE, P&CD

E, P&E Distn ACE,Communication ACE, Project-III ACE,P&E Distn. SE, P&E Distn. SE,P&CD DE,DTD, SE,P&CD

SCHEDULE – VII

Undertaking from Relay manufacturer

We hereby confirm that the main protective relay(s) type _____

i)

ii)

iii)

offered by us against your tender No._____ through M/s._____ are in our current range of production. We also confirm that these relays will not be phased out by us in the next 10 years from the date of supply. Necessary repairs/replacements if necessary during this period will be made available by us.

Name & Designation: _____

Company Seal: _____

(A. Majumder) CE : P&E (Dist.)

(P. K. Banerjee) CE : Distribution

(S. Mukherjee) CE : IT&C

(S. K. Ghosh) CE : P&CD

(P. Bhattacherjee) CE : DTD

(A. Bir) CE : CCD

(A. Mitra) ACE : DTD

(...ma Das) ACE : P&CD

(P. K. Nayek) ACE : Project-III

(D. K. Pal) ACE : Communication.

(P. S. Mondal) ACE: P&E Distn

(S. K. Guha) ACE: P&E Distn

(K. K. Maity) ACE : P&CD

(S.N. Mukherjee) SE : P&E Distn

(R. Chowdhury) SE (E) : P&CD

(F. Ahmad) SE (E) : P&CD

(A. Biswas) DE : DTD