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## ANNEXURE-7

# TECHNICAL SPECIFICATION FOR REPLACEMENT OF EXISTING CONTROL AND RELAY PANEL WITH NEW CONTROL AND RELAY PANEL AT MSETCL 220KV TROMBAY AND NERUL SUBSTATIONS FOR LILO CONNECTIVITY OF 220KV MSETCL TROMBAY- NERUL LINE AT EXISTING AEML CHEMBUR SUBSTATION

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Project : Chembur 2<sup>nd</sup> Feed

Document No. : TD-SP-220KV-CRP-353-RO

### RECORD OF REVISION

S.No	Revision No	Item/Clauser No	Nature of change	Explanatory Notes

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## 220kV CONTROL AND RELAY PANEL

### 1. SCOPE

#### 1.1 SCOPE OF SUPPLY

- a) This specification covers technical requirements, design, manufacturing, assembly, mounting and wiring of equipments on panel, testing at manufacturer's works, packing, transportation with transit insurance, loading at works, delivery at site, unloading at site, shifting of panel to desired location, erection of panel, testing and commissioning of 220kV control and relay panels (CRP) at MSETCL Trombay and MSETCL Nerul substation complete with all accessories for efficient and trouble-free operation.
- b) Any material or accessory which may not have been specifically mentioned but which is necessary or usual for satisfactory and trouble-free operation and maintenance of the equipment shall be furnished without any extra charge.

#### 1.2 SCOPE OF SERVICE

The services of a senior relay engineer, experienced in testing and commissioning of CRP shall be provided. The work shall include but not limited to:

- a) Dismantling and removal of existing CR panels
- b) Shifting of removed panels to designated location as per direction of AEML Engineer-in-charge
- c) Removal of LT power & Control cable while dismantling existing CR panel. Re-rolling and shifting of cables to designated location as per direction of AEML Engineer Incharge.
- d) Unloading of relay panels at site.
- e) Complete checking of materials at site and advising the Owner of any discrepancy thereof within seven (7) days of receipt of material at site.
- f) Erection of panels.
- g) Supply and laying of LT power and control cable for the scheme
- h) Termination of external interface wiring and interpanel wiring.

- i) Recommendation of relay configuration
- j) Recommendation of relay setting along with relay setting calculation.
- k) Testing and commissioning of relay panel as per customer requirement (MSETCL)
- l) Checking of scheme in totality.
- m) Checking of differential scheme with remote end relay at AEML Chembur substation.
- n) Integration of relays with existing SCADA system
- o) Submission of relay test reports, test report of other equipment and scheme checking.
- p) Installation of relay software in Owner's laptop. Verifying device communication with Owner's laptop.
- q) Training of purchaser's engineers by senior and experienced engineer with an objective to enhance knowledge of purchaser's engineer on relay, like familiarisation of software, hands on training on configuration of relay, communication with relay for uploading / downloading of configuration files, downloading of recorded data, analysing recorded data, trouble shooting, analysing messages, familiarisation of device functionalities etc for minimum of two (2) days at site

### 1.3 EXCLUSION OF SERVICES

- ✓ Nil

### 2. CODES AND STANDARDS

Materials, equipment and method used for manufacture and the equipment to be furnished under this specification shall be in accordance with the applicable section of the latest edition of the relevant Indian Standards and IEC publications including the following.

IEC 61010 -1	Safety requirements for electrical equipment for measurement, control, and laboratory use – General requirement
IS 3427	Metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and Including 52 kV
IEC 61326	Electrical equipment for measurement, control and laboratory use - EMC requirements
IEC 61000	Electromagnetic compatibility

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IEC 60068	Environmental testing – Vibration / Shock
IEC 60255	Electrical Relays
IS 3043	Code of practice for earthing
RAL 7032	RAL Colour standard
IEC 60947 -7	Terminal block
IS 694 – 1990	PVC Insulated cables for working voltage up to and including 1100V
IEC 60529	Degrees of protection provided by enclosures

Design, manufacturing, testing, material and devices which are not covered by IS / IEC standards shall conform to, and comply with, the latest applicable standards, codes and regulations of the internationally recognized standardizing bodies / professional societies as may approved by the purchaser. The manufacturer shall list all applicable standards; codes and submit a copy of the same in English with bid for necessary approval. Equipment shall also comply with latest revisions of Indian Electricity Act 2003 and other applicable statutory provisions, rules and regulations

In the case of conflict between various requirements / order documents, the precedence of authority of documents shall be as follows:

- i. Technical requirement of this specification
- ii. Applicable codes & standards
- iii. Approved drawings
- iv. Guaranteed Technical Particulars (GTP)
- v. Other acceptable documents

### 3. SERVICE CONDITION

Service	Indoor
Ambient temperature	0 to 50°C
Seismic Data (as per IS 1893)	Zone III
Altitude above mean sea level	≤1000m
Relative Humidity	≤ 100 %.
Atmosphere	Corrosive, Saline. GX as per ISA 71.04 - 1985

#### 4. SYSTEM DESCRIPTION

System voltage	220kV
CT secondary rating	1A
PT secondary rating	Will be confirmed during detailed engineering
Aux supply	Will be confirmed during detailed engineering
System grounding	Solidly

#### 5. TECHNICAL SPECIFICATION

Sr No	Description	Specification
a.	Function	The Control and Relay Panel (CRP) for housing controls and protection scheme of 220kV switchgear.
b.	Panel Design and Construction	<ul style="list-style-type: none"> <li>a) Panel shall be free standing, floor mounting, fixed frame with rack type mounting, simplex panel with swing frame and protective full glass door in front.</li> <li>b) Panels shall be provided with single leaf doors with louver at the back with flush type lock arrangement. Types of hinges shall be concealed.</li> <li>c) Panel shall be made of cold rolled sheet steel (CRCA) of thickness not less than 3 mm for load bearing members of the panels such as base frame, front sheet and door frames and 2 mm thick for non-load bearing members such as sides, door top and bottom portions.</li> <li>d) Panels shall be completely metal enclosed and shall be dust, moisture and vermin proof. The enclosure shall provide with a degree of ingress protection not less than IP-54.</li> <li>e) All doors, removable covers and blanking plates</li> </ul>

		<p>shall have neoprene gasket all around</p> <p>f) Ventilating louvers, if provided, shall have screens and filters. The screens shall be made of either brass or GI wire mesh.</p> <p>g) Panels shall be provided with base frame with smooth bearing surface which shall be fixed on the embedded foundation channels with intervening layers of anti vibration pad made of shock absorbing materials.</p> <p>h) Cable entries to the panels shall be from the bottom. The gland plates of the panel shall be of GI of thickness 3mm and removable type. Necessary number of cable glands to suit external cables supplied by Buyer shall be supplied by the Bidder. Cable glands shall be screwed type made of brass.. The gland plates shall be provided with gaskets to ensure ingress protection class of panel</p> <p>i) Each panel shall be capable of independent use when dismantled from the other panels and used separately as a single panel unit. Inter panel sheet of thickness 2mm shall be provided between the panels. There shall be no cut outs on the inter panel sheet than the one required for bus wiring. Neoprene gasket to be provided for bus wire slots.</p> <p>j) Panel dimension shall be 800 (W) x 800 (D) x 2315 (H) including base frame. Base frame shall be black in colour.</p>
c.	Mounting Arrangement of	<p>a) All equipment on and inside panels shall be mounted and completely wired to the terminal blocks ready for external connection.</p>



	Equipment	<p>b) The equipment on front of the panel shall be flush mounted.</p> <p>c) Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent devices and without use of special tools.</p> <p>d) The bidder shall provide cutout and carry out mounting and wiring of the free issue items supplied by others ,if any, in his panel in accordance with equipment manufacturer's drawings. Cut-outs provided for future , if any, mounting of equipment shall be properly blanked off with blanking plate.</p> <p>e) The centre line of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance.</p> <p>f) No equipment shall be mounted on the doors or at the bottom plate of the panel. All the equipment connections and cabling shall be designed and arranged to minimize the rise of fire and damage which may be caused by fire</p>
d.	Internal Wiring of Panels	<p>a) Panels shall be be fully wired at the factory as per approved scheme by Buyer. Inter panel wiring shall be furnished in the scheme drawing.</p> <p>b) All wiring shall be done with flexible 1100V grade, PVC insulated, flame retardant low smoke (FRLS), single core, multi stranded copper conductor of 2.5mm<sup>2</sup> for current (CT) and voltage circuits (PT) and 1.5mm<sup>2</sup> for control circuit.</p> <p>c) Wires used for secondary wiring of CT and PT</p>

		<p>circuit shall be color coded as per phases.</p> <p>d) Bus wiring for common services shall be provided near the top of the panels running throughout the entire length of the panels</p> <p>e) All internal wiring shall be securely supported, neatly arranged and readily accessible. Wiring gutters and troughs shall be used while terminating wiring at equipment / terminal blocks. The wiring shall be securely bunched so that the position of each individual connection wire does not get disturbed when disconnected from equipment terminals.</p> <p>f) Each wire shall be identified, at both ends, with engraved core identification interlocking type plastic ferrules . Cross ferruling system shall be followed.</p> <p>g) Ferrules should be tubular type with printed sleeve. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminals blocks. The wire numbers on the wiring diagram shall be in accordance with IS-5578 / 11353. Number 6 and 9 shall not be included for ferruling purposes.</p> <p>h) All wires directly connected to trip circuit of breaker or device shall be distinguished by the addition of red coloured unlettered ferrule.</p> <p>i) Longitudinal troughs extending throughout the full length of the panel shall be preferred for inter panel wiring. Inter-connection to adjacent panel shall be brought out to a separate set of terminal blocks located near to bus wire slot. Arrangement</p>
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		<p>shall permit easy inter-connections to adjacent panels at site.</p> <ul style="list-style-type: none"> <li>j) All spare contacts of devices shall be wired up to the terminal block.</li> <li>k) Separate terminal blocks shall be used for connection of external signals. Interface signals to different application shall not be mixed and to be terminated on separate TBs.</li> <li>l) Separate TBs shall be used for Analog and digital signals.</li> </ul>
<p>e.</p>	<p>Terminal Blocks</p>	<ul style="list-style-type: none"> <li>a) Terminal blocks shall be 1100 V grade, multi way complete with mounting channel, insulated barriers, end plate, protective cover, partition plate, washers, nuts, lock nuts, circuit identification strips and other accessories. Terminals shall be stud type.</li> <li>b) Terminal blocks shall be fully enclosed with easily removable covers and made of non-inflammable material. All terminals shall be clearly marked with identification numbers as per scheme drawing.</li> <li>c) For CT circuit, ring type lugs shall be provided. Terminals for C.T. secondary leads shall have in built disconnecting links with provision for shorting and grounding.</li> <li>d) The terminal blocks for CT should have the provision of plugging-in standard banana pins for facilitating testing purpose.</li> <li>e) Terminal blocks for voltage transformer secondary leads shall be provided with test links</li> </ul>

		<p>and isolating facilities.</p> <ul style="list-style-type: none"> <li>f) Separate terminal blocks shall be provided for AC / DC incoming supply cable termination.</li> <li>g) Not more than two wires shall be connected to any terminal. In case more than two wires to be connected at one terminal, additional wires to be terminated on separate terminals and shall be interconnected with shorting links.</li> <li>h) Spare terminals equal in number to atleast 20% active terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.</li> <li>i) There shall be a minimum clearance of 250 mm between the first row of terminal blocks and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be of minimum 150 mm.</li> <li>j) The number and sizes of external cables supplied by Buyer shall be furnished to the Bidder after placement of the order. All necessary cable terminating accessories such as gland plates, glands crimp type tinned copper lugs, supporting clamps and brackets, wiring troughs and gutters etc. for owner's cable shall be included in Bidder's scope of supply.</li> <li>k) Terminal blocks suitable for LT power (AC &amp; DC) and control cable supplied by Buyer shall be provided in the panel.</li> </ul>
f.	Painting of Panel	<ul style="list-style-type: none"> <li>a) The Panel shall be furnished with powder coating of polyester base grade A, shade RAL 7032 (Pebble Grey) for exterior. Color shade of interiors</li> </ul>

		<p>of panels shall be RAL 9003 (White Glossy). Finishing of paint shall be glossy.</p> <p>b) The powder coating with DFT thickness shall be 80-120 microns.</p> <p>c) The paint shall not scale off or crinkle or be removed by abrasion due to normal handling. All nut bolts used in the construction shall be hot dip galvanized steel only.</p>
g.	Nameplate and Marking on Panel	<p>a) All equipment mounted on the panels as well as inside panel shall be provided with individual nameplates with equipment designation engraved.</p> <p>b) Nameplates for panels shall be provided on the top of the panel both on the front and on rear.</p> <p>c) The thickness of nameplate should be minimum 3 mm. All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring.</p> <p>d) The nameplates shall be mounted directly by the side of the respective equipment and shall not be hidden by the equipment wiring.</p> <p>e) Nameplates shall be made of anodized aluminum. Type of engraving of inscription shall be white letters on black background. The dimension of plates, inscription and size of letter shall be submitted to the Buyer's approval.</p> <p>f) All devices shall be clearly marked with manufacturer's name, equipment type, serial number, primary quantity being measured and</p>

		<p>electrical rating data.</p> <p>g) Each switch shall bear clear inscription identifying its function e.g. "Trip-Neutral-Close", "LOCAL-REMOTE", etc.. Similar inscription shall also be provided on each device whose function is not otherwise identified. If any switch/ device do not bear this inscription, separate name plate giving its function shall be provided for it.</p>
<p>h.</p>	<p>Aux Supply, Panel Illumination and Heater</p>	<p>a) Two (2) nos 220V DC feeders per CRP shall be provided by Buyer to meet auxiliary supply requirement of control and relay panel.</p> <p>b) Aux supply change over and monitoring scheme shall be provided for DC feeders.</p> <p>c) Isolating devices (MCB) shall be provided on each incomer and outgoing feeder circuits. Selection of the main and sub circuit MCB rating shall be so as to ensure selective clearance of sub-circuit faults.</p> <p>d) One (1) no 240V AC feeder will be provided by Buyer to meet auxiliary supply requirement of heater and illumination of panels. Main incomer and each outgoing feeder circuit shall be controlled by MCB.</p> <p>e) Each panel shall be provided with a CFL lighting fixture rated for 240 V AC, single phase, 50 Hz for the interior illumination of the panel. The CFL light shall be controlled by panel door switch.</p> <p>f) Each panel shall be provided with one (1) no 15 A, 240V AC, single phase three (3) pin receptacle with plug and ON / OFF switch.</p>

		<p>g) Each panel shall be equipped with thermostat controlled space heaters to prevent moisture condensation within the panel. Thermostat shall be with adjustable temperature setting. Space heater shall be controlled by switch unit.</p> <p>h) Heater and switch units shall be suitable for continuous operation on 240V AC, single phase 50 Hz supply.</p>
<p>i.</p>	<p>Earthing</p>	<p>a) All panels shall be equipped with an earth bus securely fixed along inside base of the panel extending the entire length of the assembly.</p> <p>b) The size and material of the bus bar shall be minimum 50x6mm and copper. It shall have threaded holes with nut and bolt provision for fixing. Ground bus shall have provision at both end for connection to station earthing grid. Ground bus shall be bolted to the panel structures, effectively grounding the entire assembly.</p> <p>c) All metallic cases of relays and other instruments mounted in the panel shall be connected to the ground bus by independent copper wires of size 2.5 sq. mm. The colour code of earthing wires shall be green. Earthing wire shall be connected on terminals with suitable clamp connectors and soldering shall not be permitted.</p> <p>d) CT / VT secondary neutral or common lead shall be earthed at only one place where they enter the panel. Such earthing shall be made through links so that earthing may be removed from one group without disturbing continuity of earthing system</p>

		for other group
j.	Current Differential & Distance Protection Relay	<p>a) Protection relays shall be suitable for line / cable / hybrid feeders &amp; clear the faults within shortest possible time with reliability &amp; sensitivity to all type of faults.</p> <p>b) Redundant (Main-I &amp; Main-II) differential cum distance protection shall be provided. Relays shall be of different make.</p> <p>c) The maximum fault current could be as high as 50kA and the minimum fault current could be as low as 20% of rated current of CT secondary. Relay shall satisfactory operate under these extremely varying conditions.</p> <p>d) Relay shall have following protection functions</p> <ul style="list-style-type: none"> <li>✓ Current Differentail Protection</li> <li>✓ Distance Protection with permissive scheme for intertrip and ancillary functions of distance protection</li> <li>✓ Directional Over Current</li> <li>✓ Directional Earth Fault</li> <li>✓ Over Voltage</li> <li>✓ Under Voltage</li> <li>✓ Fuse Failure Supervision</li> <li>✓ CT supervision (broken conductor)</li> <li>✓ Power switng, Switch onto fault (SOFT)</li> <li>✓ High speed Auto reclose</li> </ul>



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|  |  | <ul style="list-style-type: none"> <li>✓ Local breaker back up protection</li> <li>✓ <b>Current Differential Protection</b> <ul style="list-style-type: none"> <li>a) Line differential protection shall work with different CT ratios at both ends of the line.</li> <li>b) It shall work based on phase segregated current comparison philosophy.</li> <li>c) It shall have redundant differential communication port for redundancy of communication channel</li> <li>d) It shall support differential communication through multiplexer. It shall support optical fiber based communication standard IEEE C37.94 and ITU-T G 703 for differential communication.</li> <li>e) Relays shall have user settable pick up and slope characteristics</li> <li>f) It shall be suitable for single phase tripping .</li> </ul> </li> <li>✓ <b>Distance Protection.</b> <ul style="list-style-type: none"> <li>a) It shall be non-switch type with separate measurements for all phase to phase and phase to ground faults.</li> <li>b) It shall have stepped time-distance directional characteristics &amp; four independent zones (zone 1, zone2, zone 3 &amp; zone4).</li> <li>c) It shall be possible to configure all zones as either 'forward' or 'reverse'.</li> <li>d) It shall have quadrilateral and mho characteristics which is configurable by user</li> <li>e) It shall be capable to issue single phase and three phase tripping</li> <li>f) It shall be possible to transfer permissive signals</li> </ul> </li> </ul> |
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		<p>to remote end relay through multiplexer.</p> <ul style="list-style-type: none"> <li>✓ <b>Directional Over Current &amp; directional Earth Fault Protection</b></li> </ul> <p>a. Directional over current and directional earth fault protection trip characteristic shall be as per IEC 60255.</p> <ul style="list-style-type: none"> <li>✓ Pick up, time delay and TMS shall be user settable.</li> <li>✓ Directional earth fault protection shall work on measured and calculated residual over voltage from phase voltages.</li> </ul> <ul style="list-style-type: none"> <li>✓ <b>Voltage Protection (Over Voltage &amp; Under Voltage)</b></li> </ul> <p>a) Operation of voltage function (over voltage &amp; under voltage) shall be preferably based on phase to neutral voltage.</p> <p>b) Function shall have minimum two (2) configurable stages.</p> <p>c) Operation of the function should not be blocked in absence of feeder current. If the feature (current supervision on UV operation) is available, it shall be user configurable as per site requirement.</p> <p>d) Relay operation characteristic shall be based on inverse and definite time operation (trip) characteristic as per IEC 60255.</p> <p>e) Minimum range of pick up setting for under voltage shall be 0 – 120% of PT secondary rating. Operating time shall be configurable with minimum setting of 0 -20sec for definite time.</p> <p>f) Minimum range of pick up setting for over voltage shall be 50 – 200% of PT secondary rating.</p>
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		<p>Operating time shall be configurable with minimum setting of 0 -20sec for definite time.</p> <p>g) It shall be possible to block operation of under voltage function based on the status of signal (MCB contact) wired to digital input of the relay.</p> <p>h) Under voltage function shall be automatically blocked on fuse failure</p> <p>✓ <b>Power switng &amp; Switch onto fault</b></p> <p>a) Relay shall have Power swing function.</p> <p>b) It shall be possible to block trips by distance protection during stable power swings</p> <p>c) There shall be provision for tripping during unstable power swing.</p> <p>d) Stages of distance protection to be blocked during stable power swing shall be user configurable</p> <p>e) It shall have SOFT function to disconnect feeders when switch ONTO fault.</p> <p>f) Instantaneous disconnection of feeder shall be possible</p> <p>g) Pick up and delay for SOFT function shall be user configurable</p> <p>✓ <b>Auto reclosure</b></p> <p>a. Relay shall have single phase and three phase auto reclosing facilities.</p> <p>b. Single phase and three phase dead time shall be continuously variable and in the range of 0.-10 seconds.</p> <p>c. It shall have a continuously variable reclaim time in the range of 5-300 seconds</p> <p>d. Non auto reclosing modes have facilities for selecting check synchronizing or dead line charging features.</p>
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|  |  | <ul style="list-style-type: none"> <li>e. It shall be possible to block AR function as per design requirement</li> <li>f. Auto reclose initiation shall be possible through external protection device and by internal protection function</li> <li>g. It shall have features of high speed and time delayed auto reclosing.</li> <li>h. It shall be possible to enable/disable the function by external signal, communication signal and through protection setting</li> <li>i. Auto reclose shall be possible with synch check (dead line/live bus or live line/dead bus conditions exist signal,) from external synch check device and inbuilt synch check function of the AR relays.</li> <li>j. Auto-reclose lockout shall operate on following conditions like protection operation during reclaim time, receipt of block auto-reclose signal, multi phase faults, circuit breaker failure to close, persistent fault etc</li> <li>k. Auto-reclose lockout conditions shall be reset by external signal wired to binary input, breaker closed status or after a user settable time delay</li> <li>✓ <b>Monitoring function – VT Fuse failure, CT supervision (broken wire)</b> <ul style="list-style-type: none"> <li>a) Relay shall have VT fuse failure supervision function.</li> <li>b) On fuse failure detection, operation of under voltage function shall be blocked automatically.</li> <li>c) It shall have CT secondary circuit monitoring (broken wire) function.</li> <li>d) In case broken wire condition, relay shall generate alarm and block differential protection.</li> <li>e) Configuration of “Alarm or block differential function” shall be user configurable.</li> </ul> </li> </ul> |
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		<ul style="list-style-type: none"> <li>f) Blocking of differential function at one end shall result in blocking of function in relay at both ends of lines.</li> <li>g) Transfer of blocking message shall be possible through multiplexer</li> <li>h) It shall have fault location feature.</li> <li>i) It shall be possible to communicate breaker inter trip and direct trip to remote end relay through multiplexer used for differential protection.</li> <li>j) It shall be possible to transfer signals wired to digital input of local relay to remote end relay.</li> <li>k) Relay shall have following number of analog and digital input. <ul style="list-style-type: none"> <li>✓ Three phase CT - one(1) No (one CT /phase)</li> <li>✓ Single phase CT – one(1) No (for neutral)</li> <li>✓ Three phase PT - one(1) No</li> <li>✓ Single phase PT - one(1) No (for open delta input)</li> <li>✓ Digital Input – Minimum 20No</li> <li>✓ Digital output – Minimum 20 No</li> </ul> </li> <li>l) Digital output shall not be grouped type. It shall be able to use each output signal in separate circuit as per scheme requirement.</li> <li>m) Communication protocol IEC61850</li> <li>n) Patch cords shall be provided for relay connectivity to multiplexer</li> </ul>
k.	Local Breaker backup Protection Relay (LBB)	<ul style="list-style-type: none"> <li>a. LBB function shall be initiated by trip signal of internal protective function and external trip signal which is wired to digital input of the relay. Method of initiation (Internal or external) shall be user programmable.</li> <li>b. Three phase (common phase) and single phase (segregated phase) LBB initiation shall be possible to take care of three phase and single phase</li> </ul>

		<p>tripping respectively.</p> <ul style="list-style-type: none"> <li>c. Independent operation times shall be settable for single (1) pole and three (3) pole LBB initiation.</li> <li>d. Reset of LBB function shall be based on current or breaker contact or both current and breaker contact. Reset criteria preferably shall be user selectable.</li> <li>e. Reset current of LBB function shall be settable. Pick up setting for reset current shall be sensitive to high resistance (like tree fault) fault.</li> <li>f. Relay shall have definite time operation (trip) characteristic as per IEC 60255.</li> <li>g. Operating time of all stages shall be configurable with minimum setting range of 0 – 30sec with step size of 0.01sec.</li> <li>h. Relay shall have following analog and digital input. <ul style="list-style-type: none"> <li>✓ Three phase CT - one(1) No (one CT /phase)</li> <li>✓ Single phase CT – one(1) No (For neutral)</li> <li>✓ Three phase PT - one(1) No</li> <li>✓ Digital Input – 12Nos</li> <li>✓ Digital output – 12 No</li> </ul> </li> <li>i. Digital output shall not be grouped type. It shall be able to use each output signal in separate circuit as per scheme requirement.</li> <li>j. Communication protocol IEC 61850</li> </ul>
<p>I.</p>	<p>Bay Control Unit (BCU)</p>	<ul style="list-style-type: none"> <li>a) Bay Control Unit (BCU) shall be provided for control and monitoring of line bays. SCADA Communication protocol of BCU shall be IEC-61850.</li> <li>b) Closing command from SCADA shall be hard wired to digital input of BCU.</li> <li>c) Closing interlocks of switches (breaker, isolator &amp; earth switch) shall be built in BCU. It shall have sufficient digital input and digital output to meet</li> </ul>

		<p>scheme requirement.</p> <ul style="list-style-type: none"> <li>d) It shall have Mimic control panel to display the bay configuration graphically, status of the bay, analog measurements and alarms.</li> <li>e) It shall be possible to perform control operation (Open &amp; Close) of various switching elements (breaker, isolator and earth switch) of bay using the keypad on local user interface. Physical TNC switch shall be provided for breaker operation.</li> <li>f) Local / Remote switch shall be available on BCU to control mode of operation. It shall be possible to use status of this switch in closing / opening interlocks of control switches (breaker, isolator &amp; earth switch). Additionally physical L/R switch shall also be provided on panel.</li> <li>g) Interlocking Function to prevent unsafe operation of AIS equipment such as circuit breakers, isolators, earth switches etc. Interlocking shall be implemented on bay level by user-friendly menu-driven configuration software within the BCU. An over-riding / bypass function for bay-level interlocking shall be provided at appropriate security level for maintenance or during emergency conditions. The bidder shall provide details of their design during Biding. The interlocking logic shall be defined during the details engineering phase to prevent illegal operation. Closing interlock for isolator, earth switch and circuit breaker shall be as per scheme drawing.</li> <li>h) Analog Measurements for bay voltage (per phase), current (per phase), frequency, active power and reactive power shall be available without use of any intermediate transducers. For voltage, current</li> </ul>
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		<p>and frequency, the accuracy class of measurement shall be 0.5 or higher accuracy. For active and reactive power, accuracy class shall be 1.0. The measured and computed values shall be displayed locally on BCU and on operator's workstation located in central control room. Units for current, voltage, active power and reactive power measurement shall be A, kV, MW and MVAR respectively.</p> <ul style="list-style-type: none"> <li>i) Event and Alarm Handling: BCU's shall acquire all the bay level alarms and events from field inputs with a resolution and time tagging of 1 ms and shall transfer these to operator's workstation over substation LAN.</li> <li>j) Synchronization function shall be available. The voltage difference and phase angle difference, frequency difference settings shall be adjustable.</li> <li>k) Time Synchronizing shall be on IEC61850.</li> <li>l) Relay shall have following analog and digital input. <ul style="list-style-type: none"> <li>✓ Three phase CT - one(1) No (one CT /phase)</li> <li>✓ Single phase CT – one(1) No (for neutral)</li> <li>✓ Three phase PT - one(1) No</li> <li>✓ Single phase PT - one(1) No (for synch check function))</li> <li>✓ Digital Input – 40Nos (Minimum quantity)</li> <li>✓ Digital output – 25 Nos Minimum quantity)</li> </ul> </li> <li>m) Digital output shall not be grouped type. It shall be able to use each output signal in separate circuit as per scheme requirement</li> <li>n) Communication protocol shall be IEC 61850</li> </ul>
m.	Disturbance Recorder for all types of Numerical	<ul style="list-style-type: none"> <li>a) Triggering of disturbance records shall be possible on following conditions <ul style="list-style-type: none"> <li>✓ With pick up of any protection function.</li> <li>✓ Energization or de-energisation of digital input</li> </ul> </li> </ul>



	<p>Relays &amp; Bay Control Unit (BCU)</p>	<p>and digital output</p> <ul style="list-style-type: none"> <li>✓ Through logic created in the relay</li> <li>✓ Threshold of analog values. Analog values could be directly measured or calculated</li> <li>b) It shall have the facility to record minimum eight (8) no oscillographic records each of length two (2) seconds. Total time of recording including pre and post fault record time shall be settable.</li> <li>c) It shall record oscillography records of all connected analog and digital channels (DI &amp; DO) for each trigger.</li> <li>d) Sampling rate of oscillographic record shall be minimum 16 samples per power system cycle (1600Hz)</li> <li>e) Events shall be generated and recorded in the relay during operation of the device regarding the status of device functions, measured data, protection setting and configuration change, status of digital input, status of digital output , status of LED , status of logic created in the relay etc</li> <li>f) Relay shall record trip logs for all protection trip issued by the relay. Details given in trip log shall be time stamped with events and waveforms recorded in the relay. Details like date of occurrence, time of operation of various functions; fault current etc shall be recorded in chronological order.</li> <li>g) It shall record min five hundred (500) time tagged events.</li> <li>h) It shall be possible to extract disturbance records from relay via through laptop locally and remote through communication PC. The data shall be available in COMTRADE (Common Format for</li> </ul>
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		Transient Data Exchange) format.
n.	Self Monitoring for all types of Numerical Relays & Bay Control Unit (BCU)	<ul style="list-style-type: none"> <li>a) The relay &amp; BCU shall have comprehensive self-diagnostic feature. This feature shall continuously monitor the healthiness of hardware and software elements of the relay and shall generate alarm in case of any abnormality. The fault diagnosis information shall be displayed on the LCD (HMI) and also available through the communication port.</li> <li>b) It shall be possible to report device fail signal on IEC 61850 to SCADA. In addition to this, any failure detected shall be annunciated through a dedicated output contact (watchdog).</li> </ul>
o.	Environmental Conditions	<ul style="list-style-type: none"> <li>a) Operating temperature – 0 - 50°C</li> <li>b) Storage temperature - 25 - 70°C</li> <li>c) Humidity range - 5 - 100% non condensing</li> <li>d) Degree of protection – IP 51</li> <li>e) As per The International Society for Automation (ISA) Standard 71.04-1985, our site environmental condition is under GX (severity level harsh) classification. Therefore, conformal coating / specific manufacturing process to achieve sustainability as per GX classification shall be provided for protection against harsh environmental condition.</li> <li>f) Vibration / Shock / Temperature / Humidity - The device shall be immune to all type of environment shocks / vibration requirement as per IEC 61000 or IEC 60068 or equivalent standard. It shall comply with operating temperature and humidity as per IEC 60068.</li> <li>g) The instrument shall be suitable for continuous operation at specified ratings. The temperature</li> </ul>

		<p>rise of the components shall be limited to the permissible values stipulated in relevant standards.</p>
p.	Software for all types of Numerical Relays	<p>a. The software shall be original and licensed. In case higher software version is available at the time of Factory Acceptance Test (FAT), bidder shall supply latest version of software without any extra expenses. The Supplier shall keep Buyer informed of the latest releases of software after the system is shipped.</p> <p>b. Software shall be supplied in CDs along with necessary instruction manual.</p> <p>c. Data cord with end connectors for connecting to Buyer's PC / laptop shall be supplied along with software. Front port for communication with laptop shall necessarily be USB port. In case USB port is not available, hardware (converter) required for converting port available on relay to USB port shall be provided.</p> <p>d. The PC / laptop need not be supplied unless explicitly mentioned in guaranteed technical particulars (GTP).</p>
q.	Accessories for all types of Numerical Relays & BCU	<p>a. The accessories necessary for successful operation and maintenance shall be supplied along with the relay.</p> <p>b. These shall include but not limited to battery (if applicable), data cable with end connectors for connecting device to laptop, RS 232 / USB converter (if applicable), technical /operating / maintenance and application manual (both in soft copy &amp; printed copies), software CD with manual, any other accessory required for trouble free operation maintenance and testing of relay.</p> <p>c. Length of data cable for connecting relay to</p>

		laptop shall be of minimum four (4) meter.
r.	Communication with SCADA for all types of Numerical relays & BCU	<ul style="list-style-type: none"> <li>a) Communication protocol to SCADA shall be IEC 61850</li> <li>b) Dual fiber ports shall be provided for communication on IEC 61850 to SCADA</li> </ul>
s.	HMI (Human Machine Interface) for all types of Numerical relays & BCU	<ul style="list-style-type: none"> <li>a) Front panel user interface shall consist of an LCD display, navigation key pad, function keys, LEDs etc. The user interface and menu texts shall be in English. LEDs shall be user configurable.</li> <li>b) HMI (Human Machine Interface) shall have provision to view and perform setting changes. In addition HMI should display the measured quantities, operation indications and time tagged events.</li> <li>c) Password protection shall be independently applied to the front user interface, front communication port and rear communication port. Password protection shall be available for view, control and setting change etc</li> </ul>
t.	Terminal block and connection for Relay & BCU	<ul style="list-style-type: none"> <li>a) Heavy duty terminal block shall be provided on rear side for CT and VT inputs (as applicable) to relay and meters. Terminals for power supply, digital input, digital output and communication port shall be provided on rear side. Terminal block for analog input shall be suitable for ring lug connection. Minimum cross-section of cables is 2.5 mm<sup>2</sup> for CT &amp; PT and 1.5 mm<sup>2</sup> for control cable.</li> <li>b) Provision for case grounding shall be provided on rear side (two stud connection) and shall be suitable for ring lug connection.</li> </ul>

<p>u.</p>	<p>Lockout Relays</p>	<ul style="list-style-type: none"> <li>a) Operating time of tripping relays shall be less than 10 ms (instantaneous).</li> <li>b) Tripping relays shall be electrically and manually reset latched type relays.</li> <li>c) Operation indicator shall be manually reset type.</li> <li>d) For high burden type lock out relays, operating coil shall be cut off from the supply once the relay is operated.</li> <li>e) Relays shall be provided with adequate number of NO and NC contacts (minimum 18NO + 10NC) to meet the scheme requirement</li> <li>f) Relays shall be provided with terminals for supervision of relay coil.</li> <li>g) Relay shall have minimum 20 output contacts. Redundant lockout relays shall be provided.</li> <li>h) 30% Spare contacts shall be provided.</li> </ul>
<p>v.</p>	<p>DC Supervision Relays</p>	<ul style="list-style-type: none"> <li>a) Relays shall be rated for 220V DC supply.</li> <li>b) It shall operate for voltage range of 70 -120% of rated voltage.</li> <li>c) DC supervision relay shall be provided for each incomer from DCDB.</li> <li>d) It shall be provided with self reset type contacts.</li> <li>e) It shall be provided with hand reset type operation flag indicator which drops on operation of the relay.</li> <li>f) Relays shall be provided with adequate number of NO and NC contacts (3NC +1NO) to meet the scheme requirement.</li> </ul>

		g) 20% Spare contacts shall be provided.
w.	Trip Circuit Supervision	<p>a) The relay shall be capable of monitoring the healthiness of trip-coil and associated circuit during pre and post close condition (ON &amp; OFF conditions) of circuit breaker.</p> <p>b) It shall have facility for supervision of individual phases (R,Y &amp;B)</p> <p>c) The relay shall have adequate contacts for providing signals to closing circuit, annunciation, indication circuit and event logger and SCADA.</p> <p>d) Hand reset operation indicator shall be provided for each phase.</p> <p>e) 20% Spare contacts shall be provided.</p>
x.	Trip relay supervision	<p>a) Trip relay supervision shall be provided.</p> <p>b) Relays shall be provided with adequate number of NO and NC contacts to meet the scheme requirement.</p> <p>c) 20% Spare contacts shall be provided.</p>
y.	Ethernet switch	<p>a. Ethernet switch shall be industrially hardened, fully managed, specifically designed to operate reliably in electrically harsh and climatically demanding utility substation and industrial environments.</p> <p>b. It shall have Ethernet port (fiber ports/electrical port) suitable for various standard end connectors like ST, SC, LC, RJ45, MTRJ etc suitable for major vendor IEDs</p> <p>c. Location of power connectors and Ethernet port shall be user selectable preferably both shall be on rear side. LED indicators shall be provided on front side. It shall work on universal (AC or DC ) high</p>

		<p>voltage range (88-300VDC or 85-264VAC ) aux voltage supply. It shall have dual aux supply option.</p> <p>d. 20% spare FO ports and 2Nos RJ45 ports to be provided in addition to the requirement of the relays and end connectivity to existing SCADA system . Switch shall be provided with conformal coating and with cable support brackets.</p> <p>e. It shall have self diagnostic feature and error signal shall be reported on potential free contact. Two (2) nos of Ethernet switch shall be provided per feeder</p> <p>f. Patch cords shall be provided for relay connectivity to Ethernet switch</p>
z.	Auxiliary Relays	<p>a) Aux relays shall be provided for bus PT voltage selection.</p> <p>b) It shall be considered for multiplication aux contacts of switches like breaker, isolator and earth switch.</p> <p>c) It shall have minimum 8no of contacts.</p> <p>d) 20% Spare contacts shall be provided for each application.</p>
aa.	Switches	<p>a) Control and instrument switches shall be rotary operated type with escutcheon plates clearly marked to show operating position and circuit designation plates and suitable for flush mounting with only switch front plate and operating handle projecting out.</p> <p>b) The connections shall be from the back. The contact assembly at the back of the switch shall be enclosed in dust proof removable covers.</p>

		<p>c) The access to the contacts shall be from the back by removal of the covers. Handles of different shapes and suitable inscriptions on switches shall be provided as an aid to switch identification.</p> <p>d) Number of positions of various type of switches (L/R, TNC switch etc) provided shall meet scheme requirement.</p>
bb.	Indicating Lamps	<p>a) Indicating lamps shall be provided as per scheme requirement.</p> <p>b) LED type indicating lamps shall be acceptable.</p> <p>c) All lamps shall be rated for -15% to 10% of rated DC and <math>\pm 10\%</math> of rated AC voltage</p>
cc.	Multifunction Meter	<p>a) MFM shall be digital and flush mounting type. It shall be with multi-line digital displays.</p> <p>b) It shall be configurable for 3-phase 3-wire, 3-phase 4-wire have accuracy class of 0.2s.</p> <p>c) The meter's front panel shall have a large backlit LCD (Liquid Crystal Display). LCD shall capable of displaying a group of related electrical parameter values together on a single page.</p> <p>d) The push buttons shall be provided on the front panel to navigate through various displays.</p> <p>e) It shall have programmable CT-VT ratio. Connection check and self diagnostic facilities shall be available.</p> <p>f) It shall display basic electrical parameters such as voltage, current, frequency, power factor, phase angle, load and configured energy values</p> <p>g) It shall have configurable calibration LED</p> <p>h) The voltage of the auxiliary power shall be</p>



		<p>universal and in the range of 50-300 V AC / DC</p> <ul style="list-style-type: none"> <li>i) MFM shall continuously withstand 120% of rated current and 10 times the rated current for 5 sec. without loss of accuracy. Voltmeters shall continuously withstand 120% of rated voltage.</li> <li>j) Meter shall display and record export and import values of electrical parameters like power, current etc</li> </ul>
dd.	Energy Meter	<ul style="list-style-type: none"> <li>a) Energy meter shall be mounted on control and relay panel.</li> <li>b) Energy meters shall be connected to form a separate Ethernet ring.</li> <li>c) Energy meters shall be downloadable through network within the sub-station.</li> <li>d) Energy Meters shall have provision to communicate through modem or network to remote location to download and record 24 hour lock reading</li> <li>e) Necessary software for configuration, downloading from local as well as from remote location shall be provided by the supplier</li> <li>f) Meters shall be CT/VT operated with accuracy class of 0.2S.</li> <li>g) Meter shall be three phase four wire (3P 4W) but shall also suitable for three phase three wire (3P 3W) system.</li> <li>h) It shall have back lit digital LCD display.</li> <li>i) It shall have port for data downloading and communication with Buyer's PC for remote monitoring.</li> </ul>

		<ul style="list-style-type: none"> <li>j) Data integration period shall be 15 minutes. Data shall be recorded in non volatile memory.</li> <li>k) LED / LCD pulses corresponding to pulse/kwh shall be provided calibration purpose.</li> <li>l) Tamper and fraud detection feature shall be provided. At least hundred (100) tampering events shall be recorded with date and time.</li> <li>m) Provision should be there for recording cumulative daily energy at 00:00 hours for the purpose of energy auditing.</li> <li>n) It shall have self diagnostic feature and shall record malfunctioning with date and time.</li> <li>o) It shall have eight (8) different zones for storing TOD (Time of DAY) consumption and maximum demand.</li> <li>p) Meter should have real time clock synchronization system.</li> <li>q) Meter shall be capable of storing all the parameters ( kW, KWH, kVA, kVAh etc) for at least ninety (90) days in tabular form with 15 minutes integration period. Meter shall also store power "ON" and power "OFF" time.</li> <li>r) Meter software shall have provision for automatically taking care of reading of leap year.</li> <li>s) For data security, multi level password protection shall be provided for data reading and data programming.</li> </ul>
<p>ee.</p>	<p>Annunciation System</p>	<ul style="list-style-type: none"> <li>a) Audible Annunciation system shall be provided to draw the attention of the operator.</li> <li>b) Auxiliary supply of annunciation equipment shall be universal. The annunciation facia shall have 12</li> </ul>

		<p>windows. Trip and Non trip facia shall be differentiated.</p> <p>c) Visual and audible annunciation for the failure of DC supply to the annunciation system shall be provided and this annunciation shall operate on 240 Volts AC/220V DC supply with separate fuses.</p> <p>d) Annunciator supply change shall be automatic. On failure of the power supply to the annunciation system for more than 2 or 3 sec, (adjustable setting), a facia shall light up and a bell shall sound. A separate push button shall be provided for the cancellation of this audible alarm along but the facia window shall remain steadily lighted till the supply to the annunciation system is restored. The sound of the audible alarm (bell) provided for this annunciation shall be different from the audible alarm provided for the annunciation system.</p> <p>e) One self-resetting push button shall be provided on each panel for testing the annunciator.</p> <p>f) Push buttons for testing flasher and audible alarm circuit of annunciation system and for testing the annunciation supply failure monitoring circuit shall also be provided. These testing circuits shall be so connected that while test is being done it shall not prevent the registering of any new annunciation that may occur during the test.</p> <p>g) The annunciator shall be suitable for operation with normally open fault contacts which close on a fault. For fault contacts which open on a fault, it shall be possible at site to change annunciators from "close to fault" to "open to fault" and vice</p>
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		<p>versa.</p> <p>h) Scheme for Alarm accept and reset option shall be provided.</p>
ff.	Guarantee	<p>a) Performance of CRP shall be guaranteed for minimum three (3) years from the date of supply or two and half (2.5) years from the date of successful commissioning at site whichever is shorter.</p> <p>b) Within guarantee / warranty period, if the device needs to be shifted to suppliers works for repairs, supplier shall bear the cost of spares, software, transportation, transit insurance (to &amp; fro) etc for repair at works.</p> <p>c) On receipt of complaint from Buyer, Supplier shall ensure to attend the complaint within seven (7) days of reporting. In case GOODS need to be sent back to factory for repair, Supplier shall arrange his representative to collect the material from site within seven (7) days of report of complaint. Transit insurance will be in Supplier's scope. Repaired / replaced GOODS shall be redelivered at site within 21 days after receipt of complaint. While redelivering GOODS, Supplier's representative shall verify proper functioning of repaired GOODS.</p> <p>d) All the expenses for maintaining supplied instrument "healthy and in working condition" to be borne by Supplier during guarantee period.</p>
gg.	Training	<p>a) Supplier shall to ensure the CRP system is made user friendly apart from the detailed demonstrations at site.</p> <p>b) The supplier shall arrange necessary training (as per Clause 1.2) to buyer's Engineers during</p>

		commissioning at site.
hh.	Documentation	<p>a) Supplier shall note that the drawings, data and manuals listed in Table-1 are minimum requirements only.</p> <p>b) The supplier shall ensure that all other necessary write up, information etc required to fully describe device / system shall be submitted during bidding</p> <p>c) Documents to be submitted during bidding is given in Table -1</p> <p>d) The manual shall clearly indicate in English the functions, installation, operation and maintenance</p>
ii.	Mandatory spares	a) Mandatory spares shall be supplied as per list furnished in this specification
jj.	Deviation	<p>a) Should the Bidder wish to deviate from this specification in any way, it shall be clearly mentioned in attached Schedule with reference to the respective clause of the specification.</p> <p>b) Unless such deviations are recorded in deviation sheet and submitted with the offer, it will be taken for granted that the offer is made in conformity with this specification in all respects</p>
kk.	Testing and Inspection	<p>a) Bidder shall give Buyer written notice well in advance (minimum one week) for inspection when panel is ready for testing at works.</p> <p>b) Bidder has to submit test plans of inspection at least two week prior to inspection to Buyer for approval.</p> <p>c) All panels shall be checked for connections, wiring and layout as per good Engineering practice and shall be functionally tested.</p> <p>d) Dielectric test (Insulation Resistance) for one</p>

		<p>minute shall be carried out on all panels.</p> <p>e) The Bidder shall carryout all routine tests as per IEC/IS standard , which shall also include test on different components, wherever applicable.</p> <p>f) Verification of scheme as per approved drawing and functional test shall also be done</p> <p>g) Differential scheme testing shall be done</p> <p>h) Supplier shall submit factory test reports and routine test report of all components for purchaser's approval.</p>
<p>II.</p>	<p>Drawing approval</p>	<p>a) Before starting manufacture of any equipment, the Bidder shall take approval of relevant drawings, data sheet and Quality Assurance Plan (QAP) from Buyer in writing.</p> <p>b) After receipt of PO (Purchase Order) the vendor shall submit the drawings within 10 days. Owner shall provide comments within 7 days on each submission. The bidder shall get all the drawings approved within 30 days of submission on compliance to all the comments / observations raised by Buyer.</p> <p>c) Bidder shall consider time period for drawing approval while stating delivery period of panels.</p> <p>d) Manufacturing done prior to the approval of drawings/data sheet shall be rectified in accordance with the approved drawings/data by the Bidder at his own cost and the equipment shall be supplied within the stipulated period.</p> <p>e) The drawings and document marked for 'reference' may also be reviewed by Owner, if found necessary. The Bidder shall note that the approval of drawings &amp; documents by the Buyer does not relieve him of his contractual obligation.</p>

		<p>f) All drawings shall be prepared by using Auto CAD, approved version and documents shall be generated using MS Office. Printed copies of six (6) nos of the drawings &amp; document shall be submitted for approval &amp; reference. All final drawings and documents shall be submitted in CD in Auto CAD (approved version) and MS office format as applicable for Buyer's future reference.</p> <p>g) As built drawings shall be prepared after incorporation of changes / modifications during inspection / commissioning. Printed copies in six (6) nos of the as built drawings shall be submitted to Owner.</p>
mm.	Packing and Transportation	<p>a) The equipment shall be properly packed for transportation by ship/rail or trailer. It shall be wrapped in polyethylene sheets before being placed in crates/ cases to prevent damage to finish. The crates / cases shall skid bottoms for handling. Special notations such as 'Fragile', 'This side up', 'Center of gravity', 'weight', 'owner's particulars', 'PO no', etc., shall be clearly and indelibly marked on the packages together with other details as per purchase order.</p> <p>b) The shipping section(s) shall be provided with supports in the form of steel sections, lifting eyes etc. to maintain alignment of parts during shipping, handling, hoisting and installation. Location of lifting points shall be clearly marked on shipping containers and on drawings. The shipping section(s) shall have its weight and center of gravity clearly marked on the container.</p> <p>c) Preparation for shipment shall protect the component parts against corrosion, dampness, and breakage or vibration injury during</p>

		<p>transportation or handling. Where equipment has to be split for shipping, instructions shall be provided for reassembly. Materials and special tools shall be provided if necessary for reassembly at site.</p> <p>d) The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed.</p> <p>e) The equipment complete with its accessories, spares, special tools and tackles shall be suitably protected by respective packing for shipment considering handling during transit, distance and weather conditions involved. The Bidder shall submit the packaging method for shipment to be adopted by him, if so desired by the Buyer.</p> <p>f) Each consignment shall be marked with Equipment name, Purchaser's name &amp; address, Project details, handling instruction etc. It shall be completed with part list and identification details. The copies of the part list of each consignment shall also be furnished to the Buyer after dispatch.</p> <p>g) Equipment shall be packaged for transportation so as to meet the space and weight limitation of transport facilities. The Bidder shall obtain approval from concerned authorities for transportation of over dimensioned consignment/ package, if any, before starting manufacture of such equipment.</p> <p>h) When system is despatched in containers, all small loose items shall be suitably packed in boxes along with packing list of materials</p>
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**Table: 1**

Documents to be submitted	With the bid	After award	
		For approval	For reference
General arrangement drawing (Front view, rear view, side view )	X	X	
Typical foundation plan	X	X	
Deviation, if any, from the specification	X		
List of makes of various items/ components	X	X	
Leaflets and catalogues of different protection, aux. relays and accessories along with write up on special feature	X		X
Bill of material	X	X	
Type test report	X		
Supporting document for QR	X		
Dimensional general arrangement drawing of panels showing the position of all equipments mounted on the panels, like switches, meters, indicators, relays, etc and cable entry points for all panels		X	
Foundation plan & loading for each panel.		X	
Guaranteed technical particulars	X	X	
Quality assurance plan	X	X	
Scheme drawing & Design Instruction Sheet		X	
Bill of quantity with specification of each item		X	
List of mandatory spares	X	X	
Transport / shipping details such as method of packaging, dimension & weight of package, part list etc.			X
Certified reports of Routine tests and Acceptance tests of all equipments prior to dispatch		X	
Instruction manuals of the equipment and various accessories. The manual shall clearly indicate method of installation check up and tests to be carried out before commissioning of the equipment			X

## 6. BILL OF MATERIAL

SI No	Item description	Unit	Quantity
1	Supply of integrated 220kV Control and Relay Panel for line feeder with control and protection scheme as per specification TD-SP-220kVCRP-353-RO along with accessories like (Refer Annexure -1 for SLD of MSETCL Trombay and Nerul S/S) a) Relay software - 1Nos per each type of relay b) Relay front communication cord with laptop - 1Nos per each type of relay c) USB Converter (if applicable) – 1 per relay	1 Set of 2 panels	2
2	Dismantling, removal, installation testing and commissioning of Control and Relay Panel (CRP) at MSETCL Trombay and MSETCL Nerul substation (Refer Clause 1.2 of Spec TD-SP-220kVCRP-353-RO for details)	LS	1

**Note:** The above bill of material is indicative to bidder for supply of specified package. Final bill of material (Items and quantity of each item) shall be based on approved scheme drawing. Bidder to consider all the items / equipment required in adequate quantity to meet the Buyer's scheme requirement.

## 7. MANDATORY SPARES

SI No	Item description	Unit	Quantity
a)	Current Differential Protection Relay–Main 1	No	1
b)	Current Differential Protection Relay –Main 2	No	1
c)	Local Breaker Backup Protection Relay	No	1
d)	Bay Control Unit (BCU)	No	1
e)	Lockout Relay (18NO +10NC)	No	1
f)	Trip Circuit Supervision Relay	No	1

## 8. GUARANTEED TECHNICAL PARTICULARS (GTP)

1.0	Panel (Control & Relay Panel)	Customer Requirement	Data to be filled by Bidder
1.1	Make of panel	Bidder to specify	
1.2	Type	Simplex panel with swing frame and full glass door	
1.3	Reference Standard	As per codes standards indicated in specification	
<b>1.5</b>	<b>Construction</b>		
a	Degree of protection	IP54	
b	CRCA Sheet metal thickness in mm	a. 3 mm for load bearing members of the panels b.2 mm for non load bearing members	
<b>1.6</b>	<b>Equipment Mounting</b>		
a	All relays, meters and switches are flush / semi-flush mounted?	Yes / No	
b	Relays furnished in draw-out cases with built-in test facilities?	Yes / No	
<b>1.7</b>	<b>Nameplate</b>		
a	Material	Black colour anodised aluminium with white engraving	
b	Thickness (mm)	Min 3mm	
c	Size for		
c.1	Equipment	To be submitted for approval	
c.2	Panels	To be submitted for approval	
d	Name plate provided on both front and rear side for equipment and panel	Yes / No	
<b>1.8</b>	<b>Internal Illumination</b>		
a	Type of lamp	Compact fluorescent lamp (CFL)	
b	Voltage rating (V)	240V AC	

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c	Power (Watt)	18W	
d	Door switch controlled?	Yes / No	
<b>1.9</b>	<b>Space Heater</b>		
a	Voltage rating (V)	240V AC	
b	Power (Watt)	100W	
c	Thermostat Controlled?	Yes / No	
d	Thermostat with variable setting range / voltage rating (V)	30 -90deg / 240V AC	
e	ON/ OFF switch provided for heater?	Yes / No	
<b>1.10</b>	<b>Plug Socket</b>		
a	Type	Three (3) pin	
b	Rating	15A	
c	ON/ OFF switch provided for plug?	Yes / No	
<b>1.11</b>	Panel illumination, space heater & plug socket circuits provided with individual MCB units?	Yes / No	
<b>1.12</b>	<b>Isolating MCB units provided for AC / DC Supply:</b>		
a	Incoming AC supply	Yes / No	
b	Incoming DC supply	Yes / No	
<b>1.13</b>	<b>Internal Wiring</b>		
a	Wire type	PVC FRLS	
b	Voltage grade	1100V	
c	Conductor material	Copper	
d	Conductor size for		
d.1	Current & Voltage	2.5 Sq.mm	
d.2	Control circuit	1.5 Sq.mm	

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e	Wires identified at both ends with ferrules?	Yes / No	
f	Colour Coded wires as per phase used for CT / PT?	Yes / No	
<b>1.14</b>	<b>Terminal block</b>		
a	Make	To be provided by bidder	
b	Type	To be provided by bidder	
c	20% Spare terminal furnished?	Yes / No	
<b>1.15</b>	<b>Ground bus</b>		
a	Materials	Copper	
b	Size (mm)	50 x 6mm	
<b>1.16</b>	<b>Painting</b>		
a	Type of painting	Powder coating	
b	Type of finish for inside / outside	Texture semi glossy	
c	Colour Shade – Inside / Outside	RAL 9003 / RAL 7032	
d	Details of painting procedure furnished?	Yes / No	
e	Thickness of painting	80-120 micron	
f	Colour of base frame	Black	
<b>2</b>	<b>Push Button</b>		
2.1	Make	To be provided by bidder	
2.2	Type	To be provided by bidder	
2.3	Reference Standard	IEC 61058	
2.4	Contact Voltage Rating	220V DC / 240V AC as per scheme requirement	
2.5	Contact current rating	To be provided by bidder	
2.6	Mounting	Panel, screw type	
2.7	No and type of contacts	To meet scheme requirement + 20% spare contact	
2.8	Actuator colour	Bidder to specify available colours	

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3	<b>Indicating Lamps</b>		
3.1	Make	To be provided by bidder	
3.2	Type	LED Type	
3.3	Reference Standard	IS 13947	
3.4	Rating		
a	Operating Voltage (V)	240V AC / 220V DC as per application	
b	Power (Watt)	To be provided by bidder	
c	Colours available	To be provided by bidder	
3.5	Size of lens / material	Size based on GA / Poly carbonate	
3.6	Diffuser Provided?	Yes / No	
3.7	Termination	Totally enclosed / finger proof suitable for 1.5 Sq.mm copper	
4	<b>Aux relays for contact multiplication</b>	Data to be provided for all type of contactors used in the scheme	
4.1	Make	To be provided by bidder	
4.2	Type	To be provided by bidder	
4.3	Reference Standard	IEC 60255	
4.4	Operating Coil Voltage (V)	220V DC or 220V AC as per scheme requirement	
4.5	Continuous rated current (A)	Bidder to specify	
4.6	No of contacts		
a	Normally open (NO)	To meet scheme requirement	
b	Normally closed (NC)	To meet scheme requirement	
4.7	Contacts rating		
a	Make & Continuous current (A)	To be provided by bidder	
b	Break current (A)	To be provided by bidder	
5	<b>Multifunction meter</b>		
5.1	Make	To be provided by bidder	

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5.2	Type	To be provided by bidder		
5.3	Reference Standard	IS 13779 / IS 14697		
5.4	Wiring configuration	3 Phase 4 wire & 3 phase 3 wire		
5.5	Aux supply voltage range	As per final scheme		
5.6	Measurement current range	a. Suitable for 1A and 5A CT. b. CT ratio shall be user configurable c. Bidder to specify range		
5.7	Measurement voltage range	a. Shall be suitable for rated PT secondary b. PT ratio shall be user configurable. c. Bidder to specify range		
5.8	Accuracy class	0.2S and higher accuracy		
5.9	Communication - Port / Protocol	To be provided by bidder		
5.10	VA burden	To be provided by bidder		
a	Current Coil (VA)			
b	Voltage Coil (VA)			
<b>6</b>	<b>Relays</b>			
<b>6.1</b>	<b>Line Protection</b>	Make / Type	Protection function	Cat / Order No
a	Distance cum differential protection – Main -I	Bidder to provide data		
b	Distance cum differential protection – Main -II	Bidder to provide data		
c	Numerical LBB protection	Bidder to provide data		
d	Bay control unit (BCU)	Bidder to provide data		
<b>6.2</b>	<b>Lock out relays</b>			
a	Make	Bidder to provide data		
b	Type	Bidder to provide data		



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c	Reference standard	IEC 60255	
d	Rated voltage of coil (V)	220V DC	
e	Type and No of contact	Scheme requirement + 30% spare	
f	Contact rating - Make and carry continuously	Bidder to provide data	
g	Contact rating – break current	Bidder to provide data	
h	Type of reset of contacts	Electrically and manually rest type	
i	Operation indicator provided?	Yes/ No	
j	Terminals for lock out relay supervision provided?	Yes/ No	
k	Operating time	Less than 10ms	
l	Manual reset flag indicator provided	Yes/ No	
m	Relay shall be electrically and mechanically resettable	Yes/ No	
6.3	<b>Trip circuit supervision relay</b>		
a	Make	Bidder to provide data	
b	Type	Bidder to provide data	
c	Reference standard	IEC 60255	
d	Rated voltage of coil (V)	As per aux supply of system	
e	Type and No of contact	Scheme requirement + 20% spare	
f	Contact rating - Make and carry continuously		
g	Contact rating – break current		
h	Hand reset flag indicator provided	Yes/ No	

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i	Self rest contacts provided?	Yes/ No	
j	Provision for post and pre close supervision of CB available?	Yes/ No	
6.4	<b>DC supervision relay</b>		
a	Make	Bidder to provide data	
b	Type	Bidder to provide data	
c	Reference standard	IEC 60255	
d	Rated voltage of coil (V)	As per aux supply of system	
e	Type and No of contact	Scheme requirement + 20% spare	
f	Contact rating - Make and carry continuously		
g	Contact rating – break current		
h	Hand reset flag indicator provided	Yes/ No	
i	Self reset contacts provided ?	Yes/ No	
6.5	Are make, type and catalogue of relays furnished?	Yes/ No	
6.6	Communication Protocol	IEC 61850	
6.7	Communication Port	Dual fiber port	
7	Heat load of panel	Bidder to provide data	
8	Total AC Power Consumed by the Panel (watt)	Bidder to provide data	
9	Total DC Power Consumed by the Panel (watt)	Bidder to provide data	
10	Type Test Report Submitted	Yes / No	
11	Clearances required from all sides of the Control and Relay Panel	Yes / No	
12	List of Mandatory spares submitted	Yes / No	

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13	Any Special tools required for working on Relay Terminal?	Yes / No	
14	Any Special Crimping tools required for Relay Lugs?	Yes / No	
15	Communication Cord for Uploading Settings, Down loading events, faults etc from Relay provided?	Yes / No	
16	Licensed software provided for Relays / BCU / Meters	Yes / No	
17	Relay provided with conformal coating suitable to work in GX as per ISA 71.04-1985 and Class 4 special as per IEC 60654-4.	Yes / No	
18	<b>Switches</b>	Details to be provided for all type of switches. Any additional detail required to be added by bidder	
a	Make	Bidder to provide data	
b	Type	Bidder to provide data	
c	Reference standard	IEC 13947	
d	Rated voltage of coil (V)	As per aux supply of the system	
e	Rated current (A)	Bidder to specify as per application	
f	No of ways / positions	As per application	
g	No of contact	As per scheme requirement	
h	Over all size (mm x mm)	Bidder to provide data	
19	<b>Energy meter</b>		
a	Make	Bidder to provide data	
b	Type	CT /PT Operated 3P 4W meter	
c	Standard	IS 14697 / IS 13779 / IEC 62053	

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d	Class of accuracy	0.2S	
e	Basic current (A)	1A or 5A	
f	Max continuous current (A)	200% I <sub>b</sub>	
g	Standard reference voltage (V)	110V Phase to phase	
h	Standard reference frequency (Hz)	50Hz	
i	Power consumption	As per IS 14697 / 13779	
j	Parameters measured	Provide details	
j	P.F Range	0 to unit (lagging or leading) in all four quadrant	
k	Overload capacity		
l	Minimum starting current (A)		
m	Display	LCD with backlit	
n	Tamper and fraud detection provided?	Bidder to provide details	
o	No of programmable TOD registers	Min eight (8) registers	
p	Degree of protection	Bidder to provide data	
q	Frequency of calibration	Bidder to provide data	
r	Type of calibration output provided	LED/ LCD type	
s	Low battery indication provided?	Provide details	
t	Communication protocol / port	Modbus / RS 485	
u	Memory capacity in data storage (GB)		
v	Current Secondary rating (A)	1A or 5A	
w	Voltage Secondary rating (V)	110V (Phase to Phase)	

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x	Integration period of MD	15 Minute	
y	Sealing arrangement provided for meter body, meter terminal cover, M.D reset push button	Yes /No	
20	<b>Annunciator</b>		
a	Make and Type	Vendor to specify	
b	Aux supply	Universal (220V DC/240V AC)	
c	Number of windows	12 No	
d	Hooter provided	Yes	
e	Accept & reset button provided	Yes	
24	TTB provided for energy meter?	Yes / No , provide details	
25	Test switch provided ?	Yes / No , provide details	
26	Training	Two (2) days training at site	
27	Any other equipment / component which is not mentioned above but required or usual for the satisfactory operation and maintenance to be added by bidder / OEM		

**9. DEVIATIONS**

Deviation Schedule (Technical)

If the proposal has got any deviation from the technical specification, scope of supply, etc., bidder shall tabulate those deviations and sign below. Attach more sheets if necessary. It will automatically be confirmed that except these deviations, as tabulated hereunder, the complete offer is in agreement with the specification requirement. Deviations for Technical and Commercial Conditions shall be given separately.

SI N o	Document No & description	Clause No & Page No	Description of Clause	Deviation

**Note:**

- a. Any deviations taken by the Bidder to the stipulations of the Bid document shall be brought as per given format and shall be enclosed along with offer.
- b. Any deviations not brought out in this form and written elsewhere in the Bid documents shall not be recognized and the same is treated as null and void.

Name of Firm .....

Signature of Bidder .....

Name of Bidder .....

Designation .....

Date .....

Seal of Company .....