TECHNICAL SPECIFICATION FOR 12KV,800A,18.4KA,MULTI PANEL (Incoming, Bus Coupler and Outgoing) SHUNT TRIP, INDOOR TYPE SCADA COMPATIBLE SWITCHGEAR WITH MOTOR OPERATED SPRING CLOSING VACUUM CIRCUIT BREAKER

1.0 CODES & STANDARDS:

Ratings, characteristics, tests and test procedures, etc. for the 11kV metal-clad switchgear panels and all the protection relays, measuring and indicating instruments and the control and monitoring devices and accessories, including current transformers and voltage transformers shall comply with the provisions and requirements of the standards of the International Electrotechnical Commission (IEC), IS where specified.

The latest revision or edition in effect at the time of bid invitation shall apply. Where references are given to numbers in the old numbering scheme from IEC it shall be taken to be the equivalent number in the new five-digit number scheme. The bidder shall specifically state the precise standard, complete with identification number, to which the various equipment and materials are manufactured and tested. The bid document may not contain a full list of standards to be used, as they only are referred to where useful for clarification of the text.

Standard Name / No	Standard's Description
Indian Electricity Rules 1956	Latest edition
Indian electricity act 2003	Latest edition
Switchgear and control gear	IEC: 60694, IEC: 60298, IEC: 62271-200, IEC: 60529. IS: 3427, IS 12729, IS 12063, IS:13947, IS: 9046
Circuit Breaker	IEC 62271-100, IS 13118, IS 2516
Vacuum Interrupter	IEC 60056
Current Transformers	IEC:60185, IS 2705
Voltage Transformer	IEC:60186, IS 3156
Indicating Instruments	IS:1248
Energy Meters	As mentioned in Technical Specification of Energy Meter
Relays	IS 8686, IS 3231, IS 3842
Control switches and push buttons	IS 6875
Electromagnetic Compatibility	IEC 61000
Arrangement of switchgear bus bars, main connection and auxiliary wiring	IS 375
Code of practice for phosphating iron & steel	IS 6005
Colours for ready mixed paints	IS 5

2.0 Scope of Work: This Specification covers the design and engineering, manufacture, testing at the manufacturer's factory, painting, packing for transport, insuring, transportation by road and delivery at destination point of 12 kV, 800 A, 18.4KA, Multi panel, shunt trip, Indoor Type, motor operated, spring closing Vacuum Circuit Breaker having SCADA compatible facilities and complete with all accessories as specified hereinafter.

2.1 UNIT OF MEASUREMENT AND LANGUAGE

In all correspondence, in all technical schedules and on all drawings prepared by the manufacturer, the metric units of measurement shall be used. On drawings or printed pamphlets where other units have been used, the equivalent metric measurements shall be added. All documents, correspondence, drawings, reports, operating and maintenance instructions/manuals and nameplate details of the equipment shall be in English language.

3.0 SERVICE CONDITIONS:-

From the geographical condition, the area where the switchgear panels shall be installed is categorized into the tropical climate zone. In choosing materials and their finishes, due regard shall be given to the humid tropical conditions under which the switchgear panels shall be called upon to work. The manufacturer of the switchgear panels shall submit details of his usual practice of tropicalization which have proven satisfactory for application to the switchgear panels and associated equipments to prevent rusting and ageing in the tropical climate zone. The applicable standards for tropicalization shall be listed.

Climatic condition: The equipment is required to operate satisfactorily under the following site conditions:

Max. Ambient Temperature	50^{o}C
Max. Ambient Temperature for design purpose	40^{o}C
Min. Ambient Temperature	4^{o}C
Max. Relative Humidity	100%
Average no. of rainy days per annum	100 days
Elevation	within 1000M from MSL
Maximum Wind Pressure	150kg/m2
Horizontal Acceleration due to seismic force	59/100
Pollution Level	Heavily polluted atmosphere

The switchgear panels shall be installed in a room without air conditioning but with ventilation to allow natural cooling. Therefore all the protection and control devices employed shall be capable of operating in this environment without failure for their designed life time. Particularly the power

supply modules of the protection and control devices shall be designed for minimum heat generation and effective heat dissipation to ensure that the temperature of these devices enclosed in the relay panels at the above listed ambient temperatures shall not exceed the maximum operating temperature of the device.

3.1 Tropicalization

(a) All equipment must be designed for operations in the severe tropic climate conditions and fully comply with climatic aging tests as per IEC 60932-class 2.

In choosing materials their finishes, due regard shall be given to the humid tropical conditions under which the switchgear will be called upon to work. The manufacturer shall submit details of his usual practice which have proven satisfactory for application to the parts of the Switchgear panels, which may be affected by tropical conditions.

(i) **Metals**:

Iron and Steel are generally to be painted or galvanized as appropriate. Indoor parts may alternatively have chromium or copper-nickel plates or other approved protective finish.
Small iron and steel parts (other than rustless steel) of all instruments and electrical equipment, the cores of electromagnets and the metal parts of relays and mechanisms shall be treated in an appropriate manner to prevent rusting.

(ii) **Screws, Nuts, Springs, e.t.c.:**

The use of iron and steels shall be avoided in instruments and electrical relays wherever possible. Steel screws shall be zinc, cadmium or chromium plated or where plating is not possible owing to tolerance limitations, shall be of corrosion resisting steel. Instrument screws (except those forming part of a magnetic circuit) shall be of brass or bronze. Springs shall be of non-rusting material, e.g., phosphor-bronze or nickel silver, as far as possible.

(iii) **Rubbers:**

Neoprene and similar synthetic compounds, not subject to deterioration due to the climatic conditions, shall be used for gaskets, sealing rings, diaphragms, etc.

3.2 WORKING STRESS AND EQUIPMENT/APPARATUS DESIGN

3.2.1 General

a) The design, dimensions and materials of all parts shall be such that they will not suffer damage under the most adverse conditions nor result in deflections and vibrations, which might adversely affect the operation of the equipment. Mechanisms shall be constructed to avoid sticking due to rust or corrosion.

b) The equipment and apparatus shall be designed and manufactured in the best and most substantial and workmanlike manner with materials best suited to their respective purpose and generally in accordance with up-to-date recognized standards of good practice.

c) Whenever possible, all similar parts, including spare parts, shall be made interchangeable. Such parts shall be of the same materials and workmanship and shall be

constructed to such tolerances as to enable substitution or replacement by spare parts easily and quickly.

d) All equipment shall be designed to minimise the risk of fire and consequential damage, to prevent ingress of vermin and dust and accidental contact with electrically energized or moving parts. The switchgear panels shall be capable of continuous operation with minimum attention and maintenance in the exceptionally severe conditions likely to be obtained in a tropical climate and where the switchgear is called upon to frequently interrupt fault currents on the system and also where the duty of operation is high.

3.2.2 Strength and quality

a) All steel castings and welding shall be stress-relieved by heat treatment before machining, and castings shall be stress-relieved again after repair by welding.

b) Liberal factors of safety shall be used throughout, especially in the design of all parts subject to alternating stresses or shocks.

3.2.3 Designed data for low voltage equipment

Low voltage equipment and installation shall be designed in accordance with EMC(Electromagnetic Compatibility, IEC 61000) directives. The rating and design criteria for low voltage equipment shall be as follows:

AC Supply Rating system

i. Rated voltage between phase 415 V AC
ii. Connection type 3ph 4wire
iii. Rated voltage between phase to earth 240 V AC
iv. Grounding system PME
v. Frequency 50 HZ
vi. Voltage variation ± 10 %
vii. Frequency variation ± 5 %
viii. Power frequency 1 min, Test Voltage 3 kV
ix. Thermal rating of conductors 120 % of load

The AC supply shall be used for power circuit and for lighting, indication, motor controls and similar small power circuits. Unless otherwise specified, the equipment provided

under this tender is to be capable of reliable operation at voltages as low as 85% of the rated voltage, and to withstand continuously up to 110% supply voltage above the rated value of 240V or 415V AC.

DC Auxiliary Supply Rating

i. Equipment/Device Rated voltage 30V DC
ii. Connection type 2 wire.
iii. Voltage variation 24 to 40 V DC

The auxiliary dc supply shall be used for controls, indication, alarm, protection relays, and circuit breaker tripping and closing circuit, etc. All equipment and apparatus including the circuit breakers, protective relays, control devices and accessories, measuring and indicating instruments and electronic equipment shall be capable of satisfactory operation at 80% to 130% of the rated dc supply voltage. However, in case of VCB, for tripping the range should be 70% to 110% and for closing that should be 85% to 110%.

3.2.4 Electrical controls, auxiliaries and power supplies

(a) Responsibility for electrical control and auxiliaries.

The manufacturer shall provide all control, indication, alarm and protection devices and all auxiliary equipment with wiring and interconnecting cable which are integral parts of or are directly associated with or mounted on the switchgear panels to be supplied under this tender. The design of protection and control schemes for the switchgear panels shall be subject to approval of WBSEDCL.

b) Operation and control.

Interlocking devices shall be incorporated in the control circuit to ensure safety, and proper sequence and correct operation of the equipment. The scheme will be finalised during detailed engineering and drawing approval.

3.2.5 Corona and radio interference

a) Switchgear shall electrically be designed to avoid local corona formation and discharge likely to cause radio interference.

b) The design of jointing of adjacent metal parts and surfaces shall be such as to prevent corrosion of the contact surfaces and to maintain good electrical contact under service conditions.

c) Particular care shall be taken during manufacture of busbar and fittings and during subsequent handling to ensure smooth surface free from abrasion. All joints on the busbar and the circuit within the switchgear board shall be silver or tin-plated to ensure good electrical connection.

4.0 PANEL CONSTRUCTION

In the event of direct conflict between various order documents, the precedence of authority of documents shall be as follows –

4.1	**Enclosure Type**	Dead front, floor- standing, rigid welded steel frames fully compartmentalized, Metal clad, Vermin Proof, suitable for indoor installation and provision for bolting to the floor.
4.2	**Enclosure degree of protection**	IP 5X for High Voltage compartment and IP4X for Low Voltage compartment
4.3	**Enclosure Material**	CRCA steel
4.4	**Load bearing members**	Minimum 2.5 mm thick
4.5	**Doors and covers**	Minimum 2.0 mm thick
4.6	**Gland Plate (detachable type)**	3.0mm MS detachable type for 3 core cable and aluminium 5.0mm for single core cables. Cable compartment shall have an anti vermin guard plate for protection against entry by rats, rodents etc.
4.7	**Maximum Dimension of the Panel (WxDxH)**	**700mmx2000mmx2700mm.**
	Maximum operating height of the panel	**Operating height 1800 mm (max).**
4.8	**Extensibility**	The Switchgear shall be designed so that future units can be added to each sides (unless coupled to other equipment). A removable plate will cover any unused openings in the side of the panel.
4.9	**Extension Bus and Bus Wires**	**In case of Single feeder panels, Identical Bus Bars and Bus Wires for connection with adjacent Incomer / Bus Coupler / Feeder needs to be supplied.**
4.10	**Separate compartment for**	Bus bar, circuit breaker, HV incoming / outgoing cable, LV instruments & relays.
4.11	**Breaker compartment door**	Separate with lockable handle (design with breaker trolley as the front cover is not acceptable)
4.12	**Breaker to bus bar compartment**	Through seal off bushings/Spout
4.13	**Breaker to cable compartment**	Through seal off bushings/Spout

4.14	**Pressure relief devices**	To be provided for each HV Compartment. Each compartment shall be separated from adjacent one by sheet steel barrier.
4.15	**Bus support insulator**	Non hygroscopic, track-resistant, high strength, epoxy insulators (calculation for validating dynamic force withstand capability to be submitted during detailed engineering)
4.16	**Fixing arrangement** **i. Doors** **ii. Covers** **iii. Gasket**	Concealed hinged Bolted with SS bolts and Neoprene rubber gasket , washer
4.17	**Required HV cable termination height in the cable compartment**	550mm for 11KV
4.18	**Panel Base Frame**	Steel base frame as per manufacturer's standard.
4.19	**Handle**	Removable bolted covers for cable chamber and busbar chamber shall be provided with "C" type handles
4.20	**Prevention of Internal Arc**	Shall be type tested against internal arc as per provision in IEC 62271-200. The Circuit Breaker, busbars and cable compartments shall be provided with arc venting outlet. The doors for the compartment shall be capable of withstanding the effects of maximum internal arcing fault without being blown off and causing danger to personnel and other equipment. This should be proven by successful testing for 18.4 KA with duration 0.1 second as per relevant IEC standard.
4.21	**Test Terminal Block**	13 Ways, 50A, 1100V with back connection. Dia of Entries is 5 mm & overall dimension 250X50 mm, covered with insulated cover. TTB should be Disconnecting Link type suitable for 3 Phase 4 Wire Energy Meter. Screw type TTB is not acceptable.
4.22	**Multiway terminal Block and low voltage wiring**	Delinking type, Rail/Channel mounted, Terminal Connector to be used in CT Circuit & Screw type for other Circuit. The Terminal Blocks should be suitable for 2.5 sq.mm wire and covered with insulated transparent cover. Pitch should be minimum 8mm & 10mm for Screw type & Delinking type connectors respectively. The low voltage cable shall be enclosed in grounded metal conduit when routed through a high voltage compartment. Control wiring shall be neatly bundled and tie wrapped where applicable. Wiring shall be protected from rubbing against door flanges or other parts of the enclosure.
4.23	**Cable Tray**	Netted Metal cable Tray of suitable size at the rear side of Switchgear, preferably running at the top along the panel for carrying the signal cables for SCADA interface to be provided.

4.24	**Remote Terminal Box**	To be provided suitably at the back side of the panel for termination of the following cables : A . Main AC / DC B . Inter trip from up stream C . SCADA related terminations D . Inter connection for Differential protection etc.
4.25	**Circuit Breaker**	
4.25.1	Mounting	On withdraw able truck/trolley or carriage, with locking facility in service position. Switchgear truck/trolley should be floor mounted. Racking-in and Racking-out should be such that one person can do it easily.
4.25.2	Switching duty	a) Transformer oil filled and dry type b) Underground cable with up to 10KM.
4.25.3	Interrupting medium	Vacuum
4.25.4	Breaker operation	Three separate identical single pole units operated through the common shaft and shall be fully interchangeable both electrically and mechanically. Circuit breaker poles between the interrupters and primary plug-in contacts shall be fully insulated with durable material. Each breaker shall be provided with Mechanical 'ON' and 'OFF' facility by operating suitable closing and opening devices. each breaker shall be provided with Mechanical 'ON' and 'OFF' indicators. Each breaker shall have three positions-service, test and isolated/withdrawal marked. mechanical safety interlocks shall be provided so that it is not possible for a circuit breaker a. To be put into the cubicle unless the truck is secured in position. b. To be either draw out or draw in from and to the service position unless its contacts are safely open. c. To be withdrawn or inserted in the fixed housing unless it is at the withdrawable position. d. To be operated in service position unless its primary and secondary isolating contacts are fully engaged. e. Rack In and Rack out of the VCB trolley possible when the Breaker door in close position. The interlock should be clearly mentioned on the front door of the Breaker. f. The circuit breaker racking equipment can be padlocked in closed position. g. Electrical close/trip operation should be dependent on Local/Remote switch. However, protection trip and emergency trip circuit should be independent of Local/Remote Switch.
4.25.5	Operating mechanism	Re-strike free, trip free both electrically and mechanically, with electrical anti-pumping feature
		One O-C-O operation possible after failure of power supply to the spring charging motor.
		Motor wound, spring, charged, stored energy type with manual charging facility. One no. Breaker Truck operating handle for every three panels needs to supply.

4.25.6	Trip and Closing Coil	To be rated for substation DC voltage. Suitable for operation at minimum operating voltage of 70% for tripping and 85% for closing operation. Maximum Burden shall be about 250 watt for each coil.
4.25.7	Truck	The circuit breaker shall be mounted on an inbuilt carriage to facilitate isolation and withdrawal of the breaker. **Trolley of the VCB should be horizontally isolated** and **there should be a minimum ground clearance of 0.55 meter between thimble point of cable termination and GL**. **There should be a minimum clearance of 300 mm between any 11kV live bus and GL.** Trolley should be detachable from panel without any additional supporting trolley i.e. VCB trolley itself move on ground level.
4.25.8	Adaptor Panel	Separate Adaptor Panel with each Bus Coupler panel shall be designed.
4.26	**Breaker Indications and push buttons**	
4.26.1	ON/OFF/Emergency trip push button	i) Electrical and Mechanical type in front of the panel ii) Mushroom type Emergency Off push button will be provided with a protective flap in front of the panel.
4.26.2	Mechanical ON-OFF indication	On breaker trolley front
4.26.3	Operation counter	On breaker trolley front
4.26.4	Test-service position indicator	On the front of the panel
4.26.5	Mechanism charge/discharge indicator	On breaker trolley front
4.26.6	Breaker positions	Service, test and isolated
4.26.7	**Inter changeability**	**The Circuit Breakers of Incomer, Bus Coupler & Feeder Panels should be interchangeable.**
4.26.8	Breaker control	On panel front only
4.26.9	Handle	Breaker shall be provided with handles for easy handling, rack in-out operation and manual spring charging as applicable.
4.27	**Functional Requirements**	
4.27.0	Interlock and safety devices	
4.27.1	Breaker compartment door opening	Cannot be opened unless breaker is OFF and racked out to test/isolated position
4.27.2	Breaker compartment door closing	Should be possible even when breaker in isolated position
4.27.3	Racking mechanism safety interlock	Mechanical type
4.27.4	Racking in or out of breaker inhibited	When the breaker is closed
4.27.5	Racking in the circuit breaker inhibited	Unless the control plug is fully engaged
4.27.6	Disconnection of control plug inhibited	As long as the breaker is in service position

4.28	**Additional Requirement**	
4.28.1	Exposure to live parts	In case the breaker panel door is required to be opened during a contingency, the personnel should not be exposed to any live parts. Suitable shrouds / barriers / insulating sleeves should be provided as required.
4.28.2	a. Operation of breaker in Local b. Operation of breaker in Remote c . Protection Trip	a. In either service or test position b. Only in Service Position c . Both in Local and Remote position of LR Switch.
4.28.3	Closing from local	Only when local/remote selector switch is in local position
4.28.4	Closing from remote	Only when local/remote selector switch is in remote position
4.28.5	Tripping from local	Selector Switch in Local
4.28.6	Tripping from remote	Selector switch in 'Remote' position
4.28.7	Testing of breaker	In test or isolated position keeping control plug connected
4.29.	**Safety shutters**	
4.29.1	Automatic safety shutter for primary disconnector	To fully cover contacts when breaker is withdrawn to test. Independent operating mechanism for bus bar & cable side shutters, separately padlockable in closed position.
4.29.2	Label for identification	For bus side and cable side shutters
4.29.3	Warning label on shutters of incoming and other connections	Clearly visible label "isolate elsewhere before earthing" be provided
4.30	**Breaker electrical**	
4.30.1	Trip coil supervision relay	To be given for breaker close and open condition.
4.30.2	Trip coil supervision relay contact	For indication and alarm
4.30.3	Master Trip Relay (NO) Contact	Wired directly to trip coil
4.30.4	Master trip relay (NC)contact	Wired to inhibit closing of breaker
4.30.5	Emergency Trip Push button contact	Wired directly to trip coil of breaker
4.30.6	DC Control supply and AC supply bus in all panels	Fed by single DC and AC Incoming source in bus coupler panel as well as all Incomers in case of total Switch Board. Isolating fuse units shall be provided for incoming supplies to each switchgear unit.
4.30.7	PT supply bus in all panels	Fed normally by Bus PT with changeover facility.

4.30.8	**Spring Charge Limit switch Aux. Contact Configuration**	The circuit breaker shall be provided with motor operated spring charged closing. Spring charging by motor should be smooth and hassle free and there should be nominal sound during spring charging. Motor should be 230 Volt AC operated, Tripping of the circuit breakers shall be through "Shunt trip" coils rated for 30V DC auxiliary supply. It shall be possible to trip the breaker manually in case of necessity. 2NC --- For Motor circuit 1 NO --- For Breaker Closing Circuit 1 NO --- For Breaker Closing permissive to be used in IED/Relay. 1 NO --- For panel spring charged indication AC operated contactor may be used for contact multiplication of Limit Switch, if required, for indication and spare contacts.
4.30.9	**Local/ Remote selector switch**	Switch should be 4 pole in each position, 2 way lockable and stay put type.
5.1	**Current Transformers**	Shall be cast resin type with insulation class of E or better. Contact tips on primary side shall be silver plated. Correct polarity shall be invariably marked on each primary and secondary terminal. Primary shall be wound or bar type, rigid, high conductivity grade copper conductor. Unavoidable joints on the primary conductor shall be welded type, preferably lap type. Current density at any point shall not exceed 1.6 A/sq.mm. Suitable insulated copper wire of electrolytic grade shall be used for CT secondary winding. Multi ratio in CT shall be achieved by reconnection of secondary winding tapping. The secondary terminals shall have screw type terminals. The screw should have sufficient length for connection of at least two nos wires with plain and spring washers and minimum 10 mm clearance between the adjacent screw.
5.2	**CT Mounting**	**To facilitate easy replacement of 11 KV CT afterwards, fixing of CT in hanging condition/CT base plate fixed at the upper covering of the CT Chamber may not be acceptable. Fixing in horizontal upright condition over a base channel is preferable. CT Secondary connection terminals should be clearly visible and accessible from the back side of the breaker assembly just after opening the rear cover plate.**

6.0.0	**Potential Transformer**	
6.1.0	Type	Potential Transformer should be Three Phase Five Limb type or it should be combination of three no Single Phase PT housed in a withdrawable carriage, Shall be cast resin type with insulation class of E or better. Service position locking mechanism shall be provided and indicated by bidder in relevant drawing. Rigidity of primary star point with earth bus in service position shall be confirmed. Connection of Primary neutral with main earth bus to be made with solid copper wire & minimum 10 mm diameter or equivalent copper flat. Contact tips of primary/secondary contacts shall be silver plated. Correct polarity shall be distinctly marked on primary and secondary terminal. Secondary terminal studs shall be provided with at least three nuts, two plain and two spring washers for fixing leads. The stud, nuts and washers shall be of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6 mm. the length of at least 15 mm shall be available on the studs for inserting the leads. The space clearance between nuts on adjacent studs when fitted shall be at least 10 mm.
6.2.0	**Mounting**	**Rail mounted on top of the Unit and connected on bus side. It can be plugged into and withdraw from service by pulling or pushing the PT by the handle provided on the PT. This action traverses the PT along the rails and shall automatically operate the spout shutters. The shutter drive also forms a latch which holds the PT in the service position and this latch shall be required to be released before PT can be isolated.** **Access to the PT and the reinforcement in the Panel for allowing a person to stand on the Top should be provided.** **Sealing arrangement of the PT with the carriage and secondary fuses are to be provided.** **Mounting of PT on the breaker truck is not acceptable.**
7.0.0	**Equipment Earthing**	
7.1	Material of Earthing bus	Two separate earthing terminals shall be provided in each panel and shall be connected to the earth bus within the panel. The earth bus shall be of copper and shall have adequate cross sectional area. Earthing conductors shall be of annealed high conductivity stranded Copper in accordance with Table-4 in BS.6346 and protected with an extruded PVC sheath of 1100 volt grade. The earthing conductor on the primary equipment as well as for external connection to substation earthing grid shall be adequate to carry the rated switchgear short-circuit current of 18.4kA for 1 second.
7.2.	Earth bus joints	A ground bus rated to carry maximum fault current shall be furnished along the full length of the panel board. Each stationary unit shall be grounded directly to ground bus. All bolted joints in the bus will be effected by connection of two bolts.
7.3.	Size	Rectangular Earth Bus of Minimum size 25mmX6mm

7.4.	Enclosure and non-current carrying part of the switchboard/components	Effectively bonded to the earth bus
7.5.	Hinged doors	Earthed through flexible copper braid
7.6.	Circuit breaker frame / carriage	Earthed before the main circuit breaker contacts/control circuit contacts are plugged in the associated stationary contacts.
7.7.	Metallic cases of relays, instruments and other LT panel mounted equipment	Connected to the earth bus by independent copper wires of size not less than 2.5 sq mm with green colour insulation. For this purpose LT compartment should have a clear designated earth bus to which earth connections from all components are to be connected.
7.8.	CT & PT Secondary neutral	Earthed at one place at the terminal blocks through links.
8.0	**Indicating Meters**	Flush Mounted, back connected, dust proof with Industrial grade "A" classification and conforms to IS:1248(1968)
8.1	CT operated Ammeter	3 no. Digital Ammeters to be provided in Incomer and Feeder panels for measuring load current of each phases. Display : 3 ½ -digit display, Aux. Power: : 230 V AC CTR: 600/1A for Incomer and 200/1A for Feeders.(Site Selectable) Accuracy Class: 1.0 or less. Size : 96 X 48 mm.
8.2.	Direct Ammeter	1 nos. Separate Digital Ammeter to be provided for measuring heater current drawal in all the Panels. Display : 3 ½ -digit display, Aux. Power: : 230 V AC Accuracy Class : 1.0 or less. Size : 96 X 48 mm.
8.3.	P T operated Voltmeter	One no. Digital Voltmeter to be provided in Incomer Panels for measurement of Phase to Phase system voltage, along with a Voltage Selector Switch. Display : 3 ½ -digit display, Aux. Power: : 230 V AC PTR : 11000 / 110 V Accuracy Class : 1.0 or less. Size : 96 X 48 mm.
8.4.	Direct Voltmeter	One no Analog DC Voltmeter to be provided in the Bus Coupler panel for measurement of Control DC voltage.
9.0	**Energy meter**	One Three Phase, Four Wire CT/PT operated, fully static AMR compatible TRIVECTOR Energy Meter *along* with TTB to be provided in all Incoming and outgoing breaker panels at its upper most position in a separate metering chamber. Necessary wiring to be provided with separate terminal block (suitable for CT/PT connection) for Energy meter connection and as per detailed technical specification attached in a separate sheet (Annexure-F). TTB to be installed in the metering chamber.

9.1	**CB Contact multiplier**	One 230V AC operated contact multiplier (6 NC) to be provided for CB contact multiplication. Energy Meter PT supply to be routed through the contact of the contact multiplier.
10.0	**Multi functional Transducer**	Will be supplied by the Utility and to be fixed in the metering chamber. Separate TB for connection should be provided. Space required for Transducer fixing is 100X100mm.
11.0	**Indication**	Flush mounted, insulated from 30V DC supply with appropriate coloured lens. The lens shall be made of a material, which will not be softened by the heat from the lamps
11.1	Lamps	High intensity, clustered LED type.
11.1.1	Breaker ON	Red
11.1.2	Breaker Off	Green
11.1.3	Spring Charged	Blue
11.1.4	Auto trip	Amber
11.1.5	Service position	White
11.1.6	Signal Received from Remote	White
12.0.	**Switches and push buttons**	Flush mounted on LV compartment door, with shrouded terminals
12.1	TNC Control Switch with pistol grip	Non Lockable spring return to normal position. Shall have mechanical interlock to prevent accidental operation of the switch. Terminals shall be screw type and indelibly marked. 2 nos. Contact each for Close and Open, 2 No. NAT,2 nos. NAC and one for normal position contact is required.
12.2.	Local / Remote selector switch	2 way, 4 poles in each position lockable and stay put type.
12.3	Selector switch for voltmeter	4 Positions (RY-YB-BR-OFF), 3 ways.
12.4.	Toggle ON/Off switches	For heater / illumination circuit
12.5	PT Selector switch	4 Position (PT1-PT2-PT3), 8 Poles in each position. Current rating 16 Amps
12.6	Push button of IED(Relay) Reset	Wired up to specified DI contact of Relay.
12.7	Emergency trip push button	Red colour with stay put, Current rating 10 Amps.
12.8	Push button for Annunciator accept and reset	Two nos Push button, one for annunciator accept and one for annunciator reset to be wired upto annunciator.
13.0	**Internal wiring**	450/750 V grade PVC insulated stranded flexible (FRLS) copper wire.

13.1.	Wire Size	2.5 sq. mm for CT circuit, 1.5 sq mm for PT and 1.5 sq. mm for control circuit, 4.0 sq. mm for Main, AC & DC and Bus wiring. i. A suitable wiring duct system firmly fixed on the panel and having covers shall be installed for front to rear and inter panel wiring to provide easy access for inspection and replacement of the wires. ii. Wiring between terminals of the various devices shall be point to point. Splices or tee connection will not be acceptable. Iii. Facilities for short-circuiting the current transformer secondary while the switchgear is in service shall be provided. iv. Wires shall be suitably bunched adequately supported to prevent sagging. and it shall have sufficient clearance from High voltage system. v. Sufficient Bus wires shall be provided for interconnecting with adjacent units both ways and also for future connection.
13.2	Wiring Colour code	
13.2.1	PT and CT	Red Phase : Red, Yellow Phase : Yellow Blue Phase : Blue, Neutral : Black.
13.2.2	DC Circuit	Gray
13.2.3	AC Circuit	Black
13.2.4	Earth	Green
13.3	Ferrules	At both ends of wire with same stated marking. Plastic ferrules shall be used conforming IS. Interlocked type (one additional red colour ferrule for all wires in trip circuit)
13.3.1	Ferrule marking	
13.3.1.1	AC Circuit	H1, H2 ,H3 .....
13.3.1.2	Metering CT Circuit	D11, D31, D51 .....
13.3.1.3	O/C and E/F protection CT circuit	C11, C31, C51 .....
13.3.1.4	REF/Differential protection CT circuit	A11, A31, A51 .....
13.3.1.5	Main DC distribution circuit	J1, J2, J3 .....
13.3.1.6	Control and protection circuit	K1, K2 ,K3 .....
13.3.1.7	Indication and annunciation circuit	L1, L2 ,L3 .....
13.3.1.8	Motor circuit	M1, M2 ,M3 .....
13.3.1.9	PT circuit	E11, E31, E51, E71.....
13.3.1.10	Spare contact circuit	U1, U2, U3 .../ *S1, S2, S3* .....
13.4	Lugs	Tinned copper, pre-insulated, fork type and pin type as applicable. Only Ring type is acceptable in CT &PT Circuit.

13.5	Spare contacts of relays, timers etc	Wired up to the terminal blocks
13.6	Wiring enclosure	Plastic channels, inter panel wiring through PVC sleeves or suitable grommets.
13.7	Inter panel wiring	Wiring with ferrule to be terminated in the adjacent shipping section will be supplied with one end terminated and the other end bunched and coiled.
14.0	**Terminal Blocks (TB)**	
14.1.	Terminal Blocks (TB)	1100V grade, 10 amps min. rating, Nylon 66, screw type suitable for 2 nos. Lead.
14.2.	Terminal for CT & PT secondary leads	With provision for shorting with screw driver operated sliding link. a) CT shorting links shall be provided to short CT circuits under live system condition. b) Isolation links shall be provided on the trip circuits, alarm and on the VT circuits to allow easy isolation without disconnecting the wires from TBs.
14.3	Spare terminals	25% in each TB row
14.4	TB shrouds & separators	Moulded non-inflammable plastic material
14.5	Clearance	
14.5.1	Clearance between 2 sets of TB	100 mm min.
14.5.2	Clearance with cable gland plate	250 mm min
14.5.3	Clearance between AC / DC set of TB	100 mm min
15.0	**Test Terminal blocks for energy meter**	13 Ways, 50A, 1100V with back connection. Dia of Entries is 5 mm & overall dimension 250X50 mm, covered with insulated cover. TTB should be suitable for 3 Phase 4 Wire Energy Meter. TTB used for CT Circuit should be Link type. Screw type is not acceptable.
16.0	**HT Cable Type**	3 Core XLPE,11 kV grade , Aluminium,300mm^2
17.0	**HT Cable Termination**	Cable entry from rear bottom side for Incomer and Outgoing feeders .The cable termination shall be located at least 250 mm from the CT primary terminals. For Incomer, double cable termination arrangement to be provided with two sets of nut and bolts. Copper terminator strip of adequate size shall be provided for termination of cables and shall have adequate height inside to accommodate the heat shrinkable type indoor cable termination.

18.0	**Multi-core cable termination box-- Purpose**	Incoming Panel- External DC supply from DCDB, External AC supply from ACDB, Remote Electrical Close and trip operation, Inter trip operation from upstream 33 kV circuit, Breaker spare aux. Contacts. Spare contacts of L/R Switch and Spring Charge Limit Switch etc. Feeder Panel -- Remote electrical close/trip operation, remote indication for close, trip , spring charged and trip ckt supervision, status of L/R switch, Local annunciation for remote close and trip operation, Breaker spare aux. Contacts. Bus Coupler -- External DC supply from DCDB, External AC supply from ACDB, Remote Electrical Close and trip operation, Breaker spare aux. Contact. External DC and AC supply arrangement to be provided in Incomer and Bus Coupler panel only in a switch board.
19.0	**Operation Counter**	Each breaker shall be provided with operation counter.
20.0	**Vacuum Interrupter**	Capable to withstand minimum 100 full short circuit operations at 26.3 kA as per test duty 1 to 5 of IEC-56. The continuous Current rating should be more than 800A. Manufacturer's test report/literature to be supplied along with tender.
21.0	**Insulated spacer**	It shall be made of insulated fibre glass materials shall be provided in High voltage system, to protect from absorption of moisture present in the air.
22.0	**PT selection scheme**	Each Incoming and outgoing breaker panel shall be provided with suitable manually operated selector switch having break before make type contacts including necessary wiring for selection of voltage from different PT secondary's available for connection with energy meters. Each panel should be provided with 3 PT scheme and current rating of the PT Selector Switch should be minimum 16 Amp. Voltmeter of incoming breaker panel shall be connected directly from respective PT secondary of associated unit.
21.0	**Relays for protection and control**	
21.1	General Features	
21.1.1	Relay type	Numerical with self monitoring features
21.1.2	Mounting	Flush mounted IP 5X with key pad on front
21.1.3	Relay characteristics	Numerical IED with Multiple characteristics like IDMT, DMT, instantaneous with compatible choices of time delays and multiple settings for multiple functions like over current, earth fault etc. along with control of breaker, measurement and status etc. As per detailed technical specification attached in a separate sheet (Annexure-E).

21.1.4	Relay communication	With IEC 61850 protocol by native two nos. RJ45 /F.O, 100 MBPS communication ports. Separate front port (USB/RJ45) for Relay parameterisation.
21.1.5	Relay input signal	From CT, with auxiliary DC supply
21.1.6	Relay terminals	Shall be screw type terminals large enough to accommodate 2.5 sq. mm. cables and shall be located at the back of the Relay.
21.1.7	Relay contacts	Shall make firmly without bounce and the relay mechanism shall not be affected by panel vibration or external magnetic field.
21.1.8	Electromagnetic Compatibility	Relay thermal rating shall be such that the fault clearance times on any combination of current and time multiplier settings shall not exceed the thermal withstand capability of the relay. Compliant to EMC directives as per IEC.
21.1.9	Relays for auxiliary, supervision, trip and timer relays	Static or attracted armature type with short pickup time of less than 30 ms.
21.1.10	Relay reset	Self reset contacts except for Master Trip relays.
21.1.11	Operation indicators	With hand reset operation indicators (flags) or LEDs with Push buttons for resetting, for analyzing the cause of operation
21.2	Master Trip relay	High Impedance and High speed relay flush mounted having coil cut-off contact with at least 4NO and 4NC contact and **electrical reset facility** capable to make, carry and break trip coil current of Circuit Breaker and capable for future integration with SCADA. It should be immune to capacitance discharge currents and leakage current. Operating time should be less than 20ms. Terminals shall be screw type to accommodate 1.5 sq. mm. Cable and located at the back of the relay. Terminals shall be clearly marked. Contact configuration shall be drawn on the relay casing.
21.3	Fault recording	Relay shall have the facility for recording of various parameters during a fault. It should be possible to set the duration of record through settable pre fault and post fault time. It should be possible to down load the data locally or from SCADA remotely.
21.4	Auxiliary supply	Operate on available 30 V. DC supply. To reduce the effect of Electrolysis, relay coil shall be so connected such that they are not continuously connected from the positive pole of the station battery.
21.5	Test facility	In built.
21.6	Protection in Incomer & Outgoing panel	3 phase over current protection & Earth fault protection
21.7	**Additional requirement**	
21.7.1	For each breaker panel	To be provided with anti pumping relay/contactor (94), (plug-in type contactor will not be accepted)
21.7.2	Auxiliary relays, coupling relays, transducers etc.	To effect interlocks and to exchange signals of status & control from remote.

22.0	**Additional Requirement**	The schematic diagram of control and indication circuit on a durable sticker shall be fixed in a suitable place in Incomer and feeder panels and Annunciation scheme in the Bus Coupler panel. The wiring arrangement, position of fuse, TBs etc, in the panel should be such that each and every connection can be accessed easily. Fuse tops can be opened /inserted easily. Only ring type sockets should be used for wire termination in TB/ Relays/ Meters/TTB etc. Fork type socket can be used in Annunciator only. Separate switch to be used for cubicle light instead of Door switch. Circuit Label incorporating identification, information of incoming/outgoing/bus coupler breaker shall be provided. Connection diagram plates for the PT and CT shall be provided as per provision in the relevant IS. All name, rating , circuit label, connection diagram plate shall be fixed with screws or by riveting instead of fixing by adhesive.
23.0	**Annunciation Scheme**	6/8 Window Annunciator shall be provided in each panel including Bus Coupler panel. It should be Microprocessor based having inbuilt Accept/Reset/Test/Mute push buttons for trip and non-trip functions. DC operated common Hooters shall be provided in Bus Coupler breaker panel. It shall have provision of inbuilt watch Dog and Fast fault indication with Trip (O/C , E/F and other trip signals if any)and non-trip alarm i.e AC supply fail, main DC supply fail at Bus Coupler. The functional details and scheme will be decided during finalisation of drawings.
24.0	**Space Heaters**	
24.1	Space heaters	60 W, 230 V AC each with timer controlled and switch for isolation. A Thermostat control unit with variable temperature control setting 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.
24.2	Space heater location	Two nos. each in Breaker & HV cable compartment to be mounted on an insulator.
24.3	Space heater Monitoring	One AC Ammeter with 0-1.0Amp range shall be provided in series with the heaters to monitor the current drawal of the Heaters. Size :96x48mm.
25.0	**Switch and sockets**	
25.1.	Illumination Lamp	For LV ,cable chamber & energy meter
25.2.	240V AC, 5A Switch & socket	In LV chamber

26.0	**Name Plates and rating plate of switchgear**	
26.1	Material	Material shall be stainless steel/anodized aluminium and shall not be deformed under the service condition. The entries shall be indelibly marked by engraving with black letter on white background or vice-versa as specified and 3mm thick and 100mmX150mm(approx).
26.2	Lettering	Engraved, with white letters on black background, for use inside the control compartment, a white label, engraved in Black Letters and numbers shall be used. Each major equipment shall be provided with a rating plate containing the required information as specified in the relevant IEC standard.
26.3	Name plate for feeder description & number	On front and rear side of each panel giving feeder description. On the rear side the name plate shall be fixed on the back cover.
26.4	Identification plates/labels at each cubicle and each instrument	Approved design (not stickers)
26.5	Manufacturer name plate	On front top door of panel
27.0	**Rating Plate of Switchgear**	Name of the Manufacturer and Year of Manufacture
		P.O No. and Date
		Type, Designation and Serial No.
		Rated Voltage and Current
		Lightning impulse withstand voltage
		1 minute Power frequency withstand voltage
		Rated frequency
		Rated Current
		Breaking Capacity
		Short time current making capacity
		Operating sequence
		Rated voltage of closing and opening coil
		Rated voltage of spring charging motor
		Property Label "Property of WBSEDCL"
		Guarantee for Five Years

28.0	**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 WBSEDCL. e) Each of the Switchgear panel shall be of unitised construction with all necessary accessories like end covers etc. However the design shall allow for extension on both sides without limit. Busbar design shall be such that panel to panel interconnection can be carried out without difficulty as and when required**. In case of Single feeder panels, Identical Bus Bars for connection with adjacent Incomer / Bus Coupler / Feeder needs to be supplied.** f) Explosion vents of suitable design shall be provided on the roof sheet of the busbar/cable/CT's chambers so as to enable discharge of explosive gases from inside during a flashover. However the provision of explosion vent shall not affect the degree of protection/vermin proofing of the panel.
28.1	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 as specified under each equipment in these specifications to demonstrate to the satisfaction of the WBSEDCL that the switchgear panels comply with the requirements of the relevant IEC standards.
28.2	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.

28.3	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.
28.4	Operational Details	Instructions shall be engraved on the switchgear panel, on the circuit breaker compartment describing in simple steps how to carry out correct and safe isolation, racking-in and racking-out switching operations on the circuit breaker. Similar details should be provided for the operation of the earth switch.
29.0	**Surface treatment & painting**	
29.1	Surface treatment	Sand blasting or by seven tank process
29..2	Paint type	Powder coated. Pure polyester base grade A structure finish
29.3	Paint shade	RAL 7032 for external & internal surface
29.4	Paint thickness	Minimum 80 microns
30.0	**Type Test**	
30.1	Type Tests	The product must be of type tested quality as per all tests in IEC/Indian standards. Such tests shall be done at any NABL accredited laboratory.
30.2	Type test report validity period	Last five years from due date of bid submission

30.3	Type test report to be submitted along with the bid	**A . Switchgear Panel (with circuit breaker installed)** a. Lightning Impulse Voltage withstand Test b. H.V. dry 1 min power frequency withstand test c. Short time and peak withstand current test d. Short circuit test with basic duties e . Single phase breaking capacity test. f. Cable charging breaking current test g. Temperature Rise test h. IP Test i. Internal Arc Test as per IEC 62271-200 j. Horizontal Acceleration due to seismic force (if available) **B. Circuit Breaker** a. Mechanical Endurance Test as per M2 Class of IEC **C. Current Transformer** a. Short Time Current Test b. Impulse Voltage Withstand Test c. Temperature Rise Test **D. Potential Transformer** a. Impulse Voltage Withstand Test b. Temperature Rise Test **Copies of test certificates in respect of following bought out items:-** a. Vacuum Interrupter. b. Insulators c. Bus Bar Material d. Terminal connectors e. KEMA / CPRI Certification for relay/IED i.r.o. IEC61850 compliance **Note : All the type test report on Switchgear Panel & Circuit Breaker to be conducted with offered Vacuum Interrupter.**
31.0	**Accessories**	1. One no. spring charging handle for every three panels 2. One no. Breaker Truck operating handle for every three panels 3. The equipment shall be complete with all necessary accessories and materials in accordance with the specification 4. The base channel frames for the switchgear for grouting on the floor shall be complete with anchor bolt, nuts and levelling attachment.

32.0	**Type Test after issuance of Order**	Besides submission of Type Test Report, carried out within five years as per Tender Specification, Type Test at the discretion of WBSEDCL, shall have to be arranged by the successful Manufacturer from any lot offered for inspection, sample chosen at random after successful Routine Test by our Inspection Team, as per relevant ISS from CPRI/NABL accredited/Government recognized Test House or Laboratory in presence of WBSEDCL'S representative. **However the necessary cost of the Type Test charges will be reimbursed to the party on production of necessary supporting documents.**
33.0	**Equipment Device Schedule**	Enclosed in Annexure-D. Bidder shall have to fill up GTP as per Annexure-G, Annexure-H, Annexure-J, Schedule-A, Schedule-B, Schedule-C. Bidder shall have to submit undertakings from Relay and Meter manufacturer as per Schedule-I and II.

34.0	**Drawing and documentation**	Bidder shall submit following drawing/documents along with the bid:- 1. GA of indoor 9 panel Switchgear showing constructional features and space required in the front for withdrawal of breaker truck and in back, other accessories, power and control cable entry with plan elevation and views. 2. Sectional view of incomer, bus coupler & feeder panels with parts list. 3. GA of Circuit Breaker truck. 4. GA of Current Transformer 5. GA of Potential Transformer. 6. Technical particulars of Switchgears and brochures for technical data sheet of vacuum interrupter 7. Relay and device list (Bill of Quantity) with complete details. 8. Technical manual for Relays, Meters, Switches, Instrument transformer, Terminal block and Test Terminal Block. 9. Four copies of drawing, data and manuals containing above shall be submitted for approval and afterwards for final distribution. 10. Two sets of manual, leaflet and drawing for multi panel board shall be submitted separately to the C.E(Testing), Distribution Testing Deptt., WBSEDCL. **Successful tenderer shall furnish all above drawings and following additional drawings for approval before commencement of supply**:- i. Foundation details for 9 Panel Switchgear. ii. Equipment door layout for incomer, bus coupler & feeder panels. iii. Schematic Diagram for incomer bus coupler & feeder section of Switchgear iv. Protection Circuit, Metering circuit, DC control circuit for incomer bus coupler & feeder section of Switchgear v. Annunciator and Alarm scheme. vi. P.T. supply change over scheme. ix. Terminal block details for incomer, bus coupler & feeder section. vii. Cross section view for CTs. viii. Name Plate & Connection diagram for CTs. ix. Cross section view for PTs. x. Name Plate & Connection diagram for PTs. xi. Rating Plate details of the Panel xii. Manual for installation, operation and maintenance procedure.

35.0	**Guarantee**	Guarantee of the total equipment including any integral part of the equipment should be for a period of 5 (five) years from the date of last despatch.
36.0	**Routine & Acceptance Test**	All the switchgear panels shall be tested in accordance with the requirement of IEC 62271-200. Tests shall be carried out on the circuit breakers as per the requirement of IEC 62271-100. Current transformers and Voltage transformers shall be tested in accordance with the requirement of IEC 60044-1, IS 2705 and IEC 6044-2, IS 3156 respectively. The Protection Relay shall be tested in accordance with IEC 60255 & Energy Meter shall be tested as per relevant IS. All routine tests at manufacturer's works shall be carried out and Test Reports are to be submitted to CE, P&C, WBSEDCL. All Acceptance tests shall be carried out at manufacturer's works on every lot offered for inspection as per relevant IS & IEC in presence of the WBSEDCL's representatives. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IS. The entire cost of acceptance and routine test that to be carried out shall be treated as included in the quoted price of tendered items. Six copies of test reports duly signed by the inspecting officers, shall be submitted to the Chief Engineer, P&C Department , Bidyut Bhavan (4th floor) Salt Lake, Kol -91.
36.1	Complete Switchgear Panel test	a) Dimensional Checks b) Operational Tests c) Primary Injection Tests d) Calibration Tests on Relays and Instruments e) Power frequency Withstand Test f) Insulation Test g) Contact resistance test of Primary joints h) Power frequency Withstand Test on secondary Wiring
36.2	Circuit Breaker test (six copies of test report to be submitted with Offer)	Routine tests. a) Operation test. b) Dielectric Test on the main circuit. c) Dielectric tests on controls and auxiliary circuits. d) Measurement of resistance of the main circuit. e) Timing test f) Design and visual checks g) Test Certificate for all resin cast/moulded components of circuit breakers whose partial discharge measurement are specified in the relevant IEC (No. 62271-100, Clause No.6.2.9)

36.3	Current Transformer Test (six copies of test report to be submitted with Offer)	Routine tests shall be carried out at the manufacturer's plant as per the requirement of IEC 60044-1, IS 2705 as listed below: i. Polarity test and verification of terminal markings test ii. Ratio and phase angle error test(accuracy class; composite error test) iii. Power frequency tests on primary and secondary windings iv. Power frequency withstand tests between sections(windings) v. Inter-turn over voltage tests vi. Partial discharge measurement
36.4	Voltage Transformer test (six copies of test report to be submitted with Offer)	Routine tests shall be carried out at the manufacturer's plant as per the requirement of IEC 60044-2, IS 3156 as listed below:- (a) Polarity tests and verification of terminals (b) Power frequency withstand tests on Primary windings (c) Power frequency withstand tests on secondary windings (d) Power frequency withstand tests between sections (e) Determination of errors (f) Partial discharges measurement
36.5	Protection Relay Tests (six copies of test report to be submitted before with Offer)	a. Relay Pick-up test for all functions and phases b. Relay timing test for all functions and phases c. Conformance Test as per IEC 61850

ANNEXURE – A

MANDATORY TECHNICAL PARTICULARS

1.0	**Switchgear**	
1.1	Type	Metal clad, air insulated with VCB type circuit breaker
1.2	Service	Indoor
1.3	Mounting	Free standing, floor mounted
1.4	System voltage	11KV
1.5	Highest System voltage	12 KV
1.6	Frequency	50HZ, ± 3%
1.7	Phase	3
1.8	Rated current @ 50 DEG C ambient	800 Amp.
1.9	Short time rating for 3 sec.	18.4KA
1.10	Insulation level (PF rms / impulse peak)	28 / 75 KV
1.11	System ground	Solidly earthed
1.12	Enclosure degree of protection	IP 5X for high and low voltage compartment
1.13	Bus bar – Main @ 50 DEG C ambient	1600A, Current Density 1.6 Amp/sq.mm.(Max)
1.14	Material	electrolytic copper, tinned /Silver plated
1.15	Bus Bar sleeve	Full voltage sleeved with shrouds on joints
1.16	Bus identification	Colour coded (R-Y-B)
1.17	Bus end connection	To be capable to safely withstand stress due to max. Short circuit current and thermal expansion. Necessary provision to be made for testing current transformer primary by removing insulated portion without difficulty.
1.18	Temperature rise above Ambient	40DEG C for conventional joints, 55DEG C for silver plated joints
1.19	Riser Bus	electrolytic copper, tinned /Silver plated, 800A, Current Density 1.6 Amp/sq.mm.(Max)
1.20	For the design and erection of Busbars the following minimum clearance shall be observed	
1.21	Phase to Phase(mm) (without Insulating Sleeve)	110 mm (approx)
1.21.1	Phase to earth(mm) (without Insulating Sleeve)	90 mm(approx)
1.21.2	Minimum nominal creepage distance	19mm/kV.
1.22	Auxiliary DC Supply	30V DC shall be controlled by suitably rated miniature circuit breaker.

1.23	Auxiliary AC supply	240V AC 50 Hz shall be controlled by suitably rated miniature circuit breaker.
1.24	Hardware	GI
1.25	Earth bus	Electrolytic Copper, Rectangular shape, 25X6mm(Min) and to carry 18.4 KA for 1 Second.
1.26	Power and control cable entry	From bottom for Power Cable. For control cables through Remote Terminal Box installed at the backside of the Panel.
2.0	**Circuit Breaker**	
2.1	Type of isolation & Drawout	Horizontal isolation & Horizontal Drawout.
2.2	Voltage class, insulation level, short time rating	As specified for switchgear
2..3	Rated current	800 Amps.
2.4	Duty cycle	O – 0.3sec – CO – 3min – CO
2.5	Short circuit rating	
2.5.1	AC sym. Breaking current	26.3 KA (for Vacuum Interrupter)
2.5.2	Short circuit making current	65.75KA (for Vacuum Interrupter)
2.6	Operating time	
2.6.1	Break time	Less than 80 ms.
2.6.2	Make time	Less than 100 ms.
2.7.	Range of auxiliary voltage	
2.7.1	Closing	85% - 110%
2.7.2	Tripping	70% - 110%
2.7.3	Spring charging	85% - 110%
2.8	Auxiliary Switch	Properly rated and robust in nature shall be provided in all panels and wired upto SIC (Secondary Isolated Contact) with identical SIC and ferrule numbers and sufficient number of NO and NC contacts for the following:- CB 'ON' for Local indication –NO contact CB'ON' for Remote indication—NO contact CB'OFF' for Local Indication --- NC Contact CB'OFF' for Remote Indication – NC Contact CB 'Auto Trip' for Local and Remote Indication—NC Contact. Other Contacts used as per scheme for closing and tripping and trip ckt supervision.
2.8.1	No. of spare contacts in Aux. Switch for WBSEDCL use	Minimum 6 NO + 6 NC
2.9	No. of spare contacts of service and test position limit switch contact	2 NO+2NC
2.10	No. of spare contacts of Spring charge limit switch	2 NO + 2 NC
3.0	**Current Transformers for Incoming Panel**	
3.1.	Voltage class, insulation level	As specified for switchgear

3.2.	Type	Triple core, Dual ratio, Cast resin, Indoor type . Marking on primary and secondary terminal as per requirement of IEC 60044-1, IS 2705 and shall be indelibly marked. The secondary terminals shall have screw type terminals.
3.3.	Class of insulation	Class E or better
3.4.	Ratio	600/400/1-1-1A
3.5.	Number of secondary	Three, Core 1 : Metering, Core 2 :Protection , Core 3 : Protection
3.6.	Accuracy class	Core 1 : 0.5, Core 2 : 5P15, Core 3 : PS.
3.7	ISF of Metering Core	<=5 at lower ratio
3.8	ALF of Protection Core	15
3.9	VA output	15VA for both protection and metering
3.10		
3.11	Excitation current and other particulars of PS class CT's	30mA at Vk/2 (at lower ratio), V_k>=170 V at LR
3.12	Other particulars	R_{CT} ≤ 4 ohms at 75° C at higher ratio, Panels to be supplied with CT ratio set at higher ratio. Common terminals for CT secondary shall be shorted and earthed. Only ring type socket to be used in CT circuit. P1 terminal of CT shall be at Bus side.
3.13	Short time current rating	18.4 kA for 1 second
4.0	**Current Transformers for Outgoing Panel**	
4.1.	Voltage class, insulation level	As specified for switchgear
4.2.	Type	Dual core, Dual ratio, Cast resin, Indoor type. Marking on primary and secondary terminal as per requirement of IEC 60044-1, IS 2705 and shall be indelibly marked. The secondary terminals shall have screw type terminals.
4.3.	Class of insulation	Class E or better
4.4.	Ratio	200-100/1-1A
4.5.	Number of secondary	2, Core 1 : Metering, Core 2 :Protection
4.6.	Accuracy class	Core 1 : 0.5, Core 2 : 5P15.
4.7.	ISF of Metering Core	<=5 at lower ratio
4.8.	ALF of Protection Core	15.
4.9	VA output	15 VA for both protection and metering
4.10	Short time current rating	18.4 kA for 1 seconds

4.11	Name Plate of CT indelibly marked	Name plate for the current transformer shall be provided with all the required details as per IEC 60044-1, IS 2705 Standards, including :- i) The manufacturer's name ii) Serial number and a type designation iii) Rated primary and secondary current iv) Rated frequency v) Rated output and corresponding accuracy class for each secondary winding, including the rated accuracy limit factor and Instrument security factor for protection and metering secondary windings respectively. vi) The highest voltage of the equipment vii) The rated Insulation level viii) The rated short-time thermal current (***Ith***) and the rated dynamic current ix) Class of Insulation x) Rated continuous thermal current xi) Property Label – " Property of WBSEDCL" xii) Guaranteed for 5 Years
5.0	**Voltage Transformers**	
5.1.	Type	Dry / Resin cast, draw out type, 3-phase, 5-limb or it should be combination of three no Single Phase PT housed in a withdrawable carriage complete with HV fuses. Copies of Type test certificate and routine test certificate as per IEC 60044-2, IS 3156 shall be submitted with the tender for evaluation purpose. Each PT shall be provided with Vector diagram plate as per relevant provision of IS showing primary and secondary terminals.
5.2.	Rated Voltage	
5.2.1	Primary	11000 / √3V
5.2.2	Secondary	110 / √3V
5.3	No of phases	3
5.4	No. of secondary windings	1(one)
5.5	Method of connection	Star/Star with both neutral earthed
5.6	Rated voltage factor	1.2 continuous, 1.9 for 8 hours.
5.7	Class of insulation	Class E or better
5.8	Accuracy class	0.5
5.9	Primary and secondary fuses	HRC current limiting type, primary fuse replacement shall be possible with VT in withdrawn position
5.10	Voltage class	12KV
5.11	VA Burden	100 VA per phase

5.12	PT mounting	Rail mounted on top of the Incomer Panel and Primary connected on bus side. It can be plugged into and withdraw from service by pulling or pushing the PT by the handle provided on the PT. This action traverses the PT along the rails and shall automatically operate the spout shutters. The shutter drive also forms a latch which holds the PT in the service position and this latch shall be required to be released before PT can be isolated.
5.13	PT secondary circuit	The secondary circuits from all the PTs of the incoming panels shall be wired up to all the outgoing panels so that supply to the potential coils of the meters can be maintained from any of the PTs. Plug and socket type contacts shall be provided in the PT secondary. PT secondary terminals shall be inaccessible from outside. Necessary provision shall be made for sealing PT while in racked in position. Vector of the PT will be Both Y/Y connection with both neutral earthed.
5.14	Name Plate of PT indelibly marked	Name plate for the voltage transformer shall be provided with all the required details as per IEC 60044-2, IS 3156 Standards, including :- i) The manufacturer's name ii) Serial number and a type designation iii) Rated primary and secondary voltage iv) Rated frequency v) Rated output and corresponding accuracy class for each secondary winding, vi) The highest voltage of the equipment vii) The rated Insulation level ix) Class of Insulation for the equipment x) Rated voltage factor and corresponding rated time. xi) The use each secondary winding and it's corresponding terminals xii)Property Label – " Property of WBSEDCL" xiii) Guranteed for 5 Years
6.0	**Monitoring from Remote**	Suitable arrangement to be provided to monitor the following conditions of 11kV VCB at SCADA Control Centre end through installing RTU by WBSEDCL:- 1 . DC healthy 2 .Breaker is 'OFF' 3 .Breaker is 'ON' 4 .Spring for closing mechanism is charged 5 .Breaker is in Local 6 .Breaker is in Remote 7. Trip Circuit healthy 8 . Tripping due to O/C 9 .Tripping due to E/F

7.0	**Closing from Remote**	Suitable arrangement should be provided to close the breaker from remote end in case following conditions are satisfied:- 1. DC healthy 2. Breaker is 'OFF' 3. Spring for closing mechanism is charged 4. Breaker is in Remote 5. Trip Circuit healthy 6. Breaker is not anti-pumping
8.0	**Tripping from Remote**	Suitable arrangement should be provided to trip the breaker from remote end in case the breaker is ON and certain preset conditions to be satisfied which will be decided during finalisation of drawings.

Annexure - B
Standard Make of Relay and Fitments

VCB	Panel Manufacturer should be the VCB Manufacturer.
Vacuum Interrupter	CGL / BEL / SCHNEIDER / SIEMENS / ABB
Relays	Alstom, ABB, Siemens, Schneider, GE or any other reputed relay manufacturers fulfilling relays specification as per Annexure-E of the technical specification
Current Transformer	Plastofab, BMC, Pragati, ECS, Kappa.
Potential Transformer	Plastofab, BMC, Pragati, Audio-Vision, ECS.
Breaker Control Switch/LR Switch	Kaycee / Alstom / Recom/Switron/L&T/Siemens/ABB/GE
Voltmeter/PT Selector switch	Kaycee / Recom/Switron
Digital Ammeter / voltmeter and Analog DC Volt Meter	AE / Rishav / Secure/Accord/Schneider/Meco
Energy meter	Secure Meter Ltd. / Larsen & Toubro Ltd. / Landis & Gyr Ltd. / Genus Power Infrastructure Ltd.
Push Buttons	Alstom / Kaycee / Vaishno/Teknic/Lumen/STS/ Siemens/L&T/Schneider/JVS/GE
Indicating Lamps with lenses	Alstom / Kaycee / Vaishno/Teknic/Lumen/STS./ Switron/JVS/GE
Panel wiring	ECKO / PHOENIX/Finolex/Havels/KEI/RR Kables/Poly Cab (with ISI mark)
Hooter/Buzzer/Bell	ANCHOR / KAYCEE/ Vaishno/STS/JVS/Bharani/Alan
Annunciator	MINILEC / ALAN/INSTALARM/EAPL
MCB	Siemens/L&T/Schneider/ABB/Kaycee/Legrand/GE
Terminal Block	Elmex/Connectwell
TTB	DAV Industries/CGL/JVS/Unitech Sales/Keizen/Plastofab

Annexure-C

Legend of Devices associated with Multi panel Shunt trip vacuum Circuit Breaker

Symbol Reference	Description
A1, A2, A3 & AH(heater)	Ammeter
V and V_{DC} for Bus coupler	Voltmeter
VS	Manual Voltmeter Selector Switch
EM	Energy Meter
CS	Control switch T-A / T-N-A / C-C spring return type
IL-R	CB 'ON' Indication Red lamp
IL-G	CB 'OFF' Indication Green lamp
IL-W	'Trip /Close signal received from Remote Indication white lamp
IL-B	"Spring charged" Indication Blue lamp
IL-A	CB " Auto trip" Indication Amber lamp
PB	Push Button
ANN	DC operated electric Annunciator
H,HS,TH	Heater, Heater Switch, Thermostat
FS	Fuse
LK	Link
MCB1	MCB, 2 pole 16 A for DC supply
MCB2	MCB, 2 pole 16 A for AC supply
MCB3	MCB, 2 pole for spring charging motor supply
MVS	Manual PT selector switch
IR-I	Remote inter tripping contact from 33 kV Transformer Control and relay Panel
TC	Tripping Coil
CC	Closing Coil
APR	Anti-pumping Relay
86	Tripping Relay
52	Vacuum Circuit breaker
52a,52b	NO and NC contacts of Breaker Auxiliary switch respectively
PT	Potential Transformer
CT	Current Transformer
TTB	Test Terminal Block
51/50 R-Y-B-N	O/C and E/F Relay

Annexure **D**

Sl no.	Device	Quantity		
		Incomer	Feeder	Bus coupler
1.	Numerical O/C & E/F Relay	1 No.	1 No.	Nil
2.	Trip Relay	1 No.	1 No.	1 No.
3.	AC Supervision Relay	Nil	Nil	1 No.
4.	Annunciator	1 No.	1 No.	1 No.
5.	AC Ammeter (CT operated)	3 No.	3 No.	Nil
6.	AC Voltmeter	1 No.	Nil	Nil
7.	DC Voltmeter	Nil	Nil	1 No.
8.	Ammeter (Heater Ckt.)	1 No.	1 No.	1 No.
9.	Current Transformer	3 No.	3 No.	Nil
10.	Potential Transformer	1 Set	Nil	Nil
11.	Energy meter	1 No.	1 No.	Nil
12.	TTB	1 No.	1 No.	Nil
13.	Indicating Lamp	6 No.	6 No.	4 No.
14.	MCB (DC Ckt)	1 No.	Nil	1 No.
15.	MCB (AC Ckt, 16 Amps)	1 No.	Nil	1 No.
16.	MCB (Motor ckt.)	1 No.	1 No.	1 No.
17.	3 Position PT Selector Switch (16 Amps)	1 No.	1 No.	Nil
18.	Voltage Selector Switch	1 No.	Nil	Nil
19.	Electronic Buzzer (DC Volt operated)	Nil	Nil	1 No.
20.	Electronic Buzzer (AC Volt operated)	Nil	Nil	1 No.
21.	Heater with controller	1 Set	1 Set	1 Set
22.	T-N-C Switch	1 No.	1 No.	1 No.
23.	Local – Remote Switch	1 No.	1 No.	1 No.
24.	Push Button for Emergency Trip	1 No.	1 No.	1 No.
25.	Push Button for Relay reset	1 No.	1 No.	Nil
26.	Spring Charging Handle	1 No. for every three Panel.		
27.	VCB Operating Handle	1 No. for every three Panel		
28.	HRC Fuse & Link	As required	As required	As required
29.	Trip Circuit supervision Relay	1 No.	1 No.	1 No.
30.	Push Button for Annunciator Accept & Reset	2 Nos.	2 Nos.	2 Nos.
31.	DC Supervision Relay	Nil	Nil	1 No.

NB: The Bidder has to include list of other Items for the Equipment to meet our Technical requirement.

Annexure-G

GURANTEED TECHNICAL PARTICULARS

(To be submitted by the Bidder)

1.	**General :**	
	Name of the Company	
	Office address	
	Factory address	
2.	**Panel**	
	Make	
	Type & Designation	
	Application Standard	
	Rated Voltage	
	Highest Voltage	
	Normal Current	
	Frequency	
	STC for 3 Sec.	
	Breaking Capacity	
	Making Capacity	
	Power frequency withstand voltage	
	Impulse withstand voltage	
	AC Aux. Voltage.	
	DC Aux. Voltage	
	Degree of Protection for HV & LV Compartment	
	Thickness of metal sheet (mm).	
	For load-bearing member	

	For Doors & covers	
	Dimension of Incomer Panel in mm (H x W x D)	
	Dimension of Outgoing Panel in mm (H x W x D)	
	Dimension of Bus-Coupler & Trunk Panel in mm (H x W x D)	
	Single feeder panels to be supplied with Bus Bar for connection with adjacent Incomer / Bus Coupler / Feeder. [Yes / No]	
	HV Cable termination height in the cable compartment	
3.	**Bus Bar**	
	Material	
	Shape	
	Cross sectional area of main Bus.	
	Cross sectional area of Riser.	
	Type of plating	
	Normal Current currying capacity	
	STC for 3 Sec.	
	Temp. Rise over ambient at normal current	
	Current density for main Bus & Riser	
	Phase to Phase clearance	
	Phase to ground clearance	
	Type of insulation	
	Colour Identification	
4.	**Bus support insulator**	
	Reference Standard.	

	Make	
	Material	
	Dry Power frequency Withstand Voltage for one minute	
	Wet Power frequency Withstand Voltage for one minute	
	Impulse Withstand voltage	
	Creepage distance	
5.	**Vacuum Circuit Breaker**	
	Make	
	Type	
	Reference Standard	
	Rated voltage	
	Highest voltage	
	Frequency	
	Normal Current	
	Breaking capacity	
	Making capacity	
	STC for 3 Sec.	
	Temp. Rise over ambient at normal current	
	No of break per phase.	
	Operating duty cycle	
	Single Phase Capacitor Breaking capacity	
	Three Phase Capacitor Breaking capacity	
	Line Charging Breaking capacity	
	Cable Charging Breaking capacity	

	Closing time	
	Opening time	
	Mechanical Endurance capacity	
	Electrical Endurance capacity	
	Operating mechanism	
	Type of isolation & Drawout	
	Details of mechanical interlock provided	
	DC Wattage of Trip Coil.	
	DC Voltage range for Trip operation.	
	DC Wattage of Closing Coil.	
	DC Voltage range for Closing operation.	
	Details of electrical interlock.	
6.	**Vacuum Bottle**	
	Make	
	Rated voltage	
	Type and model no.	
	Normal current	
	Breaking capacity	
	Making capacity	
	STC for 3 Sec.	
	Maximum contact separation length	
	Minimum Mechanical life in no. of operation	
	Minimum Electrical Life in no. of operation at rated normal current	
	Minimum Electrical Life in no. of operation at rated full short circuit current	

	Power frequency withstand voltage (dry)		
	Impulse withstand voltage		
	Contact material		
	Type of plating		
	Contact pressure		
7.	**Current Transformer**		
	Make		
	Reference Standard		
	Type		
	Voltage		
	Frequency		
	Insulation level		
	Class of insulation		
	Ratio (Incomer & Feeder)		
	Class of accuracy (Incomer & Feeder)		
	Burden (Incomer & Feeder)		
	STC for 1 Sec.		
	ISF of Metering Core at lower ratio		
	Vk & Magnetising Current(at lower ratio)		
	Fixing Arrangement		
8.	**Potential Transformer**		
	Make		
	Reference Standard		
	Insulation level		
	Class of insulation		

	Type	
	Frequency	
	Winding connection	
	Type of Core connection	
	Ratio	
	Class of accuracy	
	Burden per Phase	
	Over Voltage Factor for 8 hrs.	
	Fixing position.	
	Fixing arrangement	
	Primary Fuse rating	
9.	**O/C & E/F Relay**	
	Make	
	Type	
	Model no.	
	Ordering Code (with supporting Data Sheet)	
10.	**Trip Relay**	
	Make	
	Type	
	Model no.	
	ORDERING CODE **(with supporting data sheet)**	
	Whether Electrically Resettable(Yes/No)	
11.	**Digital Ammeter (CT operated)**	
	Make	
	Type	

	Size	
	Basic CTR	
	Accuracy class	
	AC Aux. voltage	
	Fixing type.	
12.	**Digital Ammeter (Heater circuit)**	
	Make	
	Type	
	Size	
	Current range	
	Accuracy class	
	AC Aux. voltage	
	Fixing type.	
13.	**Digital Volt meter (PT operated)**	
	Make	
	Type	
	Size	
	PTR	
	Accuracy class	
	AC Aux. voltage	
	Fixing type.	
14.	**Analog Voltmeter (DC Circuit)**	
	Make	
	Type	
	Size	

	Accuracy class	
	Fixing type.	
15.	**Energy meter**	
	Make	
	Type	
	Model no.	
16.	**Terminal connector**	
	Make	
	Type	
	Size	
17.	**Control Switch**	
	Make	
	Type	
	Contact configuration	
	AC & DC Current rating	
	AC Voltage rating.	
18.	**Spring Charge Limit Switch**	
	Make	
	Type	
	No of contact (NO + NC)	
	No of spare contact (NO + NC)	
	AC & DC Current rating	
	AC Voltage rating.	
19.	**Local Remote Switch.**	
	Make	

	Type	
	Contact configuration	
	AC & DC Current rating	
	AC Voltage rating.	
20.	**Spring charging motor**	
	Make	
	Type	
	Rated AC Voltage	
	Rated wattage	
	AC Voltage variation for operation	
21.	**Operation counter**	
	Make	
	Type	
	Operation count range	
22.	**Space heater**	
	Make	
	Type	
	Rated AC Voltage	
	Wattage	
23.	**Thermostat**	
	Make	
	Setting range	
24.	**Indication Lamp**	
	Make	
	Type	

25.	**Auxiliary contact switch**	
	Make	
	Type	
	No of contact (NO + NC)	
	No of spare contact (NO + NC)	
	AC & DC Current rating	
	AC Voltage rating.	
26.	**Annunciator**	
	Make	
	No of window.	
	Aux voltage	
	No of inbuilt push switch.	
27	**Voltage selector switch**	
	Make	
	Type	
28	PT **selector switch**	
	Make	
	Type	
	Current Rating	
29	**TTB**	
	Make	
	Type	
	Size	
30	**Terminal Block**	
	Make	

	Type	
31	**MCB**	
	Make	
	Type	
32	**Fuse & Link Unit**	
	Make	
	Type	
33	**HRC Fuse**	
	Make	
	Type	
34.	**Control wire**	
	Make	
	Type	
	Voltage Grade	
	Size (Sq. mm)	
	For CT & PT	
	For control indication & annunciation circuit	
	For main AC & DC and Bus Wiring	
	Colour	
35.	**Earth Bus**	
	Material	
	Shape	
	Size	
36.	**Painting details**	
	Paint type	

	Paint shade	
	Paint thickness	
37.	**Shipping dimension of equipment (HxWxD)**	
38.	**Total weight of the equipment**	
	Accessories	
39.	Spring Charging Handle	
	VCB Operating Handle	
40.	Guarantee of the total equipment including any integral part of the equipment	

1	State clearly about compliance of following provisions as per provision in relevant Clauses of Specification.	
a)	Name, Rating, Making, Property Plate, Circuit Level, Connection Diagram	
b)	Operation Instruction Chart	
2	State clearly information about type testing of similar Equipment in recognized Institution as per Technical Specification. If yes, mention clearly nature of tests carried out with Name of Testing Institution.	
3	Information about testing facilities available at the Manufacturer's Works for conducting Routing/Acceptance Tests.	

4	Information about submission of following documents with the Tender	
a)	Copies of Type Test Reports.	
b)	Copies of Tender Drawing Literature & Manual.	
c)	Copies of Tender Performance Reports & Credential	
d)	Copies of Tender Literature & Leaflets of Device	
e)	List of Recommended Spares.	
5	Information about submission of Deviation Sheet	

ANNEXURE-H

GTP for Numerical Feeder (Non directional) Protection Relay

Sl. No.	Feature and Function	Bidders response
1.1	**Make**	
	Type	
	ORDERING CODE (with supporting data sheet)	
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 bay 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 CT/PT 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. 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.	

ANNEXURE-J

GTP for Master Trip Relay

Sl. No.	Description	Bidder's Response
01.	**Manufacturer Name**	
02.	**Type and designation**	
03.	**ORDERING CODE (with supporting data sheet)**	
04.	**Electrical reset**	
05.	**Mounting**	
06.	**High Burden relay**	
07.	**Operating Time**	
08.	**Rated DC supply and tolerance**	
09.	**No. of NO Contact**	
10.	**No. of NC Contact**	

Date :

Signature:
Name:
Designation:
Company Seal:

ANNEXURE-E

Technical Specification for Non-directional over current and earth fault 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 Employer's SCADA and from the local console of the numerical relays. Numerical multifunctional combined Microprocessor based Feeder protection and management relay to protect the 11 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 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. 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	30 V DC 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 +/- 3%
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.

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.
14.	Relay parameterisation and Settings	Settings possible through relay keypad relay HMI software 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 carFry for 3 sec for trip contact c) Make and carry for trip contacts L/R<=40ms 4. Rating of Alarm contacts:- 5 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 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. All CT terminals of the Relay to be compatible with ring type lug. Necessary amount of lugs should be supplied along with each relay for CT connection and control wiring.
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.	Assistance in commissioning	As part of this offer, Bidder shall have to provide necessary support during integration of relays with the third party SCADA system which will be commissioned in future.
21.	Standard documentation per Relay, according to IEC 61850	1. MICS document(model implementation conformance statement) 2. PICS(protocol implementation conformance statement) 3. PIXIT document 4. Conformance Test certificate by KEMA/CPRI. All the above mentioned certificates shall be submitted along with Techno-commercial Bid. 5. ICD file 6. SCD file
22.	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.
23.	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 whichever is later, if needed. 4. Lifespan of standard tools and processes for relay configuration, querying and integration.
24.	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.

25.	Communication Port	1. Two nos. IEC 61850 protocol compliant, 100 MBPS Ethernet RJ45/F.O port 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.
26.	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.
27.	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).
28.	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.
29.	Credential as pre-requisite of Tender	Qualifying Requirement:- 1 . Successfully tested and in operation for minimum one year in WBSEB /WBSEDCL / WBSETCL network. OR Copies of performance certificate for minimum two years successful operation of the offered relay in respect to implementation of IEC 61850 Protocol to any SCADA / Sub Station Automation System form different Organisations specially in any Power Utility in India as on the due date of bid opening. 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. 4 . Successful Inter Operability and functional Test :- Inter Operability Test of offered relay, which complies with other technical aspects of WBSEDCL'S Technical Specifications, with the existing relays in WBSEDCL Network will be tested in Distribution Testing Department, WBSEDCL for which due intimation for supply of sample of offered relay will be given to the bidder

		after opening of the Techno-Commercial bid. The bidder needs to submit the said relay to Distribution Testing Department, Abhikshan within 15 (fifteen) days from the said date of intimation.
30.	Offer for relay	**Offer with all relevant documents for numerical relay may be submitted with different make as per Annexure-B alongwith the Bid but after placement of order, drawing for approval needs to be submitted with only one type of accepted offered relay.**

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.

SCHEDULE – I

Undertaking from Relay manufacturer

We hereby confirm that the 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 :

We have offered our relay(s) type _____

i)
ii)
iii)

to M/s. _____ against WBSEDCL's tender no._____. In this connection we hereby confirm that we would be extending all the required technical support and back-up guarantee to M/s._____ for the above mentioned relay(s).

Name & Designation :

Company Seal :

ANNEXURE-F

STANDARD

TECHNICAL SPECIFCATION

FOR

3Ph 4 WIRE HT CT/PT OPERATED FULLY STATIC

AMR COMPATIBLE TRI-VECTOR ENERGY METERS

DLMS COMPLIANT – CATEGORY 'A'

FOR

11 KV FEEDER METER

TECHNICAL SPECIFCATION FOR 3PHASE 4 WIRE CT, PT OPERATED 3PHASE LAG PLUS LEAD ONLY FULLY STATIC AMR COMPATIBLE TRI-VECTOR ENERGY METERS FOR 11 KV FEEDER.

1.0 SCOPE

Design, manufacturing, testing, supply and delivery of AC, 3 Phase, 4 Wire, CT,PT operated lag plus lead only fully Static and AMR compatible Tri-Vector Energy Meters for measurement of different electrical parameters listed elsewhere in the document including Active Energy (kWh/MWh), Reactive Energy (kVArh/MVArh), Apparent Energy (kVAh/MVAh) etc.

2.0 APPLICATION

FEEDER METER – **Category "A"**

3.0 STANDARDS TO WHICH METERS SHALL COMPLY

IS-14697:1999(2004) Specification for AC Static Transformer operated Watt Hour & VAR-Hour meters (class 0.5S);

IS-15959:2011 Data Exchange for Electricity Meter Reading Tariff & Load Control – Companion Specification

CBIP - 304 Manual on Standardization of AC Static Electrical Energy Meter

IEC 62052-11 Electricity metering equipment (AC) –General requirements, tests and test conditions -Part 11: Metering equipment;

IEC 62053-22 Electricity metering equipment (AC) –Particular requirements - Part-22: Static Meters for Active Energy (Class 0.5S);

IEC 62053-23 Electricity metering equipment (AC) –Particular requirements - Part-23: Static Meters for Reactive Energy;

IS 15707 Specification for Testing, evaluation, installation & maintenance of AC Electricity Meters-Code of Practice.

Guidelines on "Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification"

IEC 62056-21 Electricity metering: Data exchange for meter reading, tariff and load control- Part 21: Direct local data exchange

IEC 62056-31 Electricity metering: Data exchange for meter reading, tariff and load control -Part 31: Local Area Network data exchange

IEC 62056-61 Electricity metering: Data exchange for meter reading, tariff and load control- Part 61: Object identification system (OBIS)

The equipment meeting with the requirements of other authoritative standards, which ensure equal or better quality than the standard mentioned above, also shall be considered; in case of conflict the Guidelines on "Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification" enclosed with this document as annexure shall prevail upon.

4.0 GENERAL TECHNICAL REQUIREMENTS

1	**TYPE**	AMR Compatible Static, 3Ph, 4Wire 11KV Tri-Vector Energy Meter for Feeder.
2	**FREQUENCY**	50 Hz ± 5%
3	**ACCURACY CLASS**	0.5S
4	**SECONDARY VOLTAGE RATING**	Suitable for operation from 110V Ph-Ph, (3P, 4W) 63.5V Ph - N
5	**VOLTAGE VARIATION**	(-) 30% to (+) 20%
6	**BASIC CURRENT (Ib) & CURRENT RATING**	Ib- 1A, Imax – 2A,Ratio : --/1 A

7	**MAXIMUM CONTINUOUS CURRENT**	As per IS 14697:1999(2004)
8	**STARTING CURRENT**	0.1% of Ib at UPF
9	**POWER CONSUMPTION**	The active and apparent power consumption, in each voltage circuit, at reference voltage, reference temperature and reference frequency shall not exceed 1. 5 W and 8 VA. The apparent power taken by each current circuit, at basic current, reference frequency and reference temperature shall not exceed 1.0 VA.
10	**POWER FACTOR**	0 Lag – Unity – 0 Lead
11	**DESIGN**	Meter shall be designed with application specific integrated circuit (ASIC) or micro controller; shall have no moving part; electronic components shall be assembled on printed circuit board using surface mounting technology; factory calibration using high accuracy (0.05 class) software based test bench. Assembly of electronic components shall be as per ANSI /IPC-A-610 standard.
12	**DLMS TEST CERTIFICATE**	Manufacturer must have test certificate for conformance to DLMS from CPRI of Category - C.

5.0 TEMPARATURE RISE:

Under normal condition of use, winding and insulation shall not reach a temperature, which might adversely affect the operation of the meters. IS14697:1999(2004) should be followed.

6.0 CLIMATIC CONDITIONS:

Temperature : -10° C to 55° C (in shade)

Humidity : up to 95% RH non-condensing

Average annual rainfall : 150 cm.

Max Wind Pressure : 150 kg/sq.m.

Max. Altitude above MSL : 3000 m.

7.0 TROPICAL TREATMENT:

The meters shall be suitably designed and treated for normal life and satisfactory operation under hot & hazardous tropical climate conditions and shall be dust and vermin proof. All the parts & surface, which are subject to corrosion, shall either be made of such material or shall be provided with such protective finish which provides suitable protection to them from any injurious effect of excessive humidity.

8.0 CONSTRUCTIONAL REQUIREMENT/ METER COVER & SEALING ARRANGEMENT

Wherever poly carbonate cover is specified, it shall conform to IS 11731 (FH-1category) besides meeting the test requirement of heat deflection test as per ISO 75, glow wire test as per the IS:11000 (part 2/SEC-1) 1984 OR IEC PUB,60695-2-12, Ball pressure test as per IEC--60695-10-2 and Flammability Test As per UL 94 or As per IS 11731(Part-2) 1986.

9.0 CONSTRUCTION

The case, winding, voltage circuit, sealing arrangements, registers, terminal block, terminal cover & name plate etc. shall be in accordance with the relevant standards. The meter should be compact & reliable in design, easy to transport & immune to vibration & shock involved in the transportation & handling. The construction of the meter should ensure consistence performance under all conditions especially during heavy rains / very hot weathers. The insulating materials used in the meter should be non-hygroscopic, non-ageing & have tested quality.

The meter should comply latest technology such as Microcontroller or Application Specific Integrated Circuit (ASIC) to ensure reliable performance. The mounting of the components on the PCB should compulsorily be Surface Mounted Technology (SMT) type. Power supply component may be of PTH type. The electronic components used in the meter should be of high quality and there should be no drift in the accuracy of the meter for at least ten years. The circuitry of the meter should be compatible with 16 Bit (or better) ASIC with compatible processor and meter should be based on Digital measuring and sampling technique.

The meter should be housed in a safe, high grade, unbreakable, fire resistant, UV stabilized, virgin Polycarbonate/ High grade engineering plastic/Thermosetting Plastic casing of projection mounting type. **The meter cover should be transparent,** for easy reading of displayed parameters, and observation of operation indicators. The meter base may or may not be transparent, **but it should not be black in colour**. The meter casing should not change shape, size, and dimensions when subjected to 200 hrs on UV test as per ASTMD 53. It should withstand 650 deg. C. glow wire test and heat deflection test as per ISO 75.

Meters must be supplied with 2 (two) nos. manufacturers' seals between meter base and meter cover at both the sides.

Both the communication port (Optical and RS 485 port) should have proper sealing arrangement.

The bidder shall submit relevant documents (collected form Meter Manufacturer) regarding the procurement of polycarbonate material. The polycarbonate material of only the following manufacturers shall be used.

a) G.E. Plastics/Sabic: LEXAN 943A or LEXAN 143 or LEXAN 123R or equivalent for Meter & Terminal cover, and LEXAN 503R or 500R or equivalent for base.

b) BAYER/SABIC : Grade corresponding to above

c) DOW Chemicals : -Do-

d) MITSUBISHI : -Do-

e) TEJIN : -Do-

f) DUPONT : -Do-

10.0 METER CASE AND COVER

The meter should be sealed in such a way that the internal parts of the meter becomes inaccessible and attempts to open the meter shall result in viable damage to the meter cover. **This is to be achieved by using continuous Ultrasonic welding on the Meter body, fully flushed between case and cover.** In case, ultrasonic welding using plate/strip is used the material of plate/strip should be same as that of cover and base and the strip should **flush with meter body.** The manufacturer's logo should be embossed on the strip / plate.

The meter cover should be fixed to the meter base (case) with Unidirectional Screws, so that the same cannot be opened by use of screwdrivers. The meter shall withstand external magnetic influence as per latest amendments of CBIP Technical Report No. 304.

11.0 TERMINAL BLOCK AND COVER:

The terminals may be grouped in a terminal block having adequate insulating properties and mechanical strength. The terminal block should be made from best quality non-hygroscopic, flame retardant material (capable of passing the flammability tests) with nickel plated brass inserts / alloy inserts for connecting terminals.

The terminals in the terminal block shall be of adequate length in order to have proper grip of conductor with the help of screw adjustable metal plates to increase the surface of contact and reduce the contact resistance. The screws shall have thread size not less than M 4 and head having 4-6mm. diameters. The screws shall not have pointed ends at the end of threads. All terminals and connecting screws should be of tinned/nickel plated brass material.

The internal diameter of terminal hole should be minimum 5.5 mm. The holes in the insulating material shall be of sufficient size to accommodate the insulation of conductor also.

The terminal cover shall be transparent High grade Engineering Plastic/Polycarbonate/ Thermosetting Plastic with minimum thickness 2.0 mm and the terminal cover shall be of extended type completely covering the terminal block and fixing holes. The space inside the terminal cover should be sufficient to accommodate adequate length of external cables.

12.0 WORKING ENVIRONMENT

As per IS 14697:1999(2004). Meter to perform satisfactorily under Non-Air Conditioned environment (within stipulations of IS) IP51 housing for indoors.

The meter shall be suitable designed for satisfactory operation under the hot and hazardous tropical climate conditions and shall be dust and vermin proof. All the parts and surface, which are subject to corrosion, shall either be made of such material or shall be provided with such protective finish, which provided suitable protection to them from any injurious effect of excessive humidity.

13.0 MANUFACTURING PROCESS, ASSEMBLY AND TESTING

Meters shall be manufactured using latest and 'state of the art' technology and methods prevalent in electronics industry. The meter shall be made from high accuracy and reliable surface mount technology (SMT) components. All inward flow of major components and sub assembly parts (CT, PT, RTCs / Crystal, LCDs, LEDs, power circuit electronic components etc.) shall have batch and source identification. Multilayer 'PCB' assembly with 'PTH' using surface mounted component shall have adequate track clearance for power circuits. SMT component shall be assembled using automatic 'pick-and-place' machines, Reflow Soldering oven, for stabilized setting of the components on 'PCB'. For soldered PCBs, cleaning and washing of cards, after wave soldering process is to be carried out as a standard practice. Assembly line of the manufacturing system shall have provision for testing of sub-assembled cards. Manual placing of components and soldering, to be minimized to items, which cannot be handled by automatic machine. Handling of 'PCB' with ICs / C-MOS components, to be restricted to bare minimum and precautions to prevent 'ESD' failure. Complete assembled and soldered PCB should undergo functional testing using **Computerized Automatic Test Equipment.**

Fully assembled and finished meter shall under go 'burn-in' test process for 24 Hours at 55 degree Celsius (Max. temperature to not exceed 60 degree Celsius) under base current (Ib) load condition.

Test points should be provided to check the performance of each block/stage of the meter circuitry.

RTC shall be synchronized with NPL time at the time of manufacture. Meters testing at intermediate and final stage shall be carried out with testing instruments, duly calibrated with reference standard, with traceability of source and date.

14.0 DISPLAY OF MEASURED VALUES

The meter display shall have 7 digits(complete) for energy counter with alphanumeric digits for parameter identifier and tamper indication with backlit Liquid Crystal Display (LCD) of minimum 10 mm height, wide viewing angle suitable for temperature withstand of 70° C. LCD to be of 'STN' (super twisted numetic) type construction.

The data stored in the meters shall not be lost in the event of power failure. The meter shall have Non Volatile Memory (NVM), which does not need any battery backup. The NVM shall have a minimum retention period of 10 years.

Meter shall have Scroll Lock facility to display any one desired parameter can be kept on display for minimum 10 minutes.

Meter shall have Scroll Lock facility to display any one desired parameter continuously from display parameters.

Auto display cycling of each parameter should be minimum 10-12 Seconds. The time between two auto display cycles shall be 100-120 sec. OBIS code in display is not required.

It should be possible to easily identify the single or multiple displayed parameters through symbols/legend on the meter display itself or through display annunciation.

All active Energy should be displayed in KWH.

AUTO MODE:

i) LCD Test

ii) Meter Serial Number

iii) Real Time & Date (DD/MM/YYYY)

iv) Rising Apparent Demand with elapsed time

v) Cumulative Power Off Hours

vi) Cumulative Active Energy (Cumulative sign/legend must be given)

vii) Cumulative Reactive Energy Lag (do)

viii) Cumulative Reactive Energy Lead (do)

ix) Cumulative Apparent Forward Energy

x) Apparent Forward Max. Demand (with minimum 2 decimal)

xi) TOD Wise Total Active Forward Energy

xii) TOD Wise Apparent Energies

xiii) TOD Wise Apparent Max. Demand (with 2 decimal))

xiv) Cumulative Apparent Maximum Demand (Cumulative sign/legend must be given)

xv) Cumulative Billing Count

xvi) Cumulative Tamper Count

xvii) Phase Sequence & phase correspondences of Voltage & Current

xviii) Connection Check

xix) Self Diagnosis

PUSH BUTTON MODE:

(I) to (xvi) of Auto Display then

xvii) History 1 Cum Active Forward Energy

xviii) TOD wise History 1 Cum Active Forward Energy

xxi) History 1 Cum Apparent Forward Energy

xx) TOD Wise History 1 Cum Apparent Forward Energy.

xxi) Last Billing Date and Time

xxii) Phase Sequence & phase correspondences of Voltage & Current

xxiii) Connection Check

xxiv) Self Diagnosis

xxv) Battery Status

xxvi) Cumulative Programming Count

xxvii) Present/ Last MD Reset Time and Date

xxviii) Inst. Secondary Voltages –Phase Wise (P-N)

xxix) Inst. Secondary Currents – Phase Wise

xxx) Signed Inst. Power Factor – Phase Wise

xxxi) Inst. Net Power Factor

xxxii) History 1 Billed Average Power Factor

xxxiii) Signed Inst. Active Power,

xxxiv) Inst. Apparent Power

xxxv) Inst. Frequency

xxxvi) Present Tamper Status (PT/CT/Other)

xxxvii) First Occurrence with Date & Time

xxxviii) Last Occurrence with Date & Time

xiI) Last Restoration with Date & Time

xI) Front Cover Open Count

xli) Front Cover Open with Date and Time

xlii) High Resolution Cumulative Forward Active Energy

xliii) High Resolution Cumulative Forward Reactive Energy (Lag)

xliv) High Resolution Cumulative Forward Active Energy (Lead)

xlv) High Resolution Cumulative Forward Apparent Energy

Power OFF Mode

i) Meter Sl No

ii) Date and Time

iii) Cumulative Active Forward Energy

iv) Cumulative Reactive Energy(Lag)

v) Cumulative Reactive Energy(Lead)

vi) Cumulative Apparent Energy

vii) Current Apparent Forward MD

viii) History 1 Apparent Forward MD

ix) Cumulative Billing Count

x) Cumulative Tamper Count

The register shall be able to record and display starting from zero, for a minimum of 2500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.

High resolution registers required in display min 4 digits (for kWh) after decimal in case of Energy.

No decimal is required for main KWh, KVAh, KVarh (lag & lead) display.

Push button mechanism should be of high quality and should provide trouble free service for a long span of time. Up and Down scrolling facility should be there for Push Button Mode. If there is separate button for MD reset, it should also have scrolling facility.

15.0 MAXIMUM DEMAND

The meter should be capable of recording the Apparent/Active MD with integration period of 15 minutes.

MD RESET OPTION

i) Billing Date at 00:00 Hrs of 1st day of the Month (Programmable)
ii) Push button
iii) By Authenticated Command from BCS through HHU or directly from PC/REMOTE

MD reset button should have proper sealing arrangement. Specific operation should be available in downloading data.

16.0 PERFORMANCE UNDER INFLUENCE QUANTITIES

The meters performance under influence quantities shall be governed by IS 14697:1999 (2004). The accuracy of meter shall not exceed the permissible limits of accuracy as per standard IS 14697:1999(2004).

17.0 OUTPUT DEVICE

Energy Meter shall have test output, accessible from the front, and be capable of being monitored with suitable testing equipment while in operation at site. The operation indicator must be visible from the front and test output device shall be provided in the form of LED. Resolution of the test output device shall be sufficient to enable the starting current test in less than 10 minutes. Minimum gap should be maintained between Active & Reactive Test LED.

18.0 REAL TIME INTERNAL CLOCK (RTC)

RTC shall be pre-programmed for 30 Years Day/date without any necessity for correction. The maximum drift shall not exceed ± 300 Seconds per year.

The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following:

a) Hand Held Unit (HHU) or directly through BCS and this shall authentication from BCS for individual meter.

b) From remote server through suitable communication network with authentication from BCS.

19.0 TIME OF DAY FACILITIES:

The meter should have facilities to record Active, Apparent Energies and MD with a facility of 8 time zones. The time zones should be user programmable through authenticated command from BCS with the help of HHU. At present only 3 (Three) TOD zones to be activated in following manners;

TOD – 1 06:00 Hrs to 17:00 Hrs

TOD – 2 17:00 Hrs to 23:00 Hrs

TOD – 3 23:00 Hrs to 06:00 Hrs

20.0 METER READING DURING POWER OFF:

It should be possible to read the meter-display visually and with MRI and in absence of input voltages with the help of internal battery for display in power off condition or external battery pack/PPU. The interface should be inductive coupling.

21.0 SELF DIAGNOSTIC FEATURES:

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location all the time. If possible, the details of malfunctioning should be recorded in the meter memory. The bidder should furnish the details of self-diagnostic capability feature, viz (i) Memory status, (ii)Battery status (iii) NVM & (iv) RTC Status in BCS as well as it should be in display.

22.0 BASE COMPUTER SOFTWARE (BCS): Exclusively used for the manufacturers meter only.

The BCS should be user friendly. **Windows 8 / 7 based** BCS shall be supplied. The data transfer should be reliable and fraud proof. BCS should give all details pertaining to billing and load survey data. The meter condition details should also be transferred into the BCS including abnormalities/anomalies of voltage current conditions or tamper conditions which can occur due to mistake in connections or intentionally done for the purpose of tamper.

The software should show electrical conditions existing at the time of reading the meter in tabular forms as well as in graphical format (Phase diagram) i.e. Phase diagram is required for voltage, current & PF only.

All the information about energy, maximum demand and their respective TOD register readings, billing register readings and billing history readings should be shown in a manner which user can understand quickly, preferably in tabular format.

All the load survey data should be available in numerical as well as graphical format. It should also be possible to view this data in daily, weekly and monthly formats. The load survey graph should show the respective values.

All the information about tamper events should be accompanied with date and time stamping along with the ‘SNAPSHOT’ (details) of the respective electrical conditions. This information should be displayed in the sequence in which it happened, in cumulative format as well as in summary format. The cumulative format should segregate a particular tamper information and summary report should show count of tamper occurrence, restoration and the duration for which meter has remained under tamper condition.

In BCS, tamper events must be followed as per Table 32-38 as per IS 15959. However, final tamper logic will be given at the time of sample testing. Before issuing the purchase order bidder has to confirm with letter to comply the said tamper logic. In display, first tamper occurrence & last tamper occurrence & restoration with date & time and total tamper count must be available.

Facility to view data incorporating External multiplying factor due to Installed CTs & PT should be provided.

The software should be capable of preparing CMRI to read the meter information or to reconfigure the meter for change the setting of the meter as per IS 15959:2011.

The BCS should have the facility for ASCII conversion of all recorded meter data. There should be user friendly approach for viewing meter data for the reading collected now or for the reading collected in the past. All information about a particular consumer should be segregated and available at one place so that locating any consumer's past data is easy. It should be possible to locate/retrieve data on the basis of one of the following particulars:

a) Consumer ID/Number.

b) Meter Sr. No.

c) Date of meter reading.

d) Location.

The BCS shall have multi level password for data protection and security. The first level should allow the user to enter the system. The different software features shall be protected by different passwords. The configuration of passwords should be user definable. The software installed on one PC should not be copy-able on to another PC.

It is very important that the BCS has the feature to export available data to ASCII format for integrating with the WBSEDCL billing system. Here again a wizard should be available whereby user can select file format (for ASCII), what data to export, the field width selection (whether 8 characters or 10 characters, to include decimal point or not, number of digits after decimal point etc).

Help should be available with the software so that user can use all the features of the software by just reading the Help contents.

23.0 LOAD SURVEY:

The meter should be capable of recording load survey data of Phase wise Voltage, Phase wise current, Average Power Factor, Active Energy and Apparent Energy for a period of minimum 45 days for 15-minute integration period. Real time & date should be shown in all the load survey graphs and table.

24.0 MEASUREMENT OF ENERGY

The meter should be capable of measuring Fundamental Energy as well Total Energy i.e. Fundamental plus Harmonics energy. Total Energy shall be made available on meter-display and the same only shall be used for billing purpose. Fundamental Energy should be provided in display.

The Fundamental Energy shall be logged in the meter memory and be capable of downloading to the BCS through the HHU and be available for viewing at the BCS end.

25.0 MARKING OF METERS

Every meter shall have a nameplate clearly visible and indelible and distinctly marked in accordance with the relevant Standard mentioning “Category – A”. The following information should appear on an external plate attached to the meter cover.

i) Manufacturers Name or trademark and place of manufacture.
ii) Designation of type.
iii) Number of phases and wires.
iv) Serial number of meter.
v) Month and year of manufacture.
vi) Principal unit of measurement.
vii) P.T. Ratio.
viii) Basic Current and rated maximum current.
ix) C.T. Ratio.
x) Reference frequency in Hz.
xi) Meter constant (impulse/unit)) i.e. impulse/KWH.
xii) Class index of meter.
xiii) Reference temperature.
xiv) “Property of WBSEDCL”
xv) Purchaser’s Order No. & Date.
xvi) Guarantee for 5 years from the date of last despatch.
xvii) Sign. of insulation.
xviii) Bar coding of Serial Number, month & year of manufacture.

The meter shall also store name plate details as given in the Table - 30 of IS 15959:2011

26.0 COMMUNICATION CAPABILITY

The meter shall be provided with two ports for communication of the measured/collected data. The hardware port (with sealing facility) compatible with RS 485 specifications which shall be used for remote access through suitable Modem and an Optical port complying with hardware specifications detailed in IEC-62056-21. This shall be used for local data downloading through a DLMS compliant HHU or direct through BCS.

Both ports shall support the default and minimum baud rate of 9600 bps.

Optical Cord (i.e. Optical Port of Meter to PC) must be USB type.

Data downloading time from meter to HHU/PC should be within 2 min for meter data (without load survey) and within 6 min for meter data with load survey.

27.0 HAND HELD UNIT (HHU)

To enable local reading of meters data a **DLMS compliant HHU (DOS Based)** shall be used. The HHU shall be as per IS 15959:2011. It shall be compatible to the DLMS compliant energy meters that are to be procured/supplied on the basis of the specification having at least one USB communication port.

28.0 TAMPER & FRAUD MONITORING FEATURES

The meter shall work satisfactorily under presence of various influencing conditions like External Magnetic Field, Electromagnetic Field, Radio Frequency Interference, Vibrations, Harmonic Distortion, Voltage/Frequency Fluctuations, and Electromagnetic High Frequency Fields etc. The meter shall be immune to abnormal voltage/frequency generating devices and shall record the occurrence and restoration of all tampers and related snapshots as per Annexure – G of IS 15959:2011

The meters should work even in the presence of any two Potential wires.

Meter should work correctly irrespective of phase sequence.

Tamper details shall be stored in internal memory for retrieval by authorized personnel through either of the following:

a) DLMS compliant HHU.

b) Remote access through suitable communication network.

c) Direct by PC.

Meter should have a continuous and clear indication / annunciation in its display if top cover is removed/open and even refixed (non roll over) and only cover open must be logged in BCS without any restoration. Auto scroll display may be sacrificed for that **COVER OPEN .**

Minimum 400 numbers of events preferable (compartment wise) i.e. 200 no. events for occurrences & 200 no. events for restoration with date & time and snapshot should be available in the meter memory.

Default occurrence and restoration time shall be 5 minutes but it shall be programmable.

Final tamper Logic and threshold values as per our requirement is enclosed as Annexure-VI.

All the tamper information logged by the meter should be available in BCS with snapshot, Date & Time as per Table 39 of IS 15959:2011 with occurrence and restoration.

Properly designed meter tamper logic with threshold value, should be provided and clearly explained in the bid. The tamper logic should be capable of discriminating the system abnormalities from source side and load side and it should not log / record tamper due to source side abnormalities. The meter should be able to distinguish between HT PT fuse blowing and Single Phasing and record the former.

29.0 TYPE TESTS

Meters shall be fully type tested as per relevant Standard (IS 15959) (latest version). The type test certificates should be submitted as per IS 15959 along with the offer. Offer without

Type Test Report shall be liable for rejection. The type test certificate shall not be more than five years old from the Due date of submission of Tender.

30.0 ACCEPTANCE & ROUTINE TESTS:

All acceptance tests as per relevant standards shall be carried out at Meter Manufacturer's Works in the presence of WBSEDCL representatives.

Further Purchaser shall reserve the right to pick up energy meters at random from the lots offered and get the meter tested from NABL accredited lab. The supplier has no right to contest the test results NABL accredited lab or for additional test and has to replace/take corrective action at the cost of the supplier.

31.0 INSPECTION:

The inspection shall be carried out at any stage of manufacture, by the WBSEDCL authorized representatives, with prior intimation to the supplier. The manufacturer shall grant all reasonable facilities for testing free of charge for inspection and testing to satisfy the purchaser that the materials to be supplied are in accordance with their specification.

The supplier shall keep the WBSEDCL informed in advance, about the manufacturing program so that the arrangement can be made for inspection.

The representative / Engineer of the WBSEDCL attending the above testing shall carry out testing as per relevant standards and issue test certificate approval to the manufacturer and give clearance for dispatch.

32.0 QUALITY ASSURANCE:

The meter manufacturer shall have a comprehensive quality assurance program at all stages of manufacture for ensuring products giving reliable, trouble free performance. Details of the Manufacturer's quality assurance and test set up shall be furnished with the bid. A detailed quality assurance program shall be finalized with the successful bidder during the award stage.

Bidder (collected from Meter Manufacturer) shall furnish following information along with his bid:

a) Organization structure of the manufacturer and his main sub-suppliers (PCBs, SMT cards, CT/PT) with details of 'QA' setup, overall workflow.

b) Copy of system manual showing 'QAP' (Quality Assurance Plan) as actually practiced during manufacturing and final testing.

c) **List of raw materials and critical components (ASIC chip, crystal clock, memory register Chip, transformers, optical ports etc.) with their suppliers and procurement details.**

d) Stage inspection of product before final testing.

e) Procedure adopted for 'In-situ' testing of PCBs, after placement of surface mounted component, for quantitative parametric variation of tolerance by self or sub-contractor.

f) Testing and calibration facility, date of calibration of test bench, manpower data of bench operators;

g) Sample copies of test certificate of bought out components.

33.0 TESTING FACILITIES:

The Bidder (Meter Manufacturer) shall have at least the following testing facilities to ensure accurate calibration:

a) Insulation resistance measurement

b) Running at no load

c) Starting current test

d) Limits of error

e) Dial Test

f) Power loss in voltage and current ckt.

g) Repeatability of error

h) Transportation test

i) Tamper Test

j) Ageing Test

The Bidder (Meter Manufacturer) shall give a detailed list of bought out items with name of the manufacturer and details about quality control.

34.0 GUARANTEE

Equipment (Meter & CMRI) supplied shall be guaranteed for a period of 5 years from the date of last despatch. Bidders shall guarantee to replace the meters, which are found to be defective/inoperative at the time of installation, or become inoperative/ defective during guarantee period. Replacements shall be effected within 1 month from the date of intimation.

35.0 FIXING & SEALING ARRANGEMENT

Every meter shall have three fixing holes one at the top and two at the bottom. The top hole shall be provided with a special clip at the back of the meter so that holding screw is not accessible to the consumer after the fixing of the meters. The lower fixing screws shall be provided under the sealed terminal cover. The requisite fixing screws shall be supplied with each meter.

Necessary provision may be kept for fixing the utility seal also.

The manufacturers seal provided with the meter should be of high quality with tamper proof features.

36.0 SUBMISSION OF SAMPLE ENERGY METER & DOCUMENTS

After opening of the Techno-Commercial Bid, Bidder has to submit **two nos** offer Meter within 15 days from the date of intimation to C.E.DTD,WBSEDCL for sample test in presence of Bidder's representative along with inherent features, BCS and sample of seal, **Type Test Certificates, DLMS Certificate and with the test results and ISI Certificate, Tamper Logic, Display Parameters List.**

i) 3-Phase 4-Wire 11 KV, - /1A. Class of Accuracy 0.5s – 2Nos. (Without Ultrasonic welding)

ii) Sample meters shall be submitted along with 1 no. ultrasonically welded (Proto Type) case and cover. HHU, Power-Pack, Modem along with SIM Card if required, to be brought at the time of testing of sample meters submitted against the tender.

Offer with all relevant documents for Energy Meter may be submitted with different make as per Annexure-B alongwith the Bid but after placement of order, drawing for approval needs to be submitted with only one type of accepted offered Energy Meter.

37.0 SCHEDULES:

The Bidder (collected from Meter Manufacturer) shall submit the following schedules (as per Standard Format), which is part and parcel of the Specification.

Schedule A Guaranteed Technical Particulars

Schedule B List of Raw Material (as per enclosed format)

Schedule C Pre Qualification Condition

Schedule D List of Documents to be submitted during sample submission

Normally the offer should be as per Technical Specification without any deviation.
But any deviation from Specified Standards, Specified Test Requirement, Technical Specification felt necessary to improve performance, efficiency and utility of equipment must be mentioned in the 'Deviation Schedule' with reasons of such deviation. Such deviation suggested may or may not be accepted. Deviations not mentioned in Deviation Schedule will never be considered.

Schedule - A

GUARANTEED TECHNICAL PARTICULARS FOR 11KV STATIC TRIVECTOR METERS

Sl.No.	Description	Required Specification	Manufacturer's particulars
1	Maker's name and country	To be mentioned	
2	Type of meter/model	To be mentioned	
3	Accuracy class	0.5S	
4	Parameters displayed	To be mentioned	
5	P.F. Range	0 Lag – Unity - 0 Lead	
6	Basic Current (Ib)	1A	
7	Maximum Current	200 % of Ib	
8	Minimum starting current	0.1% of Ib	
9	Rated Voltage	Ph-Ph : 110V, Ph–N;63.5V	
10	Variation of voltage at which meter functions normally	-30% to + 20% of Vref	
11	Rated Frequency	50Hz	
12	Power Loss in Voltage & Current circuits	Voltage Circuit Less than 1.5W/8VA, Current Circuit Less than 1VA. (Less VA/ Watt getting the preference)	
13	Dynamic range	To be mentioned	
14	MD reset Provisions	a) Through authenticated CMRI or Remote Communication Command. b) Automatic resetting at preset date & time.	
15	No. of digits of display and height of character	Seven segment, minm. 7 digit Liquid Crystal Display (LCD) with backlit or LED, having minimum character height of 10 mm.	
16	Size of Non volatile memory	To be mentioned	
17	Principle of operation	To be mentioned	
18	MD Integration period	15 Minutes	
19	Weight of meter	To be mentioned	
20	Dimensions	To be mentioned	
21	Warranty	5 years from date of last dispatch.	
22	Outline drawings & Leaflets	To be furnished	
23	a) Remote meter-readout facility	To be mentioned	
	b) Communication protocol used.	To be mentioned	
	c) Sealing provision for meter & optical port.	To be mentioned	
	d) Baud rate of data transmission	To be mentioned	

	e) Required software to be resident in CMRI and BCS.	To be mentioned	
	f) Ultrasonic welding of body	To be mentioned	
	g) Manufacturer's Seal provided	To be mentioned	
24	Base Computer Software	Windows 8/7 based	
25	Type Test Certificates	To be furnished	
26	Time of Day Zones (Selectable)	To be mentioned	
27	Whether meter measures both fundamental & Harmonic Energy	Both required	
28	Real Time Clock Accuracy	Max. drift per annum ±300 sec for Class 0.5S.	
29	Anti Tamper Features	To be mentioned in details.	
30	Data retention by NVM without battery back up and un-powered condition.	10 years	
31	Guarantee period of meter	60 months from the date of last despatch. Guarantee period shall be printed on the nameplate.	
32	BIS license	To be mentioned	
32.1	BIS license No. & dt. with its validity for ISI certification mark on offered meter.	To be mentioned	
32.2	Details of meter design for which above BIS certification has been obtained: -	To be mentioned	
(i)	Ratio of Ib to Imax		
(ii)	Material of meter body		
(iii)	Grade of printed circuit Board material		
(iv)`	Type of assembly of component used (SMT)		
(v)	Meter constant (IMP / KWh)		
(vi)	Auxiliary power circuit (with PT or PT less)		
(vii)	Accuracy class		
33	ISO accreditation no. & dt. with its validity		
34	Other parameters / features not covered in the above GTP	Conform to specification of IS-14697 / 1999 & CBIP technical report No.88 (with its latest amendment).	
35	Past Experience	Copies of order executed in last three years along with GTP of the supplied meters to be enclosed. Past experience to be considered for manufacturing meter as per IS: 14697 & CBIP-88/304	

SHEDULE-B

Sl. No.	Component Function / Feature	Make / Origin
1	Current Element	
2	Measurement /Computing chips	
3	Memory chips	
4	Display modules	
5	Communication modules	
6	Optical port	
7	Power Supply	
8	Electronic components	
9	Mechanical parts	
10	Battery	
11	RTC / Micro controller	

SCHEDULE-C

Pre-Qualification Conditions for HT Static Meters

Sl. No.	Particulars	Remarks
1	Bidders (Meter Manufacturer) must have valid BIS certification for the offered meter. If it has started to issue by appropriate authority.	Yes / No
2	Bidder (Meter Manufacturer) preferably posses ISO 9001 certification	Yes / No
3	Bidder (Meter Manufacturer) should be manufacturers of static meters having supplied Static LT, 11/33 KV H.T. Meters with memory and LCD display as per IS 14697 & CBIP 304 to Electricity Boards / Utilities in the past 3 years.	Yes / No
4	Bidders(Meter Manufacturer) should have dust free, static protected environment for manufacture, assembly and Testing.	Yes / No
5	Bidder(Meter Manufacturer) should have automatic computerized test bench for lot testing of meters.	Yes / No
6	Bidder (Meter Manufacturer) has facilities of Oven for ageing test.	Yes / No

SCHEDULE - D

Sl. No.	LIST OF DOCUMENTS TO BE SUBMITTED DURING SAMPLE SUBMISSION			
1	Attested copy of type test reports from NABL accredited laboratory as per new IS(If Published)			
2	Attested copy of BIS certificates of the same type of meter submitted as sample			
3	Attested certificates as regards material used for meter case, cover & terminal block.			
4	Annexure – II as per tender documents			
5	Annexure – III as per tender documents			
6	Operating manual & Tamper logic of the meter submitted			

ANNEXURE - V

Component Specifications:

The meters shall be designed and manufactured using SMT (Surface Mount Technology) components, except for power supply components, LCD etc., which are PTH type. All the material and electronic power components used in the manufacture of the meter shall be of highest quality and reputed makes so as to ensure higher reliability, longer life and sustained accuracy.

Sl. no.	Component Function / Feature	Requirement	Make / origin
1.	Current Element	Current Transformer	Any make or origin conforming to IS-2705
2.	Measurement / computing chips	The Measurement / computing chips used in the meter should be with the Surface mount type.	USA:Analog Devices, AMS, Cyrus Logic, Atmel, SAMES, Texas Instruments,Teridian, Japan: NEC,Freescale, Renesas, Holland: Phillps
3.	Memory chips	The memory computing chips should not be affected by the external parameters like sparking, high voltage spikes or electrostatic discharges.	USA: National Semi Conductor, Atmel, SAMES, Texas Instruments,Teridian, ST Japan: Hitachi, OKI, Freescale, Renesas, Holland / Korea: Phillps

4.	Display modules	The display modules should be well protected from the external UV radiations. The display should be clearly visible over an angle of at least a cone of 70^{o}.The construction of the modules should be such that the displayed quantity should not disturbed with the life of display. The display should be TN type industrial grade with extended temperature range.	Singapore: Bonafied Technologies, Korea: Advantek, Japan : Hitachi, SONY, Hijing,Truly Semiconductor.
5.	Communication modules	Communication modules should be compatible for the RS 232 ports.	USA: National Semiconductors, HP, ST, Texas Instruments, Agilent, USA / Korea: Fairchild Holland/ Korea: Philips, Japan: Ligitek, Hitachi, Germany: Siemens, Tiwan: Everlight,
6.	Optical port	Optical port should be used to transfer the meter data to meter reading instrument. The mechanical construction of the port should be such to facilitate the data transfer easily.	USA: National Semiconductors, Texas Instruments, HP, Agilent, Japan: Hitachi, , Germany:Siemens, Holland / Korea:Philips, Tiwan:Everlight,
7.	Power Supply	The power supply should be with the capabilities as per the relevant standards. The power supply unit of the meter should not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections.	SMPS Type
8.	Electronic components	The active & passive components should be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	Philips, Toshiba, Fairchild, Murata, Rohm, Siemens. National Semiconductors, ATMEL, Texas Instruments, Hitachi. Ligitec, OKI, EPCOS
9.	Mechanical parts	The internal electrical components should be of electrolytic copper & should be protected from corrosion, rust etc. The other mechanical components should be protected from rust, corrosion etc. by suitable plating / painting methods.	

10.	Battery	Lithium / Lithium-ion /NiMh with guaranteed life of 10 years	Renata, Panasonic, Varta, Tadiran, Sanyo, National, Tekcell, Duracell, Maxell, Elegance, Mitshubishi,
11.	RTC / Micro controller	The accuracy of RTC shall be as per relevant IEC / IS standards	USA: Dallas, Atmel, Motorola, NEC, Renesas, Texas Instruments, ST, Micro chips, Teridian Holland / Korea: Philips, Japan: NEC, OKI,Hitachi, Mitsubishi, Freescale,

Components used in accepted sample meters should be maintained in offered meters. If any change is essential during offer of the meters, prior approval is to be taken from the Ordering Authority.

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Table 27 Instantaneous Parameters for Class C Meters (Required in Class A Meter)

(*Clause* E-2, E-3.2 and E-3.3)

Sl No	Parameter	OBIS Code A.B.C.D.E.F	Interface Class No
1.	Real Time Clock – Date and Time	0.0.1.0.0.255	8
2.	Current - IR	1.0.31.7.0.255	3
3.	Current – IY	1.0.51.7.0.255	3
4.	Current – IB	1.0.71.7.0.255	3
5.	Voltage – VRN	1.0.32.7.0.255	3
6.	Voltage – VYN	1.0.52.7.0.255	3
7.	Voltage – VBN	1.0.72.7.0.255	3
8.	Voltage – VRY	1.0.32.7.0.255	3
9.	Voltage – VBY	1.0.52.7.0.255	3

10.	Signed Power Factor –R phase	1.0.33.7.0.255	3
11.	Signed Power Factor - Y phase	1.0.53.7.0.255	3
12.	Signed Power Factor - B phase	1.0.73.7.0.255	3
13.	Three Phase Power Factor – PF	1.0.13.7.0.255	3
14.	Frequency	1.0.14.7.0.255	3
15.	Apparent Power – KVA	1.0.9.7.0.255	3
16.	Signed Active Power – kW (+ Forward; - Reverse)	1.0.1.7.0.255	3
17.	Signed Reactive Power – kvar (+ Lag; - Lead)	1.0.3.7.0.255	3
18.	Number of Power-Failures	0.0.96.7.0.255	1
19.	Cumulative Power-Failure Duration	0.0.94.91.8.255	3
20.	Cumulative Tamper Count	0.0.94.91.0.255	1
21.	Cumulative Billing Count	0.0.0.1.0.255	1
22.	Cumulative Programming Count	0.0.96.2.0.255	1
23.	Billing Date	0.0.0.1.2.255	3
24.	Cumulative Energy kWh	1.0.1.8.0.255	3 / 2
25.	Cumulative Energy kvarh Lag	1.0.5.8.0.255	3 / 2
26.	Cumulative Energy kvarh Lead	1.0.8.8.0.255	3 / 2
27.	Cumulative Energy kVAh	1.0.9.8.0.255	3 / 2

NOTES : -

The items at Sl No 5), 6) and 7) are for 3Φ / 4W system of measurement with NEUTRAL as reference point.

Signed Power factor – (+ indicates lag) and (- indicates lead).

The parameters at Sl No 18) to 22) hold cumulative values at that instant from the date of manufacturing or installation of meter as the case may be.

The above list is identified for the purpose of communication to HOST or HHU.

The utilities may choose, based on needs, additional parameters for display purpose ONLY.

Item at Sl No 21) refers to the Billing Period Counter

Item at Sl No 23) - Data type to be same as for attribute 2 of IC 8, Clock.

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Table 28 : Block Load Survey Parameters for Class C Meters (Required in Class A Meter)

(*Clauses* E-2, E-4.1 and 4.3)

Sl No	Parameter	OBIS Code A.B.C.D.E.F	Interface Class No / Attribute
1.	Real Time Clock – Date and Time	0.0.1.0.0.255	8 / 2
2.	Current - IR	1.0.31.27.0.255	3 / 2
3.	Current – IY	1.0.51.27.0.255	3 / 2
4.	Current – IB	1.0.71.27.0.255	3 / 2
5.	Voltage – VRN	1.0.32.27.0.255	3 / 2
6.	Voltage – VYN	1.0.52.27.0.255	3 / 2
7.	Voltage – VBN	1.0.72.27.0.255	3 / 2
8.	Block Energy – kWh	1.0.1.29.0.255	3 / 2
9.	Block Energy – kvarh – lag	1.0.5.29.0.255	3 / 2
10.	Block Energy – kvarh – lead	1.0.8.29.0.255	3 / 2
11.	Block Energy – kVAh	1.0.9.29.0.255	3 / 2

NOTES : -

1) The parameters listed in this table are for load survey purpose and are logged as per the block period time.

2)The parameters at Sl No 2) to 9) are the average values during the block period time and stored at the end of that time block.

3)The parameters at Sl No 10) to 13) are the actual energy consumption during that time block.

4)Capture objects for 3 Φ / 4W are items at Sl No 1) to 7) and 10) to 13)

5)Support for Selective access shall be as defined in Section 11.3

Table 29 : Billing Profile Parameters for Class C Meters (Required in Class A Meter)

(Clauses E 5.1 and E 5.3)

S.No	Parameter	OBIS Code A.B.C.D.E.F	Interface Class No / Attribute
1.	Billing Date	0.0.0.1.2.255	3 / 2
2.	System Power Factor for Billing Period	1.0.13.0.0.255	3 / 2
3.	Cumulative Energy – kWh	1.0.1.8.0.255	3 / 2
4.	Cumulative Energy – kWh – TZ1	1.0.1.8.1.255	3 / 2
5.	Cumulative Energy – kWh – TZ2	1.0.1.8.2.255	3 / 2
6.	Cumulative Energy – kWh – TZ3	1.0.1.8.3.255	3 / 2
7.	Cumulative Energy – kWh – TZ4	1.0.1.8.4.255	3 / 2
8.	Cumulative Energy – kWh – TZ5	1.0.1.8.5.255	3 / 2
9.	Cumulative Energy – kWh – TZ6	1.0.1.8.6.255	3 / 2
10.	Cumulative Energy – kWh – TZ7	1.0.1.8.7.255	3 / 2
11.	Cumulative Energy – kWh – TZ8	1.0.1.8.8.255	3 / 2
12.	Cumulative Energy – kvarh – Lag	1.0.5.8.0.255	3 / 2
13.	Cumulative Energy – kvarh – Lead	1.0.8.8.0.255	3 / 2
14.	Cumulative Energy – kVAh	1.0.9.8.0.255	3 / 2
15.	Cumulative Energy – kVAh – TZ1	1.0.9.8.1.255	3 / 2
16.	Cumulative Energy – kVAh – TZ2	1.0.9.8.2.255	3 / 2
17.	Cumulative Energy – kVAh – TZ3	1.0.9.8.3.255	3 / 2
18.	Cumulative Energy – kVAh – TZ4	1.0.9.8.4.255	3 / 2
19.	Cumulative Energy – kVAh – TZ5	1.0.9.8.5.255	3 / 2

20.	Cumulative Energy – kVAh – TZ6	1.0.9.8.6.255	3 / 2
21.	Cumulative Energy – kVAh – TZ7	1.0.9.8.7.255	3 / 2
22.	Cumulative Energy – kVAh – TZ8	1.0.9.8.8.255	3 / 2
23.	MD – kW	1.0.1.6.0.255	4 / 2 ,5
24.	MD – kW – TZ1	1.0.1.6.1.255	4 / 2 ,5
25.	MD – kW – TZ2	1.0.1.6.2.255	4 / 2 ,5
26.	MD – kW – TZ3	1.0.1.6.3.255	4 / 2 ,5
27.	MD – kW – TZ4	1.0.1.6.4.255	4 / 2 ,5
28.	MD – kW – TZ5	1.0.1.6.5.255	4 / 2 ,5
29.	MD – kW – TZ6	1.0.1.6.6.255	4 / 2 ,5
30.	MD – kW – TZ7	1.0.1.6.7.255	4 / 2 ,5
31.	MD – kW – TZ8	1.0.1.6.8.255	4 / 2 ,5
32.	MD – kVA	1.0.9.6.0.255	4 / 2 ,5
33.	MD – kVA – TZ1	1.0.9.6.1.255	4 / 2 ,5
34.	MD – kVA – TZ2	1.0.9.6.2.255	4 / 2 ,5
35.	MD – kVA – TZ3	1.0.9.6.3.255	4 / 2 ,5
36.	MD – kVA – TZ4	1.0.9.6.4.255	4 / 2 ,5
37.	MD – kVA – TZ5	1.0.9.6.5.255	4 / 2 ,5
38.	MD – kVA – TZ6	1.0.9.6.6.255	4 / 2 ,5
39.	MD – kVA – TZ7	1.0.9.6.7.255	4 / 2 ,5
40.	MD – kVA – TZ8	1.0.9.6.8.255	4 / 2 ,5

NOTES : -

1) The data are stored up to 6 billing cycles. The Billing profile is modeled as Profile generic (IC: = 7) object with OBIS Code 1.0.98.1.0.255. The capture objects of this load profile are as per Table-29. The capture object values will be copied into buffer of this object either

automatically or asynchronously. The capture period is set to zero, billing action is controlled by billing dates as provided in 10 and table 31.

2) Support for Selective access shall be as defined in Section 11.3

3) The current cycle billing parameters shall be readable as the values of the latest billing period, on demand. This shall be in addition to the last 6 billing period data which shall be available in the Profile buffer as the last 6 entries in the buffer.

4) The captured attributes in case of Interface Class 4 (Extended register) used for MD values will be attributes 2 and 5 (Value and Timestamp)

Table 30: Name Plate Details Parameters

(*Clause* F-1)

Sl No	Parameter	OBIS Code A.B.C.D.E.F	Interface Class
1.	Meter Serial Number	0.0.96.1.0.255	1 (Data)
2.	Manufacturer name	0.0.96.1.1.255	1
3.	Firmware Version for meter	1.0.0.2.0.255	1
4.	Meter type (3P-3W / 3P-4W)	0.0.94.91.9.255	1
5.	Internal CT ratio	1.0.0.4.2.255	1
6.	Internal PT ratio	1.0.0.4.3.255	1
7.	Meter year of manufacture	0.0.96.1.4.255	1
NOTE : - For item Sl No 4), a value of “0” indicates 3P-3W; a value of “1” indicates 3P-4W			

Table 31 Programmable Parameters

(*Clause* F-2)

Sl No	Parameter	OBIS Code A.B.C.D.E.F	Interface Class
1.	Real Time Clock – Date and Time	0.0.1.0.0.255	8 (Clock)
2.	Demand Integration Period	1.0.0.8.0.255	1 (Data)
3.	Profile Capture Period	1.0.0.8.4.255	1

4.	Single-action Schedule for Billing Dates	0.0.15.0.0.255	22
5.	Activity Calendar for Time Zones etc.	0.0.13.0.0.255	20

NOTES : -

1 . The parameters are programmable by the utility engineers with required access rights.

2 . Unit for Demand Integration Period and profile capture period is in “seconds”.

3 . Programming of any of the parameters shall increment the “Cumulative programming count” value.

Table 32 Indian Event Reference Table – Voltage Related

(*Clause* G-1 & G-1.1)

SI No	Event ID	Descriptions
i)	1	R-Phase – PT link Missing (Missing Potential) – Occurrence
ii)	2	R-Phase – PT link Missing (Missing Potential) – Restoration
iii)	3	Y-Phase – PT link Missing (Missing Potential) – Occurrence
iv)	4	Y-Phase – PT link Missing (Missing Potential) – Restoration
v)	5	B-Phase – PT link Missing (Missing Potential) – Occurrence
vi)	6	B-Phase – PT link Missing (Missing Potential) – Restoration
vii)	7	Over Voltage in any Phase - Occurrence
viii)	8	Over Voltage in any Phase - Restoration
ix)	9	Low Voltage in any Phase - Occurrence
x)	10	Low Voltage in any Phase - Restoration
xi)	11	Voltage Unbalance - Occurrence
xii)	12	Voltage Unbalance - Restoration

Table 33 Indian Event Reference Table – Current Related

(*Clause* G-1 & G-1.1)

Sl No	Event ID	Descriptions
i)	51	Phase – R CT reverse – Occurrence
ii)	52	Phase – R CT reverse – Restoration
iii)	53	Phase – Y CT reverse – Occurrence
iv)	54	Phase – Y CT reverse – Restoration
v)	55	Phase – B CT reverse – Occurrence
vi)	56	Phase – B CT reverse – Restoration
vii)	57	Phase – R CT Open - Occurrence
viii)	58	Phase – R CT Open - Restoration
ix)	59	Phase – Y CT Open - Occurrence
x)	60	Phase – Y CT Open - Restoration
xi)	61	Phase – B CT Open - Occurrence
xii)	62	Phase – B CT Open - Restoration
xiii)	63	Current Unbalance - Occurrence
xiv)	64	Current Unbalance - Restoration
xv)	65	CT Bypass – Occurrence
xvi)	66	CT Bypass – Restoration
xvii)	67	Over Current in any Phase – Occurrence
xviii)	68	Over Current in any Phase – Restoration

Table 34 Indian Event Reference Table – Power Related

(*Clause* G-1 & G-1.1)

Sl No	Event ID	Descriptions
(1)	(2)	(3)
i)	101	Power failure (3 phase) – Occurrence
ii)	102	Power failure (3 phase) – Restoration

Table 35 Indian Event Reference Table – Transaction Related

(*Clause* G-1 & G-1.1)

Sl No	Event ID	Descriptions
(1)	(2)	(3)
i)	151	Real Time Clock – Date and Time
ii)	152	Demand Integration Period
iii)	153	Profile Capture Period
iv)	154	Single-action Schedule for Billing Dates
v)	155	Activity Calendar for Time Zones etc.

Table 36 Indian Event Reference Table – Others

(*Clause* G-1 & G-1.1)

Sl No	Event ID	Descriptions
i)	201	Influence of Permanent Magnet or AC/ DC Electromagnet - Occurrence
ii)	202	Influence of Permanent Magnet or AC/ DC Electromagnet - Restoration
iii)	203	Neutral Disturbance - HF & DC - Occurrence

iv)	204	Neutral Disturbance - HF & DC - Restoration
v)	205	Very Low PF - Occurrence
vi)	206	Very Low PF - Restoration

Table 37 Indian Event Reference Table – Non Roll Over Events

(*Clause* G-1 & G-1.1)

Sl.No.	Event ID	Descriptions
i)	251	Meter Cover Opening – Occurrence

Table 38 Indian Event Reference Table – Control Events

(*Clause* G-1.1)

Sl No	Event ID	Descriptions
i)	301	Meter disconnected
ii)	302	Meter connected

Table 39 Capture Parameters for Events

(*Clauses* B-6.4, B 6.5 and G-1)

Sl No	Parameter	A	B	C	D	E	F	IC
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Date and Time of event	0	0	1	0	0	255	8 (Clock)
ii)	Event Code	0	0	96	11	0	255	1 (Data)
iii)	Current - IR	1	0	31	7	0	255	3 (Register)
iv)	Current - IY	1	0	51	7	0	255	3 (Register)
v)	Current – IB	1	0	71	7	0	255	3 (Register)

vi)	Voltage - VRN (3 Φ / 4W)	1	0	32	7	0	255	3 (Register)
vii)	Voltage – VYN (3 Φ / 4W)	1	0	52	7	0	255	3 (Register)
viii)	Voltage – VBN (3 Φ / 4W)	1	0	72	7	0	255	3 (Register)
ix)	Power Factor – R phase	1	0	33	7	0	255	3 (Register)
x)	Power Factor – Y phase	1	0	53	7	0	255	3 (Register)
xi)	Power Factor – B phase	1	0	73	7	0	255	3 (Register)
xii)	Cumulative Energy – kWh	1	0	1	8	0	255	3 (Register)

ANNEXURE-VI

Tamper Logic:

Feeder Meter CAT A

	TAMPERS	Occ Condition	REST. CONDITIONS	OCC TIME(MIN)	REST. TIME(MIN)
1	**Missing potential**	Vx< 5% Vref	Vx> 40% Vref	5	
		Any other phase voltage > 75% of Vref	Any other phase voltage > 75% of Vref		
		I3x> 10 % of Ib	I3x> 10 % of Ib		
		Missing potential tamper detection will be phase wise			
2	**Voltage Unbalance**			5	
		V3x> 75% Vref	V3x> 75% Vref		
		Vmax-Vmin> 30% Vref	Vmax-Vmin<30% Vref		
		I3x> 10 % of Ib	I3x> 10 % of Ib		
3	**Low Voltage**	Vx< 60% Vref	V3x> 70% Vref	5	
		Current Ignored	Current Ignored		
4	**High Voltage**	Vx>120% Vref	V3x< 120% Vref	5	
		Current Ignored	Current Ignored		
		Voltage Unbalance should not occur with high voltage event.			
5	**Power Failure**	If power goes off for more than the persistance time or all phase voltage goes less than 30% of Vref		5	Immediate
6	**Current Open**	Residual Current >20% Ib	Residual Current<20% Ib	5	
		Ix< 2% Ib	Ix Ignored		

		Average line Current :Ignored	Average Current > 10% of Ib	
		V3x>60% Vref	V3x> 60% Vref	
7	**Current Bypass**	Residual Current >20% Ib	Residual Current <20% Ib	5
		Ix>2% Ib	Ix Ignored	
		Average line Current :Ignored	Average Current > 10% Ib	
		V3x>60% Vref	V3x>60% Vref	
8	**Current Unbalance**	Residual Current < 20% Ib	Residual Current < 20% Ib	5
		Imax- Imin > 30% 0f Imax for that period	Imax- Imin <27% 0f Imax for that period	
		Average Line Current> 10% Ib	Average Line Current> 10% Ib	
		In> 5% of Ib	In Ignore	
		V3x>60 % Vref	V3x>60 % Vref	
	Current Unbalance tamper should occur only on activation of Neutral CT			
9	**Current Reversal**	Ix> 10 % Ib	Ix> 10 % Ib	5
		Direction : Negative	Direction: positive	
		Net Power Factor> 0.5	Net Power Factor> 0.5	
	Current Reversal detection will be phase wise			
10	**Over Current**	Ix> 100 % Imax	I3x< 100 % Imax	5
	No Current Unbalance tamper furthur log with Over Current			
11		V3x> 60% Vref	V3x> 60% Vref	5
		Ix> 10% Ib	Ix> 10% Ib	
	Low PF	P.F.< 0.5	P.F.> 0.5	
12	**Cover Open**	On removal of meter cover the meter will log cover open event along with date and time.		Immediate. No Restoration
13	**Invalid Phase Association**	When Voltage or current sequence is different. For example: Voltage sequence RYB and Current sequence is YBR	When voltage or current sequence is same	No tamper will be logged except low pf if satisfied after 5 Mins
	In case of Low and High Voltage Tamper, no current related tamper will be logged except CT Reverse Tamper			

V3x= Voltage in All Phases

Vx= Voltage In Any Phase

I3X= Current in All Phases

IX= Current in any phase

SCHEDULE - II
Undertaking from Meter manufacturer

We hereby confirm that the Meter(s) type _____
i)
ii)
iii)

offered by us against your tender No._____ through M/s._____ are in our range of production.

We also confirm that these meters 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 :

We have offered our meter(s) type _____
i)
ii)
iii)

to M/s. _____ against WBSEDCL's tender no._____. In this connection we hereby confirm that we would be extending all the required technical support and back-up guarantee to M/s._____ for the above mentioned meter(s).

Name & Designation :

Company Seal :
