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CEB
SPECIFICATION

**MEDIUM VOLTAGE GAS INSULATED
SWITCHGEAR PANELS**



**CEYLON ELECTRICITY BOARD
SRI LANKA**



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SPECIFICATION FOR MEDIUM VOLTAGE GAS INSULATED SWITCHGEAR PANELS

1.0 SCOPE

This specification covers the general requirements of the design, manufacture, testing, supply and delivery of following categories of Medium Voltage Gas Insulated Switchgear (GIS) Panels with necessary measuring, control & protection equipment.

1. 12kV Radial/ Ring/ MV Metering/ Bus Section/ Feeder GIS Panels of rated continuous current 800A/1250A with circuit breakers of Control Circuit Voltage 110 / 48/ 24 Vdc.
2. 36kV Feeder/ MV Metering/ Bus Section/Transformer Control GIS Panels of rated continuous current 630A/800A with circuit breakers of Control Circuit Voltage 110 / 48/ 24 Vdc.

The required GIS panel type, bus bar rating and the control circuit voltage will be as indicated in the price schedule.

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage	11kV	33kV
(b)	System highest voltage	12kV	36kV
(c)	System frequency	50 Hz	50 Hz
(d)	Number of phases	03	03
(e)	Method of earthing	Effectively earthed/ Resistively Earthed	Non effectively earthed
(f)	System fault level	25 kA	25kA

3.0 SERVICE CONDITIONS

(a)	Annual average ambient temperature	30 °C
(b)	Maximum ambient temperature	40 °C
(c)	Maximum relative humidity	90%
(d)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere
(e)	Operational altitude	0 – 1000m MSL
(f)	Isokeraunic (Thunder days) level	100 days



4.0 APPLICABLE STANDARDS

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof.

(a)	IEC 62271-200:2011	A.C. Metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to 52kV
(b)	IEC 62271-100:2008	High voltage alternating current circuit breakers
(c)	IEC 62271-102:2001	A.C. disconnectors and earthing switches
(d)	IEC 61869-2:1986	Instrument transformers – Part 2: Additional requirements for current transformers
(e)	IEC 61869-3:1980	Instrument transformers – Part 3: Additional requirements for voltage transformers
(f)	IEC 60255:1996	Electrical Relays
(g)	IEC 60529:1989	Degrees of protection provided by enclosures
(h)	BS 159:1992	Busbars and Busbar connections
(i)	BS 5493:1977	Code of practice for protective coating of Iron and Steel structures against corrosion
(j)	IEC 60243-1:2013	Electric strength of insulating materials - Test methods - Part 1: Tests at power frequencies
(k)	IEC 61850	Communication networks and systems in substation
(l)	IEC 60870-5-104:2006	Network access for IEC 60870-5-101
(m)	IEC 60870-5-103:1997	Companion standards for the informative interface of protection system
(n)	IEC 60870-5-101:2003	Companion standard for basic telecontrol tasks
(o)	IEC 60455-2:2015	Resin based reactive compounds used for electrical insulation – Part 2: Methods of test
(p)	IEC 60455-2-2:1984	Specification for solventless polymerisable resinous compounds used for electrical insulation - Part 2-2: Methods of test - Test methods for coating powders for electrical purposes.
(q)	IEC 61036:1996	Alternating Current Static Watt-Hour Meters for Active Energy (Classes 1 and 2)
(r)	ISO/EN 12944-2:1998	Paints and varnishes - Corrosion protection of steel structures by protective paint systems

5.0 TECHNICAL FEATURES

5.1 Basic Features

(a)	Rated Voltage	12kV	36kV
(b)	Design of panels	Shall be of metal clad SF ₆ Insulated and extensible type suitable for indoor application	
(c)	Frequency	50Hz	50Hz
(d)	Rated insulation levels		
	(i) Impulse (1.2/50 μ s) withstand voltage (peak)	75kV	170kV
	(ii) Power frequency withstand voltage (rms)	28kV	70kV
(e)	Rated short time current / duration	25kA /1 Sec	25kA/ 1 Sec



(f)	Degree of protection (as per IEC 60529)	Gas enclosed compartments shall be IP65 as per IEC 60529. Other compartments shall be IP 4X. All ventilation louvers if any, shall be vermin-proof and shall be provided with filter to minimize ingress of dust.
(g)	Temperature rise	As per IEC 62271

5.2 GIS Panel Construction

- 5.2.1** The panels shall be of free standing type with rear bottom cable entry facility for underground cables. They shall be completed with all necessary terminal plates, cable glands for cable entry, wiring trunkings for small wiring and multi core cables. Wiring trunkings shall be of adequate sizes for accommodating incoming and outgoing cables for present and future requirements.
- 5.2.2** All primary voltage live parts shall be hermetically pressure sealed with SF₆, except for outside terminals which shall be covered by a plug-in type bushings. Each element shall be in independent modules (Independent compartment) and safe to touch and fully ensure operational security and personnel safety under all normal and fault conditions. These individual elements must be able to be monitored and maintained as required without disturbing the other compartments except for busbar chambers. Combination of disconnecter and earthing switch (3-position switch) in one module can be accepted.
- 5.2.3** For each panel a separate cable connection compartment and a low voltage compartment shall be provided. The switchboard panel shall be suitable for mounting on a concrete floor or plinth through a suitable steel frame (which shall be provided with the panel supply) and necessary foundation fixing bolts and rails shall also be provided. The size of the panel shall preferably not exceed 1250mm (depth), 2000mm (height) and 600mm (width, except for bus section panel). All steelwork including doors shall be constructed of steel sheets with a minimum thickness of 2mm. Doors shall be equipped with concealed hinges, with foamed-in seal. Each door shall be fitted with suitable earth straps of at least 16mm² highly flexible stranded copper wire with insulation in green-yellow color.
- 5.2.4** The outer surface of the switchgear panel shall have light gray (RAL 7035) colour or any other CEB approved colour powder coating finish suitable for indoor application. All panels shall be designed and treated for corrosivity environment C5 category as per ISO/EN 12944-2. The surface shall be thorough cleaned and shall be treated with hot zinc dip/spray of minimum 50 micron thickness. Then it shall be painted with a etch primer minimum thickness of 50 micron and minimum thickness of 100 micron undercoating. Then it shall be painted with a gloss or semi-gloss paint of minimum 50 micron thickness. The ultimate dry film thickness (DFT) shall not be less than 300 microns. (ISO/EN 12944-2)
- 5.2.5** Side plates for panels shall match to cover three sets of panels as the minimum quantity. Provision for nomenclature plate should be fixed in front of the panel. This plate should be removable type and made for easy marking.
- 5.2.6** External effects of internal arc shall be limited by pressure relief openings or suitable design to prevent any danger to an operator during the time he performs his normal duties and shall not enter into adjacent panels thereby preventing spreading of the fault. The pressure surge shall be cooled in the absorber before its release into the switchgear room. Test evidence in accordance with IEC 60298 to verify the design is required.
- 5.2.7** The bidder shall provide connection diagrams for the termination of all incoming cabling.



5.3 Circuit Breaker

5.3.1 Ratings

(a)	Rated Voltage	12kV	36kV
(b)	Rated Normal Current(as per the price schedule)	800 / 1250 A	630 / 800 A
(c)	Rated short circuit breaking current (rms)	25 kA	25 kA
(d)	Rated short circuit making current (rms)	62.5 kA	62.5 kA

5.3.2 General

Circuit breaker shall be 3 pole indoor type with replaceable vacuum interrupters. Its first pole to clear factor shall be 1.5.

5.3.3 Control Mechanism

Manual and electrical charged spring assisted, trip free type with anti-pumping relay. This shall have simultaneous 3 pole operation. Circuit breaker operation with remote / local control selector switch and manual operation facility shall be provided.

Circuit breakers shall be designed so that they cannot be closed unless the closing spring is fully charged.

5.3.4 Duty cycle

Duty cycle of the circuit breaker shall be 'O' – 0.3 s – 'CO' – 3 min. – 'CO'.

5.3.5 Circuit Breaker Maintenance/Attendance

Live parts and interrupter shall be within gas insulated medium. Attendance and maintenance shall be possible to the other parts of the circuit breaker without gas releasing.

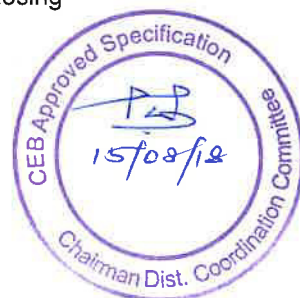
5.3.6 Control circuit

The control power supply to trip and closing coil circuits shall be provided with a separate isolating switch. Voltage shall be 110 / 48/ 24 VDC as specified in price schedule. Auxiliary contact of this switch shall be wired to alarm when the switch is in open position. Both positive and negative poles of the close coil shall be switched. At least 5 N/O & 5 N/C auxiliary contacts shall be provided.

5.3.7 Electrical spring charging motor

Shall be operated through LV AC source and same control circuit voltage specified in the price schedule. All AC and DC power other than control circuit shall have separate breakers located in LV compartment.

Normally spring charging is done with AC power source, which will be converted to DC power and in the absence of AC power, automatic selection of DC power source shall be switched. Recharging of closing spring shall occur automatically as soon as the closing spring is released.



5.3.8 Minimum number of close-open operations that can be performed by the mechanism with single spring charge

The energy storage capability of the mechanism must be sufficient for 'O'-'CO' operation without auxiliary supply.

5.4 Busbars

Vertical sections (tee-off droppers) shall be connected to the main busbar by means of sub-busbar. Interconnection of main busbars in each switchgear panel shall be plug-in type or equivalent means for easy installation.

Bus bars shall be in three phase or single phase enclosure with an independent SF6 gas insulated module with provision for extending at either end. Each panel shall be able to remove without removing adjacent panels but only the bus bar links.

Provision shall be made to allow the thermal expansion of the busbar conductors due to normal load current and short circuit currents. The bus bar and its connections shall be able to withstand the mechanical stresses under the specified short circuit conditions.

5.4.1 Ratings

(a)	Rated Voltage	12kV	36kV
(b)	Rated Continuous Current	800/1250 A	630/800 A
(c)	Minimum creepage distances of insulation exposed to air	360mm	1080 mm

5.4.2 Type and material

The primary circuit shall be of single busbar type and shall be made of electrical grade high conductivity, hard drawn copper capable of carrying continuous current specified.

5.4.3 Insulation

Insulation of live parts exposed to air shall be epoxy resin. In case of gas insulated compartments all live parts and interconnection between panels shall be insulated with SF6.

Insulating material as well as epoxy components such as busbar supports, insulators etc. should be subjected to testing for mechanical, thermal and electrical properties such as tensile and compressive strengths, glass transition temperature and proof tracking index as per IEC 60455-2 & 60455-2-2. Reports of tests carried out to this effect should be annexed to the offer.

5.5 Current Transformers

5.5.1 General

Current transformers shall conform to IEC 61869-2 standard with CT ratios specified in clause 5.16.

5.5.2 Accuracy Class, Instrument Security Factor and Accuracy Limit Factor:

(i) Measuring	3.0, FS 5
(ii) Metering	0.2, FS 5
(iii) Protection	5P20



5.5.3 Burden

Burden of the current transformers shall be kept above that of measuring, metering and protection equipment.

5.6 Voltage Transformers

5.6.1 General

Three Phase voltage transformers (VTs) shall conform to IEC 61869-3 standard with rated insulation levels specified in clause 5.1 (d) and secondary voltage of 110 V. The insulation medium of the VTs shall be cast epoxy resin type.

For the secondary winding protection of the VTs HRC type fuses or MCBs shall be provided, within the LV compartment.

5.6.2 Accuracy Class

(i) Measuring	1.0
(ii) Metering	0.2

5.6.3 Rated Voltage Factor and Burden

Rated Voltage factor of the VTs shall be 1.2 and burden shall be 50VA.

5.7 Energy Metering Instruments

5.7.1 Applicable Standard

CEB Specification 071-1:2017 (Except for the method of mounting).

5.7.2 Mounting and Meter Reading

Flush (preferred) or Semi-Flush Mounted meters shall be provided. Energy meters shall be readable without opening any front covers/doors of the panel and shall be of tamper proof sealable type.

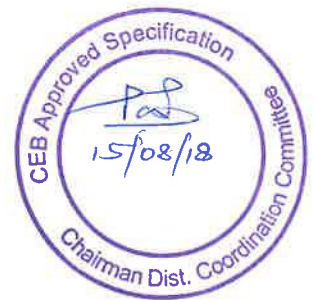
5.8 Cable Terminations

Cable terminations shall be push on (plug-in type) type suitable for use with XLPE/SWA UG cable with copper conductor and provision for earthing the screen & armour. Dual cable termination may be provided as required. The cable entry shall be through the rear bottom plate of the cable box below the termination point. The cable termination compartment shall be easily accessible. Cable glands shall be of Brass and shall fit for cables from 70 to 240 mm² for three core and up to 500 mm² for single core cables. The type of bottom plate shall be determined as per the CT ratio of the GIS Panel. The exact type of bottom plate shall be determined after awarding the contract without any cost variation.

Facilities shall be provided for high voltage testing and fault location of cables conveniently without causing major disruption to the arrangement. How to access the cables for testing shall be described in detail with the offer. Any accessory required for this purpose shall be provided in one accessory for six panels proportion.

5.9 Earthing

An un-insulated electrolytic copper grounding bus sized for the rated short circuit current and running the entire length of the switchgear assembly shall be provided. Provision shall be made for extending the ground bus at either end without the need for cutting or drilling the copper bar.



All metallic parts and panels of the functional units intended to be earthed shall be bonded to the earthing path of the panel which ultimately shall be bonded to the grounding bus. All hinged doors shall be properly bonded by un-spliced flexible wire or 10mm^2 Cu braids to the panel. All panels, devices or equipment shall be grounded as required.

Two (2) solderless type ground connectors shall be provided to connect to the grounding bus, one on each end section of the bus. Each grounding connection to the ground bus shall be arranged so that each may be disconnected without disturbing the continuity of the ground bus or any other ground connection.

The ground connectors shall be bare copper 150mm^2 ground conductor, the current density of which shall not exceed 200 A/mm^2 under the specified earth fault conditions.

5.10 Panel Wiring

All external control cables/wires shall be brought to the panel from the bottom, unless otherwise specified. Control cables/wires shall enter the panel through suitable cable glands to prevent contact with sharp metal edges. The gland-plate assembly shall be vermin proof.

There shall be no wiring run as single cores through grommets. The AC wiring shall be bundled separately from DC wiring in the same raceway. Signaling cables shall be shielded type and run in a separate raceway and shall be separated as far as practical from all LV power cables and at right angle to such wiring when the spacing is less than 300 mm.

All wiring within the switchgear shall be installed and tested at the factory unless otherwise specified. All wiring shall be heat and flame retardant, rated 90°C maximum operating temperature, rated 600/1000V, insulated, tinned, stranded annealed copper conductor, and shall not be smaller than 2.5 mm^2 for CT circuits.

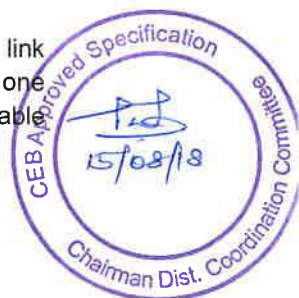
For SCADA digital and analog input signals, Annunciator and status/alarm signaling circuits wiring size shall not be less than 0.5mm^2 up to the first termination point, only if the associated device cannot accommodate larger wire sizes. For SCADA Control Output Signals and all other circuits the wiring size shall not be less than 1.5mm^2 .

All wires shall be adequately rated for thermal withstand of short circuit currents, in accordance with back-up tripping time.

Wiring for lights, space heaters and convenience outlets may be run in the same raceway in individual panels and in rigid or PVC jacketed flexible conduits between panels. Wiring of meters/relays mounted on doors shall be mechanically protected.

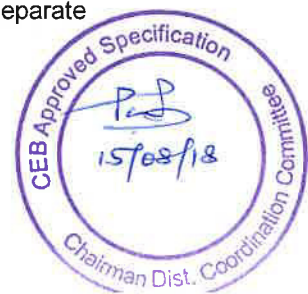
Where panels are to be shipped in sections and assembled in the field, the wiring between sections shall be provided preformed. One end of the wire shall be terminated on terminal block and the other end shall be bundled and tagged properly.

- (i) Labelling shall be provided with each panel and each circuit. Color coding of panel wiring shall be used to differentiate AC vs DC, 3 phases, Alarm circuits, CT and VT circuits.
- (ii) Cabling from CTs:
 - (a) The CT terminal blocks at the first accessible point of termination shall have shorting and grounding facilities by means of a copper bar with shorting screws.
 - (b) Each CT circuit shall be provided with a disconnectable ground link. Opening of the link shall enable all CT and relay wiring to be tested clear of ground. There shall be only one ground link per CT circuit. The termination between the ground bus bar and the isolatable



link shall be numbered starting with "C" for Overcurrent, "M" for Metering and "B" for Bus Differential.

- (c) CT terminals shall be grouped by function and then sub-grouped by phase. Each phase shall be labeled by appropriate labels attached to the terminal blocks. Each complete CT shall be identified by function and reference number. Where a CT has a multi ratio using secondary tapings, such as S1,S2, S3; the CT terminal block shall have four (4) terminals: S1, S2, S3 and ground.
- (d) The shorting bar shall cover the four terminals of each phase. The bar shall be grounded through the grounding terminal block. The other end of the bar shall be held by an insulated screw. Adjacent to the CT terminal blocks two end stops shall be located with an appropriate label mounted between them. Each stop shall have formed holes that shall be used to store the CT shorting screws.
- (e) All tapping of multi ratio CTs shall be terminated at the terminal blocks which shall be clearly marked to designate the CTs phase and ratio in use.
- (iii) The general arrangement of all indicating devices, control switches and relays etc. and single line diagram & schematic diagrams of control & protection schemes shall be to the approval of CEB.
- (iv) Both ends of every wire core and all secondary panel wiring shall be fitted with numbered ferrules of moisture and oil-resisting insulation material having a glossy finish, and with their identification numbers clearly engraved, each being the same as for the relevant terminal. All wiring shall be made without splices. The control wires shall be multi-stranded flexible and shall be terminated with size 1 hooked crimps or ring type terminals as applicable. Spade type, pin type or boot lace type crimp terminals are not acceptable.
- (v) Ferrules permanently marked, of white colour with black letters, shall be fitted in such a way that they cannot become detached when the wire is removed from the terminal (i.e. end crimps shall be provided) and shall be made of material that will not deform or deteriorate and shall withstand a temperature of 90°C. Adhesive type terminal markers are not acceptable.
- (vi) Terminal blocks shall be numbered consequently in both sides, preferably beginning with 1, from left to right or top to bottom. Terminal blocks shall have 20% spare terminals of each type. Spare cores shall also be numbered. All spare contacts from protective relays or tripping relays shall be wired to the terminal blocks for future use.
 - (a) Terminal blocks shall be screw clamp type termination and shall be heat and fire resistant. If a common termination is required between terminal blocks, preformed wire jumpers or manufacture's own shorting bar can be used. Compatible end stops, end plates, barriers and terminal block identifiers shall be used. Groups of terminal blocks shall be identified using engraved labels.
 - (b) Not more than 2 (two) terminations shall be connected to one side of a terminal block. In special circumstances where wire sizes exceed the terminal block capability, correctly sized terminal blocks shall be used.
 - (c) In all instances, terminal blocks shall be mounted on DIN rails.
 - (d) Terminal blocks shall be grouped according to function, i.e. Power Supplies (AC or DC), VT, CT, DC controls, annunciation, SCADA etc. and the function shall be labeled accordingly. Terminal blocks for different voltages (AC/DC) shall be located on separate DIN rails.



- (e) All VT circuits shall be provided with sliding link type terminal blocks to facilitate isolation of VTs from the circuit to perform voltage injection tests. These terminal blocks shall be clearly marked with phase, function, core number and ratio.
- (f) At least two (2) spare (1 NO + 1 NC) contacts of lockout relay shall be wired to the terminal block for future use.

5.11 Protection

- (i) Basic features of Numerical Relays:

	Description	Requirement
(a)	Auxiliary Supply	24/48/110 VDC +/- 10%
(b)	Rated VT Secondary	110 V (L-L)
(c)	CT inputs	4 Nos
(d)	VT inputs	3 Nos

- (ii) Settings:

Approximate settings possible shall be as follows.

- Inverse Time Phase Over Current & Earth Fault for both groups 1 & 2

(a)	IEC Curve	Normal Inverse, Very Inverse, Extreme Inverse, Long Inverse (Selectable)
(b)	Pickup	10% to 200% in 1% steps
(c)	Time Multiplier	0.05 to 3.00 in 0.01 steps

- Definite Time Phase Over Current /Earth Fault for both groups 1 & 2

(a)	Pickup	50% to 2000% in 1% steps
(b)	Time Delay	0 s to 20 s in 0.01 s steps

- Differential – instantaneous for both groups 1 & 2

- (iii) Minimum 3 Nos. Binary inputs and 3 Nos. Binary outputs shall be provided as spares other than the Binary input/output which are already used in the control and indication circuit.

- (iv) Memory and Recording Features:

(a) Relay should have event log, trip log and Oscillographic disturbance record (DR). All logs should go into history. All tripping of relay should initiate DR without extra binary input. Triggering of DR with binary input should be user configurable.

(b) Relays shall be able to be synchronized with an external GPS Clock. The fault should be date and time stamped.

- (v) The relays used shall only be from the following manufactures of the countries indicated.

- ABB Relays AB, Sweden/Switzerland/Germany
- Alstom France/ England
- Toshiba Corporation, Japan
- Siemens AG, Germany
- Group Schneider, England/France/Italy
- Schweitzer Engineering Laboratories, Inc. (SEL), USA
- General Electric, USA



- (vi) The numerical relay unit shall be suitable for use in the tropical climatic as given under the clause 3.0 service conditions. The relay should be able to be tested by external test sets using the panel wiring and terminal block without any modifications.
- (vii) Conformal Coating should be provided to protect printed circuits boards from the contaminants in the environment, moisture and dust. Bidder should submit the detail and documents to prove the standards and the specifications of materials used for conformal coating with their offer.
- (viii) It shall be possible to select required type of IDMT characteristics for over current and earth fault protection. Relay should contain at least two relay protection groups and the remote and manual changing of the relay protection group.
- (ix) The numerical relay unit shall have RS485 interface to communicate with the RTU via IEC 60870-5-103 protocol (or Ethernet Interface to communicate through TCP/IP with RTU via IEC 61850). All the addresses and other information for each parameter shall be provided by the supplier with regards to data communication with the relay.
- (x) Trip output of the relay should not be latched type.
- (xi) The relay should have facility to monitor the healthiness of its circuits and components by own watchdog monitoring system.
- (xii) All the numerical type protective relays shall be able to program / parameterized directly (locally) by a portable computer (PC). The complete software working on Windows OS running on a portable computer / laptop, for relay configuring, operation testing, should be provided with installation guidelines, free of cost. All other accessories equipment needed to communicate with the relays shall be provided.
- (xiii) Relay contacts shall be suitable for making and breaking the maximum currents which they may be required to control in normal service but where contacts of the protective relays are unable to deal directly with the tripping currents, approved auxiliary contacts, relays or auxiliary switches shall be provided. In such cases the number of auxiliary contacts or tripping relays operating in tandem shall be kept to the minimum in order to achieve fast fault clearance times. Separate contacts shall be provided for alarm and tripping functions.
- (xiv) Relays shall be provided with clearly inscribed labels describing their application, version, type, serial number and rating etc. in addition to the general purpose labels. To minimize the effect of electrolysis, relay coils operating on DC shall be so connected that the coils are not continuously energized from the positive pole of the battery. Relay shall be suitable for operation on DC systems as specified in Technical Particulars and Guarantees, without the use of voltage dropping resistors. Terminal arrangements shall be to the engineer's approval.
- (xv) All protection relays shall be equipped with dedicated DC supply via MCB. The DC supply of all the protection relays shall be maintained by means of an auxiliary contact of the related MCB, which provide an alarm in case of loss of supply. Any interruption of the DC supply to relays (internal and external) shall initiate an alarm. The type and rating of above MCBs shall be acceptable to CEB.
- (xvi) Converters and inverters used for feeding relays shall have their outputs monitored and shall initiate an alarm in the event they fail. These devices shall be of short circuit proof design. All relays shall be adequately protected against damage from incoming surge and shall meet relevant IEC standards.
- (xvii) Following shall be configured and engineered in relay to send the signals using the IEC 60870-5-103 protocol via RS485 to acquire/receive relevant information to/from RTU of the SCADA system. (or IEC 61850 protocol via TCP/IP Ethernet Port)



(a)	Alarms / Signals / Indications	<ul style="list-style-type: none"> • Over Current IDMT • Over Current Definite Time • Over/Under Voltage • Earth Fault IDMT • Earth Fault Definite Time • Differential (Instantaneous) • Relay Group Indication 1 • Relay Group Indication 2 • Circuit Breaker Spring Charge Failure • Protection Relay Watch Dog (Protection relay fail) • Trip circuit supervision • Circuit breaker status indicators • Isolator status indicators • Earth switch status indicators • Gas pressure low • Circuit Breaker Lockout
(b)	Measurement	<ul style="list-style-type: none"> • Current Measurement • Voltage Measurement
(c)	Controls	<ul style="list-style-type: none"> • Relay Group Setting Change to 1 • Relay Group Setting Change to 2 • Circuit breaker control • Isolator control

(xviii) Protection scheme for Relay:

	ANSI Code	Protection Function	Feeder Type		
			Incoming & Outgoing	Transformer & HT metering	Bus Section
(a)	51	IDMT Over Current	X	X	X
(b)	51N	IDMT Earth Fault	X	X	X
(c)	50	Definite Time Over Current 1	X	X	X
(d)	50N	Definite Time Earth Current 1	X	X	X
(e)	50	Definite Time Over Current 2	X	X	X
(f)	50N	Definite Time Earth Current 2	X	X	X
(g)	87	Differential	X	X	X
(h)	59/27	Over/Under Voltage	X		
(i)	50BF	Breaker Failure	X	X	X
(j)		Number of protection setting groups	2	2	2
(k)		Self-supervision of the relay	X	X	X
(l)	74TC	Trip circuit Supervision	X	X	X
(m)		Additional Functions			
(n)		Oscillographic fault records	X	X	X
(o)		Event logging / fault logging	X	X	X
(p)		Relay alarm / Trip Indication Reset	X	X	X
(q)		Measurements			
(r)		Voltage, Current	X	X	X
(s)		Zero sequence current measurement	X	X	X



5.12 Relays, Meters and Instruments

Relays, meters and instruments shall be located in a low voltage compartment of the same feeder breaker panel.

All protective relays shall be mounted in 19 inch racks.

Target indicators shall be provided on all relays performing protective or tripping functions. Relay contacts shall be self-aligning.

The meters shall be fitted with dust and moisture proof covers and shall have non-reflecting glass. Analog meters shall have 240° scale and dimensions 96 x 96mm.

Meters, instruments and indicating type transducers shall have test facilities separate from protective relays, so that testing and calibration can be done without equipment outages. Test facilities, suitably shrouded, shall be similar in function to type FT-1 test switches and shall be mounted on the front panel.

Upper edge of protective relays and meters shall be no higher than 2.2m to allow convenient maintenance, inspection, target reset, and testing from ground level. As a special case, where upper edge of protective relays higher than 2.2 m, suitable means shall be provided for the accessibility to the relays with CEB prior approval.

All accessories such as DC/DC converters and transducers shall be located inside the panel or as specified by CEB.

Indicating lights of panels shall have a current limiting resistor to facilitate replacing the bulb without activating the respective trip/close coil. The rating of the resistor shall be selected to provide adequate illumination of the lamp at normal operating conditions. Shorting of the lamp terminals shall not damage the resistor itself or blow the control circuit fuses (or trip the control circuit MCBs) considering that maximum DC control voltage is limited to 110% of its nominal rating. This shall be met by restricting the current passing through the trip coil to less than 25% of its minimum pick-up current.

The trip 1, trip 2, close and spring charge circuit MCBs shall be located at the switchgear in the LV compartment.

All switchgear MCBs shall have normally open auxiliary contacts. Each breaker shall have its MCB contacts connected in series with the Trip Circuit 1 positive supply located on that breaker. Any MCB operation shall de-energize the breaker DC supervision relay and provide an alarm.

In substations, with Substation Automation IEDs shall be installed in the LV compartment.

5.13 Interlocks and Safety Features

The switchgear shall be provided with a system of preventive mechanical interlocks to protect the equipment, operator and service personnel from the dangers of mal-operations. CB, DS and ES shall be provided with adequate number of auxiliary contacts for interlocking purposes without the use of contact multiplying relays.

Grounding switches shall be mechanically and electrically interlocked with associated disconnection switch such that closing operation of grounding switch shall not be possible unless the related disconnection switch is in open position.

Grounding switch of an incoming transformer line shall also be interlocked with transformer HV breaker and transformer HV disconnect switch such that closing operation of grounding switch in LV side shall not be possible unless HV breaker and HV disconnect switch are open and HV



breaker closing operation is not possible unless grounding switch in LV side is open and vice versa. LV circuit breaker closing shall not be possible unless HV circuit breaker is closed.

Bus bar grounding switch shall be interlocked with the incoming circuit breaker and bus section breaker as well as with all outgoing breakers on the respective bus side, such that closing operation of grounding switch shall not be possible unless all associated circuit breakers and disconnectors are open and vice versa, the associated circuit breakers and disconnectors closing operations shall not be possible unless the bus bar grounding switch is open.

5.14 SCADA Provision

The following shall be provided by the supplier for the completion of the SCADA System which will be provided by another party.

- (i) All necessary equipment and material including auxiliary relays, cables, cable containment, wiring terminal blocks, test switches, isolation devices and labeling.
- (ii) All the wiring and terminations from protective relays, auxiliary contacts and energy meters to the relevant destinations detailed in the "Input Output Schedule for the SCADA system".
- (iii) Sufficient digital inputs and outputs in the numerical protection relays and auxiliary contacts must be available to initiate / process the following in the "Input output Schedule for the SCADA system".

- Double Command (DC) via auxiliary contacts

Two auxiliary contacts with one normally on state and other in normally off state are wired up to for two independent volt free contacts which will create the operation upon the double command information received through RTU of the SCADA.

- Single Command (SC) through relays

Relay is configured to receive single point information through IEC 60870 via RS485 from RTU of the SCADA system and to carry out the necessary operations.

- Single Point (SP) through relays

Single signal of normally on state is configured by the protection relay as binary input and send through IEC 60870-5-103 via RS485 or IEC 61850 to the RTU of the SCADA system.

- Single Point (SP) via Auxiliary contact

Single signal is taken from an independent volt free contact in normally on state and wired to an auxiliary contact on the circuit breaker panel which shall send the signal to the RTU of the SCADA system.

- Double Point (DP) via Auxiliary contact

Two signals are taken from two independent volt free contacts with one in normally on state and other in normally off state. They shall be wired up to two adjacent auxiliary contacts on the terminal block which shall send the each signal to the RTU of the SCADA system.

- Double Values (DV) Measurement

Protection relays in clause 5.11 shall be configured and engineered to provide Current, Voltage measurement values to a RTU the SCADA system through IEC 60870-5-103 via RS485.

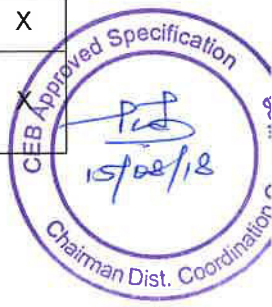


- Energy Measurement

Energy meters in clause 5.7 should be wired to auxiliary contact at terminal block configured to provide a switching contact accordance with the energy (kWh) to RTU as a counter to the SCADA to calculate energy.

(iv) Input Output Schedule for the SCADA system.

	SCADA Provision	Signal Type	Taken from or Sent to	Feeder Type				
				Ring & Radial	Outgoing	Transformer	HT Metered	Bus bar
Measurements	Voltage	DV	Relay		X		X	X
	Current	DV	Relay	X	X	X	X	X
	Energy	Switching	Energy Meter				X	
Controls	Circuit Breaker Open / Close	DC	2xAuxC	X	X	X	X	X
	Relay Protection Group Change to 1	SC	Relay	X	X	X	X	X
	Relay Protection Group Change to 2	SC	Relay	X	X	X	X	X
Status indications	Circuit Breaker Open / Close	DP	2xAuxC	X	X	X	X	X
	Isolator Position	DP	2xAuxC	X	X	X	X	X
	Gas Pressure Low	SP	1xAuxC	X	X	X	X	X
	Circuit breaker lock out	SP	Relay	X	X	X	X	X
	Earth position Open / Close	DP	2xAuxC	X	X	X	X	X
	Panel Control Local / Supervisory	DP	2xAuxC	X	X	X	X	X
	Relay Protection Setting Group Position 1	SP	Relay	X	X	X	X	X
	Relay Protection Setting Group Position 2	SP	Relay	X	X	X	X	X
Alarm / Trip Indications	Over Current Operated IDMT	SP	Relay	X	X	X	X	X
	Earth Fault Operated IDMT	SP	Relay	X	X	X	X	X
	Over Current Operated Definite Time (1 &2)	SP	Relay	X	X	X	X	X
	Differential	SP	Relay	X	X	X		X
	Earth Fault Operated Definite Time	SP	Relay	X	X	X	X	



(1 &2)								
Relay Faulty	SP	Relay	X	X	X	X	X	X
Trip Circuit Fail	SP	Relay	X	X	X	X	X	X
Circuit Breaker Spring Charge Fail	SP	Relay	X	X	X	X	X	X
11kV Panels Auxiliary DC MCB Trip / Off	SP	MCB 1xAuxC	X	X	X	X	X	X
11kV Panels Auxiliary DC MCB Trip / Off Group alarm for all panels	SP	MCB 1xAuxC	X	X	X	X	X	X

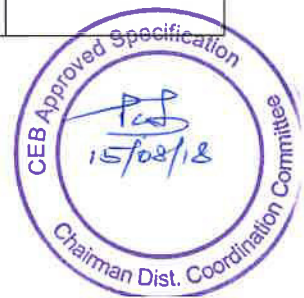
5.15 Auxiliary Circuits

- (i) Two auxiliary contacts should be available to give out a double point signal to indicate the Local / Supervisory status of the panel.
- (ii) Sufficient additional auxiliary contacts shall be provided to accommodate SCADA facility.
- (iii) Control and auxiliary devices shall be segregated by earthed metallic partitions from the main circuit.
- (iv) Terminal and other auxiliary apparatus requiring attention while the equipment is in service, shall be accessible without exposing to high voltage conductors. .
- (v) Auxiliary switches and auxiliary circuits shall be capable of carrying a current of at least 10A at 24/48/110 VDC continuously.
- (vi) PVC insulated flexible copper wire shall be used for control wiring. For the purpose of identification, the control wiring shall be provided with numbered tags to distinguish the different circuits.
- (vii) DC supply to relays, meters and control circuits shall monitor and DC failure alarm shall be available for future SCADA use.

5.16 Types of Switchgear Panels

(a) 12kV GIS Panels

	Bus Section Panel	Radial Feeder Panel	Ring & Feeder Panels	Transformer Control Panel	Metering Panel
Busbar Rating	As per selected bus bar rating				
Circuit Breaker – Normal operating current	As per selected bus bar rating	630 A	630 A	800 A	800A
Current Transformer (3 nos.) ratio for over current, earth fault protection & measurement	Bus bar current : 1-1	600:1-1	400/200:1-1	800/400:1-1	800/400/100:1-1



Ammeter with selector switch with scale range (Multi Scale Plates shall be provided if required)	0-Bus bar current	0-600A	0 – 200/400 A	0-400/800 A	0-100/400/800 A
Current Transformers ratio for Energy Management	-	-	-	-	0-100/400/800 A
3-phase Voltage Transformer ratio for Voltage & Energy Measurement	11 kV/110 V				
Voltmeter with selector switch	Yes	Yes	Yes	Yes	Yes
Integral numerical relay for measuring, protection and control purposes	Yes	Yes	Yes	Yes	Yes
Live Cable Indication	Yes	Yes	Yes	Yes	Yes
Programmable Poly Phase Meter As per CEB Standard 071-1:2017	-	-	-	-	Yes
Auxiliary contacts normally opened and normally closed to be used for new inter tripping connections	-	-	-	Yes	-

(b) 36kV GIS Panels

	Bus Section Panel	Feeder Panel	Transformer Control Panel	Metering Panel
Busbar Rating	As per selected bus bar rating			
Circuit Breaker – Normal operating current	As per selected bus bar rating	630 A	630 A	630 A
Current Transformer(3 nos.) ratio for over current, earth fault protection & measurement	Bus bar current: 1-1	600/300:1-1	300/150/50:1-1	400/200/50:1-1
Ammeter with selector switch with scale range (Multi Scale Plates shall be provided if required)	0-Bus bar current	0-300/600A	0-50/150/300 A	0-50/200/400 A
Current Transformers ratio for Energy Management	-	-	300/150/50:1	400/200/50:1
3-phase Voltage Transformer ratio for Voltage & Energy Measurement	33 kV/110 V			
Voltmeter with selector switch	Yes	Yes	Yes	Yes
Integral numerical relay for measuring, protection and control purposes	Yes	Yes	Yes	Yes
Live Cable Indication	Yes	Yes	Yes	Yes
Programmable Poly Phase Meter	-	-	Yes	Yes

As per CEB Standard 071-1:2017 (Flush mounting type with rear terminal) attached				
Auxiliary contacts normally opened and normally closed to be used for new inter tripping connections	-	Yes	Yes	-

6.0 QUALITY ASSURANCE

The manufacturer shall possess ISO 9001:2008 or latest Quality Assurance Certification for the manufacture of 12kV/36kV Metal Enclosed GIS Panels for the plant where the offered Switchgear Panels are manufactured. Bidders shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacturer, along with the offer.

7.0 ADDITIONAL REQUIREMENTS

7.1 Minimum Requirements for Manufacturers and Main Equipment

Each main equipment (listed below) offered under this contract shall be manufactured by a manufacturer with a minimum of fifteen (15) years successful experience in manufacturing comparable equipment, in rated voltage and capacity, to the equipment offered under the contract. In addition, minimum of ten (10) years' experience shall be in manufacturing for orders from outside the country of the manufacturer.

In respect of each main equipment offered under this contract, the equipment identical in design had been in satisfactory service for a minimum period of five (5) years and out of that minimum of three (3) years' satisfactory service shall be outside the country of the manufacturer.

If the offered equipment is manufactured under license, the manufacturing /service experience of equipment manufactured by the parent company would be counted only if clear documentary evidence is given to prove that the equipment is identical in design to original equipment manufactured by the parent company.

Bidder shall provide adequate evidence of compliance to above requirements to the satisfaction of CEB. Bids non-complying with above requirements or with incomplete evidence of compliance would be rejected.

Main equipment list:

- (a) Indoor Switchgear
- (b) Circuit Breakers
- (c) Current Transformers
- (d) Voltage Transformers
- (e) Disconnecting switches
- (f) Earthing Switches



7.2 Tools

All special tools and accessories required for installation, operation and maintenance of equipment shall be clearly indicated in the offer and shall be supplied with panels, free of additional costs. The following mandatory accessories shall be supplied:

- A set of each relay manufacturer's test plugs & accessories for relay & meter testing and software and interfacing/communication cable.
- One set of high voltage portable testing plugs of continuous current rating of 200A.

- A suitable box or container shall be supplied for storage of test plugs.
- Crank levers or equivalent devices which shall be more than 20% of the GIS panels supplied, for manual charging of the spring-operated stored energy closing mechanism of the circuit breaker, disconnecter and earthing switch, if this device is not built in to the circuit breaker.
- Any special tools required for circuit breaker maintenance and relay adjustments.
- Interfacing apparatus for gas pumping and vacuuming.

7.3 Spares

The Annex - A indicates the suggested spares for a 10 year trouble free service. That shall include the minimum percentage stipulated in Annex – A of quantity (of included number in offered set of panels) from each category and rating (rounding up to the highest integer). However, the Bidder shall indicate in the schedule of prices the type of spares and the quantities recommended by the manufacturer for the product they have offered. It is the bidder's responsibility to include all the spares for all ratings in this list. If any spare item is missed, at evaluation stage a cost will be assigned for missed item, based on the comparable item of bid or the similar cost of next highest offer. All the prices of spares shall be indicated and the total cost of spares will be taken for the evaluation.

7.4 Warranty

A minimum warranty of twelve (12) months shall be granted with effect from the delivery date to CEB.

7.5 Name Plates

Appropriate identification in the form of engraved or embossed non-corrodible material rather than plastic nameplate shall be provided on each equipment, instrument, relay, control/test switch and other devices. These nameplates shall be made of non-corrodible material and shall be of appropriate size. The nameplate shall be fastened by stainless steel screws or rivets. Other nameplates for CTs, VTs etc.

Switchgear assembly shall also bear a nameplate permanently and legibly marked in English with the information in accordance with IEC 62271-200 or equivalent ANSI Standards.

Name Plates shall also include the following information.

- Manufacturer's name and trademark.
- Serial number or type designation.
- Applicable rated values
- Number and year of the relevant standard.

The name of each functional unit shall be legible during normal service. The removable parts, if any, shall have a separate nameplate with the data relating to the functional unit they belong to, but this nameplate need only be legible when removable part is in the removed position.

7.6 Labeling

Each device shall be permanently identified/ edged by clear markings and labeling in English Language with relevant colour code to correspond to the device identification symbol utilized on the wiring diagrams. This identification shall be adjacent to the terminals of the device. Standard relay device numbers shall be provided for protective relays. For switchgears phase conductors when viewed from operating side, the phase designation shall be R, Y, B from left to right, from front to back and from top to bottom. In case of augmentations/ enhancements of substations the three phases shall be designated as per the existing system.



7.7 Circuit Labels

All panels shall be provided with a Blank label (white) and mounting arrangement for the label for Circuit labeling.

8.0 INSPECTION AND TESTING

8.1 Type Tests

(i) Switchgear Panels

Certified copies of the type test carried out in accordance with the IEC62271-200 and as indicated below shall be furnished with the offer.

- (i) Lightning Impulse Voltage Tests.
- (ii) Power Frequency Tests.
- (iii) Partial Discharge Tests
- (iv) Dielectric Test on Auxiliary and Control circuits
- (v) Temperature-rise tests
- (vi) Measurement of resistance of the main circuit.
- (vii) Tests on main circuits.
- (viii) Tests on main earthing circuits.
- (ix) Mechanical operation tests;
 - a) Interlocks.
 - b) Switching device and removable parts.
- (x) Verification of degree of protection.
- (xi) Measurement of leakage currents.
- (xii) Weatherproofing test
- (xiii) Arcing due to internal faults in all HV Compartments.
- (xiv) Short time and peak withstand current
- (xv) Verification of making and breaking capacities.
- (xvi) Pressure withstand test gas-filled compartments
- (xvii) Tightness tests for gas filled compartments



(ii) Circuit Breaker

Certified copies of the Certificates of type tests carried out in accordance with the IEC 62271-100 and IEC 60694 indicated below shall be furnished with the offer.

- i) Dielectric test.
- ii) Temperature-rise tests.
- iii) Measurement of the resistance of the main circuit.
- iv) Time - current tests.
- v) Mechanical operation test.
- vi) Making and breaking and short time withstand current tests.
- vii) Duty cycle test (full breaking capacity)

Records and reports of the type tests for making, breaking and short time current performance as per "APPENDIX CC" of IEC 60056 shall be furnished.

(iii) Auxiliary Equipment

Certified copies of the certificates of type tests carried out in accordance with the following standards shall be furnished with the offer.

- i) Current Transformers - IEC 61869-2

- ii) Voltage Transformer - IEC 61869-3
- iii) Programmable polyphase meters - IEC 61036

(iv) Protection Relays

Type test reports for the following tests shall be submitted for the approval of CEB along with Bid.

- i) Dielectric Withstand Test - IEC 60255-5
- ii) High Voltage Impulse Test, Class III - IEC 60255-5
(5 kV peak, 1.2/50 μ s; 3 Positive and 3 negative shots at interval of 5 s)
- iii) DC Supply Interruption - IEC 60255-11
- iv) AC Ripple on DC supply - IEC 60255-11
- v) Voltage Dips and Short Interruptions - IEC 61000-4-11
- vi) High Frequency Disturbance - IEC 60255-22-1, Class III
- vii) Fast Transient Disturbance - IEC 60255-22-4, Class IV
- viii) Surge withstand capability - IEEE / ANSI C 37.90.1(1989)

Type Test Certificates shall clearly indicate the relevant standard, items concerned, showing the manufacturers identity, type No. /catalogue No. and basic technical parameters.

Test certificates referred to shall be from an **accredited independent testing laboratory acceptable to the CEB**. Proof of accreditation by a national/ international authority shall be forwarded with the offer. Test certificates shall be complete including all the pages as issued by the testing authority. Type test certificates shall be in English language. Parts of test certificates shall not be acceptable.

8.1.1 Accepted test laboratories and institutions

The type test certificates for short and peak withstand current tests, verification and making and breaking capacities/duties cycle tests as indicated in Clause 8.1 (i) (xv) and 8.1(ii) (iv) shall be from one of the following testing authorities who are the members of the European Organization for Testing and Certification for Short Time Current Test and Short Circuit Breaking / Making Tests.

- i) ASTA Certification Services - (ASTA) UK
- ii) Centro Elettrotecnico Sperimentale Italiano S. P. A. - (CESI) Italy
- iii) Ensemble Des Stations D'Essais a" Grande Puissance Francaises (ESEF) – France
- iv) B.V. KEMA - (KEMA) – Netherlands
- v) Gesellschaft for Elektrische Hocheleistungsprufungen - PEHLA- Germany
- vi) Scandinavian Association for Testing of Electrical Power Equipment - (SATS) Scandinavia
- vii) Short Circuit Testing Liaison North America - (STLNA) - North America
- viii) Central Short-Circuit Testing Committee - (STLNA) - North America
- ix) Central Short-Circuit Testing Committee - (JSTC) - Japan
- x) Central Power Research institute (CPRI) India
- xi) KERI – SEOUL, Korea Electrotechnology Research Institute – Republic of Korea

8.2 Routine Tests

The following Routine tests as per IEC 62271-200 shall be carried out on each panel and the routine test reports shall be made available for the observation of the CEB Inspector at the time of inspection.

- (i) Power-frequency voltage tests on the main circuit
- (ii) Dielectric tests on auxiliary and control circuits
- (iii) Measurement of the resistance of the main circuit



- (iv) Partial discharge measurement
- (v) Mechanical operation tests
- (vi) Pressure tests of gas-filled compartments
- (vii) Tests of auxiliary electrical, pneumatic and hydraulic devices
- (viii) Verification of correct wiring

8.3 Inspection

The Successful bidder shall make necessary arrangements for inspection by an Engineer appointed by the CEB and also to carry out in his presence necessary Acceptance tests on equipment and material. The CEB may waive off the inspection with the condition of witnessing the acceptance tests by an independent testing authority acceptable to the CEB. In such a situation a notice of waive off will be issued in advance to the supplier.

8.4 Acceptance Tests

The following Sample/Acceptance tests as per IEC 62271-200 shall be witnessed by the Engineer appointed by the CEB. Extra copies of these test certificates shall also be furnished with the equipment.

- a) Power frequency voltage test on main circuit.
- b) Dielectric test on auxiliary and control circuits.
- c) Measurement of the resistance of the main circuit.
- d) Partial discharge measurement.
- e) Mechanical operation tests.
- f) Measurement of gas condition after filling.
- g) Pressure test of gas-filled compartments.
- h) Gas tightness test of gas-filled compartments
- i) Tests on electrical devices.
- j) Verification of correct wiring
- k) All routine tests as per IEC 62271-100 for circuit breakers shall also be carried out.
- l) Functional tests as specified



9.0 INFORMATION TO BE FURNISHED WITH THE OFFER

The following shall be furnished with the offer.

- a) Catalogues describing the equipment and indicating the model number (in English Language).
- b) Make, rated values and characteristics of all breakers, switches, busbars, fuses, instruments, relays, wiring materials etc.
- c) Mechanical characteristics incorporating overall dimensions, weight, constructional features, operating mechanism of switches and associated equipment/interlocks/access covers and doors.
- d) List of materials, kit and accessories that shall be supplied for each cable termination.
- e) Details of earthing, earth bar, earth conductor/ strap bonding and termination.
- f) Type test certificates as per clause 8.1.
- g) Number of operations (normal & fault conditions) after which vacuum bottle has to be replaced.
- h) ISO 9001:2008 or latest Certification for all components as per Clause 6.0.
- i) Completed schedule of guaranteed technical particulars (Annex B)
- j) A list of power utilities outside the country of manufacture to whom the panels were sold, indicating the name of the utility, quantities sold and the year of sale during the last five (05) years.
- k) Magnetization curves and the secondary resistance shall be provided for each type and rating of current transformer. Also all technical details, routine test reports of CTs shall be furnished with the offer.

- l) Following drawings of size 'A3' (minimum) with the offer:
- General arrangement & sectional view drawing of Switchgear Panel of each type.
 - Switchgear Layout Drawing.
 - Single Line Diagram.
 - General Arrangement and Component List of Circuit Breaker.
 - DC Schematic.
 - Panel Wiring Diagram.
 - Component List of Switchgears with sub-supplier (make) and country of manufacture.
 - GIS SF6 Gas diagram

10.0 TECHNICAL LITERATURE AND DRAWINGS

The selected Bidder shall supply along with the equipment at the delivery five copies of operational/maintenance manuals of Circuit breakers, Relays, switches, CT, VT, energy meters & selector switches etc. for each type of panel ordered including all relevant drawings, technical literature, hand books, wiring diagrams in order to facilitate easy installation, faultless operation and maintenance. Routine test reports and the following shall also be furnished with the equipment.

	Description	Quantity
(a)	Cable for connection of Relay to Laptop along with converter and power supply if required for relay local setting	3 Set
(b)	Manual, hard copy in good quality paper properly bounded	3 Set
(c)	Copy of Type Test Certificate along with manual	With offer
(d)	Basic application software for setting change, parameterization etc.	3 Nos.
(e)	CD with software (licensed) to download disturbance recorder, event logger collection and evaluation of those	3 Nos.
(f)	Graphical configuration tool for I/P, O/P and functional building block for protection	3 Nos.
(g)	IEC 60870-5-103 Interoperability tables and mapping details shall be supplied in IEC format	3 Nos.
(h)	Any other software, if required for integration with SCADA	3 Nos.

11.0 ANNEX

- Annex - A : Schedule of Spares
 Annex – B : Schedule of Guaranteed Technical Particulars
 Annex – C : Non-Compliance Schedule



SCHEDULE OF SPARES
(To be filled and submit with the bid)

The approximate requirement of spares suggested by the purchaser is indicated below. The total price of the spares also shall be indicated in the schedule of prices.

	Qty % (Specified by the Procurement Entity)	Unit FOB	Total FOB
Current Transformers of each rating (Single-phase units)	10%		
i) (pl. specify ratio)			
ii) (pl. specify ratio)			
iii) (pl. specify ratio)			
iv) (pl. specify ratio)			
v) (pl. specify ratio)			
Voltage Transformers (Single phase units)	10%		
Voltage Transformer;			
i) Primary Fuses	10%		
ii) Secondary Fuses / Breakers	10%		
Vacuum interrupters complete with CB contacts if replaceable	5%		
Numerical relays from each category	5%		
Complete circuit breaker assembly	5%		
Spring charging motor	10%		
Auxiliary opening coil	10%		
Auxiliary closing coil	10%		
Trip relay	10%		
Anti-pumping relay	10%		

Total FOB value

Total CIF value



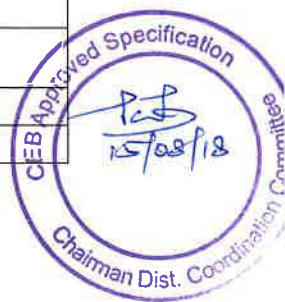
Note

- 1: CEB reserves the right of ordering all the items or selected items depending on the requirement.
- 2: Above quantity shall be equal to the percentage of the ordering quantity, rounded up to the closest integer. The minimum quantity shall be considered as one.

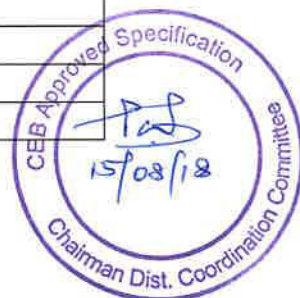
SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

(Following Information shall be furnished for each panel with the offer by the Manufacturer)

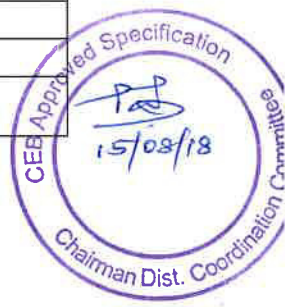
			CEB Requirement	Offered
1	Switchgear panels			
	(a) Name of Manufacturer			
	(b) Country of Origin			
	(c) Make and Model No. / Catalogue number			
	(d) Rated voltage	kV	As per the price schedule	
	(e) Normal Current Rating	A	As per the price schedule	
	(f) Frequency	Hz	50	
	(g) No. of phases		Three	
	(h) Rated Insulation Levels			
	i) Lightning impulse (1.2/50 μ s) withstand voltage (peak)	kV	As per the clause 5.1	
	ii) 1 min. power frequency withstand voltage (rms)	kV	As per the clause 5.1	
	(i) Degree of Protection			
	i) Gas enclosed compartments		IP65	
	ii) Other compartments		IP4X	
	(j) Rated short time current (1 Sec)	kA	25	
	(k) Temperature rise	°C	As per IEC 62271	
	(l) Thickness of the Sheet Metal of the cubicle	mm	2	
	(m) Type and method of earthing of cable terminal		As per clause 5.9	
	(n) Whether the primary circuit is full-insulated	Yes/No	Yes	
	(o) Indicate particulars of mechanical interlocking facilities provided			
	(p) Where the remote operation facility provided	Yes/No	Yes	
	(q) Whether the provision for incorporating SCADA system In the future provided (Furnish details)	Yes/No	Yes	
2	Circuit breaker			
	(a) Name of Manufacturer			
	(b) Country of Origin			
	(c) Make & Model No. and year of manufacture			
	(d) Number of poles		3	
	(e) Rated voltage	kV	As per the price schedule	
	(f) Rated frequency	Hz	50	
	(g) Rated Insulation Levels			
	i) Lightning impulse (1.2/50 μ s) withstand voltage (peak)	kV	As per the clause 5.1	
	ii) 1 min. power frequency withstand voltage kV (rms)	kV	As per the clause 5.1	
	(h) Rated normal current	A	As per the clause 5.16	
	(i) Rated short circuit breaking current (rms)	kA	25	
	(j) Rated short circuit making current (peak)	kA	62.5	



	(k)	Rated short time withstand current & duration	kA/s	25/1	
	(l)	First pole to clear factor		1.5	
	(m)	Rated operating duty cycle		'O' – 0.3 s – 'CO' – 3 min. – 'CO'	
	(n)	Opening time	ms		
	(o)	Closing time	ms		
	(p)	Method of Closing		As per clause 5.3	
	(q)	Method of Tripping		As per clause 5.3	
	(r)	Whether the Circuit Breaker is Trip free type with anti-pumping relay ?	Yes/No	Yes	
	(s)	Tripping supply voltage	V	As per the price schedule	
3	Interruption				
	(a)	Name of Manufacturer			
	(b)	Country of Origin			
	(c)	Make and Model No. and year of manufacture			
	(d)	Rated current	A		
	(e)	Rated voltage	kV		
	(f)	Recommended No. of operations at rated current			
	(g)	Recommended No. of operations on short circuit			
4	MCBs				
	(a)	Name of Manufacturer			
	(b)	Country of Origin			
	(c)	Make and Model No. and year of manufacture			
	(d)	Type			
	(e)	Rated current	A		
	(f)	Rated voltage	V		
5	Bus bars				
	(a)	Name of Manufacturer			
	(b)	Country of Origin			
	(c)	Type and formation of Bus Bars		As per clause 5.4	
	(d)	Material		As per clause 5.4	
	(e)	Type of insulation		As per clause 5.4	
	(f)	Whether the busbar is fully insulated	Yes/no	Yes	
	(g)	Clearance between busbars:			
		i) Phase – Phase	mm	Please Specify	
		ii) Phase – Earth	mm	Please Specify	
	(h)	Cross sectional area	mm ²	Please Specify	
	(i)	Continuously current carrying capacity	A	As per the price schedule	
	(j)	Maximum Temperature rise at rated current	°C	As per IEC 62271	
	(k)	Busbar layout		Horizontal	
6	Current transformers				
	(a)	Name of Manufacturer			



	(b) Country of Origin			
	(c) Model / catalogue No. & year of manufacture			
	(d) Accuracy Class			
	i) Measuring		3.0	
	ii) Metering		0.2	
	iii) Protection		5 P	
	(e) Rated voltage	kV		
	(f) Rated short time rating/ Duration	kA/sec	25/1	
	(h) Accuracy limit factor			
	i) Measuring		-	
	ii) Metering		-	
	iii) Protection		20	
	(i) Burden		As per Clause 5.5.3	
	(j) Frequency	Hz	50	
	(k) C.T. ratios & no. of cores			
	i) Measuring			
	ii) Metering			
	iii) Protection			
7	Voltage transformers			
	(a) Name of Manufacturer			
	(b) Country of Origin			
	(c) Model / catalogue No. & year of manufacture			
	(d) Rated voltage	kV	As per clause 5.1	
	(e) Rated insulation level			
	i) One minute power frequency withstand voltage (rms.)	kV	As per clause 5.1	
	ii) Lightning impulse (1.2/50 μ s) withstand voltage (peak)	kV	As per clause 5.1	
	(f) Accuracy Class		0.2 for metering/ 1.0 for measuring	
	(g) Burden	VA	50	
	(h) Frequency	Hz	50	
	(i) V.T. ratios		11kV/110V or 33kV/110V	
8	Earthing			
	(a) Name of Manufacturer			
	(b) Country of Origin			
	(c) Material of earth conductor			
	(d) Whether the earth conductor is provided for entire length of panel	Yes /No	Yes	
	(e) Cross sectional area of the earth conductor	mm ²	Minimum 150	
	(f) Current density at rated fault current	A/mm ²	200	
	(g) Indicate particulars of mechanical interlocking facility provided in the earthing circuit			
9	Relays			
	(a) Name of Manufacturer			
	(b) Country of Origin			
	(c) Model / catalogue No. & year of manufacture			
	(d) Type	Numeric al/ Static		



	(e) Whether the following types of characteristic curve programmable			
	i) Over Current 1. IDMT 2. Instantaneous	Yes/No Yes/No		
	ii) Earth fault 1. IDMT 2. Instantaneous	Yes/No Yes/No		
	(f) Whether the provision for incorporating SCADA system in future is available	Yes/No		
	(g) Whether the hand held programming unit provided? Quantity provided?	Yes/No Nos		
10	Energy metering instruments			
	(a) Name of Manufacturer			
	(b) Country of Origin			
	(c) Model / catalogue No. & year of manufacture			
	(d) Whether the instrument is programmable type	Yes/No	Yes	
	(e) Whether the programming software provided	Yes/No	Yes	
	(f) Whether the hand held programming unit provided? Quantity provided?	Yes/No Nos.	Yes	
11	Whether Cable Terminations provided as per Clause 5.8?	Yes/No	Yes	
12	Whether cable testing fault locating facility provided as per clause 5.8?	Yes/No	Yes	
	Indicate number of accessories provided.	Nos	One for six panels	
13	Whether Panel Wiring provided as per Clause 5.10?	Yes/No	Yes	
14	Whether Protection Features provided as per Clause 5.11?	Yes/No	Yes	
15	Whether Relays, Meters and Instruments provided as per Clause 5.12?	Yes/No	Yes	
16	Whether Interlocks and Safety Features provided as per Clause 5.13?	Yes/No	Yes	
17	Whether SCADA Provision provided as per Clause 5.14?	Yes/No	Yes	
18	Whether Auxiliary Circuits provided as per Clause 5.15?	Yes/No	Yes	
19	Whether Bus Section, Radial, Ring & Feeder, Transformer Control, Metering Panels Conform to Clause 5.16?	Yes/No	Yes	
20	Whether ISO 9001:2008 or latest quality assurance certificate provided with the offer as per clause 6.0?	Yes/No	Yes	
21	Whether evidence provided for the requirements stipulated in clause 7.1?	Yes/No	Yes	
22	Whether complete type test certificates as per clause 8.1 are furnished with the offer?	Yes/No	Yes	
23	Whether information as per clause 9.0 is furnished with the offer?	Yes/No	Yes	

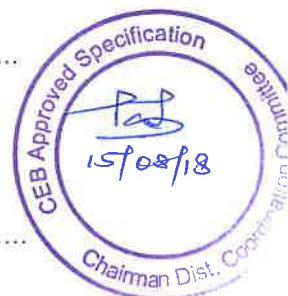
.....
Signature of the Manufacturer and seal

.....
Date

I/We certify that the above data are true and correct

.....
Signature of the Bidder and seal

.....
Date



Annex – C

NON-COMPLIANCE SCHEDULE

On this schedule the bidder shall provide a list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to the relevant specification clause.

Clause No.	Non-Compliance

.....
Signature and seal of the Manufacturer

.....
Date

I/We certify that the above data are true and correct

.....
Signature and seal of the Bidder

.....
Date

