025: 2008

CEB
SPECIFICATION

12KV AIR INSULATED SWITCHGEAR PANELS

CEYLON ELECTRICITY BOARD
SRI LANKA

Specification

for

12KV AIR INSULATED SWITCHGEAR PANELS

CEB Specification 025 : 2008

CEYLON ELECTRICITY BOARD

No. 50, Sir Chittampalam A. Gardener Mawatha, Colombo 2.
Sri Lanka

CONTENTS

SPECIFICATION FOR 12KV AIR INSULATED SWITCHGEAR PANELS

1.0 SCOPE

This Specification covers the general requirements of the design, manufacture, testing, supply and delivery of 12kV Metal Clad Air insulated Switchgear Panels with necessary Measuring, Control & Protection equipment.

2.0 SYSTEM PARAMETERS

a)	Nominal Operating Voltage	-	11 kV
b)	System highest voltage	-	12 kV
c)	Frequency	-	50 Hz
d)	Number of phase	-	3
e)	Type of earthing	-	Effective
f)	System fault current (Symmetrical)	-	20 kA
g)	Fault duration	-	3 second

3.0 SERVICE CONDITIONS

a)	Maximum ambient temperature	-	40°C
b)	Maximum annual average temperature	-	30°C
c)	Maximum relative humidity	-	90%
d)	Environmental conditions	-	Humid tropical climate with heavily polluted atmosphere
e)	Operational altitude	-	Up to 1500 meters above m.s.l.
f)	Isokeruanic (Thunder days) level	-	90 days

4.0 APPLICABLE STANDARDS

The equipment and the components supplied shall be in accordance with the latest editions of the Standards specified below and amendments thereof. However the CEB Specification shall supersede these Standards in the event there is a discrepancy.

a)	IEC 62271-200	-	A.C. Metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to 52kV.
b)	IEC 62271-100	-	High voltage alternating current circuit breakers.
c)	IEC 62271-102	-	A.C disconnectors and earthing switches.
d)	IEC 60044/1	-	Current transformer
e)	IEC 60044/2	-	Voltage transformer
f)	IEC 60255	-	Electrical Relays
g)	IEC 60529	-	Degrees of protection provided by enclosures
h)	BS 159	-	Busbars and Busbar connections.
i)	BS 5493 (1977)	-	Code of practice for protective coating of Iron and Steel structures against corrosion.
j)	IEC 61243	-	Testing of Electrical Strength of Insulating Material
k)	IEC 61850	-	Communication networks and systems in substation
j)	IEC 60870-5-104	-	Network access for IEC 60870-5-101 using standard transport profiles
m)	IEC 60870-5-103	-	Companion standards for the informative interface of protection system
n)	IEC 60870-5-101	-	Companion standard for basis telecontrol tasks

5.0 BASIC FEATURES

5.1 Technical Requirements

a)	Rated Voltage	kV	-	12
b)	Rated continuous current	A	-	630 / 800
c)	Frequency	Hz	-	50
d)	No. of phase		-	Three
e)	Rated Insulation levels			
	i) Impulse (1.2/50μs) withstand voltage (peak)	kV	-	75
	ii) Power frequency withstand Voltage (rms).	kV	-	28
f)	Rated short time current / duration	kA	-	20 / 3 Sec.
g)	Degree of Protection (as per IEC 529)		-	1P4XD
h)	Temperature rise		-	As per IEC 62271

5.2 Design

The 12 kV switchgear panels shall be of metal, clad air insulated and extensible type suitable for indoor application. Primary circuit (12kV bus bars) shall be covered with epoxy insulating material.

Female terminals in the breaker should be insulated with epoxy insulating material and provision should be made for test probes to be inserted without short circuiting the phases.

The breaker shall be of vacuum circuit breaker with the facility to replace the vacuum interrupter. All 12kV live parts shall be covered with epoxy resin insulating material.

5.3 Equipment and Materials

5.3.1 Circuit Breakers

i) The circuit breakers shall be of standard design and construction conforming to IEC 62271-100. The interrupting medium of the circuit breaker shall be of Vacuum.

ii) The control mechanism of the circuit breakers shall be of spring assisted trip free type with remote / local control selector switch and manual operational facility.

iii) Electrical and manual spring charging shall be possible with manual & electrical close/open of the circuit breaker.

iv) The circuit breaker shall have a mechanical counter to register the number of circuit breaker trappings due to operation of protective relay.

v) Characteristics of the Circuit Breakers shall be as follows;

a)	Number of poles			- 3
b)	Type			- Indoor
c)	Rated voltage		kV	- 12
d)	frequency		Hz	- 50
e)	Rated insulation level			
	i) Impulse (1.2/50μs) withstand voltage (peak)		kV	- 75
	ii) Power frequency withstand voltage (rms)/1min		kV	- 28
f)	Rated normal current (as per in the schedule of prices)		A	- 630/800
g)	Rated short circuit breaking current (rms)		kA	- 20
h)	Rated short circuit making current (rms)		kA	- 50
i)	First pole to clear factor			- 1.5
j)	Duty cycle	`O' – 0.3 min. - `CO' - 3 min. -`CO'		
k)	Tripping supply voltage		VDC	- 24
l)	Electrical spring charging motor		VDC	- 24

5.3.2 Busbars

i) The primary circuit shall be of single busbar type and the busbar shall be made of electrical grade high conductivity, hard drawn copper capable of carrying continuously a current of 630 / 800Amps (as per the requirement indicated in the price schedule) without exceeding the maximum temperature rise specified in the relevant Standard.

ii) All 12kV live parts and interconnection between panels (bus bars) shall be covered with epoxy resin insulating material.

iii) Material use for epoxy insulation should be of good quality. Epoxy material as well as epoxy components such as bus bar 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.

5.3.3 Current Transformers

i) Current transformers shall conform to IEC. 60044/1 and comply with the following.

		Measuring	**Metering**	**Protection**
a)	Class	3.0	0.5	10 P
b)	Burden	To match the measuring, metering and protection equipment		
c)	Accuracy limit factor	-	-	20
d)	Frequency	50 Hz	50 Hz.	50 Hz.
e)	C.T. ratios	As specified	As specified	As specified

ii) Magnetizing curves and the secondary resistance shall be provided for each type and rating of current transformer. Also all technical details, routine test reports of CT's shall be furnished with the offer.

iii) Type Test Certificates confirming to IEC 60044/1 shall be furnished with the offer.

5.3.4 Voltage Transformers

i) Voltage transformers shall be of cast epoxy resin insulated type complying with IEC. 60044/2, HRC type fuses or MCBs shall be provided for protection of secondary windings

ii) Primary fuses of three phase set of voltage transformers shall preferably be withdrawal type for easy removal.

iii) The Characteristics of the Voltage Transformer for Metering and Measuring shall be as follows;

a)	Class		-	05 for metering & 1.0 for measuring
b)	Rated voltage	kV	-	12
c)	Rated insulation level			
	i) Impulse (1.2/50μs) withstand voltage peak	kV	-	75
	ii) Power frequency withstand voltage (rms.)	kV	-	28
d)	Rated Voltage factor		-	1.2
e)	Burden	VA	-	50
f)	Frequency	Hz	-	50
g)	Transformation ratio		-	11kV/110V
h)	No. of phases		-	3

5.3.5 Energy Metering Instruments

i) The programmable poly phase metering equipment shall conform to CEB Standard 071:1998 - Static (Electronic) Three Phase Meters, Accuracy Class 0.5 except for the method of mounting. The metering equipment shall be of the flush mounting type.

ii) The meters shall be calibrated by the supplier and test results identifying meter serial number & the panel serial number shall be dispatched with panels.

iii) Necessary software package and the hand held programming unit shall be supplied with the metering panels.

5.3.6 Cable Terminations

i) Terminals shall be suitable for heat shrinkable type with provision for earthing the armour upto 240 mm², 12 kV, Wire Armoured Cables. In the case of radial panels the terminals should be suitable for three phase cables up to 240mm^2 and single phase cable up to 400mm^2.

ii) Provision for cables testing and cable fault locating shall also be provided at the termination.

5.3.7 Protection

i) The programmable type numerical protection relays, conforming to IEC 60255, shall be used. The relays used shall only be from the following manufactures of the countries indicated.
   a) ABB Relays AB, Sweden/Switzerland/Germany
   b) Alsthom France/ England
   c) Toshiba Corporation, Japan
   d) Siemens AG, Germany
   e) Group Schneider, England/France/Italy

iii) Necessary software package and the hand held programming unit shall be supplied with the numerical protection relays to set the protection relays as required. Software shall be compatible with Windows XP 2003 or upper versions.

iv) The numerical relay unit shall be suitable for use in the tropical climatic conditions as given under the Clause 3.0 Service Conditions.

iv) It shall be possible to select required type of over current and earth fault protection of IDMT characteristics.

v) The numerical relay unit shall have provision for accommodating RTU for incorporating SCADA system in the future. Communication protocols for the purpose of communicating between the relay and RTU shall be IEC 61850(preferred), IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104. Communication protocols to be used between normal RTUs and Master RTUs shall be IEC 60870-5-101, IEC 60870-5-104.

vi) Where relays of resetting types are included, electrical resetting via SCADA shall facilitate.

vii) Trip circuit supervision indication too should be provided.

5.3.8 Earthing

i) The copper earthing conductor shall be provided along the entire length of the panel. The cross sectional area of earthing conductor shall be such that the current density shall not exceed 200 A/mm² under the specified earth fault conditions.

ii) Inter-panel Copper links shall be provided to facilitate the continuation of earthing conductor, when panels are to be connected together.

iii) Integral earthing should be provided. It shall be possible to earth the cable with facility for padlocking, and mechanical interlocking shall be provided to prevent earthing the busbar.

iv) All metallic parts of the functional units intended to be earthed shall be bonded to the earthing conductor of the panel.

5.3.9 Auxiliary Circuits

i) Control and auxiliary devices shall be segregated by earthed metallic partitions from the main circuit.

ii) Terminal and other auxiliary apparatus requiring attention while the equipment is in service, shall be accessible without exposing to high voltage conductors.

iii) Auxiliary switches and auxiliary circuits shall be capable of carrying a current of at least 10A at 24 V.d.c. continuously.

iv) 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.

v) DC supply to relays, meters and control circuits shall monitor and DC failure alarm shall be available for future SCADA use.

5.3.10 Construction of Panels

The panels shall be of free standing type with bottom cable entry facility for all cables up to three-core 240mm^2.Radial panels in addition, have bottom entry facility for 400mm^2 single core cables. All steelwork shall be constructed of steel sheets with a minimum thickness of 2mm. They shall be complete with all necessary terminal plates, cable glands for cable entry, wiring trunkings for small wiring and multi core cables. Cable glands shall be of Brass and shall fit for cables from 70 mm^2 to 240 mm^2. Wiring trunkings shall be adequate sizes for accommodating incoming and outgoing cables for present and future requirements.

The length of panels should not exceed 2000mm for any type of panel.

Indoor cubicles and panels shall be of at least IP 41 protection class. The panels shall be dust and vermin proof type. Anti-condensation Heaters, controlled by thermostats shall be provided at the breaker compartment and the cable compartment of each panel.

Doors shall be of 2 mm thick sheet steel, equipped with 120° concealed hinges, with foamed-in seal. Each door shall be fitted with suitable earth straps of at least 16mm^2 highly flexible stranded copper wire with insulation in green-yellow color.

The switchboard panel shall be suitable for mounting on a concrete floor or plinth and necessary foundation fixing bolts and rails shall also be provided.

External effects of internal arc shall be limited by a suitable design to prevent any danger to an operator during the time he performing his normal duties. Test evidence in accordance with IEC 60298 to verify the design is required.

Side plates for panels shall be provided equivalent to 50% of the panels ordered, at the rate of one side plate for a panel. Provision for nomenclature plate should be fixed in front of the panel. This plate should be removable type and made for easy marking.

5.3.11 Panel wiring

Labeling shall be provided with each panel, and each circuit. Cabling from CTs shall terminate at the panel on isolating links of the "shorting disconnecting type". Shorting Links shall also be provided.

The General arrangement of all indicating devices, control switches & relays etc and Single line diagram & Schematic diagrams of control & Protection schemes shall be to the approval of Ceylon Electricity Board.

Both ends of every wire core and all secondary panel wiring shall be fitted with numbered slip-on 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.

Ferrules, of white color 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).

Terminal blocks shall be numbered consecutively 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.

5.3.12 SCADA provisions

Following signals shall be wired up to the terminal block for future SCADA applications.

a. Over current operated
b. Earth fault operated
c. Circuit breaker close/ open position
d. Earthing switch close/ open position
e. DC fail
f. CB fault
g. Measurands transducer output for Current
h. Measurands transducer output for Voltage

Circuit breaker close/ open and electrical resetting of relays shall be possible via future SCADA. Necessary wiring should be completed up to the terminal block.

5.3.13 Finish

The outer surface of the switchgear panel shall have light gray (RAL 7035) colour powder coating finish suitable for indoor application. The thickness of powder coating shall not be lees than 50μm.

5.4 Types of Switchgear Panels

5.4.1 Radial Feeder Panels

Radial and ring feeder panels rated 630 Amps and 800 Amps shall be equipped with the following.

			630 A Panels	**800A Panels**
1 No.	Busbar set of rating.	A	630	800
1 No.	Circuit Breaker-normal current rating	A	630	800
3 Nos.	Current Transformer for over current, earth fault protection & measurement	Ratio	600/1	800/1
1 No.	Ammeter with selector switch with scale range	A	0 - 600A	0 – 800A
1 No.	Voltage Transformers three phase 12kV for Voltage & Energy Measurement.	Ratio	11kV/110V	11kV/110V

1 No.	Voltmeter with selector switch
1 No.	Integral Numerical relay for measuring, protection and control purposes.
3 Nos.	Live cable indication
2 Nos.	Anti-condensation Heaters & thermostats (Temperature adjustable range from 25°C to 40°C)

5.4.2 Ring Feeder Panels

Radial and ring feeder panels rated 630 Amps and 800 Amps shall be equipped with the following.

			630 A Panels	**800A Panels**
1 No.	Busbar set of rating.	A	630	800
1 No.	Circuit Breaker-normal current rating	A	630	800
3 Nos.	Current Transformer for over current, earth fault protection & measurement	Ratio	600/1	800/1
1 No.	Ammeter with selector switch with scale range	A	0 - 600	0 – 800
1 No.	Integral Numerical relay for measuring, protection and control purposes.			
3 Nos.	Live cable indication			
2 Nos.	Anti-condensation Heaters & thermostats (Temperature adjustable range from 25°C to 40°C)			

Provision for installation of 3 single phase voltage transformers for voltage measurement should be made by means of necessary clamping, wiring etc.

5.4.3 Outgoing Feeder / Transformer Control Panels

Outgoing feeder panels and the Transformer Panels rated 630 A/ 800 A shall be equipped with the following.

			630A Panels	**800A Panels**
1 No.	Busbar set of rating.	A	630	800
1 No.	Circuit Breaker-normal current rating	A	630	800
3 Nos.	Current Transformers for Over Current, Earth Fault Protection & measurement	Ratio	300 /150/1	300/150/1
1 No.	Ammeter with selector switch with scale range		0 – 300/150	0 – 300/150
1 No.	Integral Numerical relay for measuring, protection and control purposes			
3 Nos.	Live cable indication			
2 Nos.	Anti-condensation Heaters & thermostats (Temperature adjustable range from 25°C to 40°C.)			
2 Sets.	Auxiliary contacts normally opened and normally closed to be used for new inter tripping connections(for Transformer Control Panels)			

5.4.4 Bus Section Panel

Bus section panel rated 630 Amps / 800 Amps shall be equipped with the following.

			630A Panels	**800A Panels**
1 No.	Busbar set of rating.	A	630	800
1 No.	Circuit Breaker-normal current rating	A	630	800
3 Nos.	Current Transformers for over Current, earth fault protection & Measurement.	Ratio	600 / 1	800/ 1
1 No.	Ammeter with selector switch with scale range		0 – 600A	0– 800A
2 Nos.	Anti-condensation Heaters & thermostats (Temperature adjustable range from 25° C to 40° C.)			

5.4.5 Metering Panel

These Metering Panels are to be used to meter the power fed to consumers at 11kV and the Metering Panels shall be equipped with the following.

		630A Panels	800A Panels
1 No.	Busbar set of rating. A	630	800
1 No.	Circuit Breaker-normal current rating A	630	800
3 Nos.	Current Transformers for Over Current and Earth Fault Protection & measurement Ratio	150-300/1	200-400/1
1 No.	Ammeter with selector switch (Dual scale plates shall be provided)	0-150/300A	0-200/400A
3 Nos.	Current Transformers for Energy Measurement. Ratio	150-300/1	200-400/1
1 No.	Voltage Transformers three phase 12kV for Voltage & Energy Measurement. Ratio	11KV / 110V	
1 No.	Voltmeter with selector switch		
1 No.	Integral Numerical relay for measuring, protection and control purposes		
3 Nos.	Live cable indication		
2 Nos.	Anti-condensation Heaters & thermostats (Temperature adjustable range from 25°C to 40° C)		
1 No.	Programmable Poly Phase Meter As per CEB Standard 071:1998 (Flush mounting type with rear terminal) attached		

6.0 QUALITY ASSURANCE

The manufacturer shall posses ISO 9001-2000 Quality Assurance Certification for the manufacturer of 12kV Metal Enclosed Switchgear Panels for the plant where the offered Switchgear panels are manufactured. The Bidder 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 Manufacturing Experience

The manufacturer shall have at least 05 years experience in manufacturing and supply of offered type of 12kV switchgear panels and manufacturer shall furnish documentary evidence with the offer to prove his manufacturing experience.

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.

7.3 Spares

The Annex - A indicates the suggested spares for a 10 year trouble free service. 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. The prices of spares shall also be indicated.

7.4 Name Plates

Name Plates shall include the following information.

a) Manufacturer's name and trademark.
b) Serial number or type designation.
c) Applicable rated values.

d) 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.

7.5 Labeling

All equipment, control positions, indicator positions, control/indicator identification, terminals, small wiring of instrumentation and protection of the panel shall be identifiable by clear markings and labeling in English Language with relevant colour code, if any. The labels shall be made out of durable materials and prints permanently edged.

7.6 Circuit Labels

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

7.7 Routine Tests

The following Routine tests as per IEC 62271-200 and IEC 60694 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. Tests of auxiliary electrical, pneumatic and hydraulic devices
vii. Verification of correct wiring

8.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

8.1 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 of the epoxy components used in the interconnection.
g) The number of operations (normal and fault conditions) after which vacuum bottle has to be replaced.
h) ISO 9001 Certification for all components as per Clause 6.0.
i) Completed schedule of guaranteed technical particulars (Annex B)
j) A list of power utilities out side the country of manufacture to whom the 12kV panels were sold, indicating the name of the utility, quantities sold and the year of sale during the last five (05) years.
k) Magnetisation 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.

8.2 Type Test Certificates

a) 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.
xii) Measurement of leakage currants.
xiii) Weatherproofing test
xiv) Arcing due to internal faults in all HV Compartments.
xv) Short time and peak withstand current
xvi) Verification of making and breaking capacities.

b) 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.
viii) Making and breaking and short time withstand current tests.
ix) 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.

The Type Test Certificates for short and peak withstand current tests, verification and making and breaking capacities/duties cycle tests as indicated in Clause 8.2 (a) (xv) and 8.2 (b) (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 Electtrotecnico 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 Hochleistungsprufungen - PEHLA- Germany
vi) Scandinavian Association for Testing of Electrical Power Equipment - (SATS) - Scandinavia
vii) Short Circuit Testing Liasion North America - (STLNA) - North America
viii) Central Short-Circuit Testing Committee - (JSTC) - Japan
ix) Central Power Research institute (CPRI) India

c) 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 conforming to IEC 60044-1
ii) Voltage Transformer conforming to IEC 60044-2
iii) Programmable polyphase meters conforming to IEC 61036

8.3 Test certificates

The test certificates should clearly identify the equipment concerned, showing the manufacturer's identity, type/model and basic technical parameters. The test certificates referred to shall be issued from a **recognized independent testing authority acceptable to the Purchaser.**

8.4 The Bidders should furnish the particulars requested in Clause 8.1, 8.2 and 8.3.

9.0 INSPECTION AND TESTING

9.1 Inspection

The report of routine tests performed on each equipment shall be made available for the observation of the inspector.

9.2 Sample/Acceptance Test

The following Sample/Acceptance tests shall be witnessed by the Engineer. 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) Tests on electrical devices.
g) Verification of correct wiring.
h) All routine tests as per IEC 62271-100 for circuit breakers shall also be carried out.
i) Functional tests as specified

10.0 TECHNICAL LITERATURE AND DRAWINGS

The selected Bidder shall supply along with the equipment **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 shall also be furnished with the equipment.

11.0 ANNEX

A - Schedule of Spares
B - Schedule of Guaranteed Technical Particulars - To be filled by the Bidder.

Annexure - A

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.

		% of the ordered	Qty	Unit FOB	Total FOB
	Current Transformers of each rating (Single-phase units)				
	i) …….. (pl. specify ratio)	5%			
	ii) ……..….. (pl. specify ratio)	5%			
	iii) ……..….. (pl. specify ratio)	5%			
	iv) ……..….. (pl. specify ratio)	5%			
	v) …….... (pl. specify ratio)	5%			
	Voltage Transformers (Single phase units) ….	1%			
	Voltage Transformer;				
	i)Primary Fuses	15%			
	ii)Secondary Fuses / Breakers	5%			
	Vacuum interrupters complete with CB contacts if replaceable	2%			
	Numerical relays	1%			
	Anti-condensation Heaters & Thermostats	10%			
	Auxiliary opening coil	5%			
	Auxiliary closing coil	5%			

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 to the closest integer. The minimum quantity shall be considered as one.

Annex - B

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

(This schedule shall be duly filled by the Manufacturer)

1) SWITCHGEAR PANELS

a)	Name of Manufacturer & Country of Origin		
b)	Make and model / catalogue number		
c)	Rated voltage	kV	
d)	Normal Current Rating	A	
e)	Frequency	Hz	
f)	No. of phase		
g)	Rated Insulation levels		
	i) Lighting impulse (1.2/50µs) withstand voltage (peak)	kV	
	ii) 1 min. power frequency withstand voltage (rms)	kV	
h)	Degree of Protection:-		
	i) Against approach to live parts		
	ii) Enclosure		
i)	Rated short time current (1 Sec)	kA	
j)	Temperature rise	°C	
k)	Thickness of the Sheet Metal of the cubicle	mm	
l)	Type and method of earthing of cable terminal		
m)	Whether the primary circuit is full-insulated	Yes/No	
n)	Indicate particulars of mechanical interlocking facilities provided		
o)	Where the remote operation facility provided	Yes/No	
p)	Whether the provision for incorporating SCADA system In the future provided (Furnish details)	Yes/No	

2) CIRCUIT BREAKER

a)	Name of Manufacturer & Country of Origin		
b)	Make and Model No. and year of manufacture		
c)	Number of poles		
d)	Rated voltage	kV	
e)	Frequency	Hz	
f)	Rated Insulation levels		
	i) Lighting impulse (1.2/50µs) withstand voltage (peak)	kV	
	ii) 1 min. power frequency withstand voltage (rms)	kV	
g)	Rated normal current	A	
h)	Rated short circuit breaking current (rms)	kA	
i)	Rated short circuit making current (peak)	kA	
j)	Rated short time withstand current & duration	kA/sec	
k)	First pole to clear factor		
l)	Rated operating duty cycle		
m)	Opening time	ms	
n)	Closing time	ms	
o)	Method of Closing		
p)	Method of Tripping		
q)	Whether the Circuit Breaker is Trip free type	Yes/No	
r)	Tripping supply voltage	V	

3) INTERRUPTERS

a)	Name of Manufacturer/country of origin		
b)	Make and Model No. and year of manufacture		
c)	Rated current	A	
d)	Rated voltage	kV	
e)	Recommended No. of operations at rated current		
f)	Recommended No. of operations on short circuit		

4) BUSBARS

	Name of Manufacturer/country of origin		
	Type and formation of Bus Bars		
	Material		
	Type of insulation		
	Whether the busbar is fully insulated	Yes/no	
	Clearance between busbars: i) Phase – Phase ii) Phase - Earth	 Mm mm	
	Cross sectional area	mm^2	
	Continuously current carrying capacity	A	
	Maximum Temperature rise at rated current	^0C	
	Mounting Arrangements vertical/horizontal		

5) CURRENT TRANSFORMERS

Following Information shall be supplied for each CT Ratio.

			Measuring	**Metering**	**Protection**
a)	Name of Manufacturer and Country of origin				
b)	Model / catalogue No. & year of manufacture				
c)	Accuracy Class				
d)	Rated voltage	kV			
e)	Rated short time rating	kA			
f)	Duration	sec			
g)	Accuracy limit factor				
h)	Burden	VA			
i)	Frequency	Hz			
j)	C.T. ratios				

6) VOLTAGE TRANSFORMERS

a)	Name of Manufacturer and country of origin		
b)	Model / catalogue No. & year of manufacture		
c)	Rated voltage	kV	
d)	Rated insulation level i) One minute power frequency withstand voltage (rms.) ii) Lightning impulse (1.2/50μs) withstand voltage (peak)	 kV kV	
e)	Accuracy Class		
f)	Burden	VA	
g)	Frequency	Hz	
h)	V.T. ratios		

7) EARTHING

a)	Name of Manufacturer/country of origin		
b)	Material of earth conductor		
c)	Whether the earth conductor is provided for entire length of panel	Yes /No	
d)	Cross sectional area of the earth conductor	mm^2	
e)	Current density at rated fault current	A/mm^2	
f)	Indicate particulars of mechanical interlocking facility provided in the earthing circuit		

8) RELAYS

a)	Name of Manufacturer and country of origin		
b)	Model / catalogue No. & year of manufacture		
c)	Type	Numerical/ Static	
d)	Whether the following types of characteristic curve programmable i) Over current 1. IDMT 2. Instantaneous ii) Earth fault 1. IDMT 2. Instantaneous	 Yes/No Yes/No Yes/No Yes/No	
e)	Whether the provision for incorporating SCADA system in future is available	Yes/No	
f)	Whether the hand held programming unit provided Quantity	yes/No Nos.	

9) ENERGY MEASURING INSTRUMENTS

a)	Name of Manufacturer and country of origin		
b)	Model / catalogue No. & year of manufacture		
c)	Whether the instrument is programmable type	Yes/No	
d)	Whether the programming software provided	Yes/No	
e)	Whether the hand held programming unit provided Quantity	Yes/No Nos.	

10) Whether the duly completed ANNEXURE -B- Schedule of Technical Particulars of CEB Standard 025: 2008 furnished Yes/No -

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

SEAL AND SIGNATURE OF THE MANUFACTURER/ Date