

CEB STANDARD 031 : 1996

*Specification*

*for*

***MEDIUM VOLTAGE POWER CAPACITOR BANKS  
AND ACCESSORIES***

**CEYLON ELECTRICITY BOARD**

**SRI LANKA**

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**CEYLON ELECTRICITY BOARD**

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## SPECIFICATION FOR MEDIUM VOLTAGE POWER CAPACITOR BANKS AND ACCESSORIES

### 1.0 SCOPE

This Specification covers the design, manufacture and testing of Power Capacitor Banks and Accessories of the following types for use in the 12 kV and 36 kV overhead lines to improve the power factor of the Medium Voltage Distribution system .

- i) **Fixed Type Power Capacitor Bank and Accessories**
- ii) **Switching Type Power Capacitor Bank and Accessories**

### 2.0 SYSTEM PARAMETERS

a)	Nominal Voltage	-	11 kV	33 kV
b)	System Highest Voltage	-	12 kV	36 kV
c)	System Frequency	-	50 Hz	50 Hz
d)	System Fault Level	-	13.1 kA	13.1 kA
e)	Method of Earthing	-	Effectively earthed	Non effectively earthed

### 3.0 SERVICE CONDITIONS

a)	Annual average ambient temperature	-	30 deg. C	
b)	Maximum ambient temperature	-	40 deg. C	
c)	Maximum Relative Humidity	-	90%	
d)	Environmental	-	Humid tropical climate with polluted atmosphere.	Condition
e)	Operational Altitude	-	From M.S.L. to 1000 m above M.S.L.	
f)	Isokeraunic (Thunder day) Level	-	90 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 | 871-1     | (1987) | - | Shunt capacitors for a.c. power systems having a rated voltage above 660V. |
| b) | IEC | 56        | (1987) | - | High-voltage alternating- current Circuit-Breakers                         |
| c) | IEC | 289       | (1988) | - | Reactors   |
| c) | IEC | 672       | (1980) | - | Ceramic and glass electrical insulating materials                          |
| f) | IEC | 71-1,2 &3 | (1976) | - | Insulation Co-ordination.  |
| g) | IEC | 60-1      | (1982) | - | High-voltage test techniques.  |
| h) | BS  | 729       | (1986) | - | Hot dip galvanized coatings on iron and steel articles.                    |

#### 5.0 BASIC FEATURES

The three phase Power Capacitor Banks shall be of the two types stipulated in Clause 1.0 - Scope for use in the medium voltage overhead feeders and shall be suitable for continuous operation under the climatic conditions stipulated in Clause 3.0 -Service conditions above.

The design shall also ensure that the Capacitor Banks, including their connections, are adequately rated so that they are not damaged if their terminals are short circuited.

**The Fixed Type Power Capacitor Banks** shall have capacitor banks and accessories mounted on a bracket which shall be suitable for mounting on a concrete pole support of the existing feeders.

**The Switching Type Power Capacitor Banks** shall have capacitor banks, accessories and the switchgear with automatic switching facilities, suitable for mounting on two concrete pole supports, ie. an additional concrete pole to be erected close to the existing

feeder pole support.

Earthing facilities shall be provided on the steel structure/mounting brackets for effectively bonding the power capacitor tank and relevant accessories to the structure/ bracket as well as for the earthing lead.

A detail drawing of mounting arrangements shall be furnished with the offer.

The Bidder shall provide a detailed description of the construction features, manufacturing process, the internal arrangement of elements and the protective devices.

## **5.1 Fixed Type Capacitor Banks and Accessories**

The Fixed Type Power Capacitor Banks shall consist of the following;

- i) Naturally cooled static type shunt Power Capacitors - Three/six Nos.
- ii) Mounting Bracket to accommodate six Nos. of Power Capacitors
- iii) Earth Electrodes - Four Nos
- iv) 95mm<sup>2</sup>, Black PVC Insulator Stranded Copper Earth Conductor of length thirty meters
- v) And necessary connecting Leads & Connectors.

### **5.1.2 Manufacture**

The basic unit of the Power Capacitor Bank shall consist of three Numbers of single phase power capacitors, each of rating 100/150 kVAr, assembled to form a Star connection to provide a basic unit of rating 300/450 kVAr respectively. The rating required is indicated in the schedule of prices.

When the Bank consists of 6 Nos of Power Capacitors (two basic units assembled in parallel) the unit rating shall be 600/900 kVAr respectively and the star point (neutral) shall be kept unearthed.

Provision shall be made to earth the capacitors and the mounting bracket.

### **5.1.3 Mounting Brackets**

The mounting bracket shall be made of Galvanized Steel and shall be suitably designed to carry upto six Nos. of Power Capacitors of rating either 100 or kVAr and for mounting on a single concrete pole by clamping to the vertical surface of the pole of section 400mm x 300mm. Through bolting shall not be acceptable.

#### 5.1.4 Minimum Technical Requirements - Fixed Type Capacitor Banks & Accessories

	11kV	33kV
1. Rated Voltage	12	36
2. kVAr output at rated voltage	300/450/600/900	
3. Tolerance on kVAr	0 to + 10%	
4. No. of Units/Bank	3/6	3/6
5. Rating of Single Units kVAr	100/150	
6. Mode of connection of Bank (floating neutral)	Star	
7. Frequency Hz	50	50
8. No. of phases of Bank	3	3
9. Location	Outdoor	Outdoor
10. Type of Fuses	External expulsion type unit fuses	
11. Type of Bank	Open type	

#### 5.2 Switching Type Capacitor Banks and Accessories

The Switching Type Power Capacitor Banks shall consist of the following ;

- i) Naturally cooled static type shunt Power Capacitors 100/150 kVAr with external fuses - Nine Nos. The rating required is indicated in the schedule of prices.
- ii) Three Phase Medium Voltage (MV) Switch with automatic switching facilities for switching the capacitor bank - One No
- iii) Current Limiting Reactors - Three Nos.
- iv) MV Current Transformer - One No.
- v) MV Voltage Transformer with fuse protection - One No.
- vi) Mounting Platform for the above equipment
- vii) Four Nos.of Earth Electrodes
- viii) 95mm<sup>2</sup>, Black PVC Insulated Stranded Copper Earth Conductor of length forty meters
- ix) And necessary connecting leads & Connectors.

### 5.2.1 Manufacture

The above mentioned items shall be assembled on a platform as indicated in the schematic drawing attached. The platform shall be suitable for mounting on two or four concrete pole supports as shown in Drawing No. DS&S/95/7699 and the control cubicle shall be suitable for mounting on the same concrete pole support.

Three nos. of the above Capacitors shall be assembled to form a star connection to provide a basic unit of rating 400/450 kVAr, connected permanently to the feeder. The remaining six Nos. shall be assembled to form a double star of rating 600/900 kVAr connected in parallel to the permanently connected unit mentioned above through the current limiting reactors and MV Switch. The star points (neutral) shall be kept unearthed.

The MV Current Transformer (CT) and Voltage Transformer (VT) shall be connected to one of the phase conductors to sense the feeder current and voltage respectively.

The single phase Power Factor Relay connected to the secondary of the CT and VT shall automatically control the operation of the MV Switch through auxiliary relays at present low and high power factors of the feeders.

An adjustable time delay facility of 2 to 5 minutes before switching in the capacitor bank and 0.5 to 1 minute before switching off the capacitor bank shall be introduced to prevent



too frequent switching operations due to load variation in the feeder as well as power failure.

The capacitor bank switching in power factor shall be adjustable from 0.8 to 0.9 lagging (for making adjustment to suit the find requirements), and switching off power factor shall be 0.99 lagging.

Provision shall be made to switch off the Capacitor Banks automatically during the control (LV) and feeder (MV) power failure periods.

### **5.2.2 Sensing Relays and Control Equipment**

All necessary sensing relays and control equipment such as indicated below shall be provided. They shall be tropicalize and durable for use in a tropical climate.

- a) Single Phase Power Factor Relay.
- b) Time Delay Switching Equipment.
- c) Auxiliary Relays
- d) Feeder Power (MV) Failure Sensing Relay.
- e) Control Power (LV) Failure Sensing Relay/Indicator.
- f) Automatic/Remote/Local Control Switch
- g) Necessary Control Wiring
- h) Any other

### **5.2.3 Control Cubicle**

The Sensing Relays and Control Equipment stipulated in Clause 5.2.2 above (other than the MV Switch) shall be housed in control cubicle (with locking facility). It shall be made of steel and galvanized. The control cubicle shall be designed to protect the sensing relays and control equipment from the tropical climatic conditions in Sri Lanka. The necessary thermal insulation and ventilation shall be provided.

### **5.2.4 Mounting Brackets**

The power capacitor bank mounting platform shall be suitably designed to be mounted on two concrete poles of cross section 400mm X 300mm by clamping to the tapered surface. Through bolting shall not be acceptable.

The mounting brackets shall be made of galvanized steel and they shall be of light weight and strong enough to carry the weight of the power capacitors, Current limiting Reactors and the MV Switch as stipulated in Clause 5.2 above.

### 5.2.5 Technical Requirements - Switching Type Capacitor Banks & Accessories

		11kV	33kV
a.	Rated Voltage	12	36
b.	kVAr output at rated voltage	900	1350
c.	Tolerance on kVAr	0 to + 10%	
d.	No. of Units/Bank	9	9
e.	Rating of Single Units kVAr	100	150
f.	Mode of connection of Bank	Star Neutral)	(floating
g.	Frequency Hz	50	50
h.	No. of phases of Bank	3	3
i.	Location	Outdoor	
j.	Type of Fuses	Internal/External	fuses
k.	Type of Bank	Open type	

### 5.3 Capacitor Units

- a) The capacitor unit shall be of self contained outdoor type of two bushing and dead tank construction and shall conform to the Minimum Technical Requirements stipulated in Clause 5.4.
- b) The bushing shall be glazed porcelain having a minimum creepage distance and protected creepage distance as stipulated in Clause 5.4 - Technical Requirement

Requirements of Power Capacitor units and shall be effectively sealed to case.

- c) The case shall be of stainless steel type with a coating of suitable Primer and a coat of Epoxy base light grey Enamel applied in accordance with the relevant standard specified. The case shall be strong enough to withstand the system fault current specified without explosion.
  - d) The dielectric of the unit shall be pure Polypropylene Film and the electrode shall be soft annealed aluminium foil.
  - e) Capacitor units shall have the required number of capacitor elements each of which is protected by an internal fuse. In the case of a blown internal fuse the lost reactive power shall not be more than 2% of the reactive power of the capacitor unit.
  - f) Capacitor elements shall have extended foil type construction where, one edge of the foil is extended suitably beyond dielectric layers.
  - g) Each capacitor unit shall be fitted with a permanently connected discharge resistor. This shall be designed so that when the Capacitor Banks are disconnected from the supply, the residual voltage across the terminals of the banks is reduced from the crest value of the rated voltage to 50V or less within 300 seconds.
  - h) The power leads shall be connected to the extended portion of Aluminium Foil by soldering/crimping or any other suitable method, eliminating conventional tabs in order to make a strong and positive electrical contact. The other edge of the foil shall be folded suitably to form a corona ring in order to minimise partial discharges.
  - i) The impregnant shall be introduced into the capacitor tanks by means of a sealed vacuum system and it shall be environmentally safe and bio-degradable and shall not be of the polychlorinated biphenyl type Condenser Oil.
- The method of handling and disposal of the capacitor insulating fluid shall be indicated.
- j) Capacitors shall be suitable for continuous operation provided that none of the following limitations are exceeded.
    - a) 110% of nameplate kVAr.
    - b) 110% of rated voltage RMS including harmonics but, excluding transients.
    - c) 140% rated current RMS including harmonics.

- k) Momentary transient and power frequency voltages shall be in accordance with IEC Standard specified and the partial discharge voltage shall also be not less than that specified in the relevant IEC Standard.
- l) Capacitors shall be thermally stable in accordance with the definition and operating conditions outlined in the IEC and the Radio Influence Voltage shall be kept to a minimum not exceeding 250<sub>μ</sub>v.

#### 5.4 Technical Requirements - Capacitor Units

a.	Rated Voltage	-	12kV	36kV
b.	Basic Insulation Level			
	i. Lightning impulse withstand voltage	-	70kV	170kV
	ii. Power frequency withstand voltage (wet)	-	28kV	70kV
c.	Insulator Bushing Creepage distance			
	i. Total (min.)	-	300mm	900mm
	ii) Protected (min.)	-	105mm	315mm
d)	Rated kVAr	-	100/150	100/150
e)	No. of Phases	-	Single	Single
f)	No. of Bushings	-	Two	Two
g)	Loss Mxx. W/kVAr	-	0.15	0.15
h.	Discharge Device	-	Built in discharge Resistors	
i.	Discharge Time (max.)	-	300 sec.	300 sec.
j.	Type of dielectric	-	Polypropylene (all PP)	
k.	Type of electrode	-	Aluminium Foil	
l.	Type of elements	-	Extended foil type	
m.	Impregnant	-	Non-PCB, Non-Toxic,	

Biodegradable

n.	Fuse Protection	-	Internal/External fuse type
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### **5.5 Current Transformer 12kV and 36kV**

The Current Transformer shall conform to the IEC 185 having transformation ratio 400-200/5.5 suitable for out door installation in tropical climate as stipulated in Clause 3.0. The Rated Voltage, Basic Insulation Level and Creepage Distance shall be the same specified in Clause 5.4 Technical Requirements for Power Capacitor units.

### **5.6 Voltage Transformer 12kV and 36kV**

The Voltage Transformer shall conform to the IEC 186, suitable for out door installation in tropical climate as stipulated in Clause 3.0. The Rated Voltage, Basic Insulation Level and Creepage Distance shall be the same specified in Clause 5.4 Technical Requirements for Power Capacitor Units.

### **5.7 Current Limiting Reactors 12kV and 36kV**

The capacity of Reactors provided with the switching type capacitor banks shall be suitable to limit the inrush current to a low level for the safe operation of the switchgear and equipment.

The Reactor shall be of air core type conforming to IEC 289 (1988) Reactors, suitable for out door installation in tropical climate as stipulated in Clause 3.0. The Rated Voltage, Basic Insulation Level and Creepage Distance shall be the same specified in Clause 5.4 Technical Requirements for Power Capacitor units.

The calculation for proper selection of Current limiting reactors for the respective capacitor banks shall be furnished.

### **5.8 Medium Voltage Switch 12kV and 36kV**

The MV Switch shall be of three phase Outdoor type complete with operating mechanism. It shall be Oil/Vacuum/SF6 type, conforming to the System Parameters and the Service Conditions specified in Clause 2.0 and 3.0 and suitable for switching the Capacitor Bank in and out of the feeder. The Rated Voltage, Basic Insulation Level and Creepage Distance shall be the same specified in Clause 5.4. Technical Requirement for Power Capacitor.

It shall be suitable for mounting on the platform specified in Clause 5.2.1.

The control voltage of the operating mechanism and closing & tripping coil voltage shall be 230V AC. The operating mechanism shall be so designed that the Switch is free to open immediately when the tripping circuit is energised without any additional external power to

the operating mechanism. Energy needed for tripping shall be made to open the Switch when there is a failure of control voltage LV supply.

### **5.8.1 Operating Mechanism**

The operating mechanism shall be re-charged automatically for further operations as soon as the Switch has completed the closing operation. The design of closing mechanism shall be that the Switch cannot be operated inadvertently due to external shock forces resulting from short circuit Switch Operations or any other cause.

The three poles of the Switch shall make and break the circuits simultaneously. In the event of any phases failing to complete a closing operation, provision shall be made for automatic tripping of all phases of the Switch. In the event of the mechanism failing to latch in the closed position, the Switch shall be arranged to open at normal speed.

A mechanically operated indicator shall be provided on the operating mechanism to indicate whether the switch is closed or open. A mechanically operated re-settable operating counter shall also be provided.

### **5.8.2 Temperature Rise**

Each current carrying component of the equipment supplied shall be capable of continuous operation at the specified ratings without exceeding the maximum temperature rise stated in the appropriate IEC recommendations.

## **5.9 Earth Electrodes and Leads**

### **5.9.1 Earth Electrode**

Earth rods shall be 16mm diameter X 2.4m long copper clad steel with drive heads to permit hammer installation. Four numbers of earth rods shall be supplied with each unit.

The bonding between the copper and steel shall be such that there will be no corrosion and will not peel off when driven into earth.

The thickness of copper shall be adequate enough to protect the steel rod from corrosion during its life span.

### **5.9.2 Earth Leads**

Earth leads shall be of 95mm<sup>2</sup> Black PVC Insulated Stranded Copper Earth Conductor and suitable bolted type connectors for effectively bonding the copper earth conductor with the earth electrodes shall also be provided with each earth electrode.

### **5.10 Galvanizing**

Except where specified to the contrary all iron and steel parts such as mounting and support brackets, bolts and nuts, washers etc. shall be galvanized after the process such as sawing, shearing, drilling, punching, filling, bending and machining are completed.

Galvanizing shall be carried out using the hot-dip process to comply with the standard BS 729 specified.

## **6.0 ADDITIONAL REQUIREMENTS**

### **6.1 Nameplate Marking**

Each power capacitor shall be provided with a permanent nameplate which includes the following information.

- 1) Name of manufacturer
- 2) Serial number
- 3) Manufacturer's type, model, style, or catalog number
- 4) Year of manufacture
- 5) Rated reactive power
- 6) Rated voltage, rms
- 7) Number of phases
- 8) Rated frequency
- 9) BIL
- 10) Statement as to whether insulating liquid in the capacitor is or is not flammable. (If flammable, amount in gallons shall be shown).
- 11) Statement that capacitor contains an internal discharge device.

### **6.2 Tools**

Any special tools if required for installation and maintenance shall be supplied with the equipment.

## 7.0 CAPITALIZATION OF LOSSES

The power loss of capacitor shall not exceed 0.15 Watt/kVAr. All capacitor losses shall be capitalised and added to the cost of the capacitor bank in evaluating the offer. The losses shall be capitalized for a period of 8 Years. For the purpose of comparing the offers following values will be adopted when capitalizing the loss.

US \$ 2.0 for loss in Watt per kVAr

Interest and sinking fund Charges - 10%

## 8.0 QUALITY CONTROL

Quality Assurance System conforming to ISO 9001 shall be followed in the manufacture of Power Capacitors and Accessories and the Bidders shall furnish documentary evidence with the offer to prove this.

## 9.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

- a) Manufacturers catalogues (indicating type and model number) of all equipment (including the sensing relays and control equipment) offered shall be furnished.
- b) Bidders shall recommend maintenance requirements for the Capacitor Banks and shall state the interval between scheduled maintenance works.
- c) Bidders shall state the method by which capacitor units can be removed and replaced.
- d) The following Certificate of Type Test for Power Capacitors from an independent testing authority shall be provided with the offer and shall be in accordance with the relevant standards and this specification.
  - i) Tests for output/capacitance
  - ii) Thermal stability tests
  - iii) Tangent of dielectric loss angle at elevated temperature
  - iv) Capacitor discharge tests
- e) List of Purchasers for the same make and similar model for the last five years and performance certificates from the user utilities.
- f) Schedule of Particulars - Annexure 1



Failure to furnish the above details will result in the offer being rejected.

## **10.0 TECHNICAL LITERATURE AND WORKING DRAWINGS**

10.1 The Supplier shall provide to the Purchaser the Layout Drawings of the equipment and the Wiring Diagrams and obtain his approval prior to manufacture.

10.2 The Tenderer shall furnish the following with the equipment.

- i) Equipment Layout drawings and foundation details.
- ii) Full technical literature of all items of the equipment.
- iii) Installation instructions of all items in detail.
- iv) Full wiring drawings of the equipment.
- v) Instruction for commissioning the equipment and details of commissioning Tests to be carried out.
- vi) Operation and maintenance instructions.

## **11.0 INSPECTION AND TESTING**

### **11.1 Inspection and Testing**

The selected tenderer shall make arrangements for inspection by an Engineer appointed by the Purchaser and also make arrangements to carry out in his presence necessary simulation and conventional tests of the materials and items offered.

All tests shall be made prior to despatch in the presence of the representative of the purchaser and the test results in quadruplicate shall be supplied to the purchaser for approval. No material shall be despatched without prior approval of the test certificate by the purchaser.

Copies of the type tests already performed on similar type of equipment shall be enclosed with the Bid to judge the merits of the equipment offered by the Bidder.

### **11.2 Tests on Capacitors**

#### **11.2.1 Type Tests on Capacitors**

Type Tests shall be carried out on one unit of each rating provided that, where batch production occurs, all batches of the same rating shall be manufactured from the same

stock of materials. If more than one stock of materials is used for each rating, one unit, manufactured from each stock of materials, shall be tested for this rating.

The following Type Tests shall be carried out in accordance with the IEC specified.

- a) Tests for output/capacitance
- b) Thermal stability tests
- c) Tangent of dielectric loss angle at elevated temperature
- d) Capacitor discharge tests

### **11.2.2 Routine Tests on Capacitors**

The following Routine tests as per IEC 871 shall be carried out on all capacitor units and shall comprise of:

- a) Visual Examination
- b) Sealing Test
- c) Voltage Test between terminals
- d) Test for efficacy of discharge device
- e) Measurement of tangent of loss angle.
- f) Discharge device test

### **11.2.3 Acceptance Tests on Capacitors**

The following Acceptance Tests in accordance with the relevant IEC 871 shall be carried out in samples selected at random at the time of inspection.

- a) Visual Examination
- b) Sealing Test
- c) Voltage Test between terminals
- d) Test for efficacy of discharge device
- e) Measurement of tangent of loss angle
- f) Galvanizing Test on Steel Hardware Components

## **12.0 ANNEXURE**

- A - Guaranteed Technical Particulars for Power Capacitor Bank.  
Medium Voltage 12kV/36kV Capacitor Bank Switching Type
- B) Connection Drawing.
- C) Typical Double Concrete Pole Platform Mounted Construction

**Annexure - 1****GUARANTEED TECHNICAL PARTICULARS FOR POWER CAPACITOR BANK**

(The Bidders Shall furnish these particulars for each type offered)

1)	Manufacturer's Name	-
2)	Maker's type designation	-
3)	Standard followed	-
4)	Purpose	-
5)	Location (outdoor/indoor)	-
6)	Capacitor Bank :	
6.1	Rated output MVAR	-
6.2	Rated voltage kV.	-
6.3	Rated current Amp.	-
6.4	Rated frequency Hz.	-
6.5	(i) Rated capacitance per phase, micro-farad	-
	(ii) Tolerance on rated capacitance	-
6.6	Rated reactance per phase, Ohms	-
6.7	No. of phase	-
6.8	Type of connection	-
6.9	No. of units per Bank	-
6.10	Power frequency withstand voltage, kV (RMS)	-
6.11	Impulse withstand voltage, kV (Peak)	-
6.12	Type of mounting structure	-
6.13	Galvanizing thickness mm.	-
6.14	Height of life conductor from the ground level mm.	-

6.15	Approx. overall dimension and weight	-
<b>7.</b>	<b>Capacitor Unit</b>	
7.1	Rated output KVAr.	-
7.2	Rated voltage kV.	-
7.3	Rated current A.	-
7.4	Rated frequency Hz.	-
7.5	(a) Rated capacitance micro-farad	-
	(b) Tolerance on rated capacitance %	-
7.6	Phase	-
7.7	No. of bushing terminals	-
7.8	Type of fuse	-
7.9	Losses as per IEC (W/kVAr)	-
7.10	Insulation Level	
	a) Power frequency withstand voltage kV (RMS)	-
	b) Impulse withstand voltage kV (peak)	-
7.11	Permissible overloads	
	7.11.1 Voltage including harmonics	-
	7.11.2 Current including harmonics	-
	7.11.3 Output	-
7.12	Type of dielectric and type of impregnant	-
7.13	Type of foil material	-
<b>8.</b>	<b>Discharge device to discharge capacitor bank to 50V or less in 300 sec after disconnection from supply</b>	-
8.1	Directly connected., internal discharge resistor	-
8.2	Other discharge device	-

9.	Type of construction of elements	-
10.	Insulation level of bushing used	-
11.	No. of bushing/unit	-
12.	Type of bushing	-
13.	Upper limit of temp. category	-
14.	Material of container	-
15.	Medium Voltage Switch	

Item	Description	Units	Details
(a)	Rated voltage	kV	
(b)	Rated current	A	
(c)	Impulse withstand Voltage(1.2/50 $\mu$ s)kV peak	kV	
(d)	Rated power frequency Withstand Voltage (wet)	kv	
(e)	Rated short-circuit breaking current	kA	
(f)	Rated short- circuit making current	kA	
(g)	Control mechanism operating Voltage	V	
(h)	Closing Coil operating Voltage	V	
(i)	Tripping Coil operating voltage	V	
(j)	Minimum number of auxiliary contacts normally open normally closed	Nos. Nos.	
(k)	Minimum Electrical clearance between phases	mm	
(l)	Minimum Creepage distance	mm	
(m)	minimum Protected distance	mm	
(n)	Gas monitoring (for SF6 type only)	-	

