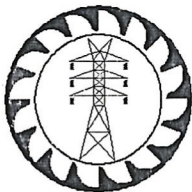


132-1: 2020

CEB  
SPECIFICATION

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**TEMPORARY PROTECTIVE  
GROUNDING EQUIPMENT  
(POLE APPLICATION)**



**CEYLON ELECTRICITY BOARD**



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## TEMPORARY PROTECTIVE GROUNDING EQUIPMENT (POLE APPLICATION)

### 1.0 SCOPE

This specification covers the general requirement of design, manufacture and testing of Temporary Protective Grounding Equipment to be used on electric power lines for 400 V, 11kV and 33kV overhead distribution system of the CEB.

### 2.0 SYSTEM PARAMETERS

(a)	Nominal voltage	400 V	11kV	33kV
(b)	System highest voltage	440 V	12kV	36kV
(c)	System frequency	50 Hz	50Hz	50Hz
(d)	Number of phases	03	03	03
(e)	Line configuration	Mostly Vertical.	Mostly Horizontal. Occasionally Triangular or Vertical.	
(f)	System fault level/ duration	14 kA/1s (below 400kVA transformers)	16.4 kA/1s	17.6 kA/1s
(f)	Method of earthing	Effectively earthed	Effectively earthed	Non-Effectively earthed

### 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 polluted atmosphere
(e)	Operational altitude	From M.S.L. to 1900 m above M.S.L.
(f)	Isokeraunic (Thunder days) level	100 days

### 4.0 APPLICABLE STANDARDS

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

(a)	ASTM F855 : 2014	Temporary Protective Grounds To be used on De-Energized Electric Power Lines and Equipment
(b)	IEC 61230: 2008	Live Working – Portable Equipment for earthing or earthing and short- circuiting
(c)	IEC 61138: 2007	Cables for Portable Earthing and Short-Circuiting Equipment
(d)	IEC 60228:2004	Conductors of Insulated Cables
(e)	IEC 60227-1: 2007	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V
(f)	IEC 61235: 1993	Live Working- Insulating Hollow Tubes for Electrical Purposes



(g)	IEC 60855:2009	Insulating Foam-Filled tubes and solid rods for live working
(h)	ASTM F711-02:2013	Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools 1

## 5.0 BASIC FEATURES

5.1 The Temporary Protective Grounding Equipment shall be suitable for the earthing procedures done in following manner.

Step 1 – Ensuring the de-energization of the line using medium voltage detector. (Detector will be removed only after earthing is completed)

Step 2 – Assembling earthing kit and fixing earth rods and trifurcation point (cluster) on pole.

Step 3 – Fixing the earthing clamp to the line earth wire using operating stick.

Step 4 – Inserting and tightening of clamps to the phase conductors one by one using operating stick.

5.2 The Temporary Protective Grounding Equipment shall be suitable for earthing 33kV, 11kV and LV lines where only the operating rod will distinguish applicable voltage and shall be comprised of parts as depicted in table-01. When designing the highest fault current in all three system voltages shall be taken as design fault current.

**Table-01: Parts of the Temporary Protective Grounding Equipment.**

Part of the equipment	Nos.	Clause No.
Clear insulated grounding cable between phase to trifurcation point to withstand design fault current, complete with lugs, bolting arrangement and clamp –length 2.5m to 3.0m	3	5.3,5.4
Clear insulated grounding cable between line earth wire to trifurcation point to withstand design fault current, complete with lugs, bolting arrangement and clamp –length 2.5m to 3.0m	1	5.3,5.4
Clear insulated grounding cable between trifurcation point to earth rod in ground to withstand design fault current, complete with lugs, bolting arrangement and two earth rods connected to each other at 3m distance–length 12m	1	5.3,5.4,5.6
Cluster arrangement for trifurcation	1	5.5
Medium voltage operating stick	1	5.7

Temporary Protective Grounding Equipment shall conform to the following minimum conditions.

### 5.3 Grounding Cables:

The conductor of the grounding cable shall be stranded Annealed Copper or Stranded Aluminium/Aluminium Alloy as per referred standards. The cross section of the cables shall be able to withstand 17.6 kA fault current for X/R ratio of above 10. The cable covering shall be





transparent, 1.5mm  $\pm$ 0.25mm thick and made of general-purpose thermoplastic based on a compound of thermoplastic polyvinylchloride or one of its co-polymers as per IEC 61138.

Cables shall be free of structural defects that affect installation, assembly or performance. And solder parts are not allowed.

#### 5.4 Clamps:

Clamp shall be of Copper or Aluminium based alloy and having following mechanical and electrical properties.

The type of the clamp should be an equivalent of C-type grounding Clamp and Jaws of the clamps should have serrated contact surfaces. Clamp should be able to:

- a) Insert and hold to the conductor in an unwavering manner.
- b) Tighten the screw to get sufficient grip/contact by turning the operating rod without slipping out. Positive screw locking device or any other mechanism to protect against unintentional loosening of nut of the ferrule after fixing it to the grounding clamp shall be provided. Yielding torque and tensile strengths of the clamp shall be as per the referred standards in clause 4.0.
- c) Easily detach the operating rod from the clamp once the tightening is over.

Resistance of the clamp shall be less than that of an equal length (equal to the length of the clamp) of grounding cable.

Clamps shall accept hand assembly of grounding cables fitted with a lug through bolting arrangement. Clamp shall accommodate conductor sizes from 4mm to 20mm diameter.

In the event the clamp is fractured installation, attached cable should remain under control by being retained with the stick.

#### 5.5 Cluster arrangement:

Cluster arrangement shall be designed to attach five grounding wires (described in clause 5.3) with a proper bolted arrangement, and the chain/pole fixing arrangement of the cluster arrangement shall be of adjustable type to hold on to the pole, which should be able to withstand weight of the worker and having sufficient footing area. The current rating of the cluster arrangement should be twice that of the current rating of clamps.

Periphery to be covered by pole fixing arrangement	150cm $\pm$ 5cm
Cluster bar material	Copper based alloy/ Aluminium base alloy/Aluminium

#### 5.6 Temporary Grounding rod:

The copper clad steel spindle, screw type Temporary Grounding Rods shall be provided with a suitable bronze spiral and a handle, pinned at both the ends.

Total Length	120cm ~ 150cm
Diameter of the rod	15mm~ 19mm.



**5.7 High Insulating Operating Stick:**

All the properties shall be in accordance with IEC 61235 and IEC 60855 or ASTM F711-02, and it should be not less than two meters (2m) in length. Head of the operating rod should match with the design of the clamp.

Top end of the insulating stick shall have a fitting to accommodate clamps described in clause 5.4 in a trouble-free manner to lock and unlock.

Operating Rod category (Pole Category)	Reinforced
Bending Force for the maximum deflection of 65mm	100N
Maximum deflection	65mm

**6.0 REQUIREMENTS FOR SELECTION****6.1 Quality Assurance**

The manufacturer shall possess ISO 9001:2015 or latest Quality Assurance Certification valid throughout the delivery period of this bid, for the manufacture of similar equipment for the plant where manufacturing is being done. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacturer, along with the offer.

**6.2 Manufacturing Experience**

Manufacturer shall have sound expertise on manufacturing equipment with similar technology and their products shall have been successfully used in tropical countries with rated power distribution voltages of 400V, 11kV and 33kV for more than ten (10) years. The make and the model offered shall have satisfactory sales records in the international market for more than five (5) years.

Makes with proven after sales service; excellence track records and well known in Sri Lanka will be exempted from above requirements.

**6.3 Type Tests**

The following Type Test Certificates conforming to applicable standards or any other international standard which is not less stringent, issued by:

Either

- an accredited independent testing laboratory acceptable to the CEB or
- an accredited or independent testing laboratory acceptable to the CEB where the type tests have been witnessed by CEB or a reputed independent body acceptable to CEB

shall be furnished with the offer. Type Test Certificates shall clearly indicate the relevant standard, items concerned, showing the manufacturers identity, type No. /catalogue No. and basic technical parameters. In case if the submitted type tests are according to any other international standard which is not less stringent than the specified, then the copy of the used standard in English shall be submitted with offer.



Proof of accreditation and accredited scope 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.

Temporary protective ground set should be subjected to following type tests according to IEC 61230 or design tests as per ASTM F 855 – 97.

**Table-02: Type/Design tests as per IEC 61230 and ASTM F 855 – 97.**

	IEC 61230	ASTM F 855 – 97
(a)	Fatigue test on cable with end fittings on grounding clamps (IEC 61230, Clause 6.2)	Mechanical torque strength test on grounding clamps (ASTM F 855, Clause 12.2)
(b)	Short circuit current test on grounding cable (IEC 61230, Clause 6.6)	Electrical short circuit capacity test on grounding cable (ASTM F 855, Clause 12.3, and Clause 25.2)
(c)	Testing of jackets of grounding cables (IEC 60227-1, Table 2)	Testing of jackets of grounding cables (ASTM Test Methods D470, D2633, and Clause 35.2.3.2)
(d)	Bending Test on Insulated Operating Sticks (IEC 61230, Clause C.3)	Bending deflection check on Insulated Operating Sticks (ASTM F 711-02, Clause 12.3.1)

## 7.0 INFORMATION TO BE FURNISHED WITH OFFER

The following documents shall be furnished with the offer.

- a) A Catalogue describing the equipment, type, model number and all the features.
- b) A User Manual containing relevant technical literature and complete user guide.
- c) Completed schedule of particulars (Please see Annex – A)
- d) Certified copy of the quality assurance conforming to ISO 9001:2015 or latest.
- e) Type test certificates as per clause 6.3.
- f) Evidentiary documents should be produced as a proof of manufacture's experience and performance as per clause 6.2.

## 8.0 MARKING AND PACKAGING

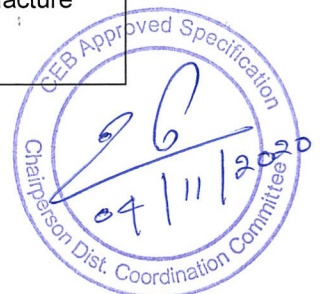
### 8.1 Markings

Markings shall be clearly legible and durable. The letters size shall be at least 3mm high.

Markings are described item wise in the table-03.

**Table-03: Markings on the Temporary Protective Grounding Equipment.**

Item	Marking
Cable	Cross section in mm <sup>2</sup> and material of conductor on each cable.
Clamp	Name or the logo of the manufacturer, identity number and the year of the manufacture.
Cluster Bar	Manufacturer's identity code
Insulating Operating Stick	(a) Manufacturer's name or Trade mark, Year of Manufacture and warranty period (b) Model number / Identification number





	(c) Applicable Standard & Number (d) Applicable voltage and number of sections (e) The letters "CEB"
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## 8.2 Packing

The temporary protective grounding equipment shall be supplied with carrying case suitable for rough use at the field for disallowing any deformity of any part of the equipment.

## 9.0 INSPECTION AND TESTING

### 9.1 Routine Test:

The following routine tests as per ASTM F 855 or IEC 61230 shall be carried out on all the Temporary Protective Ground sets ordered and the routine test reports shall be made available for the observation of the CEB Engineer at the time of inspection.

- a) Visual Inspection and hand operation to verify technical requirements in accordance with Clause 6.0.
- b) Verification of the clamps, lugs and cable size, for markings and lengths as specified.

### 9.2 Inspection:

The selected Bidder shall make necessary arrangements for inspection of the equipment by an Engineer appointed by the Purchaser and also to carry out in his presence necessary Acceptance / Sample tests of the materials and equipment, offered. CEB may waive off the inspection with the condition of carrying out the acceptance tests by an independent testing authority acceptable to CEB. In such a situation a notice of waive off will be issued in advance to the supplier.

### 9.3 Acceptance /Sample Tests:

The following Acceptance/Sample tests conforming ASTM F 855 or IEC 61230 shall be witnessed by the Engineer.

- a) Mechanical torque strength (ASTM F 855, Clause 12.2) or Fatigue test on cable with end fittings (IEC 61230, Clause 6.2)
- b) Resistance comparison test (Size of ferrules should be suitable for the current carrying capacity and the size of the grounding cable).
- c) Visual Inspection and hand operation to verify workmanship, finish and appearance.
- d) Verification of clamps, ferrules and cable size, marking and lengths as specified.

## 10.0 ANNEX

- Annex-A      Schedule of guaranteed technical particulars
- Annex-B      Non-Compliance Schedule





## Annex – A

**SCHEDULE OF TECHNICAL REQUIREMENTS AND GURANTEED TECHNICAL PARTICULARS**

(CEB Requirements shall be filled by the procurement entity and information of the offer shall be filled by the manufacturer)

		CEB Specified	Offered
1.	Name of the manufacturer		
2.	Country of the manufacturer		
3.	Model No. as stipulated in the catalogue		
4.	Applicable Standards	As per Clause 4.0	
5.	a) Cable size	Please specify	
	b) Cable Material	Annealed copper / Stranded Aluminium	
	c) No of strands of the cable	Please specify	
	d) Covering Material	As per IEC 61138, clause 1.6.2.1	
	e) Thickness of the covering mm	1.5 ±0.25 as per IEC 61235	
	f) Color of the covering	No color (Transparent)	
6.	a) Clamp material	Copper based alloy/ Aluminium based alloy	
	b) Clamp material Tensile strength Mpa		
	c) Clamp material Yield strength, min Mpa		
	d) Clamp material Elongation, min %		
	e) Line Clamp conductor range mm	4-20	
	f) Clamp torque strength Yield, min Nm		
	g) Clamp torque strength Ultimate, min Nm		
	h) Type of the line Clamp	C-Type or equivalent	
	i) Marking on the clamp	Name or Logo of the manufacturer, Identity number, year of manufacture	
7.	a) Cluster arrangement peripheral length	150cm±5cm	
	b) Material of cluster	Copper based alloy/ Aluminium based alloy/Aluminium	



	c) Whether it can withstand a worker's weight?		
	d) Area of the stepping surface		
	e) Current rating of the cluster arrangement	Minimum, twice that of the current rating of the provided clamp	
	f) Marking on the cluster arrangement	Manufacture's identity code	
8.	a) Temporary Grounding rod type	screw type	
	b) Material of the spindle	Copper clad steel	
	c) Material of the screw and handle	Bronze	
	d) Diameter of the rod mm	15-19	
	e) Length of the Rod cm	120 -150	
9.	a) High insulating operating rod category	Reinforced	
	b) High insulating operating rod bending force, minimum N	100	
	c) High insulating operating rod maximum deflection, maximum mm	65	
	d) Marking of the operating rod	Name or the trade mark of the manufacturer.	
10.	Ultimate current carrying capacity of the equipment for 1 second, X/R ratio above 10.		
11.	Whether the Type Test Certificates are furnished as per Clause 7.0? Yes/ No	Yes	
12.	Whether the Acceptance /Sample Tests as per Clause 8.0 will be carried out? Yes/ No	Yes	
13.	Whether the certificate of ISO 9001:2015 or latest quality assurances furnished? 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 – B

## 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 of the Manufacturer and seal

.....  
Date

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

.....  
Signature of the Bidder and seal

.....  
Date

