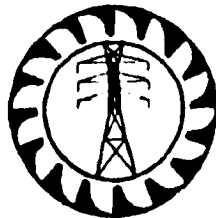


CEB STANDARD 051 : 1997

Specification

for

COPPER CLAD STEEL EARTH ROD ASSEMBLY



CEYLON ELECTRICITY BOARD

SRI LANKA

Specification

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CEB Standard 051 : 1997

CEYLON ELECTRICITY BOARD

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SPECIFICATION FOR COPPER CLAD STEEL EARTH ROD ASSEMBLY

1.0 SCOPE

This Specification covers the general requirements of design, manufacture and testing of Copper Clad Steel Earth Rod Assembly suitable for earthing of electrical equipment.

The Copper clad Earth Rod Assembly consists of the following components

- (a) Copper clad rod.
- (b) Coupling.
- (c) Driving head.
- (d) Clamp.
- (d) Adopter (Plug)

2.0 APPLICABLE STANDARDS

- | | | | |
|----|-----------------|----------|--|
| a) | BS 2871, Part 2 | : 1972 - | Specification for Copper & Copper Alloys Tubes |
| b) | BS 2874 | : 1986 - | Specification for Copper & Copper Alloy Rods & Sections (other than forging stock) |
| c) | BS 3692 | : 1967 - | ISO metric precision hexagon bolts screws & nuts |
| d) | BS 4360 | : 1990 - | Specification for weldable structural steels. |
| e) | ISO 9002 | : 1987 - | Quality systems-Model for quality assurance. |

3.0 BASIC FEATURES

3.1 Copper Clad Earth Rod

The Copper Clad Earth Rod shall be made of a core of high tensile-low carbon steel of quality not inferior to grade 43E complying with BS 4360 (1990). The cladding shall be of 99.9% purity electrolytic copper molecularly bonded to the steel core. The radial thickness of the copper shall be not less than 0.25 mm.

The Earth Rod shall be fully covered with the copper cladding without any cracks, holes, Cavities etc. preventing exposure of the steel core to the soil and moisture. The Rod shall be suitable treated to prevent oxidation of copper bonding.

The Earth Rod shall be of circular cross section and the diameter shall not be less than 19 mm and the length of the rod shall not be less than 1.2 m.

One end of the Earth Rod shall be tapered off to a smaller diameter not more than 10 mm, so that it could be used as a driving tip. Length of the tapered portion shall not be less than 10 mm. The Tip of the tapered end of the rod shall be strong enough not to expose the steel core after the rod has been driven into the ground.

The other end of the rod shall be so formed (counter-sunk) to allow the tapered tip of the other Copper Clad Earth Rod to provide sufficient contact area when two Earth Rods are used (coupled).

Both ends of the rods shall have external threads to enable the rods to be coupled, by means of the coupling as specified in section 3.2 as shown in the drawing No. DS&S/51/97. The threads on rods shall be suitably formed to prevent chipping of threads while driving the rods in the ground.

Length of the threaded portion of each end shall not be less than half the length of the coupling.

Threads shall be of ISO Metric Type and the threads shall not cut into the steel core which would cause quick corrosion at coupling making the system ineffective. Suitable caps shall be provided at both the ends of the rod to prevent threads getting damaged during, transport handling and storage.

3.2 Coupling

Coupling shall be made from Silicon Bronze Alloy, grade CS 101 of BS 2874 or Aluminum Bronze Alloy Grade CA 102 of BS 2871. It shall be counter bored to completely enclose threads, and shall be able to couple two rods or a rod & a driving head specified in section 4.3, as shown in the drawing No. DS&S/51/97. Coupling shall be of high strength & corrosion resistant. It shall ensure good electrical & mechanical contact of the two rods and permit the driving force to be directly applied on the rods and not through the coupling threads.

Length of the coupling shall not be less than 40 mm.

3.3 Driving Head

Driving head shall be ISO metric hexagon bolt of high strength steel, having rolled thread end complying with BS 3692 : 1967. It shall be suitable to be used with the couplings as specified in section 3.2. and be able to withstand hammer blows.

It shall be suitable for use many times over as well. Threaded length shall not be less than half the length of the coupling.

Nominal size (thread diameter)	-	19 mm
Nominal length	-	30 mm
Applicable standard	-	BS 3692 : 1967

3.4 Clamp

The clamp shall be made of tinned copper or other suitable alloy. It shall be suitable for effectively connecting the following types of earthing leads to Copper Clad Earth Rod (19 mm diameter).

- a) 5 mm galvanised steel wire
- b) 10 mm tinned copper adaptor (plug)
- c) 7/4.0 mm galvanized stranded steel wire
- d) 95mm² stranded copper wire .

The clamp shall be able to make good electrical contact between earth rod and the earthing lead and the connection shall not loosen off in use.

Clamp shall comprise of the following,

- a) A device for making contact with the Cu clad earth rod.
- b) Means of tightening the device on to the copper clad earth rod.
- c) Means of attaching the earthing lead to the device.

3.5 Adapter (Plug)

The Adaptors shall be used to connect the galvanized steel earth wire to the Copper Clad Earth Rod with the clamp as stipulated in Clause 3.4 above to prevent Galvanic Corrosion.

The Adapter (Plug) shall be made of tinned copper and the internal diameter of the barrel shall be suitable for crimp jointing either 5 mm diameter galvanized steel wire.

The length of the Barrel and Plug shall not be less than 22 mm and 18 mm respectively. The External diameter of the plug shall be 10 mm.

The Adapter shall be suitable for crimping with MD6 Burndy compatible Hand (Mechanical) Crimping Tool using W241 Die (Burndy compatible).

3.6 Tolerance

The following dimensional tolerance shall be allowed on all components;

	Dimension	Tolerance
a)	Upto and including 40 mm	± 0.5 mm
b)	Over 40 mm	± 1%

4.0 QUALITY CONTROL

The manufacturer shall have obtained Quality assurance certification conforming to ISO 9002 for the manufacturer of Copper Clad Earth Rods. Bidders shall furnish documentary evidence to prove this.

5.0 ADDITIONAL REQUIREMENTS

5.1 Marking of Components

Every component shall bear the following information and they shall be engraved or embossed on the external surface.

- a) The manufacturer's name or trade mark, and the year of manufacture.
- b) Length and the diameter (in mm), of the rod.
- c) Letters "C.E.B."

5.2 Packing

The Copper Clad Earth rods, Couplings, Clamps, Driving Heads and Adapters (Plugs) shall be suitably packed separately in wooden boxes and the quantity of items in a package is as in i), ii), iii), iv) or v) given below.

i)	Copper Clad Earth Rods	50 Nos
ii)	Couplings	100 Nos.
iii)	Clamps	100 Nos
iv)	Driveing Heads	100 Nos
v)	Adapters (Plugs)	100 Nos

Each Packing shall be clearly and indelibly marked with the following;

- i) Name of Item
- ii) Quantity
- iii) Gross Weight

6.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

The following shall be supplied with the offer.

- a) The catalogues (in English) describing the items and indicating the following;
 - i) Model/Reference number, Code Name
 - ii) Current carrying capacity and the % of current through the Coupling.
 - ii) Constructional features and material used for components, the standards to which the items are manufactured and relevant technical literature.

- b) The following Type Test certificates from an independent testing authority acceptable to the purchaser;
 - i) Verification of Dimensions
 - ii) Adherence of Copper Clad to Steel Core
 - iii) Current carrying Capacity
 - iv) Mechanical Strength.
 - v) Checking the condition of the threads (of the Rod, Coupling and Driving Head) and copper cladding after performing a driving (in to hard soil) operation.
- c) The Manufacturer shall have at least ten years of experience in the manufacture of Copper clad Earth Rods. He shall furnish sufficient documentary evidence in the Bid to prove his manufacturing experience.
- d) Certification for Quality Assurance conforming to ISO 9002
- e) Duly Completed Schedule of Particulars (Annexure - A)
- f) Dimensional Drawings of all items

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

7.0 SAMPLE STUDY

Two (2) Samples of each item offered shall accompany the bid to facilitate analysis and evaluation.

8.0 INSPECTION & TESTING

8.1 Inspection

The selected Bidder shall make necessary arrangements for inspection by an Engineer appointed by the Purchaser and also to carry out in his presence necessary routine/sample tests on the materials offered.

The Items shall be stored in such a manner for easy selection of samples to carry out Sample/Acceptance Tests as given below.

8.2 Sampling

For every batch of 100,000 Nos. of Copper Clad Steel Rod Assembly 20 Nos of Rods, & 20 Nos of Clamps , 20 Nos. of Couplings, 20 Nos of Driving Heads and & 20 Nos of Adapters shall be selected randomly to carry out sample/acceptance test as per Clause 8.3.

8.3 Testing (Sample/Acceptance Tests)

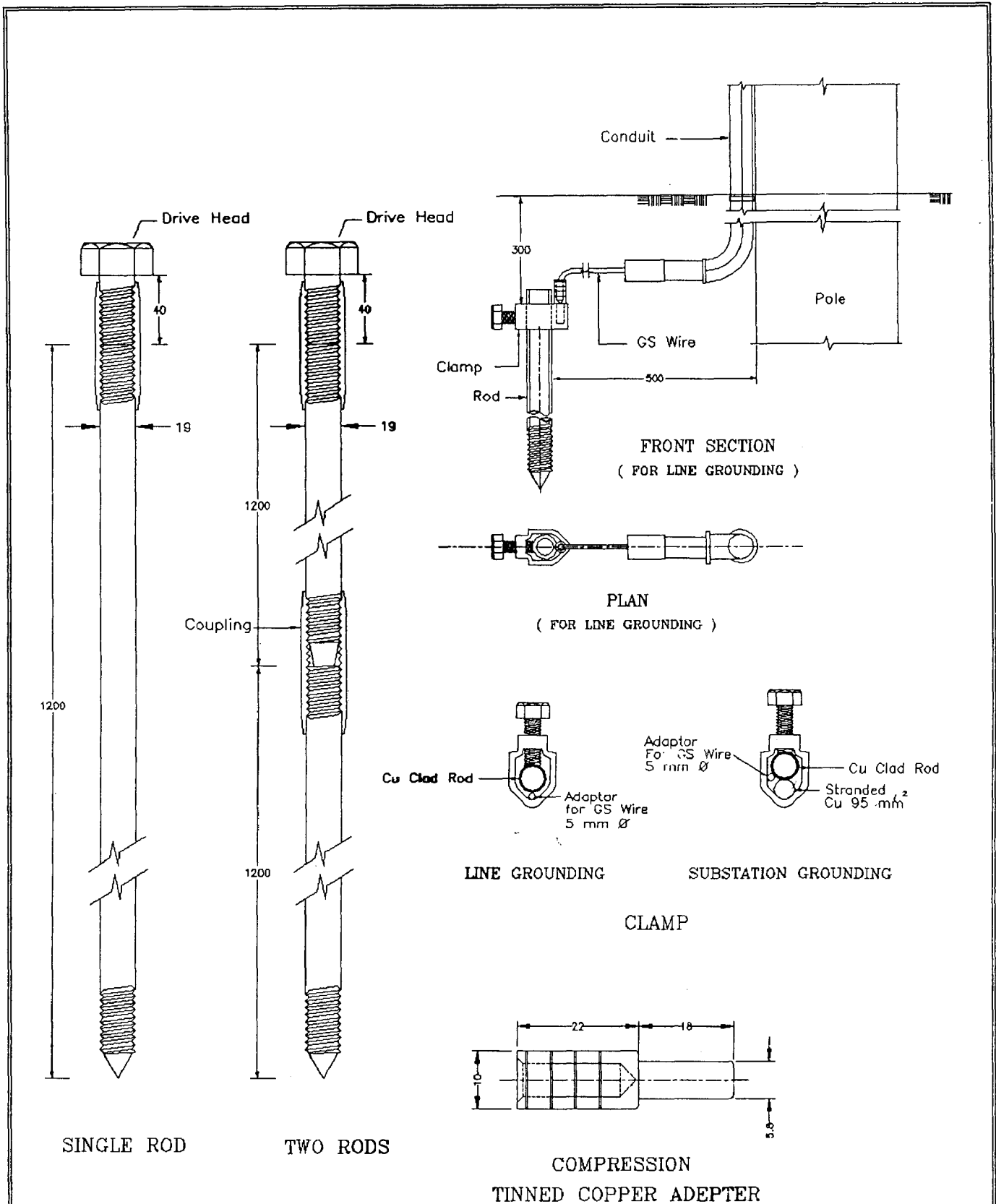
The following Sample /Acceptance Tests shall be witnessed by the Engineer appointed by the Purchaser.

- i) Verification of Dimensions
- ii) Adherence of Copper Clad to Steel Core
- iii) Current carrying Capacity
- iv) Mechanical Strength.
- v) Checking the condition of the threads (of the Rod,Coupling and Driving Head) and copper cladding after performing a driving (in to hard soil) operation.


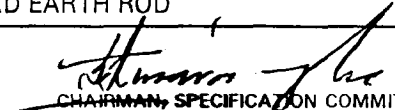
9.0 ANNEXURE

- A - Drawing No. DS&S/51/97
- B - Schedule of Particulars (to be filled by the Manufacturer)

COPPER CLAD EARTH ROD



All dimensions are in mm.

ELECTRICITY BOARD	DISTRIBUTION STANDARDS AND SPECIFICATIONS		SCALE :
	COPPER CLAD EARTH ROD		DRAWN : Lalani
DD BRANCH	DESIGNED  CE (DS & S)	APPROVED  CHAIRMAN, SPECIFICATION COMMITTEE	DATE : FEB. 97
			DRAG NO:

SCHEDULE OF PARTICULARS
(To be filled by the Manufacturer for each item offered)

1)	Name of Manufacturer and country of origin.			-
2)	Applicable Standards.			-
	Copper Clad Earth Rod			
3)	Grade of steel rod.			-
4)	Tensile Strength of steel rod.			-
5)	Current Carrying Capacity of the Rod.	Amps		-
6)	Whether the Copper Cladding is molecularly Bonded to the Steel Rod.	Yes/No.		-
7)	Details of Bonding Process.			-
8)	Thickness of Copper Cladding.	Minimum	mm	-
9)	Type of thread			-
10)	Whether caps are provided at both the ends of the rod to protect the threads	Yes/No.		-
11)	Length.		m	-
12)	Diameter.		mm	-
13)	Length of tapered portion (tip).	Maximum	mm	-
			mm	-
14)	Length of threaded portion.			-
15)	Weight.		kg	-
16)	Method adopted to prevent oxidation of copper bonding			-
	Coupling			
17)	Material.			-
18)	Length		mm	-
19)	Diameter	Inner	mm	-
		Outer	mm	-
20)	Weight		kg	-
21)	Percentage of the current that passes through the coupling			-

Driving Head

22)	Nominal Size (threaded Diameter)	mm	-
23)	Nominal Length	mm	-
24)	Applicable Standard	-	-
25)	Threaded Length	mm	-
26)	Material of Driving Head	-	-
27)	Weight of Driving Head	kg	-

Clamp

28)	Material of Clamp	-	-
29)	Length of Clamp	-	-
30)	Weight of Clamp	kg	-

Adapter (Plug)

31)	Length of barrel	mm	-
32)	Diameter of barrel	mm	-
33)	Length of plug	mm	-
34)	Diameter of Plug	mm	-
35)	Weight of Adapter	kg	-
36)	Whether the following Certificates from independent Authority is furnished		
1)	Type tests	Yes/No	-
2)	ISO 9002 Quality assurance certification	Yes/No.	-
37)	Marking details		-

.....
 Seal and Signature of the Manufacturer

C:\sr\copper_C

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 Date

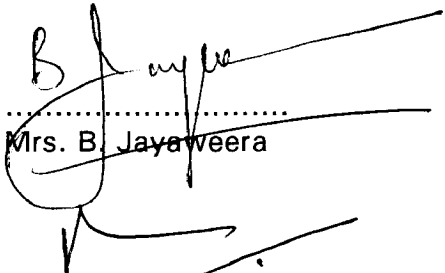
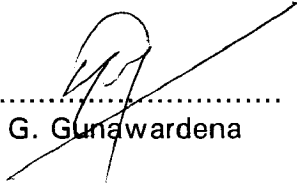

APPROVAL OF CEB STANDARDS

CEB Standard No. : *CEB Standard 051 : 1997*

Title of the Standard : *Specification for Copper Clad Steel Earth Rod Assembly*

Date of Approval : *March 1997*

This is to certify that the above Standard has been approved by us.

 S.C. Amarasinghe	Chairman	Specification Committee
 A.M. Tissera	Member	Specification Committee
 Mrs. B. Jayaweera	Member	Specification Committee
 R.J. Gunawardena	Member	Specification Committee
 G. Gunawardena	Member	Specification Committee
 K. Dayaparendran	Convenor	Specification Committee

CEB Standard 051 : 1997 - Specification for Copper Clad Steel Earth Rod Assembly is approved for adoption in the CEB.


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**General Manager,
Ceylon Electricity Board.**

21-04-1997

Date :