
E A R T H F O D



PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
DESIGN DEPARTMENT (T&G) WAPDA

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SPECIFICATION P-116: 81

E A R T H R O D

0 FOREWORD

- 0.1 This specification has been prepared by the Design Department of Power Wing, WAPDA.
- 0.2 This specification is intended for the procurement of material and does not include provision of the contract.

1 SCOPE

- 1.1 This specification covers earth rods for use in sub-station grounding system.

2 GENERAL

- 2.1 The earth rods are the mild steel rods which are protected against rusting by a thick exterior of copper, permanently molten welded or electrolytically deposited to a high strength steel core which provides rigidity for easy driving without bending.
- 2.2 The earth rod should have a cone point and chamfered head for ease in driving in the soil.

3 MATERIAL

- 3.1 The steel used in the manufacture of earth rods shall have the following characteristics:

Tensile strength	41-56 kg/mm ²
Min. yield point	25 kg/mm ²
Min. elongation	20% in 200mm gauge length

4 CONSTRUCTIONAL REQUIREMENTS

- 4.1 The earth rod shall be manufactured from mild steel of the characteristics as defined in clause 3.1.
- 4.2 After manufacturing the steel rods, a thick surface of copper shall be permanently molten welded or electrolytically deposited uniformly.
- 4.3 The thickness of the copper surface shall not be less than 0.33 millimeter.
- 4.4 The earth rod shall have a cone point and chamfered head as per drawing No. PDW/DF-268 (Rev.I).

4.5 The covers and edges of earth rod shall be rounded off and there shall be no cracks or burrs or sharp projections.

4.6 The dimensions of the earth rod shall be according to the Drawing No. PDW/DF-268 (Rev. I).

5 TESTS

5.1 The following tests shall be carried out on the earth rod:

- 1) Visual Examination
- 2) Verification of Dimensions
- 3) Bending Test
- 4) Tensile Test
- 5) Adherence Test

6 TESTS METHODS

6.1 Visual Examination

Individual rods shall be visually examined for the defects given below:

T A B L E

Sr. No.	Examination	Defects
1.	Construction	Not of shape shown in drawing. Not of correct material. Any crack on the material.
2.	Finish	Copper thickness not proper, presence of burrs, black or base spots, and projections which will interfere with the proper use of the article. Corner edges not rounded.
3.	Marking	Missing, not legible, in- complete or not permanent.

6.2 Verification of Dimensions

The dimensions shall conform to the drawing attached.

6.3 Bending Test

6.3.1 The earth rod shall be capable of withstanding the cold-bend test as specified in the following clause 6.3.2

with out any evidence of pits, cracking, or separation of copper from steel on the surface of the bent portion.

- 6.3.2 The earth rod shall be subjected to a cold bending test at ambient temperature. The rod shall be held in a suitable rigid clamp or vice and the free end bent by applying a force perpendicular to the rod at a distance of 40 times rod diameter from the clamping device. The normal force shall be applied until a permanent angular bent of 30 degrees is achieved by the rod. The rod shall meet the requirements of 6.3.1.

6.4 Tensile Test

- 6.4.1 The steel shall be tested for tensile strength as per ISO/R-82-1947.

6.5 Adherence Test

- 6.5.1 The earth rod shall be subjected to adherence test to determine the bondage between copper and steel surfaces. A half meter length of rod with one end cut to a 45 degree point. This end shall be driven between two steel clamping jaws of a vice set at one millimeter less than the diameter of the rod so as to shear off sufficient metal to expose the bond between the jacket and steel core. There shall be no evidence of any separation.

7 SAMPLE, ACCEPTANCE AND REJECTION

- 7.1 The earth rod shall be divided into lots containing upto 500 units each. A sample of 50 rods shall be drawn at random from each lot.
- 7.2 The selected samples shall be subjected to visual examination and verification of dimensions. If the number of defective units is four the lot shall be accepted, if the number of defective units is more than five the lot shall be rejected. If the number of defective units is five, another sample of 50 units shall be selected at random and subjected to tests. If the number of defective units is again five or more, the lot shall be rejected. If the number of defective units is four or less the lot shall be accepted.
- 7.3 Three random samples of all items selected from lot of 500 each rods shall be subjected to tensile, bending and adherence tests.
- 7.4 If one rod from any group of three units selected as per clause 7.3 fails to meet the requirement, another group of three rods shall be selected at random. If any units

in the second group fails the test, the lot shall be rejected.

8 MARKING

- 8.1 Individual earth rod shall be punched with 'WAPDA-ED' and manufacturer's name or trade mark. The size of lettering shall be at least 5 millimeter.
- 8.2 The marking of earth rod shall be located within 300 millimeter of the top of the rod.

9 PACKING

- 9.1 The earth rods shall be bundled and banded in group of five to seven. The bundling shall be at three locations with galvanized steel wire or steel binding strap. The bundles then be packed in wooden crates, capable of withstanding the rigours of transportation and handling.

Enclosure: Drawing No. PDW/DF-268 (Rev-I)

2mm x 45° CHAMFER

STEEL

COPPER

Wt. 54.000g

THICKNESS OF COPPER 0.3mm

NOMINAL DIA = 15.8 mm (5/8")
ACTUAL DIA = 14.3 ± 0.178 mm

1	2-3-81	DIAMETER CHANGED FROM 15.8 mm TO 14.3 mm & THICKNESS IS 0.3mm	
NO	DATE	REVISIONS	BY

EARTH ROD

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