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SPECIFICATIONS

Grounding Conductor 95 mm², as per WAPDA Specification No: P-16:68 (amended to date).

SPECIFICATION P-16:60
(UDC 621.315.512)

COPPER WIRE FOR EARTHING
Revised Jan:1968



PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
DESIGN DEPARTMENT (TAG)

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PRINTING HISTORY

First revised on 16th January, 1968.

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FOREWORD

This standard has been prepared by the Engineering Department
Power Wing WAPDA.

This specification is subject to revision as and when required.

This standard is intended only for the purpose of procurement
of material and does not include the provisions of contract.

SCOPE

This specification covers the following sizes of medium hard
drawn copper wire for earthing purposes:

- i) 4.0 mm wire (solid)
- ii) 5.5 mm wire (solid)
- iii) 6.5 mm wire (solid)
- iv) 13 mm strand (7/4.2 mm)

MATERIAL

The material shall be copper of such quality and purity that
the finished product shall have the properties and characteri-
stics described in this specification.

No joints shall be made in the complete wire.

The wire shall be clean, smooth and free from harmful defects.

The wire entering into the construction of stranded conductors
shall, before stranding, satisfy all the requirements of this
standard.

The lay ratio of 13 mm strand (7/4.2 mm) shall be not less than
20 or greater than 25.

CHARACTERISTICS

The copper wires shall have the following characteristics:

Dia. mm	Min. Tensile Strength kg/mm.	Max. Tensile Strength kg/mm.	Resistance ohms/k. meter at 20°C	Elongation		Weight kg/km
				in 25 cm	in 150 cm	
4.0	33	38	1.407	-	1%	112.34
5.5	33	38	0.745	-	1.75%	212.4
6.5	33	38	0.533	2.50%	-	296.66
13	33	38	0.184	-	1%	874.20

TESTS

All tests shall be carried out at the manufacturer's works. The

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necessary testing equipment and assistance shall be provided by the manufacturer free of cost.

Test Samples

Test samples for determination of compliance this specification shall be taken from each lot of material offered for acceptance. The minimum number of samples to be taken from each lot shall be as follows:

No. of coils/reels in lot	No. of coils/reels in lot
1 to 50	14
51 to 100 inclusive	19
101 to 200 inclusive	24
201 to 400 inclusive	29
401 to 800 inclusive	33
Over 800	34

From each sample, coil test specimen of sufficient length shall be removed and shall be subjected to all the tests prescribed in clause 4.3 of this specification.

Sample shall normally be cut from the end but may also at the direction of the inspector, be cut from any part of a coil. Samples thus cut shall not be welded or jointed together. Each length shall be bound into a separate coil. These samples will be accepted if the wire satisfies all the requirements of this specification.

The following tests shall be carried out on solid conductors of all diameters and on the component wires of standard conductors.

- i) Tensile test
- ii) Elongation test
- iii) Resistance test

4.3.1 Tensile Test

The load shall be applied gradually and the rate of separation of the jaws of the testing machine shall be not greater than 10 cm per minute, and shall be so adjusted that the total time of testing from the moment of application of the load till the wire is broken is between 15 and 60 seconds. The minimum and maximum tensile strength of the wire when so tested shall be as specified in clause 3.1.

In case of 13 mm strand test shall be made before stranding. If it is not possible to test the component wires, the tensile strength of any wire shall not be less than 92.5% of the value given in clause 3.1 and the tensile strength of all the wires in a stranded conductor shall be not less than 94% of the value specified in clause 3.1.

Elongation Test.

The load shall be applied on the straightened wire length of 25 cm. The extension shall be measured on the wire after the fracture ends have been fitted together provided that the fracture occurs between the gauge marks and not closer than 25 mm to either mark. If the fracture occurs outside these limits and if the required elongation is not obtained, the test shall be discarded and another test made.

Resistance Test

The electrical resistance in ohms per kilometre for a temperature of 20° C shall be calculated to three decimal places in accordance with "International Electrotechnical Commission Publication No. 28" "International standard of resistance for copper".

The calculated value shall not be greater than the value specified in clause 3.1 of this specification.

PACKING

The solid copper wire of 4 mm and 5.5 mm diameters shall be supplied in coils and each coil shall weigh approximately 100 kg.

The wire shall be protected against damage in ordinary handling and transport.

The eye of the coil shall not be less than 60 cm.

Each coil shall be securely bound with three separate binders.

The coil shall be wrapped in jute.

6.5 mm (solid) and 13 mm strand wire shall be supplied on wooden reels, with approx. One kilometre on each reel. The barrel of the reel shall not have diameter less than 45 times the overall diameter of the complete wire. Reel shall be non-returnable, made of new wood, properly fixed with heavy wood lagging adequately constructed to withstand rough handling. Wood lagging shall be securely fastened by steel straps. Wooden reels and lagging shall be treated with preservatives.

MARKING AND LABELLING

A paper label marked with manufacturer's name, size of wire, weight of the coil in kilograms and date of manufacture, shall be pasted on the jute packing, anywhere on the other periphery.

The following information shall be clearly marked on each reel of 6.5 mm (solid) and 13 mm strand wire.

- i) Length of wire in kilometer.
- ii) Gross, tare and net weight
- iii) Size of the wire
- iv) Direction of un-reeling

REJECTION

If any wire fails to meet any requirement of this specification, two new specimens shall be taken from the same coil and retested. If any failure occurs in the second test the entire lot shall be rejected.

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