



AMENDMENT - NOTIFICATION

AA 281 45

REV. No. 01

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AA 281 45 : POLYESTER ENAMELLED ROUND COPPER CONDUCTORS (TEMPERATURE INDEX 155)

1 Preface sheet:

1.1 "Equivalent/Comparable standards" to be replaced by
"Comparable standards"

1.2 "Replaced Plant Specifications/References" to be
replaced by "User Plants and Replaced Plant
Specifications/References".

2 Page 1 of 6

Cl. 6.3 : "Resistance" to be replaced by the
following:

6.3 Electrical Resistance/Resistivity:

a) Upto and including 1.0 mm dia.

"The resistance of the conductors in "as
received" condition at 20°C shall be as per
IS:4800, Part 1.

Contd...2.

Please see instructions on the reverse.

Ref:	Amd. No.	Approved	Issued	Date	Cum. Sr. No.
Cl. 31.3.5 of MOM of MRC(E)	02	MRC(E)	CORP. R&D	1-12-96	A 1996



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b) Over 1.0 mm dia.
"The resistivity of the conductors in "as received" condition shall not be greater than 0.01739 ohm/mm²/m.

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Add the following new clause as Cl.11 at the end.

Cl.11 REFERRED STANDARDS (Latest publications incl. amndts.

1) IS : 335

Please see instructions on the reverse.

Ref:	Amd. No.	Approved	Issued	Date	Cum. Sr. No.
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CONDUCTORS (TEMPERATURE INDEX 155)

1. Page 5 of 6:

Include the following new clause as clause 8.10

8.10 Abrasion Test (IS:4800-Parts 3 & 4):

Shall pass the test.

REF:	AMD. NO.	APPROVED	ISSUED	DATE	CUM.SR. NO.
CI.26.2.111 of MOM of MRC(E)	01	MRC(E)	Corp.R&D	Jan. '93	A 0975



POLYESTER ENAMELLED ROUND COPPER CONDUCTORS

(Temperature Index 155)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE
BEFORE ISSUE TO SUPPLIERS

Equivalent Standards:

Replaced Plant Specifications/References:

- 1. BHOPAL PS 31420
PS 31440

Revision : 01. Thick covering was not on.
Brought upto date.

Date : July '84

Approved : INTERPLANT MATERIAL
RATIONALISATION COMMITTEE - MRC(E)

Prepared
BHOPAL

Issued
CORP. R & D

Date of first
Issue:
Nov. '78

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POLYESTER ENAMELLED ROUND COPPER CONDUCTORS
(Temperature Index 155)

1. **GENERAL:** This specification governs the quality of round copper conductors insulated with flexible insulating enamel based on terephthalate polyester of temperature index at least 155 in Fine, Medium and thick covering.
2. **APPLICATION:** For use in winding of Transformer, Switchgear, Industrial Machines, controlgear and Traction Motors etc.
3. **COMPLIANCE WITH NATIONAL STANDARDS:** The specification generally conforms to IS:4800 Pt. V with alternative/additional requirements laid in clauses 5, 6.3, 8.7.
4. **SIZES AND GRADE:**
- 4.1 The conductor shall be supplied to the sizes and grade of covering specified on our order.
- 4.2 The sizes shall preferably be selected from col. 1 of table 1 and overall dia. of the covered conductor shall also be stated on the order.
5. **JOINTS:** No joints shall be made in the copper conductor after it is drawn. Any joints made during the drawing process shall be only resistance welded.
6. **CONDUCTOR:**
- 6.1 Tolerance on Nominal Diameter:
The tolerance on diameter of conductor shall be in accordance with column 2 of table I.
- 6.2 Conductor Material:
The conductor shall be manufactured from ETP grade high conductivity copper conforming to IS:191.
- 6.3 Resistance:
The resistance at 20°C of a conductor of one metre in length and a uniform cross sectional area of 1 mm² shall not be greater than 0.01739 ohm.

Revisions: 01. Thick covering was not on.
Brought upto date.

Date: July '84

Approved: **INTERPLANT MATERIAL
RATIONALISATION COMMITTEE-MRC(E)**

Prepared
BHOPAL

Issued
CORP. R & D

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Issue:
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**6.4** Elongation:

The elongation of fracture shall not be less than that given in column 3 of table-I.

7. OVERALL DIAMETER & INCREASE IN DIAMETER:

The maximum overall diameter of the covered conductor for fine, medium and thick covering shall be as specified in column 4, 6 and 8 of Table 1 respectively. The increase in diameter due to fine, medium and thick covering shall not be less than that given in columns 5, 7 and 9 of Table 1 respectively.

8. ENAMEL COVERING:**8.1** General:

The conductor shall be completely and uniformly covered with a durable, flexible, synthetic enamel of terephthalate polyester base. The enamel shall have a smooth surface free from embeded particles of dust and other deleterious materials.

8.2 Flexibility and Adherence of Enamel:**8.2.1.** Mandrel Winding test:

After winding ten contiguous turns on a polished mandrel, the diameter of which is in accordance with column 10 of Table 1, the covering of the sample shall show no cracks when examined under a magnification of 10 to 15 times.

Conductor of bare nominal diameter upto and including 0.25 mm shall be stretched 20 percent or to the breaking point of the conductor material whichever is less before winding on the mandrel.

The mandrel shall be rotated at between 1 and 3 turns per second, the tension on the wire being just sufficient to keep it in contact with the mandrel. Care shall be taken to avoid elongation or twisting of the wire. Three tests shall be made.

8.2.2 Jerk Test:

This test is applicable to conductors of dia upto and including 1 mm. When the specimen is suddenly stretched to the breaking point or to the elongation as specified in column 3 of Table 1, the covering of sample shall show no cracks or loss of adhesion when examined under a magnification of 10 to 15 times.



8.2.3 Peel Test:

This test is applicable to conductor of diameter over 1 mm. The enamel shall show flexibility and it shall not be possible to remove the enamel without difficulty from the wire e.g. with thumb nail, when the wire twisted in the rotating device to the extent that the product of the bare nominal diameter and the number of revolution is 150.

8.3 Cut through Test:

When tested in accordance with clause 5.8 of IS:4800 Pt. III specimen shall show no break down within 2 minutes at 240°C.

8.4 Springness Test:

This test is applicable to conductors of diameter from 0.05 mm, upto and including 1.6 mm. When tested in accordance with clause 5.4 of IS:4800 Pt. III the wires shall not extend the maximum spring as given in Table-3 of IS:4800 Pt. V on a mandrel and under a tension specified therein.

8.5 Heat Shock Test:

Three test specimens shall be prepared by winding 10 contiguous turns on a polished mandrel with mandrel dia. given below. The samples shall be kept for 30 minutes in a forced air circulating oven at a temperature 175° - 180°C. After removal from the oven, the specimen shall be allowed to cool to room temperature and shall be examined under a magnification of 10 - 15 times. Each specimen shall be free from cracks.

Nominal Diameter (mm)		Mandrel Diameter(mm)
Over	Upto and including	
--	0.04	0.20
0.04	0.25	5 d
0.25	1.00	6 d
1.00	2.00	7 d
2.00	5.00	8 d

8.6 Solvent Test:

When tested in accordance with clause 5.10 of

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IS:4800 Pt. III the enamel of the conductor shall not be removed down to the conductor in any one of three tests with a pencil of hardness 'H'.

8.7 Resistance of Enamel to Oil:

When tested in accordance with the method mentioned below the enamel shall be such that it shall not be removed down to the conductor by scraping with thumbnail.

8.7.1 Test Method:

The enamelled wire shall be wound in contiguous turns on a polished metal mandrel 2.5 cm in diameter for about 10 mm length on the mandrel. The mandrel with the wire shall then be immersed in insulating oil to IS:335 for 6 hours at $110^{\circ} + 2^{\circ}\text{C}$, then out and allow to cool to room temperature. The specimen shall then be scraped with the thumb nail.

8.8 Breakdown Voltage:

8.8.1 Breakdown Voltage At Room Temperature

8.8.1.1 Conductor Sizes upto and including 0.040 mm.

When tested in accordance with clause 5.11.2 of IS:4800, Pt. III at least four of five samples shall not breakdown at voltages less than those given in columns 11 & 12 of Table I.

8.8.1.2 Conductor sizes over 0.040 mm, upto and including 2.5 mm:

When tested in accordance with clause 5.11.3 of IS:4800:Part III the breakdown voltage shall be higher than the value given in columns 11, 12 and 13 of Table - I. If however, one of the five samples tested one has a lower value than that mentioned in column 11, 12 and 13 of Table - I, the test shall be repeated with a second series of samples and no failure shall occur.

8.8.1.3 Conductor Sizes Over 2.5 mm:

When tested in accordance with clause 5.11.4 of IS:4800: Part III atleast four of five samples shall not breakdown at voltages less than 1000 volts (for fine covering) 1600 volts (for medium covering) and 2400 volts (for thick covering).



8.8.2 Breakdown Voltage at Higher Temperature:

75 percent minimum of the appropriate values given in the columns 11, 12 and 13 of Table I when tested at 155°C.

8.9 Continuity of Covering:

This is applicable to conductors of diameter upto and including 0.5 mm. When tested in accordance with clause 5.12 of IS:4800 Pt. III the number of faults in a 50 metres length shall not exceed the appropriate value given in columns 14, 15 and 16 of Table I.

9. TEST CERTIFICATE:

Three copies of a test certificate shall be supplied which shall give the following information:

AA 28145 - Polyester Enamelled Round Copper Conductors
(Temp. Index 155) (Revision 01)

BHEL's Order No.

Supplier's Reference

Batch No.

Test values obtained/certificate of compliance with clause 6 to 8.

On first consignment for establishment of material, supplier shall indicate the type and make of enamel with life time characteristics along with the sample of enamel for infra-red spectrograph for our approval on subsequent orders. Certificate that the supplier has used the approved enamel as identified by IR spectrographic method only shall be used.

10. PACKING AND MARKING:

The conductors shall be wound on reels, and packed, wrapped and labelled in accordance with IS:482 - 'Specification for Reels for Covered, Solid, Round Electrical Winding Wires'

Flange diameters of reels shall conform to Table - I of above IS, but wires between 0.914 mm and 0.315 mm shall be wound only on reels conforming to column 2 or 3 Table III of the above IS.

Each reel shall be marked with the following:

AA 28145 - Polyester Enamelled Round Copper Conductors
(Temp. Index 155)

BHEL Order No.

Supplier's Name.

Size and Grade of conductor.

Quantity

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