



PLANT PURCHASING SPECIFICATION BHOPAL

BP 28187

Rev. No. 03

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SUPERSEDES
BP 28187 Rev. 02

GLASS POLYESTER / MIX YARN INSULATION SINTERED RECTANGULAR COPPER CONDUCTORS

1. GENERAL :

This specification governs the requirement of rectangular copper conductors with sintered insulation of glass polyester mix yarn. Two or more layers of glass polyester mix yarn are spun in alternate direction and then sintered. The conductor after insulation & sintering has temperature index of at least 155.

2. APPLICATION :

For use in windings of synchronous motors.

3. COMPLIANCE WITH NATIONAL STANDARDS:

There is no Indian Standard covering this type of material.

4. SIZES :

The conductor shall be supplied to the size specified on our order.

5. TEST METHOD: As stated against each clause.

6. SAMPLE FOR TEST :

10 meter long sample shall be sent to TSD by QC for testing and approval.

7. JOINTS :

No joints shall be made in the copper conductor after it is drawn. Any joint made during the drawing process shall be only resistance welded.

8. CONDUCTOR :

8.1. Conductor Material :

The bare conductor shall be manufactured from high conductivity copper complying with AA 12030 "Rectangular Copper Conductors – Annealed, Controlled Oxygen".

Revision: -
Based on: QPA 064.154 of DW Siemens
Clause 6 and 9.3 are modified.

Issued by :

STANDARDS AND MATERIALS GROUP
TECHNICAL SERVICES DEPARTMENT

Rev. No 03 Date : 02.11.2019

Date of first issue : April 1988



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Except that 0.2% Proof Stress for all thickness shall not exceed 100 N/mm²

Note: It is preferable to manufacture conductor from continuous cast copper bars provided all other acceptance parameters & conditions remain same.

8.2 Surface finish :

The surface of the conductor should be smooth and shining. Surface damages, oxide layers and drawing marks visible by eye are not permitted. The conductor shall also not have faults like thickening or pickles which reduce electric strength appreciably.

9. INSULATION :

9.1. Increase in thickness due to insulation :

Increase in thickness due to insulation shall be as below.

Minimum : 0.25 mm

Nominal : 0.31 mm

However overall dimension of the Insulated conductor shall not exceed the maximum dimensions of the conductor plus nominal increase in dimension due to insulation.

9.2 Increase in width due to insulation :

Following requirements shall be met.

Width / Thickness Ratio	Deviation of Width Increase from thickness increase (%)
Upto and including 2:1	+ 10 - 5
Above 2:1 and upto & including 4:	+ 10 - 20

9.3. Organic Content % (Annexure – 1)

45-55

10. PROPERTIES OF INSULATED CONDUCTOR :

10.1 Flexibility Test :

Samples of insulated conductor in as received condition shall be bent flatwise and edgewise through 180 deg. Round a mandrel having diameter as specified in the Table-1. Separate samples shall be bent, two on edge and two on flat, and when so tested the covering shall not open sufficiently to expose the bare shining conductor to view, when examined under diffused light by normal eyesight. There shall be no appreciable loosening of the insulation. No cracks shall be seen in the insulation.

Table – 1

Direction of bending	Thickness of Conductor	Diameter of mandrel
Edge wise	< 4.4 mm ≥ 4.4 mm	5 × b d.b / 0.7 - b
Flat wise	All thickness	7 × d

d : Thickness of Conductor

b : Width of Conductor

10.2. Adherence :

A sample of approximately 300 mm length shall be straightened by 1% elongation. The insulation shall be removed from all but from the central 100 mm of the wire. The specimen shall be elongated by 20% strain test in a tensile testing machine. The free measuring length shall be between 200 and 250 mm. The conductor shall be elongated at a rate of 60 ÷ 300 mm per minute.

The insulation shall not detach from the conductor and also the individual layers of insulation should not separate from each other.

10.3. Electric Strength (BDV) at Room Temperature :

Samples bent as per Cl. 10.1 above shall be used for carrying out electrical strength test. The insulation shall be stripped off at the ends for electrical connection. Samples bent flat wise as well as edgewise as per Cl.10.1 shall be subjected to electric strength (BDV) at room temperature.

The samples shall be placed in a metal vessel filled with metallic balls, 1 to 3 mm diameter and vessel solidly connected to earth. A sinusoidal a. c. Voltage of 50 Hz is applied and increased from zero with an uniform rate of approximately 50 volts per second until breakdown occurs. The breakdown value shall not be less than 530 Volts.

10.4. Electrical Flow Test :

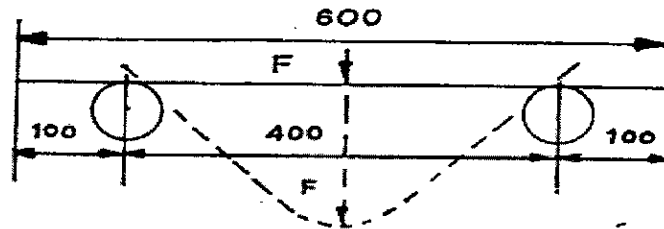
This test shall be performed during production.

The total wire is run for testing with a test voltage of 250 volt. Mark the faults cleanly with color pen.

No. of faults per roll shall not exceed 2.

11.1. Hardness : 60, HV Max

11.2. Stiffness Test : (Upto 10 mm width)



The straightened flat wire 600 mm long, is placed with the width horizontal on 2 Rollers of 15 mm dia. and an axial distance of 400 mm so that there is a projection of 100 mm each on both sides.

Load is applied at the Centre of the flat wire till it slides through the rollers.

The stiffness value **XW** is calculated by the formula.

$$XW = \frac{F \times 100}{W} \times N / mm^2$$

F = Load in Newton's

$$W = \text{Moment of Resistance} = \frac{b_1 \times s_1^2}{6} \times mm^3$$

Where 'b₁' = width & 's₁' = thickness, in mm.

Three tests shall be carried out. The mean value shall not exceed X_w value as given in the table below :

Stiffness N/mm ²	Thickness mm					
	Upto 1	Over 1 Upto 2	Over 2 Upto 3	Over 3 Upto 4	Over 4 Upto 5	Over 5 Upto 6
XW	110	160	175	180	185	190



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12. TEST CERTIFICATE :

Unless otherwise specified, three copies of test certificates shall be supplied with each consignment.

In addition, the supplier shall ensure to enclose one copy of the test certificate Alongwith their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information

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BHEL Order No.

Batch No.

Test values obtained & certificate of compliance with clauses 4 & 8 to 11.

13. PACKING AND MARKING :

The covered conductor Shall be wound on drum No.5624 (Dia. Of flange 560 mm And approx. capacity 150 Kgs) to IS: 2069.

The wire shall be protected against possible damage, from the inner of the Flanges of the drums, by lining each flange with thick paper or card-board. Paper spacers shall be filled in the empty space between conductor and flange of the drum. A layer of packing paper shall be inserted between each layer of conductor during winding on drums.

Each drum shall be marked with the following :

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BHEL Order No.

Supplier's Name

Size of conductor.

Weight of wire (i) Gross (ii) Net.



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ANNEXURE – 1

TEST METHOD FOR DETERMINATION OF ORGANIC CONTENT

Separate a piece of insulation in the form of sleeve by stretching 200 mm long conductor. Dry the specimen at $110 \pm 2^{\circ}\text{C}$ for one hour, determine the weight (M_1) after cooling it to room temperature. Heat the specimen to ash in a furnace at $900 \pm 20^{\circ}\text{C}$ for 30 minutes, determine the weight (M_2) after cooling down.

Calculate the Organic Content as below :

$$\text{Organic Content} = \frac{M_1 - M_2}{M_1} \times 100\%$$