



CORPORATE PURCHASING SPECIFICATION

AA 120 03

Rev. No. 04

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COPPER STRIP – HARD

1.0 GENERAL:

This specification governs the quality requirements of bright annealed bare Copper strip of thickness over 0.15 mm and upto 10 mm and widths upto 800 mm with radiused edges.

2.0 APPLICATION:

Used for general electrical purposes such as bus bars, transformers, switchgears etc.

3.0 CONDITION OF DELIVERY:

The strip shall be supplied in annealed condition, in coils or straight lengths as specified in BHEL order. The strips shall be supplied with their edges radiused as per clause 5.3.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following national standard and also meet the requirements of this specification.

IS: 1897 – 2008 : Copper strips - for Electrical Purposes.

Gr.HD – Hard

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes: Copper Strips shall be supplied to the dimensions specified in BHEL order:

5.2 Tolerances:

Tolerances on width, thickness, length and straightness shall be as per IS:3052, reproduced below.

5.2.1 Width:

5.2.1.1 Tolerance on width for rotary sheared strip upto 4mm thickness shall be as follows:

Width, mm			Tolerance, ±mm			
Over	upto and incl.	upto and incl. 0.25 thick	over 0.25 upto & incl. 0.55 thick	over 0.55 upto & incl. 1.0 thick	over 1.0 upto & incl. 2.0 thick	over 2. upto & incl. 4.0 thick
-	10	-	By agreement			
10	50	0.10	0.15	0.2	0.3	-
50	100	0.15	0.20	0.3	0.5	0.6

Revisions :

CI: 24.1 of MOM of MRC-NFCW+HE

APPROVED :

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE-MRC (NFCW+HE)

Rev. No. 04

Amd.No.

Reaffirmed

Prepared

Issued

Dt. of 1 st Issue

Dt: 06.06.2012

Dt :

Year :

BHOPAL

Corp. R&D

December, 1978

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100	200	0.20	0.30	0.5	0.6	0.8
200	400	0.30	0.50	0.6	0.8	1.0
400	600	0.50	0.60	0.8	1.0	1.4
600	800	0.60	0.80	1.0	1.4	1.6

5.2.1.2 Tolerance on width for guillotine sheared strip above 4 mm thick shall be as follows:

Width, mm		Tolerance, $\pm$ mm	
Over	upto & Incl.	over 4.0 upto & incl. 5.0 thick	over 5.0 upto & incl. 10.0 thick
----	500	2	3
500	800	3	4

5.2.2 Thickness:
Tolerance on thickness shall be as follows:

Thickness, mm			Tolerance, $\pm$ mm			
Over	upto and incl.	upto and incl. 160 wide	over 160 upto & incl. 300 wide	over 300 upto & incl. 450 wide	over 450 upto & incl. 630 wide	over 630 upto & incl. 800 wide
0.16	0.20	0.015	0.020	0.025	0.03	0.04
0.20	0.63	0.020	0.025	0.03	0.04	0.05
0.63	0.90	0.025	0.030	0.04	0.05	0.06
0.90	1.20	0.030	0.04	0.05	0.06	0.07
1.20	2.00	0.040	0.05	0.06	0.07	0.09
2.00	2.80	0.050	0.05	0.07	0.09	0.11
2.80	3.50	0.060	0.07	0.09	0.11	0.14
3.50	4.50	0.070	0.09	0.11	0.14	0.17
4.50	6.00	0.090	0.11	0.14	0.17	0.20
6.00	8.00	0.110	0.14	0.17	0.20	0.25
8.00	10.0	0.140	0.17	0.20	0.25	0.30

5.2.3 Length (Rotary Sheared):

Length, mm		Tolerance, $\pm$ mm
Over	upto & incl.	
160	1000	3
1000	2000	6
2000	4000	9

5.2.4 Straightness:
The edges of strips supplied in straight lengths shall not vary from a straight line by more than 3 mm in any 1000 mm length.



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5.3 Radius on Edges:

The strip shall be supplied with edges radiused as per IS:1897, reproduced below:

Thickness, mm		Nominal radius on edge, mm	Tolerance on radius, mm
Over	up to & incld.		
--	1.00	semi-circular	± 0.06
1.0	1.60	0.60	+ 0.15 - 0.10
1.6	2.25	0.80	± 0.15
2.25	3.55	1.00	± 0.20
3.55	10.00	1.25	± 0.25

6.0 MANUFACTURE:

The material shall be manufactured from copper of ETP grade conform to IS:191.

The conductor shall be manufactured from ETP grade copper conforming to BHEL specification: AA 12024: Electrolytic Tough Pitch Copper Wire/Bars/Ingots/Continuously cast wire rods.

NOTE: It is preferable to manufacture conductor from continuously cast copper rods provided all other parameters and conditions remain same.

7.0 FREEDOM FROM DEFECTS:

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

8.0 CHEMICAL COMPOSITION:

The analysis of copper when analysed in accordance with IS: 440 or any other conventional/instrumental methods shall be as follows:

Element	Percent, min.	Percent, max.
Copper and Silver	99.90	--
Bismuth*	--	0.001
Lead*	--	0.005
Total of all impurities excluding silver and oxygen excl. silver and oxygen	--	0.030

* These elements need not be determined when the material supplied conforms with mechanical and electrical properties specified in this specification. However, the supplier shall ensure that the composition of the material lies within the limits specified above.

9.0 TEST SAMPLES:

One sampling per size per melt per consignment of 3 tonnes or part thereof shall be taken for chemical, mechanical and electrical tests.

The sample shall be cut off cold and shall receive no further treatment before being tested.

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10.0 MECHANICAL PROPERTIES:

10.1 Tensile strength (For sizes over 0.5mm to 10mm thick):

The test samples, when tested in accordance with IS:1608 shall show the following properties:
IS:1608 , shall show the following properties:

Thickness mm		Tensile Strength, N/mm ² Minimum	
		For widths	
Over	upto & incl.	Upto & incl.3000 mm	Over 300 mm & Upto & Incl. 800 mm.
0.50	2.50	310	285
2.50	10.00	295	275

10.2 Bend Test:

The strip shall not be subjected to transverse bend test. where this is not possible, it shall be subjected to a longitudinal bend test. The strip when tested in accordance with IS: 1897 shall withstand a close bend test, through an angle of 180°, without showing any sign of cracks or failures upon the convex surface of the bend.

10.3 Hardness (Vickers):

When tested in accordance with IS:1501, the strips shall have a Vickers hardness not exceeding
90 HV, min.

11.0 ELECTRICAL RESISTIVITY (AS RECEIVED):

When measured in accordance with IS: 3635, the electrical resistivity at 20° C shall not be greater than 0.01777 ohm-mm²/metre, which is equivalent to an electrical conductivity of 97%, minimum of IACS standard. (Refer Appendix B of IS: 613 for temperature correction factor).

Alternatively, the method of measurement employing eddy current probes as per ASTM E 1004 is also acceptable.

12.0 INSPECTION AT SUPPLIER'S WORKS:

Whenever specified, tests and inspection are to be conducted in the presence of BHEL'S representative.

The supplier shall offer BHEL'S representative all reasonable facilities, without charge to satisfy the latter that the material is being furnished in accordance with this specification.



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The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his carrying out the prescribed tests elsewhere. The supplier shall notify BHEL in advance about the readiness of the material for inspection and BHEL reserves the right to test the material at BHEL'S works and the final acceptance of the testing.

BHEL reserves the right to test the material at BHEL's works and the final acceptance of the material shall be based on these test results.

13.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:

AA 120 03, Rev 04: Copper strip – Hard

BHEL Order No,

Manufacturer's/Supplier's Name :

Lot/Identification/Batch/Melt No.

Sizes and Quantity Supplied

Results of dimensional inspection, chemical analysis, mechanical and electrical tests called for in this specification.

14.0 PACKING AND MARKING:

The material shall be supplied in coils or drums or in straight length as ordered. The minimum eye of coil or barrel diameter of drums shall be 250 mm.

The material not supplied in drums shall be hessian wrapped and tied with string and not with wire and shall be suitably protected to with wire and shall be suitably protected to avoid damage in transit. Each coil or drum or bundle shall be legibly marked or labeled with the following information.

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AA 12003 : Copper strip – Hard

BHEL Order No.

Manufacturer's/Supplier's Name :

Lot/Identification/Batch/Melt No.

Sizes and Quantity Supplied

15.0 REFERRED STADARDS (Latest Publications Including Amendments):

- | | | | |
|----------------|------------|------------|-------------|
| 1. IS:191 | 2. IS:440 | 3. IS:613 | 4. IS: 1501 |
| 5. IS:1897 | 6. IS:1608 | 7. IS:3052 | 8. IS:3635 |
| 9. ASTM E 1004 | | | |