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REVISION HISTORY SHEET

REV NO	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	01/06/92	Supersedes CN87505	-	MRV, AV	N.J
01	21/05/96	CL 12.1 TENSILE TEST REMOVED	F.B FROM MPC	SHG	N.J
02	20/12/99	IS.Year of Issue Removed	-	CCR	NS
03	19/02/08	Clause 5.1 & 7.0 revised.	F.B.FROM FABN	K.SAI	M.T.R.
04	04/11/10	Clause 5.1 (a) added	F.B. from CE-FAB	BKD	MS

APPROVED :
M Sivaramaiah

PREPARED : ISSUED : DATE :
BKD STDS GROUP 04/11/2010

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COPPER STRIP, HALF HARD.

- 1.0 GENERAL:
This specification covers the requirements of bright half-hard copper strip, over 0.16 mm and upto 10 mm thick and width upto 800 mm with radiused edges.
- 2.0 APPLICATION:
Used for general electrical purposes.
- 3.0 CONDITION OF DELIVERY:
The material shall be supplied in half-hard condition, in coils or straight lengths as specified on our order. The strip shall be supplied with their edges radiused as per clause 6.0.
- 4.0 COMPLIANCE WITH NATIONAL STANDARDS:
The material shall comply with the requirements of the following Indian standard:
IS:1897 - Copper strip for electrical purposes.
Gr:HB - Half Hard.
- 5.0 DIMENSIONS AND TOLERANCES:
- 5.1 Sizes:
The copper strip shall be supplied to the dimensions specified on the order. Length of the strip should be
a) 3.5 Meters for flat size 6 X 50 mm, and
b) 4 meters for all other sizes
- 5.2 Tolerances:
IS:3052.
- 5.2.1 Thickness:
Tolerance on thickness shall be as follows:

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TABLE-1

Specified thickness, mm		Tolerance Plus or minus, mm				
Over	Upto & incl.	Upto & 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	0.28	0.015	0.02	0.025	0.03	0.04
0.28	0.63	0.02	0.025	0.03	0.04	0.05
0.63	0.90	0.025	0.03	0.04	0.05	0.06
0.90	1.2	0.03	0.04	0.05	0.06	0.07
1.2	2.0	0.04	0.05	0.06	0.07	0.09
2.0	2.8	0.05	0.06	0.07	0.09	0.11
2.8	3.5	0.06	0.07	0.09	0.11	0.14
3.5	4.5	0.07	0.09	0.11	0.14	0.17
4.5	6.0	0.09	0.11	0.14	0.17	0.20
6.0	8.0	0.11	0.14	0.17	0.20	0.25
8.0	10.0	0.14	0.17	0.20	0.25	0.30

5.2.2 Width:

Upto 4.0 mm thick. as per Table-2: Rotary Sheared.

Above 4.0 mm thick. as per Table-3: Guillotine sheared.

Table-2: Rotary Sheared.

Specified width, mm		Tolerance Plus or minus, mm				
Over	Upto & incl.	Upto & 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 2.0 upto & incl. 4.0 thick.
-	10	By agreement				
10	50	0.1	0.15	0.2	0.3	-
50	100	0.15	0.2	0.3	0.5	0.6
100	200	0.2	0.3	0.5	0.6	0.8
200	400	0.3	0.5	0.6	0.8	1.0
400	600	0.5	0.6	0.8	1.0	1.4
600	800	0.6	0.8	1.0	1.4	1.6

Table-3: Guillotine Sheared.

Specified width, mm		Tolerance (Plus or minus, mm)	
Over	Upto & incl.	Over 4.0 upto and incl. 5.0 thick.	Over 5.0 upto and incl. 10.0 thick.
-	500	2	3
500	800	3	4

5.2.3 Length

Table-4

Specified length, mm		Tolerance mm
Over	Upto and incl.	Plus or minus
160	1000	3
1000	2000	6
2000	4000	9

6.0 RADIUS ON CORNERS:

The strip shall be supplied with edges radiused as given in Table-5.

Table-5

Thickness of strip mm		Nominal radius on edges mm	Tolerance mm
Over	Upto and incl.		
-	1.0	Semi circular	± 0.60
1.0	1.60	0.60	+ 0.15 - 0.10
1.60	2.25	0.80	± 0.15
2.25	3.55	1.00	± 0.20
3.55	10	1.25	± 0.25

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- 7.0 STRAIGHTNESS:
Dimensional tolerances on straightness, bowness & twist shall be as below:

Table-6

Dimensional tolerances on	1000 mm Length	2000 mm Length	3000 mm Length & above.
Straightness	3.3	6.6	10.0
Bowness	3.3	6.6	10.0
Twist	3.3	6.6	10.0

- 8.0 FREEDOM FROM DEFECTS:
The material shall be clean, bright, smooth and free from harmful defects.

- 9.0 CHEMICAL COMPOSITION:
The strip shall be manufactured from copper of ETP grade to IS:191 (Part 5).

Table-7

Element	Percent
Copper + Silver, Min.	99.90
Bismuth, Max.	0.001
Lead, Max.	0.005
Total of all impurities excluding silver and oxygen, Max.	0.03
Oxygen, Max.	0.06

- 10.0 TEST SAMPLES:
One sample per size per consignment of 3 tones or part thereof shall be selected for testing.

- 11.0 RETEST:
If a test result of chemical analysis fails to satisfy the requirements for any element, two more tests for that element, shall be done on the same sample in order to confirm that the analysis has been done properly. If both the test results satisfy the relevant requirements, the lot shall be considered as conforming to the specification, otherwise not.

Should any one of the test pieces first selected fail to pass the mechanical tests, two further samples from the same batch shall be selected for testing, one of which shall be from the strip from which the original test sample was taken, unless that strip has been withdrawn by the supplier.

Should the test pieces from both these additional samples pass, the batch represented by the test sample shall be deemed to comply with this standard. Should the test pieces from either of these additional samples fail, the batch represented by the test samples shall be deemed not to comply with this standard.

12.0 MECHANICAL PROPERTIES:

12.1 Bend Test:

Where possible, the strip shall be subjected to transverse bend test made on test pieces cut with their major axes at right angles to the direction of rolling (See Fig-1); where this is not possible, it shall be subjected to a longitudinal bend test made on test pieces cut with their major axes parallel to the direction of the rolling (See Fig-1). Both surfaces of the test pieces shall be tested.

The strip when tested according to IS:1897 shall withstand a bend test, through an angle of 180°, over a former of radius equal to the thickness of the strip. The material shall show no sign of cracks or failures upon the convex surface of the bend. The longer edges shall be carefully rounded and smoothed longitudinally so that the cross section has approximately semi-circular edges.

FIGURE-1

12.2 Hardness:
When tested in accordance with IS:1501 (part-1), the hardness of the material shall be in the range of 75 HV to 90 HV.

13.0 ELECTRICAL RESISTIVITY:
The standard value at 20°C for the electrical resistivity of annealed high conductivity copper shall be taken as 0.01724 ohm mm²/metre. The electrical resistivity of the strip shall be measured in accordance with IS:3635. Resistivity at 20°C: 0.01777 ohm mm²/metre (Max.). Conductivity: 97% IACS (Min.) (56.75 micro ohm mm²). Refer IS:613 Appendix B for temperature correction factor.

14.0 TEST CERTIFICATE:
Three copies of a test certificate shall be supplied, which shall give the following information:
ED 12099: Copper strip, half hard.
BHEL Order number :
Manufacturer's name & Trade mark:
Size & Number of Strips / Rolls :
Batch number :
The results obtained for Electrical & Mechanical properties, chemical composition and Dimensional tolerances as per specification.

15.0 PACKING AND MARKING

15.1 Packing:
The material shall be supplied in coils or drums or straight lengths as ordered. The minimum eye of coil or barrel diameter of drums shall be 250 mm. Material not supplied on drums shall be Hessian wrapped and tied with string, and not with wire and shall be suitably protected to avoid damage in transit.

15.2 Marking:
Each coil or drum or bundle shall be legibly marked or labeled with the following information:

ED 12099: Copper strip, half hard.
Material code number :
BHEL Order number :
Manufacturer's Name & Trade mark:
Weight, size & length :



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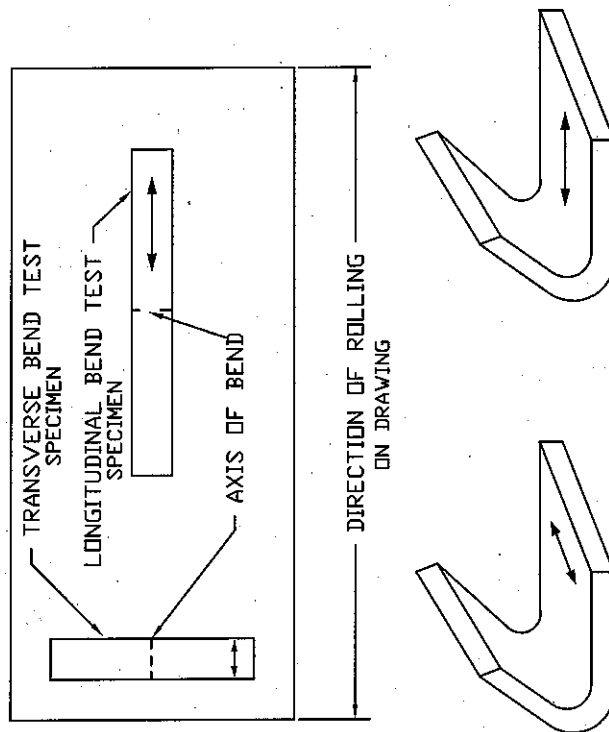


FIGURE-1 : TRANSVERSE AND LONGITUDINAL BEND TEST SPECIMEN.