



PLANT PURCHASING SPECIFICATION BHOPAL

BP 12089

REV NO. 05

PAGE 1 of 04

SUPERSEDES
BP 12089 Rev 04

RECTANGULAR COPPER STRIP, CORNERS ROUND HALF HARD (Fine Tolerance)

1. GENERAL :

This specification governs the quality of Half Hard Rectangular Copper Strip up to 10 net thick & 76mm width with fine tolerance.

Refer AA 12005 for Copper Strip, Half Hard, with Normal Tolerance.

2. APPLICATION :

For use in Electrical equipment .

3. CONDITION OF DELIVERY :

Strip shall be supplied in the bright Half-Hard condition, with corners radiused having a fine tolerances as called for in this specification .

Strip shall be supplied in coil form or in straight lengths as stated on the order.

4. COMPLIANCE WITH NATIONAL STANDARDS :

The material shall comply with the requirements of

IS :1897-1983 } Copper Strip for Electrical Purposes.

(Reaffirmed 2016) Condition - Half Hard Except for finer tolerances .

5. DIMENSIONS & TOLERANCES

5.1 Size

This copper strip shall be supplied to the dimensions specified in the order .

5.2 Tolerance :

5.2.1

Thickness (mm)	Tolerance (mm)
Upto 10	+ 0.025 - 0.051

Revision :

Reviwed & IS Reaffirmed

Issued by :

**STANDARDS AND MATERIALS GROUP
TECHNICAL SERVICES DEPRTMENT**

Rev. 05

Date : 11.12.2019

Date of first Issue: Jan 1966



PLANT PURCHASING SPECIFICATION BHOPAL

BP 12089

REV NO. 05

PAGE 2 of 4

5.2.2

Width (mm)	Tolerance, (mm)
Upto 38	+ 0.025 - 0.051
Over 38 Upto 76	+ 0.038 - 0.076

5.2.3

Length (mm)	Tolerance ± (mm)
Upto 160	1.0
Above 160, Upto & including 1250	2.0
Above 1250, Upto & including 2500	3.0
Above 2500, Upto & including 4000	6.0
Over 4000	10.0

5.2.4

Radius of Corners

Over mm	Thickness Upto & incl. mm	Nominal Radius on Edges mm	Tolerance Plus or Minus mm
-	1.2	0.4	0.06
1.2	1.7	0.5	0.08
1.7	2.5	0.6	0.08
2.5	4.0	0.8	0.12
4.0	10.0	1.0	0.15

6. STRAIGHTNESS : (Edgewise Curvature)

The edgewise curvature of strips shall not exceed 3 ran in any 1000 ma length .

7. FREEDOM FROM DEFECTS :

The material shall be clean, smooth, free from fins, spills, scaling, blisters, cracks and other harmful defects.

8. MANUFACTURE :

The conductor shall be manufactured from ETP grade copper conforming to CPS AA 12024 "Electrolytic Tough Pitch Copper wire Bars/ingots/continuously Cast Wire Rods".

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

9. FINISH :

The material shall be finished by such cold working as would produce the required temper, corner, edge & surface finish .



PLANT PURCHASING SPECIFICATION BHOPAL

BP 12089

REV NO. 05

PAGE 3 of 4

10. TEST SAMPLES :

10.1 For Chemical Analysis

One sample per size per heat shall be taken for chemical analysis .

10.2 For Mechanical Tests :

One sample per size per heat shall be taken for mechanical testing. The sample shall be cut off cold and shall receive no further treatment before being tested .

10.3 For Electrical Resistivity Test:

One sample per size per heat shall be taken for electrical resistivity test .

11. CHEMICAL COMPOSITION :

Chemical Composition of the material shall conform to AA 12024.

12. MECHANICAL PROPERTIES :

12.1 Tensile

When tested to IS : 1608 the test pieces shall show the following properties :

Thickness		Tensile Strength N/mm ² Min.	1 % Elongation on 44X7 gauge length with a minimum of 50 ran Min
Over nut	up to & inald.mn		
0.50	2.50	245	10
2.50	10	245	15

12.2 Bend Test

The strip shall 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 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 of the strip or failure upon the convex surface of the bend .

12.3 Hardness (Vicker's) :

The hardness of the material when tested in accordance with IS:1501 (Part 1) shall show vicker's hardness of 75-90 HV.



PLANT PURCHASING SPECIFICATION BHOPAL

BP 12089

REV NO. 05

PAGE 4 of 4

13 ELECTRICAL RESISTIVITY :

The resistivity at 20⁰C, measured directly on a one metre length of sample shall not be greater than 0.01777 ohm mm²/m which corresponds to 97% of Electrical Conductivity of the IEC standard.

Refer IS 613 Appendix B, for temperature correction factor .

14. TEST CERTIFICATE:

Unless otherwise specified three copies of the test certificates shall be supplied.

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

The test certificate shall bear the following information :

BP 12089 : Rectangular Copper Strip, Corners Round

Rev. 05 Half-Hard (Fine Tolerance)

BHEL Order No.

Supplier's Reference:

Name

Size S Weight.

Consignment/ Identification.

Results of Tests :

Test results Obtained for Electrical, Mechanical Properties, Chemical Composition and Dimensional Tolerances as per specification.

15. PACKING AND MARRING :

The material shall be supplied in straight lengths as ordered. Material shall be hessian wrapped and tied with string, (not with wire) and shall be suitably protected to avoid damage during transit .

Each package shall bear the following information :

BP 12089 : Rectangular Copper Strip, Corners Round, Half-Hard (Fine Tolerance)

BHEL Order No.

Supplier's Name.

Size and weight.



CORPORATE PURCHASING SPECIFICATION

AA 120 20

Rev. No. 03

PAGE 1 OF 4

COPPER FOIL – HALF HARD**1.0 GENERAL:**

This specification governs the quality requirements of copper foil in half-hard condition upto 0.15mm thick and widths upto 630 mm.

2.0 APPLICATION:

Used in switchgear.

3.0 CONDITION OF DELIVERY:

The foil shall be supplied in half hard condition in coils on drums with straight parallel edges.

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: 3331- 1977 : Copper and Brass Strips/Foils for Radiator Cores.

Condition : HB (Half Hard) .

5.0 DIMENSIONS AND TOLERANCES:**5.1 Sizes.**

The copper foil shall be supplied to the dimensions as specified in BHEL order.

5.2 Tolerances:**5.2.1 Thickness:**

Tolerance on thickness shall be as follows:

Thickness, mm		Tolerance, \pm mm		
Over	upto & incld.	upto & incld. 160mm wide	160 – 300mm wide	300 – 450mm wide
-	0.05	10%	--	--
0.05	0.10	10%	12.5%	--
0.10	0.16	0.012 mm	0.015mm	0.02mm

Revisions :

CI: 19.10.18 of MOM of MRC-NFCW+HE

APPROVED :

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE-MRC (NFCW+HE)

Rev. No. 03

Amd.No.

Reaffirmed

Prepared

Issued

Dt. of 1st Issue

Dt:15-10-04

Dt :

Year :

HYDERABAD

Corp. R&D

01-09-78

AA 120 20	CORPORATE PURCHASING SPECIFICATION	
Rev. No. 03		
PAGE 2 OF 4		

5.2.2 Width:

Tolerance on width shall be as follows:

Width, mm		Tolerance, \pm mm
Over	up to & incld.	
—	50	0.10
50	100	0.15
100	200	0.20
200	400	0.30
400	630	0.50

6.0 MANUFACTURE:

The foil shall be manufactured from copper of ETP grade conforming 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 foil shall be clean, bright, smooth and free from fins, spills, scaling, blisters, cracks and other defects.

8.0 CHEMICAL COMPOSITION:

The analysis of copper when analyzed in accordance with IS 440 or any other conventional/instrumental methods 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.	-	0.030

- These elements need not be determined when the material supplied conforms with the 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 sample 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 .

	CORPORATE PURCHASING SPECIFICATION	AA 120 20
		Rev. No. 03
		PAGE 3 OF 4

10.0 HARDNESS (VICKERS):

When tested in accordance with IS:1501, the foil shall have Vickers hardness in the range of 75 to 85 HV.

11.0 ELECTRICAL RESISTIVITY (As Received):

When measured in accordance with IS: 3635, the electrical resistivity of the sample in as received condition at 20⁰ 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. 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 works, the supplier shall make necessary arrangements for carrying out the prescribed tests elsewhere. The supplier shall notify BHEL in advance about the readiness of the material for inspection and 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 stated, three copies of test certificates shall be supplied along with each consignment.

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

The test certificate shall bear the following information:


AA 12020, Rev. No. 03 : Copper foils- Half 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 as per this specification.

AA 120 20	CORPORATE PURCHASING SPECIFICATION	
Rev. No. 03		
PAGE 4 OF 4		

14.0 PACKING AND MARKING:

The material shall be supplied in coils or drums and shall be packed suitably to prevent damage during transit. The minimum eye of the coil or barrel diameter of the drum shall be 250mm.

Each coil or drum shall be legibly marked or labeled with the following information.

AA 12020 : Copper foil - Half Hard
 BHEL Order No
 Manufacturer's/ supplier's Name
 Lot/Identification/ Batch /Melt No.
 Size and Quantity supplied.

15.0 REFERRED STANDARDS (Latest publication including amendments):

1) IS:191 2) IS:440 3) IS:613 4) IS:1501
 5) IS:3331 6) IS:3635 7) ASTM E 1004



CORPORATE PURCHASING SPECIFICATION

AA 120 23

Rev. No. 08

PAGE 1 OF 5

COPPER RODS AND SECTIONS - HARD

1.0 GENERAL:

This specification governs the quality requirements of copper rods/bars and sections.

2.0 APPLICATION:

Used for general electrical purposes in Transformers, switch gears, Bus - bars, HT/MT caps and control equipment.

3.0 CONDITION OF DELIVERY:

The copper rods shall be supplied in hard condition in straight lengths. Rectangular rods shall be supplied with radiused edges to clause 5.3.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

IS: 613- 2000 : Copper Rods and Bars For
Condition : Hard Electrical purposes - specification.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes.

Copper rods and sections shall be supplied to the dimensions specified in BHEL order / drawing.

5.2 Tolerances:

5.2.1 The tolerances for round, square, rectangular and hexagonal rods / bars shall be as given below :

[Table - 2 of IS: 613]

5.2.2 Sections:

Shall be as per BHEL drawing accompanying the order.

Revisions :

CI: 24.1 of MOM of MRC-NFCW+HE

APPROVED :

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE-MRC (NFCW+HE)

Rev. No.08

Amd.No.

Reaffirmed

Prepared

Issued

Dt. of 1st Issue

Dt:06.06.2012


Dt :

Year :

BHOPAL

Corp. R&D

Nov, 1978

AA 120 23	CORPORATE PURCHASING SPECIFICATION		
Rev. No. 08			
PAGE 2 OF 5			

5.2.3 Length - Rod/Sections:

Tolerance on length shall be as follows:

Length, mm		Tolerances, \pm mm
Over	Upto & incl.	
-	150	1.2
150	1200	1.5
1200	2400	2.5
2400	-	5.0

5.2.4 Straightness:

The straightness and/or edgewise curvature (edge bow) shall not exceed 3 mm for every 1000 mm length.

5.2.5 Radius on Edges - Rectangular & Squares:

Thickness, mm		Edges Radius, mm	Tolerance in Radius \pm mm
Over	Upto and incl .		
6	25	2.5	0.25
25	50	3.2	0.25
50	-	as agreed to between BHEL & manufacturer.	

6.0 MANUFACTURE:

The copper rods shall be manufactured from copper of ETP grade conforming to IS: 191. The conductor shall be manufactured from ETP grade copper conforming to BHEL specification AA 120 24:: 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 copper rods shall be clean, bright, smooth and free from fins, spills, scaling, blisters, cracks and other defects.

8.0 CHEMICAL COMPOSITION:

The analysis of copper when analyzed in accordance with IS 440 or by any other Conventional/ Instrumental method shall be as follows:

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



CORPORATE PURCHASING SPECIFICATION

AA 120 23

Rev. No. 08

PAGE 3 OF 5

- These elements need not be determined when the material supplied conforms with the 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:

9.1 Tests shall be conducted as follows:

Rods and bars : Mechanical and Electrical.
Sections : Hardness and Electrical.

9.2 One sample 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 .

10.0 MECHANICAL PROPERTIES:

10.1 Tensile Strength:

The test samples, when tested in accordance with IS: 1608 shall show the following properties and hardness as per IS:1501.

10.1.1 Round: TABLE FOR HD

Dia., Width, Across flats or Thickness, mm		Tensile strength, N/mm ² ,min.			Elongation on 5.65√So of gauge length, % min.			Hardness for all shapes
Over	Upto & incl.	Round	Square/ Hexagonal	Rect- angular	Round	Square/ Hexagonal	Rect- angular	HV, min.
6.0	10.0	330	-	-	-	-	-	90
10.0	12.0	320	310	270	6	6	8	
12.0	25.0	290	280	260	8	8	8	
25.0	90.0	260	250	250	12	12	10	
> 90.0		As agreed between BHEL and manufacturer.						

10.1.2 Rods /Bars other than rectangular:

For material over 30 mm dia, thickness or width a cross flats, the test piece shall be turned with its centre 14mm from the surface of the material for material of smaller dia or width, which may not be tested in the condition as manufacture of the test pieces shall be turned from the centre of the material.

10.1.3 Rectangular Bars/Rods:


The test piece shall be taken from the centre of the rod/bar.

10.2 Bend Test:

The material shall be tested for bend test in accordance with IS:1599, if specified in BHEL order.

11.0 ELECTRICAL RESISTIVITY (As Received):

When measured in accordance with IS: 3635, the electrical resistivity of the sample in as received condition at 20° C shall not be greater than 0.0177 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.

AA 120 23	CORPORATE PURCHASING SPECIFICATION	
Rev. No. 08		
PAGE 4 OF 5		

12.0 CHECK LIST:

The supplier shall fill up the enclosed checklist as per Annexure-A and submit the same alongwith each batch.

13.0 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. 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 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.

14.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:
 AA 12023 (Rev. No. 08) : Copper Rods and sections - 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 as per this specification.


15.0 PACKING AND MARKING:

The material shall be suitably packed to prevent damage during transit.

Each package shall be legibly marked or labeled with the following information.
 AA 12023 : Copper Rod and sections - Hard
 BHEL Order No
 Manufacturer's/ supplier's Name
 Lot/Identification/ Batch /Melt No.
 Size and Quantity supplied.

16.0 REFERRED STANDARDS(LATEST PUBLICATION INCLUDING AMENDMENTS):

1) IS:191	2) IS:440	3) IS:613	4) IS:1501
5) IS:1599	6) IS:1608	7) IS: 2826	8) IS: 3635 9) ASTM E 1004

	CORPORATE PURCHASING SPECIFICATION	AA 120 23 Rev. No. 08 PAGE 5 OF 5
---	---	--

ANNEXURE - A (Clause 12.0)

CHECK LIST FOR AA 120 23: COPPER RODS AND SECTIONS - HARD
(To be filled by Supplier)

A. Name of Principal Supplier :

B. Name of Indian Agent :

1. Grade of material as per specification : Yes/No

2. Tolerance on diameter/ Width/thickness/ length and flatness as per specification and drawing : Yes/No

3. Chemical composition as per specification : Yes/No

4. Mechanical properties as per specification : Yes/No

5. Electrical Resistivity : Yes/No

6. Tests : (1) Bend

7. Details of previous experience enclosed : Yes/No.
 (For New suppliers only)

C. Deviations taken (Please specify clearly, if any) : Yes/No.

1
2
3

Date:

Place:

Signature &

Seal of Supplier