EXTRUDED COPPER SECTIONS - ANNEALED

1.0 GENERAL:

This specification governs the quality requirements of Extruded copper sections in annealed condition.

2.0 APPLICATION:

Used in winding of electrical machines.

3.0 CONDITION OF DELIVERY:

The copper sections shall be supplied in annealed condition in straight lengths as specified in BHEL order. Joints are not permitted.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

There is no Indian standard covering this material. However assistance has been drawn from the following National standard.

IS: 613- 2000 , Condition : Annealed : Copper Rods and Bars For Electrical purposes

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

Extruded copper sections shall be supplied to the dimensions specified in BHEL order / drawing.

5.2 Tolerances:

5.2.1 Thickness and width:

The tolerances on sections shall be specified in BHEL order/drawing.

5.2.2 Radius on edges:

Radius on edges and tolerances on radius shall comply with the following:

Thickness, mm		Radius on edges,	Tolerance on radius
Over	Upto and incl .	mm	± mm
-	1.2	0.40	0.06
1.2	1.7	0.50	0.08
1.7	2.5	0.60	0.09
2.5	4.0	0.80	0.12
4.0	10	1.00	0.15
10	25	2.5	0.25
25	80	3.2	0.25

6.0 MANUFACTURE:

The copper sections 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 sections shall be clean, bright, smooth and free from fins, spills, scaling, blisters, cracks, piping, pitting, folds, waviness, camber 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 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:

9.1 Test samples shall be drawn from the same ingot as the sections they represent and shall be treated in the same manner. Test samples shall be of such size as to give test pieces of 15mm dia and 350mm long after machining. One test sample for each melt shall be supplied. Test samples shall bear necessary identification mark.

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 **Bend Test Edgewise:**

The copper sections shall not show any sign of cracks, when bent once on edge through an angle of 180^0 on smaller parallel dimensions, over a former diameter equal to the width of the section.

10.2 **Hardness:**

When tested in accordance with IS:1501, the material shall have a hardness of 60 HV, maximum. The copper sections shall have a uniform hardness any where along the length and cross section.

11.0 ELECTRICAL RESISTIVITY (As Received):

When measured in accordance with IS: 3635, the electrical resistivity of the sample in as received condition at 20^0 C shall not be greater than 0.01737 ohm mm^2 / metre, which is equivalent to an electrical conductivity of 99.25%, 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 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 dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA 12021, Rev. No. 02 : Extruded Copper Sections - Annealed
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 copper sections shall be suitably packed to prevent damage during transit.

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

AA 12021: Extruded Copper Sections - Annealed
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: 3635
6) ASTM E 1004 7) AA 12024

ANNEXURE - A (Clause 12.0)

CHECK LIST FOR AA 120 21: EXTRUDED COPPER SECTIONS – ANNEALED

(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/ across flats/radius on edge/ 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: Signature &

Place: Seal of Supplier