



CORPORATE PURCHASE SPECIFICATION

AA 123 29

Rev. No. 04

PREFACE SHEET

ALUMINIUM ALLOY RODS, BARS, TUBES, SECTIONS AND PROFILES HEAT TREATED - Gr: 63401

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS : 5082 - 1998, Gr: 63401, WP
2. BRITISH : BS EN 755 - 2008

Suggested/Probable suppliers and grades:

Refer plant vendor list

User Plant References:

1. BHOPAL : BP 12388.
2. ED/BANGLORE : USING IS Grade
3. HYDERABAD : HY 12395

Revisions:

CI: 24.1 of MOM of MRC-NFCW+HE

APPROVED:

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE -MRC (NFCW+HE)

Rev. No. 04

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Dt. of 1 st Issue

Dt: 07.06.2012

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Year:

BHOPAL

Corp. R&D

June, 1984



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ALUMINIUM ALLOY RODS, BARS, TUBES, SECTIONS AND PROFILES

HEAT TREATED - Gr: 63401

1.0 GENERAL:

This specification governs the requirements of Wrought Aluminum Alloy Bars, Drawn Tubes, Sections and Profiles.

2.0 APPLICATION:

For bus bars, shunt reactors, etc.

3.0 CONDITION OF DELIVERY:

Fully heat treated.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

IS: 5082 - 1998 : " Specification for Wrought Aluminum Alloy Bars, Rods, Gr.: 63401, Condition: WP Tubes and Sections for Electrical Purposes."

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes: The material shall be supplied as per the dimensions specified in BHEL order.

5.1.1 Size for equal leg angles shall be as per IS: 3908 (Specifications for Aluminum Equal Leg Angles).

5.1.2 Sizes for unequal leg angles shall be as per IS:3909 (Specification for Aluminum Unequal Leg Angles).

5.1.3 Sizes for channels shall be as per IS:3921 (Specification for Aluminum Channels).

5.1.4 Sizes for Drawn tubes shall be as per IS:2678 (Specification for Aluminium and Aluminium alloys, Drawn Tubes).

Revisions :

Cl: 24.1 of MOM of MRC-NFCW+HE

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5.1.5 Sizes and tolerances for profiles shall be as per drawing/Order.

5.1.6 Sizes and tolerance for bars, rods and section shall be as per IS:3965

5.2 Tolerances:

5.2.1 Tolerances on diameter of Round Bars:

DIAMETER	TOLERANCE		
	CLASS A		CLASS B
	Plus (+)	Minus (-)	±
Up to 12.0	0.03	0.07	± 0.20
Over 12 upto 25	0.05	0.10	± 0.25
Over 25 upto 40	0.07	0.13	± 0.30
Over 40 upto 50	0.13	0.13	± 0.38
Over 50 upto 56	0.15	0.15	± 0.46
Over 56 upto 71	0.20	0.20	± 0.53
Over 71 upto 80	0.25	0.25	± 0.61
Over 80	Half % of Diameter	Half % of Diameter	± 1 % of diameter

Note: Class A tolerances are applicable for drawn rods and not to the as extruded rods. In case of diameters other than standard and not included in the above table, the tolerance applicable are those for the nearest smaller diameter.

5.2.2 Tolerance on length:

Unless otherwise agreed, the length tolerances shall be as given below:

<u>Nominal diameter, mm</u>		<u>Length, mm</u>		
Over	Upto & incld.	Upto & incld. 1500	Over 1500 upto & including 6000	Over 6000
-	50	± 4	± 5	± 6
50	100	± 5	± 6	± 7
100	150	± 6	± 7	± 8
150	--	± 7	± 8	± 9



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5.2.3 Tolerance on over all widths and width across flats of bars and regular sections.

Width and width Across Flats, mm	Tolerance, mm
6.4	± 0.20
10	± 0.23
12	± 0.25
16	± 0.28
25	± 0.30
32	± 0.38
50	± 0.46
60	± 0.53
80	± 0.69
100	± 0.75
120	± 0.85
160	± 1.02
200	± 1.14
250	± 1.40
300	± 1.65
320	± 1.70

Note: For intermediate sizes, tolerance for the next higher size shall be taken.

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5.2.4 Tolerances on thickness of regular sections and bars (other than those cover by clause 5.2.1. and 5.2.2):

(All dimensions in millimeters)
Width of Sections

Thickness of section	12	16	20	25	32	40	50	63	80	100	125	160	200	250	320
1.2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1.6	0.18	0.20	0.20	0.20	0.20	*	*	*	*	*	*	*	*	*	-
2	0.18	0.20	0.20	0.20	0.20	0.23	0.25	0.28	0.30	0.33	0.36	0.38	0.41	0.46	-
2.5	0.18	0.20	0.20	0.20	0.20	0.23	0.25	0.28	0.30	0.33	0.36	0.38	0.41	0.46	-
3.2	0.18	0.20	0.20	0.20	0.23	0.25	0.28	0.30	0.33	0.36	0.38	0.41	0.43	0.48	-
4	0.20	0.23	0.23	0.23	0.25	0.28	0.30	0.33	0.36	0.38	0.41	0.43	0.46	0.51	-
5	0.20	0.23	0.23	0.23	0.25	0.28	0.30	0.33	0.36	0.38	0.41	0.43	0.46	0.51	-
6	0.20	0.23	0.23	0.23	0.25	0.28	0.30	0.33	0.36	0.41	0.46	0.51	0.56	0.66	-
8	0.23	0.25	0.25	0.25	0.28	0.30	0.33	0.36	0.38	0.43	0.48	0.53	0.58	0.71	-
10	0.23	0.25	0.25	0.25	0.28	0.30	0.33	0.36	0.38	0.43	0.48	0.53	0.58	0.71	-
12	0.25	0.28	0.28	0.28	0.30	0.33	0.36	0.38	0.41	0.46	0.48	0.53	0.58	0.74	0.97
16	0.28	0.30	0.30	0.30	0.33	0.36	0.38	0.41	0.43	0.48	0.51	0.56	0.61	0.76	1.02
20		0.30	0.30	0.30	0.36	0.38	0.41	0.43	0.46	0.51	0.53	0.61	0.69	0.79	1.04
25		0.30	0.30	0.30	0.36	0.38	0.41	0.43	0.46	0.51	0.53	0.61	0.69	0.79	1.04
32					0.38	0.41	0.43	0.46	0.48	0.53	0.56	0.66	0.74		
40						0.46	0.48	0.51	0.53	0.56	0.61	0.71	0.79		
50							0.53	0.56	0.58	0.61	0.66	0.76	0.84		
63								0.61	0.64	0.66	0.71	0.81	0.89		
80									0.69	0.71	0.74	0.86	0.94		
100										0.76	0.79	0.91	0.99		
125											0.89	0.97	1.04		
160												1.02	1.09		
200													1.14		

*To be regarded as special sections.

Note – for intermediate sizes, take tolerances for the next higher value.



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- 5.2.5** Tolerances for Drawn Tubes shall be as per IS: 2678.
- 5.2.6** Tolerances for bars and sections of dimensions larger than those covered above shall be subject to mutual agreement between BHEL and the supplier.
- 5.2.6.1** Sections not covered in clause 5.2.1 and 5.2.4 and where additional manufacturing operations are necessary, where specially close tolerances are required, such tolerances shall be agreed upon between BHEL and the supplier.
- 5.3 Tolerance** for concavity and convexity, twist and straightness.
All the bars, sections shall be supplied in a straightened condition and reasonably free from twist.
- 5.3.1** The twisting of profile, bars, flats, etc. around the axis shall not exceed 1° per meter length.
- 5.3.2** The deflections in any one meter length of profile bars and flats not be more than 2mm.
- 5.3.3** The bars, profiles, rods etc., shall be cut at right angle to the longitudinal axis. The skewing of the cut relative to the axis shall not exceed 3° .
- 5.4** Angular tolerance:

The tolerance on angles of regular sections measured at the extremities of the section shall be as follows:

Thickness of thinnest leg, mm		Allowable deviation from angle specified
Over	Upto & including	
--	5.1	$\pm 2^{\circ}$
5.1	19.0	$\pm 1.5^{\circ}$
19.0	-	$\pm 1^{\circ}$

- 5.4.1** Tolerance on angle of other sections shall be agreed to between BHEL and the supplier.

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6.0 MANUFACTURE:

The method of manufacture of the material shall be at the discretion of the manufacturer. However the sections shall be manufactured by the extrusion process.

7.0 HEAT TREATMENT:

The bars, tubes, sections and profiles shall be fully heat treated i.e. solution treated and subsequently precipitation hardened.

8.0 FREEDOM FROM DEFECTS:

The material shall be clean, smooth and free from fins, spills, porosity, cracks or other defects and shall be reasonably straight and free from twists.

9.0 CHEMICAL COMPOSITION:

The chemical composition of the material, when analysed in accordance with IS: 504 (Methods of chemical analysis of aluminum alloys and its alloys) shall be as follows:-

Element	Percent	
	Min.	Max.
Magnesium	0.4	0.9
Silicon	0.3	0.7
Copper Iron	-	0.05 *
Iron	-	0.5 *
Manganese		0.13
Zinc		0.10
Titanium		0.10
Chromium		0.03
Total Impurities		0.10
Alluminium	Remainder	

***Note:** The impurities need be determined only when the mechanical electrical properties do not meet the specification requirements.

10.0 TEST SAMPLES:

10.1 Bars, tubes, sections and profiles of the same dimensions produced under similar conditions and of the same composition, shall be grouped into lots or 2000 kg/heat treatment batch/consignment.

Note: In case a heat treatment batch is less than a lot size as defined above, it shall be considered as a lot by itself.



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- 10.2** One test sample, shall be cut from a bar, tube section or profile selected from each lot.
- 10.2.1** The test sample, after heat treatment shall not be mechanically worked except for preparing the test piece before they are tested.
- 10.3** One sample from each heat shall be analysed for chemical composition.
- 10.4** Should any of the test pieces first selected fail in the mechanical tests, two further samples from the same lot shall be selected for testing, one of which shall be from the same bar or tube from which the original test sample was taken, unless those material have been withdrawn by suppliers.

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

11.0 MECHANICAL PROPERTIES:

11.1 Tensile Test:

The material when tested in accordance with IS:1608 shall show the following tensile properties:

Tensile strength	200 N/mm ² , minimum
0.2 % Proof Stress	170 N/mm ² , minimum
Elongation on $5.65\sqrt{S_0}$ or 50mm G.L.	10 percent, minimum

11.2 Bend Test (Up to 12mm thick):

Flat sections shall withstand, when bent cold, flat wise through an angle of 90⁰ cover a former of radius equal to twice the thickness, without showing signs of visible fracture.

12.0 ELECTRICAL RESISTIVITY:

The electrical resistivity shall not exceed a value of 3.13 micro-ohm cm at 20⁰ C, when tested to clause 9 of IS: 5082, 55% IACS conductivity.

**13.0 TEST CERTIFICATES:**

The supplier shall submit three copies of test certificates giving the following information:

AA 12329 (Rev No. 04): Aluminium alloy Bars, Tubes, Sections & Profiles – Heat Treated - Gr. 63401.

BHEL order No.

Supplier's reference and Name

Batch No.

Drawing/Pattern No.

Consignment/Identification No.

Results of chemical analysis, mechanical and all other tests as called for in this specification/order

14.0 PACKING AND MARKING:

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

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

AA12329

BHEL order No.

Batch No.

Identification Mark/No

Weight.

Supplier's reference and Name.

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 504

2) IS: 1608

3) IS: 2678

4) IS:3965

5) IS: 3908

6) IS: 3909

7) IS: 3921

8) IS: 5082