STANDARD / SPECIFICATION	NUMBER
EXTRUDED BARS FROM ALUMINIUM AND ALUMINIUM ALLOYS.	GOST 21488-76
	SUPERSEDED ✱
	SHT 1 OF 12

✱ GOST 4783-69 except points 5.1-5.7, 5.9, 5.10, GOST 13800-68 and GOST 7857-73.

This standard pertains to extruded bars from aluminium of grades AD0, AD1 and from aluminium alloys of grades АМг2, АМг2С, AD31, AD33, АМг2, АМг3, АМг5, АМг6, АВ, Д1, Д16, В95, АК4, АК4-1, АК6, АК8, 1915 and 1925.

By mutual agreement between manufacturer and customer it is allowed to fabricate bars from aluminium of other grades having very high and tech. finish as per GOST 11069-74.

1. CLASSIFICATION.

1.1. Bars are classified :

a) as per shape of section :

round - ~~Кр~~, КР

square - ~~Кв~~, КВ

hexagonal - ~~Ш~~; ШГ

b) as per manufacturing accuracy:

of normal accuracy - ~~Н~~; Н

of high accuracy - ~~П~~; П

U.T.S.

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HINDUSTAN AERONAUTICS LIMITED-NASIK DIVN. INDIA

c) as per material condition :

without heat treatment (hot extruded) - denoted by alloy grade without additional symbols (АД0, АД1, АМг5, АМг3, АД31, АД33, АМг2, АМг3, АМг5, АМг6, АВ, Д1, Д16, В95, АК4, АК4-1, АК6, АК8, 1915, 1925); annealed - М (АМг3М, АМг5М, АМг6М, 1925М);

hardened and naturally aged - Т (АД31Т, АД33Т, АВТ, Д1Т, Д16Т, 1915Т, 1925Т),

hardened and artificially aged - Т1 (АД31Т1, АД33Т1, АВТ1, В95Т1, АК4Т1, АК4-1Т1, АК6Т1, АК8Т1);

d) as per strength :

of normal strength - denoted by grade without any additional symbols (Д1, Д1Т, Д16, Д16Т, В95, В95Т1, АВ, АВТ1, АК6, АК6Т1, АК8, АК8Т1),

of high strength - ПП (АВПП, АК1ПП, Д1ПП, Д1ТПП, Д16ПП, Д16ТПП, В95ПП, В95Т1ПП, АК6ПП, АК6Т1ПП, АК8ПП, АК8Т1ПП).

NOTES : 1. Bars without heat treatment (hot extruded) from aluminium of grades АД0, АД1 and aluminium alloys of grades АМг5, АМг2, АМг3 may be fabricated in annealed condition if their mechanical properties meet the requirements set for bars without heat treatment.

2. Bars in hardened and naturally or artificially aged condition are fabricated with diameter 250 mm. maximum. Fabrication of bars of diameter above 200 mm. in hardened, naturally or artificially aged condition is

done by mutual agreement between manufacturer and customer.

3. Bars of high strength are fabricated with diameter not above :

300 mm. - round,
150 mm. - square,
100 mm. - hexagonal.

2. ASSORTMENT.

2.1. Dimensions of round bars and linear density of 1 m. bar should correspond to the values given in table 1.

2.2. Ovality of round bars should not lead their dimensions beyond the tolerances on diameter.

2.3. Dimensions of square bars and linear density of 1 m. bar should correspond to the values given in table 2.

2.4. Dimensions of hexagonal bars and linear density of 1 m. bar should correspond to the values given in table 3.

2.5. The opposite planes of square and hexagonal bars should be parallel.

Non-parallelism of sides, not exceeding the tolerances on diameter of inscribed circle, is allowed.

2.6. Maximum values of rounding radii of square and hexagonal bars should correspond to the values given in table 4.

Table No. 1.

Nominal diameter, mm	Tolerances on bar diameter, mm, for manufacturing accuracy: Normal (H)	High (P)	Cross-sectional area, cm^2	Linear density of 1 m bar, kg/m
(1)	(2)	(3)	(4)	(5)
5	±0.40	±0.30	0.196	0.053
6			0.283	0.077
7	±0.53	±0.35	0.385	0.105
8			0.503	0.138
9			0.636	0.174
10			0.785	0.215
11	±0.70	±0.43	0.950	0.260
12			1.131	0.309
13			1.327	0.363
14			1.539	0.422
15			1.767	0.484
16			2.011	0.550
17			2.270	0.621
18			2.545	0.696
19	±0.84	±0.52	2.835	0.775
20			3.142	0.859
22			3.801	1.039
24			4.155	1.136
25			4.521	1.236
26			4.909	1.342
28			5.309	1.452
30			5.725	1.565
			6.158	1.684
			7.069	1.933

Contd...../-

(1)	(2)	(3)	(4)	(5)
32			8.042	2.292
34			9.079	2.588
35			9.621	2.742
36			10.179	2.901
38			11.341	3.244
40	-1.00	-0.62	12.566	3.591
42			13.854	3.949
45			15.904	4.533
46			16.619	4.736
48			18.096	5.157
50			19.635	5.596
52			21.237	6.053
55			23.758	6.771
58			26.421	7.530
60	-1.20	-0.74	28.274	8.058
65			33.183	9.457
70			38.485	10.968
75			44.179	12.591
80			50.265	14.328
85			63.745	16.172
90			63.617	18.131
95			70.882	20.201
100	-1.40	-1.00	78.540	22.384
105			86.590	24.678
110			95.033	27.084
115			103.869	29.603
120			113.097	32.235

Contd.../-

(1)	(2)	(3)	(4)	(5)
125			122.719	24.975
130			132.732	27.829
136			143.139	29.795
140			153.938	43.872
145			165.130	47.062
150			176.715	50.354
155	-1.50	-	188.692	53.777
160			201.062	57.303
166			213.825	60.940
170			226.980	64.689
175			240.529	69.551
180			254.469	72.524
185			268.803	76.609
190			283.529	80.806
200			314.169	89.538
210			346.361	98.713
220	-2.00	-	380.133	108.332
230			415.476	118.411
240			426.339	128.931
250			490.874	139.899
260			530.929	151.315
270			572.557	163.178
280	-2.50	-	615.752	175.489
290			660.521	188.249
300			706.863	201.455

Contd..../-

(1)	(2)	(3)	(4)	(5)
310			754.769	215.109
320			804.250	229.211
330	±4.00	-	855.301	243.761
340			907.922	258.758
350			962.115	274.203
360			1017.878	290.096
370			1075.213	306.436
380	±6.00	-	1134.118	323.224
390			1194.593	340.459
400			1256.640	358.142

NOTE : Bars of diameter above 300 mm. may be fabricated with negative and positive tolerances on diameter, in this case the tolerance limit should not exceed the limits, given in table 1.

Table No. 2.

Nominal diameter of inscribed circle, mm.	Tolerances on diameter of inscribed circle, mm, for manufacturing accuracy.		Cross-sectional area, cm^2.	Linear density of 1 m. bar, kg/m.
	Normal (N)	High (P)		
(1)	(2)	(3)	(4)	(5)
7			0.49	0.140
8	±0.53	±0.36	0.64	0.182
9			0.81	0.231
10			1.00	0.285

Contd...../-

(1)	(2)	(3)	(4)	(5)
11			1.21	0.345
12			1.44	0.410
13			1.69	0.482
14			1.96	0.559
16	-0.70	-0.43	2.25	0.641
16			2.56	0.730
17			2.89	0.824
18			3.24	0.923
19			3.61	1.029
20			4.00	1.140
22			4.84	1.379
24			5.76	1.642
25	-0.84	-0.52	6.25	1.781
26			6.76	1.927
27			7.29	2.078
28			7.84	2.234
30			9.00	2.565
32			10.24	2.918
34			11.56	3.295
36			12.96	3.694
38			14.44	4.115
40			16.00	4.560
42	-1.00	-0.62	17.64	5.027
44			19.36	5.518
46			21.16	6.031
48			23.04	6.566
50			25.00	7.125

Contd..../-

(1)	(2)	(3)	(4)	(5)
52			27.04	7.706
56			30.25	8.621
58		±0.74	33.64	9.587
60	±1.20		36.00	10.260
65			42.25	12.041
70			49.00	13.965
75			56.25	16.031
80		±1.00	64.00	18.240
85			72.25	20.591
90			81.00	23.085
100	±1.40		100.00	28.500
110			121.00	34.485
120			144.00	41.040
130			169.00	48.165
140	±1.60		196.00	55.860
160			225.00	64.125

Table No. 3.

Nominal diameter of inscribed circle, mm.	Tolerances on diameter of inscribed circle of bar, mm, for manufacturing accuracy.		Cross-sectional area, cm^2.	Linear density of 1m. bar, kg/m.
	Normal (N)	High (P)		
(1)	(2)	(3)	(4)	(5)
7			0.424	0.121
8	-0.63	-0.36	0.554	0.158
9			0.701	0.200
10			0.866	0.247
11			1.048	0.299
12			1.247	0.356
13	-0.70	-0.43	1.697	0.484
14			2.042	0.582
17			2.503	0.713
19			3.126	0.891
22			4.192	1.196
24	-0.84	-0.52	4.988	1.422
27			6.313	1.799
30			7.794	2.221
32			8.863	2.527
36			11.221	3.199
41	-1.00	-0.62	14.663	4.149
46			18.325	5.222
50			21.651	6.170
55			26.197	7.466
60	-1.20	-0.74	31.177	8.885
65			36.590	10.428
70			42.430	12.093

Contd...../-

(1)	(2)	(3)	(4)	(5)
75	-1.20		48.710	13.882
80			65.430	15.797
85		-1.00	62.570	17.832
90	-1.40		70.148	20.000
95		-	78.160	22.276
100			86.600	24.681

Table No. 4.

mm

Nominal diameter of inscribed circle.	Rounding radius, maximum. For square bars.	For hexagonal bars.
Upto 10.0	1.0	0.5
Above 10.0 upto 25.0	2.0	1.0
-"- 25.0 upto 50.0	2.5	1.2
-"- 50.0 upto 100.0	3.0	1.5
-"- 100.0 upto 150.0	3.5	-

NOTE : Rounding radii are checked on the tool.

2.7. By mutual agreement between the parties it is allowed to fabricate bars of diameter, not indicated in tables 1-3.

NOTE : In case of fabrication of bars of intermediate diameters, the tolerances for these diameters are taken as those of the nearest lesser diameter.

2.8. As regards length, bars are fabricated :

a) with non-standard length :

from 1 upto 6 m. - if diameter is from 5 upto 10 mm;

from 1 upto 5 m. - if diameter is above 10 upto 50 mm;

from 0.6 upto 4 m. - if diameter is above 50 upto 400 mm;

b) with standard and multiple standard length within the limits of non-standard length with tolerances :

+10 mm. - for bars of diameter from 5 upto 300 mm;

+20 mm. - for bars of diameter above 300 upto 400 mm.

NOTE : By mutual agreement between the manufacturer and customer it is allowed to fabricate bars of other lengths.

2.8.1. Bars of multiple standard length should be ordered considering an allowance of 5 mm. for each cut.

2.8.2. By mutual agreement between the manufacturer and customer it is allowed to fabricate bars of diameter upto 16 mm. in bundles.

2.9. Cross-sectional area and linear density of bars are calculated as per nominal dimensions.

While calculating linear density of 1 m. bar, the density of aluminium alloy is taken as equal to 2.85 gm/cm^3 which corresponds to the density of aluminium alloy of grade VD 5.

For calculating the approximate linear density of other aluminium alloys, the conversion coefficients given in reference

appendix 1 should be used.

Linear density of 1 m. bar is not the basis for despatch of product.

2.10. If there are no instructions as regards manufacturing accuracy and strength in the order, the bars are fabricated with normal accuracy and strength.

Method of calling :

bar from alloy of grade D16, hardened and naturally aged, of normal strength, round, of diameter 50 mm, of normal manufacturing accuracy, of non-standard length :

Bar D16 kr. 50N GOST 21488-76.

- do -, square, of diameter 50 mm, of high manufacturing accuracy, of length 2500 mm :

Bar D16 kv. 50Px2500 GOST 21488-76,

- do -, hexagonal, of diameter 50 mm, of normal manufacturing accuracy, having length in multiples of 1500 mm :

Bar D16T SH - 50Nx1500 kd. GOST 21488-76,

- do -, of high strength, round, of diameter 50 mm., of normal manufacturing accuracy, of non-standard length :

Bar D16TPP kr. 50N GOST 21488-76

2.11. The codes given in appendix 2 should be used for indicating nomenclature of the product in the order.

3. TECHNICAL REQUIREMENTS.

3.1. Chemical composition of the bars should meet the requirements of GOST 4784-74.

3.2. Mechanical properties of bars of normal strength should correspond to table 5.

Table No. 5.

Grade of aluminium and aluminium alloy.	Material condition.	Condition of test specimens.	Bar diameter, mm.	Tensile strength σ_u, kg/mm^2.	Yield point $\sigma_{0.2}$, kg/mm^2.	Percentage elongation δ_5
				Minimum.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
AD0 AD1	Without heat treatment.	Without heat treatment.	From 5 upto 300	6.0	-	25.0
AM1.5 AM1.5S	" "	" "	From 5 upto 350	10.0	-	20.0
AD31	Without heat treatment.	Hardened and naturally aged.	From 5 upto 300	14.0	7.0	13.0
		Hardened and artificially aged.	From 6 upto 300	20.0	15.0	8.0
	Hardened and naturally aged.	Hardened and naturally aged.	From 5 upto 100	14.0	7.0	13.0
	Hardened and artificially aged.	Hardened and artificially aged.	From 5 upto 100	20.0	15.0	8.0

Contd..../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Hardened and naturally aged.	From 5 upto 300	12.0	11.0	15.0
	Without heat treatment.	Hardened and artificially aged.	From 5 upto 300	27.0	23.0	10.0
AD33	Hardened and naturally aged.	Hardened and naturally aged.	From 6 upto 100	18.0	11.0	15.0
	Hardened and artificially aged.	Hardened and artificially aged.	From 5 upto 100	27.0	23.0	10.0
Alg 2	Without heat treatment.	Without heat treatment.	From 8 upto 300	18.0	-	13.0
Alg 3	- " -	- " -	From 8 upto 300	18.0	8.0	13.0
	Annealed.	Annealed.	From 6 upto 300	18.0	8.0	13.0
Alg 5	Without heat treatment	Without heat treatment.	From 5 upto 300	27.0	12.0	15.0
			Above 300 upto 400	25.0	11.0	10.0
	Annealed.	Annealed.	From 5 upto 300	27.0	12.0	15.0

Contd..../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
AMG6	Without heat treatment.	Without heat treatment.	From 5 upto 300	32.0	16.0	15.0
			Above 300 upto 400	29.0	12.0	11.0
	Annealed.	Annealed.	From 5 upto 300	32.0	16.0	15.0
AV	Without heat treatment.	Hardened and naturally aged.	From 5 upto 300	18.0	-	14.0
		Hardened and artificially aged.	From 5 upto 300	30.0	-	12.0
	Hardened and naturally aged.	Hardened and naturally aged.	From 5 upto 100	18.0	-	14.0
	Hardened and artificially aged.	Hardened and artificially aged.	From 5 upto 100	30.0	-	12.0
D1	Without heat treatment.	Hardened and naturally aged.	From 5 upto 130	38.0	22.0	12.0
			Above 130 upto 300	36.0	20.0	10.0

Contd...../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
M1	Hardened and naturally aged.	Hardened and naturally aged.	From 5 upto 100	38.0	22.0	12.0
D16	Without heat treatment.	Hardened and naturally aged.	From 5 upto 22	40.0	28.0	10.0
			Above 22 upto 130	43.0	30.0	10.0
			Above 130 upto 300	42.0	28.0	8.0
			Above 300 upto 400	40.0	26.0	6.0
	Hardened and naturally aged.	Hardened and naturally aged.	From 5 upto 22	40.0	28.0	10.0
			Above 22 upto 100	43.0	30.0	10.0
V95	Without heat treatment.	Hardened and artificially aged.	From 5 upto 22	50.0	40.0	6.0
			Above 22 upto 130	54.0	43.0	6.0
			Above 130 upto 300	52.0	43.0	5.0
			Above 300 upto 400	50.0	40.0	4.0

Contd..../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
V95	Hardened and artificially aged.	Hardened and artificially aged.	From 5 upto 22	50.0	40.0	6.0
			Above 22 upto 100	54.0	43.0	6.0
AK4	Without heat treatment.	Hardened and artificially aged.	From 5 upto 300	36.0	-	8.0
	Hardened and artificially aged.	- " -	From 5 upto 100	36.0	-	8.0
AK4-1	Without heat treatment.	Hardened and artificially aged.	From 5 upto 100	40.0	32.0	6.0
			Above 100 upto 300	37.0	28.0	6.0
	Hardened and artificially aged.	- " -	From 5 upto 100	40.0	32.0	6.0
AK6	Without heat treatment.	Hardened and artificially aged.	From 5 upto 300	36.0	-	12.0
	Hardened and artificially aged.	- " -	From 5 upto 100	36.0	-	12.0

Contd...../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
AK8	Without heat treatment.	Hardened and artificially aged.	From 5 upto 150	43.0	-	10.0
			Above 150 upto 300	44.0	-	8.0
	Hardened and artificially aged.	- " -	From 5 upto 100	43.0	-	10.0
D16	Without heat treatment.	Hot extruded with natural aging for 30-35 days.	From 5 upto 15	35.0	20.0	10.0
		Hardened and naturally aged for 30-35 days.	From 5 upto 300	35.0	22.0.	10.0
		Hardened and artificially aged.	From 5 upto 130	38.0	25.0	8.0
			Above 130 upto 200	36.0	25.0	8.0
	Hardened and naturally aged.	Hardened and naturally aged for 30-35 days.	From 5 upto 100	35.0	22.0	10.0
		Hardened and artificially aged.	From 5 upto 100	30.0	25.0	8.0

Contd..../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
1925	Without heat treatment.	Hot extruded with natural aging for 30-35 days.	From 5 upto 15	35.0	20.0	10.0
		Hardened and naturally aged for 30-35 days.	From 5 upto 300	36.0	22.0	10.0
		Hardened and artificially aged.	From 5 upto 130	38.0	25.0	8.0
			Above 130 upto 200	36.0	25.0	8.0
	Annealed.	Annealed.	From 5 upto 300	30.0	-	12.0
	Hardened and naturally aged.	Hardened and naturally aged for 30-35 days.	From 5 upto 100	36.0	22.0	10.0
		Hardened and artificially aged.	From 5 upto 100	38.0	25.0	8.0

NOTE : Mechanical properties of bars of diameter above 300 mm. from aluminium of grades AD0, AD1 and from aluminium alloys of grades AD31, AD33, AMg 2, AMg3, AV, D1, AK4, AK4-1, AK6, AK8, 1915 and 1925 are not regulated.

3.2.1. Mechanical properties of bars made from alloys of grades 1915 and 1925 after 4 days of natural aging should correspond to the values, given in table 6.

3.3. Mechanical properties of bars of high tensile strength should correspond to the values given in table 7.

3.4. Surface of bars should not have cracks, exfoliations, seams, unevenly pressed portions, porosity, non-metallic inclusions, corrosion spots and traces of saltpeter.

3.4.1. Dents, nicks, scratches, lines, wornout places, solitary blow holes, which exceed the tolerances on diameter and cause the bars to exceed the negative tolerance, are not allowed on the bar surface.

3.4.2. Temper colour, dark and white spots without roughness and spiral-shaped bright strips caused due to dressing are allowed.

3.4.3. Slight slopy cleaning of bars is allowed, if it does not lead the bar dimensions beyond the negative tolerances.

Cleaning is done only in longitudinal direction using abrasive wheel, scrapor or emery paper on fabric base having grain size not above no. 6 (GOST 3009-75).

Final cleaning to smooth surface is done with emery paper on paper base having grain size not above no. 10 (GOST 6456-75). Cleaning-off of cracks is not allowed.

3.5. Macrostructure of bars should not have cracks, porosity, shrinkage cavities, breaks and liquation conglomerations.

Table No. 6.

EXTRUDED BARS FROM ALUMINIUM AND ALUMINIUM ALLOYS.

Grade of aluminium alloy.	Material condition.	Condition of test specimens.	Bar diameter, mm.	Tensile strength σ_u, kg/mm^2.	Yield point $\sigma_{0.2}$, kg/mm^2.	Percentage elongation δ_5.
				Minimum.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1915	Without heat treatment.	Without heat treatment but with natural aging.	From 5 upto 15	28.0	17.0	10.0
	Hardened and naturally aged.	Hardened and naturally aged.	From 5 upto 100	28.0	18.0	10.0
1925	Without heat treatment.	Without heat treatment but with natural aging.	From 5 upto 15	28.0	17.0	10.0
	Hardened and naturally aged.	Hardened and naturally aged.	From 5 upto 100	29.0	18.0	10.0

Table No. 7

Grade of aluminium alloy.	Material condition.	Condition of test specimens.	Bar diameter mm.	Tensile strength σ_u, kg/mm^2.	Yield point $\sigma_{0.2}$, kg/mm^2.	Percentage elongation δ_5.
				Minimum.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
AV	Without heat treatment.	Hardened and artificially aged.	From 5 upto 300	32.0	23.0	8.0
	Hardened and artificially aged.		From 5 upto 100	32.0	23.0	8.0
D1	Without heat treatment.	Hardened and naturally aged.	From 5 upto 300	43.0	28.0	8.0
	Hardened and naturally aged.		From 5 upto 100	43.0	28.0	8.0
D16	Without heat treatment.	Hardened and naturally aged.	From 5 upto 300	46.0	33.0	8.0
	Hardened and naturally aged.		From 5 upto 100	46.0	33.0	8.0

Contd...../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Without heat treatment.	Hardened and artificially aged.	From 5 upto 22	52.0	41.0	7.0
			Above 22 upto 130	56.0	44.0	6.0
			Above 130 upto 300	54.0	44.0	6.0
VD5	Hardened and artificially aged.		From 5 upto 22	52.0	41.0	7.0
			Above 22 upto 100	53.0	44.0	6.0
	Without heat treatment.	Hardened and artificially aged.	From 5 upto 300	33.0	27.0	10.0
AK6	Hardened and artificially aged.		From 5 upto 100	38.0	27.0	10.0
	Without heat treatment.	Hardened and artificially aged.	From 5 upto 300	47.0	34.0	8.0
AK8	Hardened and artificially aged.		From 5 upto 100	47.0	34.0	8.0

3.6. The following defects are not allowed on macro-templates, cut from bars :

non-metallic inclusions of size above 0.5 mm., if their quantity exceeds :

2 - for bars of diameter upto 50 mm,
3 - for bars of diameter above 50 upto 300 mm,
5 - for bars of diameter above 300 mm;

spot intermetallides, on bars made from alloy of grade AM65, of size above 0.5 mm. in quantity of 5 nos., and on bars made from alloy of grade AM66 - of size above 0.1 mm. in the form of solitary separated spots;

bright spots of crystalline grains of impoverished solution on bars from alloy V95 having diameter above 150 mm. - of size more than 10 mm. in quantity above 3.

3.7. On macrotemplates, cut from bars of high strength, limited large-crystalline border located partially or along the whole perimeter is allowed, if the depth of their occurence does not exceed :

3 mm. - for bars from alloys of grades V95, D1 and D16;
8 mm. - for bars from alloys of grades AV, AK6 and AK8.

3.7.1. On macrotemplates, cut from bars of normal strength, large-crystalline border (whose magnitude is not restricted) is allowed.

On customer's request the large-crystalline border should be limited, in this case the permissible magnitude of border is set by mutual agreement between the parties.

3.7.2. Surfacial defects, found on macrotemplates and which are within the set tolerances, are allowed.

3.8. Microstructure of bars should not have traces of burns.

3.9. The bars should be uniformly trimmed from the sides. Bars of diameter above 50 mm. should not have burrs. Obliquity of cut should not lead the standard length or multiple to standard length of bars beyond the limits of minimum length and should not exceed 3°.

Bars of diameter upto 50 mm. are supplied without deburring.

3.10. Curvature of bars over 1 m. length should not exceed :

3 mm. - for bars of diameter upto 100 mm;
6 mm. - for bars of diameter above 100 upto 120 mm;
9 mm. - for bars of diameter above 120 upto 160 mm;
12 mm. - for bars of diameter above 160 upto 200 mm;
15 mm. - for bars of diameter above 200 upto 300 mm;
20 mm. - for bars of diameter above 300 upto 400 mm.

3.10.1. In bars of diameter upto 12 mm. incl. smooth curvature, which can be rectified by pressing with a weight of 5 kg, is allowed.

3.11. Angle of twist around the longitudinal axis over 1 m. length of any portion of square and hexagonal bar should not exceed :

3° - for bars having nominal diameter of inscribed circle upto 27 mm;

5° - for bars having nominal diameter of inscribed circle above 27 mm.

Square and hexagonal bars having nominal diameter of inscribed circle upto 27 mm. with standardised value of twisting, are fabricated on customer's request.

4. ACCEPTANCE RULES.

4.1. Bars are accepted for acceptance in batches. A batch should consist of bars of same grade of aluminium or aluminium alloy, same material condition, same dimensions, same manufacturing accuracy and same strength.

Bars, to be supplied in heat-treated condition, are grouped into a batch from a single heat treatment charge. Bars, to be supplied without heat treatment, are grouped into a batch from a single melt.

Weight of a batch is not restricted.

NOTE : A batch may be composed from bars of several heat treatment charges or several melts, provided each melt or charge is checked for conformity to the requirements of this standard.

4.2. Chemical composition of aluminium and aluminium alloys is checked at the manufacturing plant on bars from each melt.

Each melt is subjected to chemical analysis for determining the alloying elements and main admixtures.

4.3. Each bar is subjected to checking of surface quality and dimensions.

4.4. Mechanical properties of bars of normal strength from aluminium of grades АД0, АД1 and from aluminium alloys of grades АМг3, АД31, АД33, and also mechanical properties of bars, without heat treatment, from aluminium alloys of grades АВ, Д1, Д16, В95, АК6, АК8 are not checked by the manufacturing plant.

On customer's request bars, without heat treatment, from alloys of grades АВ, Д1, Д16, В96, АК6, АК8 of diameter above 100 mm. are subjected to checking of mechanical properties in quantity of 5% bars from a batch.

4.4.1. For checking the mechanical properties of bars of normal strength from aluminium alloys of grades АМг3, АМг2, АМг3, АМг5, АМг6, АК4, АК4-1, 1915, 1925 in all material conditions, and also bars from alloy of grades АВ, Д1, Д16, В95, АК6, АК8 in annealed and hardened conditions, 6% bars from a batch (but not less than 3 bars from each batch) are taken.

4.4.2. From a batch 10 bars, but not less than 3 bars from each batch, are taken for checking the mechanical

properties of bars of high strength from aluminium alloys of grades AV, D1, D16, V95, AK6, AK8.

4.4.3. If the batch is composed of bars from several heat treatment charges or several melts, checking of mechanical properties is done on not less than 2 bars from each heat treatment charge or melt.

4.5. For checking the macrostructure of bars of normal strength of diameter above 20 mm., 5% bars from a batch (but not less than 3 bars from each batch offered for acceptance) are taken.

Bars of normal strength of diameter upto 20 mm. inclusively are not subjected to checking of macrostructure.

4.5.1. For checking the macrostructure of bars of high strength of diameter above 20 mm., 10% bars from a batch (but not less than 3 bars from each batch offered for acceptance) are taken, and in case of bars of diameter upto 20 mm. inclusively - 5% bars from a batch (but not less than 3 bars from each batch offered for acceptance) are taken.

4.6. In case unsatisfactory test results are obtained (for mechanical properties and macrostructure) even for one of the properties, repeated tests are done for the same on double quantity of bars taken from the same batch.

Results of repeated tests are final and pertain to the whole batch.

4.7. If unsatisfactory test results for shrinkage cavity are obtained (and if macrostructure corresponds to the other requirements), the test is done till the complete elimination of shrinkage cavity; in this case all the other bars in a batch are cut to value of maximum propagation of shrinkage cavity or checked for shrinkage cavity piecewise.

4.8. Checking of macrostructure of bars, to be hardened, for burns is done on one specimen from each heat treatment charge. If there are bars of several melts in a heat treatment charge, checking of microstructure is done on one specimen from each melt.

In case of presence of burns, repeated checking of microstructure is not allowed.

4.9. For checking the bars (to be hardened in saltpeter baths) for presence of saltpeter on the surface, 1% bars from a batch are taken, but not less than one bar from each batch offered for acceptance.

If saltpeter is detected, the batch of bars is subjected to repeated washing and rechecking for presence of saltpeter on the bar surface.

5. TEST METHODS.

5.1. Determination of chemical composition is done:

as per GOST 12697-67 - GOST 12706-67 - for aluminium;

as per GOST 11739-66 - GOST 11760-66 - for aluminium alloys.

5.2. Examination of bars should be done without using optical devices.

5.3. Measurement of bar diameter is done with measuring instruments, which ensure the required measuring accuracy.

5.4. One specimen from each test batch is taken from the outer end in longitudinal direction.

Specimens for checking the mechanical properties are taken as follows :

from the centre of section of the bar - if bar diameter is upto 130 mm; at a distance of 1/3 radius from the surface - if bar diameter is above 130 mm.

5.5. Tensile test of bars is done as per COST 1497-73.

Gauge length of specimen (l_0), in mm, is calculated as per formula : $l_0 = 5d_0$

where : d_0 - gauge diameter of specimen, mm.

Specimens for tensile test are cut from bars in supply condition in longitudinal direction.

5.6. If there are no instructions in the order regarding condition of test specimens, hot-rolled bars from alloys of grades AD31, AD33 and AV are tested by manufacturing plant on hardened and naturally aged or hardened and artificially aged specimens.

5.7. Presence of saltpeter on bar surface is checked by application of a drop of 0.5% solution of diphenylamine in

sulphuric acid (10 cm^3 distilled water and 25 cm^3 sulphuric acid of density 1.84 gm/cm^3 are added to 0.5 gm. diphenylamine) on the bar surface.

After dissolution of diphenylamine the volume of solution is brought upto 100 cm^3 by adding sulphuric acid (density 1.84 gm/cm^3). Intensive blue colour of the drop of solution in 10-15 secs. indicates the presence of saltpeter at that particular place. After testing, the drop is removed with filter paper and the test portion is thoroughly washed with water and rubbed dry.

5.8. Macrostructure of bars is checked on sectional macrotemplates, cut from the shrinkage cavity end of the bar.

5.9. Presence of large-crystalline border is checked on hardened specimens (templates) of thickness 30 mm. minimum, meant for determining the macrostructure.

While fabricating the macrotemplate, cut from hot extruded bar and subjected to hardening, a layer of metal upto depth 30 mm. minimum is removed.

While fabricating the macrotemplate from annealed or hardened bar, depth of layer to be removed is not restricted.

5.10. Microstructure of bars is checked on one specimen as per method adopted by the manufacturing plant, approved in the established order.

6. MARKING, PACKING, TRANSPORTATION AND STORAGE.

6.1. On bars of diameter 30 mm. and above the stamp of inspection department of manufacturing plant, and also a stamp indicating alloy grade, supply condition and batch number are stamped.

Bars of diameter less than 30 mm. are bound into packets, to which a tag, indicating the above listed data, is fastened.

6.2. Preservation, packing, transportation, marking should correspond to the requirements of GOST 9.011-73.

6.3. Each batch of bars should be furnished with a document which certifies their conformity to the requirements of this standard . The document should contain :

a) name of manufacturing plant;
b) name of customer;
c) alloy grade, metal condition and category of strength;
d) dimensions of bars and manufacturing accuracy;
e) batch number;
f) net weight of batch;
g) test results (only maximum and minimum values are indicated for mechanical properties);
h) date of despatch;
i) this standard number.

6.3.1. On customer's request, protocols (or their copies) of mechanical tests are sent.

APPENDIX (REFERENCE) 1.

CONVERSION COEFFICIENTS FOR CALCULATING THE APPROXIMATE LINEAR DENSITY OF 1 METRE BAR MADE FROM ALUMINIUM AND ALUMINIUM ALLOYS.

For aluminium of all grades	—	0.950
For aluminium alloy of grade АМцС	=	0.958
" " " " " АМгС	=	0.958
" " " " " АД31	=	0.950
" " " " " АД33	=	0.951
" " " " " АМг2	=	0.940
" " " " " АМг3	=	0.937
" " " " " АМг5	=	0.930
" " " " " АМг6	=	0.926
" " " " " АВ	=	0.947
" " " " " Д1	=	0.982
" " " " " Д16	=	0.976
" " " " " АК4	=	0.972
" " " " " АК4-1	=	0.982
" " " " " АК6	=	0.964
" " " " " АК8	=	0.982
" " " " " 1915	=	0.972
" " " " " 1925	=	0.972

APPENDIX - 2.

CODE DENOTATIONS OF NOMENCLATURE OF THE PRODUCT (SHAPE, GRADE OF ALUMINIUM OR ALUMINIUM ALLOY AND MATERIAL CONDITION).

Grade of aluminium or aluminium alloy.	Material condition.	Code denotations.
(1)	(2)	(3)
	ROUND BARS.	
АД0	Without heat treatment.	18 1161 1190 9
АД1	- " -	18 1161 1490 7
АМгS	- " -	18 1461 1190 8
АМгSS	- " -	18 1461 1590 9
АД31	- " -	18 1361 3190 9
	Hardened and naturally aged.	18 1361 3131 9
	Hardened and artificially aged.	18 1361 3132 1
АД33	Without heat treatment.	18 1361 3390 4
	Hardened and naturally aged.	18 1361 3331 4
	Hardened and artificially aged.	18 1361 3332 5
АМg2	Without heat treatment.	18 1561 2190 8
АМg3	- " -	18 1561-3190 1
	Annealed.	18 1661 3110 7
АМg5	Without heat treatment.	18 1561 6190 9
	Annealed.	18 1561 6110 4
АМg6	Without heat treatment.	18 1561 6390 8
	Annealed.	18 1561 6310 3
АВ	Without heat treatment.	18 1361 4190 2
	Hardened and naturally aged.	18 1361 4131 2
	Hardened and artificially aged.	18 1361 4132 3

Contd..../-

(1)	(2)	(3)
D1	Without heat treatment.	18 1261 1290 3
	Hardened and naturally aged.	18 1261 1231 3
D16	Without heat treatment.	18 1261 6190 3
	Hardened and naturally aged.	18 1261 6131 3
V95	Without heat treatment.	18 1961 6190 4
	Hardened and artificially aged.	18 1961 6132 3
AK4	Without heat treatment.	18 1261 4190 6
	Hardened and artificially aged.	18 1261 4132 7
AK4-1	Without heat treatment.	18 1261 4390 1
	Hardened and artificially aged.	18 1261 4332 2
AK6	Without heat treatment.	18 1361 6190 1
	Hardened and artificially aged.	18 1361 6132 0
AK8	Without heat treatment.	18 1361 8190 7
	Hardened and artificially aged.	18 1361 8132 8
1915	Without heat treatment.	18 1961 1590 0
	Hardened and naturally aged.	18 1961 1531 0
1925	Without heat treatment.	18 1961 2590 7
	Annealed.	18 1961 2510 1
	Hardened and naturally aged.	18 1961 2531 7

SQUARE BARS.

AD0	Without heat treatment.	18 1162 1190 3
AD1	- " -	18 1162 1490 1
AMts	- " -	18 1462 1190 3
AMtsB	- " -	18 1462 1590 3
AD31	- " -	18 1362 3190 3
	Hardened and naturally aged.	18 1362 3131 3

Contd..../-

(1)	(2)	(3)
	Hardened and artificially aged.	18 1362 3132 4
AD33	Without heat treatment.	18 1362 3390 9
	Hardened and naturally aged.	18 1362 3331 1
	Hardened and artificially aged.	18 1362 3332 1
AMg2	Without heat treatment.	18 1562 2190 2
AMg3	- " -	18 1562 3190 6
	Annealed.	18 1562 3110 1
AMg5	Without heat treatment.	18 1562 6190 3
	Annealed.	18 1562 6110 9
AMg6	Without heat treatment.	18 1562 6390 2
	Annealed.	18 1562 6310 8
AV	Without heat treatment.	18 1362 4190 7
	Hardened and naturally aged.	18 1362 4131 7
	Hardened and artificially aged.	18 1362 4132 3
D1	Without heat treatment.	18 1262 1190 2
	Hardened and naturally aged.	18 1262 1231 2
D16	Without heat treatment.	18 1262 6190 8
	Hardened and naturally aged.	18 1262 6131 8
V95	Without heat treatment.	18 1962 5190 9
	Hardened and artificially aged.	18 1962 5132 1
AK4	Without heat treatment.	18 1262 4190 0
	Hardened and artificially aged.	18 1262 4132 1
AK4-1	Without heat treatment.	18 1262 4390 6
	Hardened and artificially aged.	18 1262 4332 7
AK6	Without heat treatment.	18 1362 6190 3
	Hardened and artificially aged.	18 1362 6132 3
AK8	Without heat treatment.	18 1362 8190 1
	Hardened and artificially aged.	18 1362 8132 2

Contd.../-

(1)	(2)	(3)
1915	Without heat treatment.	18 1962 1590 0
	Hardened and naturally aged.	18 1962 1631 6
1925	Without heat treatment.	18 1962 2590 9
	Annealed.	18 1962 2510 4
	Hardened and naturally aged.	18 1962 2531 0

HEXAGONAL BARS.

AD0	Without heat treatment.	18 1163 1190 8
AD1	- " -	18 1163 1490 6
AMгв	- " -	18 1463 1690 6
AMгвS	- " -	18 1463 1590 8
AD31	- " -	18 1363 3190 8
	Hardened and naturally aged.	18 1363 3131 8
	Hardened and artificially aged.	18 1363 3132 8
AD33	Without heat treatment.	18 1363 3390 3
	Hardened and naturally aged.	18 1363 3331 8
	Hardened and artificially aged.	18 1363 3332 4
AMг2	Without heat treatment.	18 1563 2190 7
AMг3	- " -	18 1563 3190 0
	Annealed.	18 1563 3110 6
AMг5	Without heat treatment.	18 1563 5190 8
	Annealed.	18 1563 5110 3
AMг6	Without heat treatment.	18 1563 6390 7
	Annealed.	18 1563 6310 2
AV	Without heat treatment.	18 1363 4190 1
	Hardened and naturally aged.	18 1363 4131 1
	Hardened and artificially aged.	18 1363 4132 2

Contd.../-

(1)	(2)	(3)
D1	Without heat treatment.	18 1263 1290 7
	Hardened and naturally aged.	18 1263 1231 7
D16	Without heat treatment.	18 1263 6190 2
	Hardened and naturally aged.	18 1263 6131 2
V95	Without heat treatment.	18 1963 5190 3
	Hardened and artificially aged.	18 1963 5132 4
AK4	Without heat treatment.	18 1263 4190 5
	Hardened and artificially aged.	18 1263 4132 6
AK4-1	Without heat treatment.	18 1263-4390 0
	Hardened and artificially aged.	18 1263 4332 1
AK6	Without heat treatment.	18 1303 6190 9
	Hardened and artificially aged.	18 1363 6132 1
AK8	Without heat treatment.	18 1363 8190 6
	Hardened and artificially aged.	18 1363 8132 7
1915	Without heat treatment.	18 1963 1590 1
	Hardened and naturally aged.	18 1963 1531 1
1925	Without heat treatment.	18 1963 2590 4
	Annealed.	18 1963 2510 9
	Hardened and naturally aged.	18 1963 2531 4

Other standards referred to in this standard :

(1) GOST 11069-74.

(2) GOST 6009-75.

(3) GOST 12697-67 to GOST 12706-67.

(4) GOST 11739-66 to GOST 11760-66.

(5) GOST 1497-73.

(6) GOST 4784-74.

(7) GOST 6456-75.

(8) GOST 9.011-73.