

STANDARD / SPECIFICATION

NUMBER

EXTRUDED BARS FROM ALUMINIUM AND
ALUMINIUM ALLOYS.

GOST 21432-76

HINDUSTAN

PART 1 OF 22

GOST 4730-68 except
points 5.1-5.7, 5.9,
5.10, GOST 13890-68
and GOST 7857-73.

This standard pertains to extruded bars from aluminium of grades AD0, AD1 and from aluminium alloys of grades AM_{re}, AM_{re}S, AD31, AD33, AM_e2, AM_e3, AM_e5, AM_e6, AV, DL, D16, V35, AK4, AK4-1, AK6, AK8, 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 = *IV*, KA

square = *IV*, KB

hexagonal = *SH*, LIT

b) as per manufacturing accuracy:

of normal accuracy = *III* H

of high accuracy = *A1* H

U.T.S.

APPROVED	<i>Wadhwa</i>	16-75	MATL. SPECN.			
ENGINEER / OP. INCHARGE	<i>Malhotra</i>	17-75	HEAT TREAT			
CHECKED	<i>Malhotra</i>	17-7-81	FINISH			
DRAWN						
				ISS. NO.	ISSD BY	APPRD.

HINDUSTAN AERONAUTICS LIMITED-NASIK DIVIN. INDIA

11/11/75

a) as per material condition :

without heat treatment (hot extruded) - denoted by alloy grade without additional symbols (AD0, AD1, AM₂, AM₂S, AD31, AD33, AM₂2, AM₂3, AM₂5, AM₂6, AV, D1, D16, V95, AK4, AK4-1, AK6, AK8, 1915, 1925); annealed - H (AM₂3H, AM₂5H, AM₂6H, 1925H);

hardened and naturally aged - T (AD31T, AD33T, AVT, D1T, D16T, 1915T, 1925T),

hardened and artificially aged - T1 (AD31T1, AD33T1, AVT1, V95T1, AK4T1, AK4-1T1, AK6T1, AK8T1);

4) as per strength :

of normal strength - denoted by grade without any additional symbols (D1, D1T, D16, D16T, V95, V95T1, AV, AVT1, AK6, AK6T1, AK8, AK8T1),

of high strength - PP (AVPP, AKT1PP, D1PP, D1T1PP, D16PP, D16T1PP, V95PP, V95T1PP, AK6PP, AK6T1PP, AK8PP, AK8T1PP).

NOTES :

1. Bars without heat treatment (hot extruded) from aluminium of grades AD0, AD1 and aluminium alloys of grades AM₂, AM₂2, AM₂3 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 100 mm. maximum. Fabrication of bars of diameter above 100 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 3 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:		Cross-sectional area, cm ² .	Linear density of 1 m. bar, kg/m.
	Normal (H)	High (P)		
(1)	(2)	(3)	(4)	(5)
6			0.196	0.081
8	-0.04	-0.03	0.503	0.212
10			0.785	0.332
12			0.880	0.371
14			0.803	0.342
16	-0.53	-0.36	0.635	0.281
18			0.785	0.332
20			0.785	0.332
22			0.785	0.332
24			0.785	0.332
26	-0.70	-0.49	1.767	0.754
28			2.011	0.870
30			2.270	0.967
32			2.515	1.073
34			2.835	1.210
36			3.142	1.330
38			3.501	1.469
40			4.155	1.761
42	-0.84	-0.62	4.524	1.900
44			4.909	2.050
46			5.292	2.200
48			5.723	2.350
50			6.153	2.500
52			7.069	2.926

HAL (NK)

EXTENDED BARS FROM ALUMINUM AND
ALUMINUM ALLOYS

COST 21088-76

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Contd...../-

(1)	(2)	(3)	(4)	(5)
32			8.042	2.292
34			9.079	2.588
35			9.621	2.742
35			10.179	2.901
35			11.341	3.244
40	-1.00	-0.62	12.566	3.531
42			13.854	3.949
45			15.904	4.533
46			16.619	4.736
48			18.095	5.157
50			19.635	5.596
52			21.257	6.073
55			23.756	6.771
58			26.421	7.530
60			28.274	8.052
65	-1.20	-0.74	33.183	9.467
70			38.485	10.963
75			44.179	12.591
80			50.255	14.325
85			56.745	16.172
90			63.617	18.131
95			70.887	20.202
100			78.540	22.381
105	-1.40	-1.00	86.590	24.673
110			95.031	27.084
115			103.869	29.608
120			113.097	32.233

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(1)	(2)	(3)	(4)	(5)
125			122.719	34.975
130			132.732	37.829
135			143.139	40.795
140			153.938	43.872
145			165.130	47.062
150			176.715	50.554
155	-2.60	-	188.692	53.777
160			201.062	57.303
165			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			283.629	80.806
200			314.159	89.635
210			346.361	98.713
220	-2.00	-	380.133	108.333
230			415.476	118.411
240			425.339	122.831
250			490.874	133.899
260			530.929	151.315
270			572.557	163.173
280	-2.50	-	618.752	175.439
290			660.521	188.229
300			706.853	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	258.753
350			962.115	274.203
360			1017.878	290.095
370			1075.213	306.436
380	-6.00	-	1134.118	323.221
390			1194.593	340.459
400			1256.640	358.142

NOTE a 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. 2a

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
15	-0.70	-0.43	2.25	0.642
16			2.56	0.720
17			2.89	0.824
18			3.24	0.923
19			3.61	1.029
20			4.00	1.140
22			4.84	1.373
24			5.76	1.642
25	-0.84	-0.62	6.25	1.781
26			6.76	1.927
27			7.29	2.073
28			7.84	2.234
30			9.00	2.565
32			10.24	2.913
34			11.56	3.285
36			12.96	3.684
38			14.44	4.113
40			16.00	4.560
42	-1.00	-0.62	17.64	5.027
44			19.36	5.613
46			21.16	6.031
48			23.04	6.583
50			25.00	7.125

Contd. . . . /-

(1)	(2)	(3)	(4)	(5)
52			27.04	7.706
56			30.25	8.621
58			33.64	9.537
60		-0.74	36.00	10.260
65	-1.20		42.25	12.041
70			49.00	13.965
75			56.25	16.031
80			64.00	18.240
85		-1.00	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
150			225.00	64.125

Table No. 3a.

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 ln. bar, kg/m.
	Normal (N)	High (P)		
(1)	(2)	(3)	(4)	(5)
7			0.424	0.121
8			0.564	0.159
9	-0.53	-0.36	0.701	0.200
10			0.866	0.247
11			1.048	0.299
12			1.247	0.355
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	1.195
24	-0.84	-0.52	4.988	1.422
27			6.313	1.799
30			7.784	2.221
32			8.668	2.527
36			11.224	3.193
41	-1.00	-0.62	14.653	4.140
46			18.325	5.222
50			21.651	6.170
55			26.197	7.436
60	-1.20	-0.74	31.177	8.985
65			36.590	10.423
70			42.450	12.038

Contd...../-

(1)	(2)	(3)	(4)	(5)
75	-1.20		48.710	13.832
80			55.430	15.797
85		-1.00	62.570	17.832
90			70.148	20.000
95	-1.40		78.160	22.276
100			86.600	24.681

Table No. 4.

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 0.5 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 2.86 gm/cm^3 which corresponds to the density of aluminium alloy of grade V95.

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 alloy	Material condition	Condition of test specimens	Bar diameter, mm	Tensile strength, kg/mm ²	Yield point, kg/mm ²	Percentage elongation, %
(1)	(2)	(3)	(4)	(5)	(6)	(7)
AD0	Without heat treatment	Without heat treatment	From 5 upto 300	60.0	-	25.0
AD1	Without heat treatment	Without heat treatment	From 5 upto 350	10.0	-	20.0
AD2	Without heat treatment	Without heat treatment	From 5 upto 300	14.0	7.0	13.0
AD3	Without heat treatment	Without heat treatment	From 5 upto 300	20.0	15.0	8.0
AD31	Without heat treatment	Without heat treatment	From 5 upto 100	14.0	7.0	13.0
AD32	Without heat treatment	Without heat treatment	From 5 upto 100	20.0	15.0	8.0

Minimum

Contd.../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Harden and	From 5	10.0	22.0	25.0
		naturally aged	upto 300			
		Harden and	From 5	27.0	23.0	30.0
		artificially	upto 300			
		aged.				
AD33		Harden and	From 5	18.0	11.0	15.0
		naturally aged	upto 100			
		Harden and	From 5	27.0	23.0	19.0
		artificially aged	upto 100			
		aged.				
AD42		Without heat	From 5	18.0		23.0
		treatment.	upto 300			
AD43		Annealed.	From 5	18.0	8.0	13.0
			upto 300			
		Annealed.	From 5	18.0	8.0	12.0
			upto 300			
		Without heat	From 5	27.0	12.0	15.0
		treatment.	upto 300			
AD45			Above 300	25.0	11.0	19.0
			upto 400			
		Annealed.	From 5	27.0	12.0	15.0
			upto 300			

Contd...../-

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

Contd...../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Harden and naturally aged.	Harden and naturally aged.	From 5 upto 100	33.0	22.0	12.0
		Harden and naturally aged.	From 5 upto 22	40.0	23.0	10.0
	Without heat treatment		Above 22 upto 130	43.0	30.0	20.0
			Above 130 upto 300	42.0	23.0	8.0
			Above 300 upto 400	40.0	25.0	6.0
D16						
	Harden and naturally aged.	Harden and naturally aged.	From 5 upto 22	40.0	23.0	10.0
			Above 22 upto 100	43.0	30.0	10.0
	Harden and artificially aged.	Harden and artificially aged.	From 5 upto 22	50.0	40.0	6.0
	Without heat treatment		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
D35						

Contd. /-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
V96	Hardened and artificially aged.	Hardened and artificially aged.	From 5 upto 22 Above 22 upto 100	50.0 54.0	40.0 43.0	6.0 6.0
AK4	Without heat treatment. Hardened and artificially aged.	Hardened and artificially aged.	From 5 upto 300 From 5 upto 100	36.0 38.0	- -	8.0 8.0
AK4-1	Without heat treatment. Hardened and artificially aged.	Hardened and artificially aged.	From 5 upto 100 Above 100 upto 300 From 5 upto 100	40.0 37.0 40.0	32.0 28.0 32.0	6.0 6.0 6.0
AK6	Without heat treatment. Hardened and artificially aged.	Hardened and artificially aged.	From 5 upto 300 From 5 upto 100	36.0 36.0	- -	12.0 12.0

Contd...../-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
AL3	Without heat treatment	Hardenad and artificially aged.	From 5 upto 150	43.0	=	10.0
		aged.	Above 150 upto 200	44.0	=	8.0
	Hardenad and artificially aged.		From 5 upto 100	44.0	=	10.0
1015		Not extruded with natural aging for 30-35 days.	From 5 upto 15	35.0	20.0	20.0
		Hardenad and naturally aged for 30-35 days.	From 5 upto 200	38.0	22.0	10.0
		Hardenad and artificially aged.	From 5 upto 130 upto 200	38.0	25.0	8.0
			Above 130 upto 200	36.0	25.0	8.0
		Hardenad and naturally aged for 30-35 days.	From 5 upto 100	35.0	22.0	10.0
		Hardenad and naturally aged.	From 5 upto 100	39.0	25.0	8.0

Contd. / -

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

1925

Mechanical properties of bars of diameter above 300 mm. from aluminium of grades AD0, AD1 and from aluminium alloys of grades AD2, AD3, AM2, AM3, AV, DL, AK4, AK4-1, AK6, AK8, 1915 and 3025 are not tabulated.

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, worn-out 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, scraper or emery paper on fabric base having grain size not above no. 6 (COST 6009-75).

Final cleaning to smooth surface is done with emery paper on paper base having grain size not above no. 10 (COST 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.

Grade of aluminium alloy	Material condition	Condition of test specimens	Bar diameter, mm	Yield strength, $\sigma_{0.2}$, kg/cm ²	Tensile strength, σ_u , kg/cm ²	Elongation, %
1915	Without heat treatment	Without heat treatment but with natural aging	From 5 upto 15	23.0	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	23.0	17.0	10.0
	Hardened and naturally aged	Hardened and naturally aged	From 5 upto 100	29.0	18.0	10.0

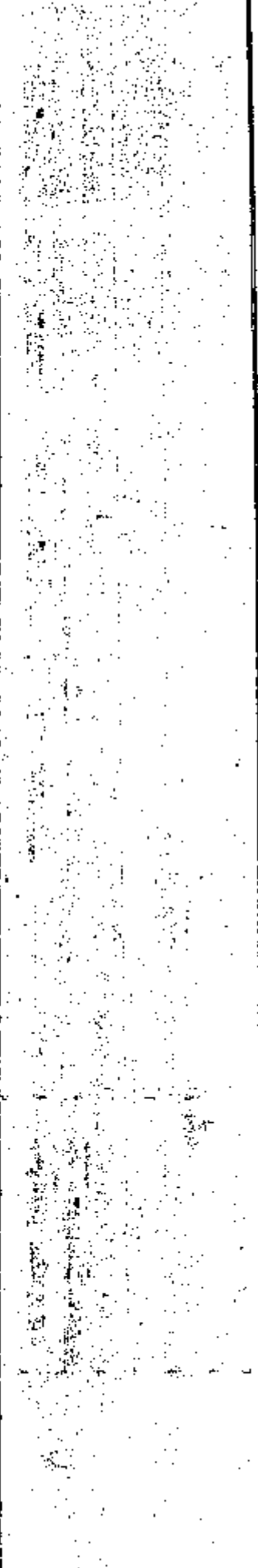


Table No. 7

Grade of aluminium alloy	Material condition	Condition of test specimens	Bar diameter, mm	Tensile strength, $\sigma_{0.2}$, kg/mm ²	Yield point, $\sigma_{0.2}$, kg/mm ²	Percentage elongation, $\delta_{5.0}$
(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
D18	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

Minimum

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
VDE	Without heat treatment.		From 6 upto 22	62.0	41.0	7.0
	Harden and artificially aged.		Above 22 upto 130	63.0	44.0	6.0
			Above 120 upto 300	64.0	44.0	6.0
			From 6 upto 22	62.0	41.0	7.0
			Above 22 upto 100	63.0	44.0	6.0
AIG	Without heat treatment.		From 5 upto 300	30.0	27.0	10.0
	Harden and artificially aged.		From 5 upto 100	30.0	27.0	10.0
AAS	Without heat treatment.		From 5 upto 300	47.0	31.0	8.0
	Harden and artificially aged.		From 5 upto 100	47.0	31.0	8.0

(1)

(2)

(3)

(4)

(5)

(6)

(7)

7.50

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 intermetallics, on bars made from alloy of grade A145, of size above 0.5 mm. in quantity of 5 nos., and on bars made from alloy of grade A146 - of size above 0.2 mm. in the form of solitary separated spots;

bright spots of crystalline grains of impoverished solution on bars from alloy V96 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 occurrence 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. Surface 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 150 mm;
- 12 mm. - for bars of diameter above 150 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. On 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 1

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 AD0, AD1 and from aluminium alloys of grades AM2, AD31, AD33, and also mechanical properties of bars, without heat treatment, from aluminium alloys of grades AV, D1, D16, V95, AK6, AK9 are not checked by the manufacturing plant.

On customer's request bars, without heat treatment, from alloys of grades AV, D1, D16, V95, AK6, AK9 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 AM2, AM3, AM5, AM6, AK4, AK4-1, 1916, 1925 in all material conditions, and also bars from alloy of grades AV, D1, D16, V95, AK6, AK9 in annealed and hardened conditions, 5% 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.

6. TEST METHODS

6.1. Determination of chemical composition is done as per GOST 12697-67 - GOST 12706-67 - for aluminium as per GOST 11739-66 - GOST 11760-65 - 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					AM18S	0.958
o	o	o	o	o	AM12	0.958
o	o	o	o	o	AD31	0.950
o	o	o	o	o	AD33	0.951
o	o	o	o	o	AM42	0.940
o	o	o	o	o	AM43	0.937
o	o	o	o	o	AM45	0.930
o	o	o	o	o	AM46	0.926
o	o	o	o	o	AV	0.947
o	o	o	o	o	D1	0.982
o	o	o	o	o	D16	0.976
o	o	o	o	o	AK4	0.972
o	o	o	o	o	AK4-1	0.982
o	o	o	o	o	AK6	0.964
o	o	o	o	o	AK8	0.982
o	o	o	o	o	1915	0.972
o	o	o	o	o	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.

AD0	Without heat treatment.	18 1161 1190 9
AD1	- " -	18 1161 1490 7
AM1S	- " -	18 1461 1190 8
AM1S	- " -	18 1461 1590 9
AD31	- " -	18 1361 3190 9
	Hardened and naturally aged.	18 1361 3131 9
	Hardened and artificially aged.	18 1361 3132 1
AD33	Without heat treatment.	18 1361 3390 4
	Hardened and naturally aged.	18 1361 3331 4
	Hardened and artificially aged.	18 1361 3332 5
AM2	Without heat treatment.	18 1561 2190 8
AM3	- " -	18 1561-3190 1
	Annealed.	18 1561 3110 7
AM5	Without heat treatment.	18 1561 5190 9
	Annealed.	18 1561 5110 4
AM6	Without heat treatment.	18 1561 6390 8
	Annealed.	18 1561 6310 3
AV	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 1230 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 5190 4
	Hardened and artificially aged.	18 1961 5132 5
AK4	Without heat treatment.	18 1261 4190 3
	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 6
1916	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 3
AM15	- " -	18 1462 1190 3
AM15B	- " -	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
AM42	Without heat treatment.	18 1562 2190 2
AM43	" " "	18 1562 3190 6
	Annealed.	18 1562 3110 1
AM45	Without heat treatment.	18 1562 6190 3
	Annealed.	18 1562 6110 9
AM46	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 1290 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
VS5	Without heat treatment.	18 1962 6190 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 5
AK8	Without heat treatment.	18 1362 6190 1
	Hardened and artificially aged.	18 1362 8132 2

Contd..../-

(1)	(2)	(3)
1915	Without heat treatment.	18 1962 1590 3
	Hardened and naturally aged.	18 1962 1531 3
1925	Without heat treatment.	18 1962 2590 3
	Annealed.	18 1962 2510 4
	Hardened and naturally aged.	18 1962 2531 3

HEXAGONAL BARS.

AD0	Without heat treatment.	18 1163 1190 3
AD1	- " -	18 1163 1490 6
AM15	- " -	18 1463 1690 3
AM15S	- " -	18 1463 1590 3
AD31	- " -	18 1363 3190 3
	Hardened and naturally aged.	18 1363 3131 3
	Hardened and artificially aged.	18 1363 3132 3
AD33	Without heat treatment.	18 1363 3390 3
	Hardened and naturally aged.	18 1363 3331 3
	Hardened and artificially aged.	18 1363 3332 4
AM2	Without heat treatment.	18 1563 2190 7
AM3	- " -	18 1663 3190 6
	Annealed.	18 1563 3110 6
AM5	Without heat treatment.	18 1563 5190 3
	Annealed.	18 1563 5110 3
AM6	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
T95	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
AK5	Without heat treatment.	18 1363 6190 9
	Hardened and artificially aged.	18 1363 6132 1
AK8	Without heat treatment.	18 1363 8190 6
	Hardened and artificially aged.	18 1263 8132 7
1915	Without heat treatment.	18 1963 1590 1
	Hardened and naturally aged.	18 1963 1531 2
1925	Without heat treatment.	18 1963 2390 4
	Annealed.	18 1963 2510 9
	Hardened and naturally aged.	18 1963 2531 4

Other standards referred to in this standard s

- (1) GOST 11069-74.
 - (2) GOST 8009-75.
 - (3) GOST 12097-67. to GOST 12706-67.
 - (4) GOST 11739-65 to GOST 11700-65.
 - (5) GOST 1497-73.
 - (6) GOST 4734-74.
 - (7) GOST 6456-75.
 - (8) GOST 9.011-73.
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