

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 lm. bar, kg/m.
	Normal (N)	High (P)		
(1)	(2)	(3)	(4)	(5)
7			0.434	0.121
8			0.554	0.153
9	-0.58	-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	-0.81	-0.52	4.988	1.422
27			6.313	1.799
30			7.794	2.221
32			8.868	2.527
36			11.224	3.199
41	-1.00	-0.62	14.558	4.149
46			18.325	5.222
50			21.651	6.170
55			26.197	7.466
60	-1.30	-0.74	31.177	8.885
65			36.300	10.423

Contd...../-

(1)	(2)	(3)	(4)	(5)
75	-1.20		48.710	13.882
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 15 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 V95.

201 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, σ_u , kg/mm^2 .	Yield point $\sigma_{0.2}$, kg/mm^2 .	Percentage elongation δ_5
AD0 AD1	Without heat treatment.	Without heat treatment.	From 5 upto 300	6.0	-	25.0
AD15, AD15S	- " -	- " -	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 naturally aged.	Hardened and artificially aged.	From 5 upto 300	20.0	15.0	8.0
AD31	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

HAL (NK)

EXCLUDED: PARTS FROM ALUM. AND ALUM. ALLOYS.

COST 21488-76

Page No. 16

No. of Pages 42.

Contd. /-

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Without heat treatment.	Hardened and naturally aged.	From 5 upto 300	18.0	11.0	15.0
		Hardened and artificially aged.	From 5 upto 300	27.0	23.0	10.0
AD33	Hardened and naturally aged.	Hardened and naturally aged.	From 5 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
AM 2	Without heat treatment.	Without heat treatment.	From 5 upto 300	18.0	-	13.0
			From 5 upto 300	18.0	8.0	13.0
AM 3	Annealed.	Annealed.	From 5 upto 300	16.0	8.0	13.0
	Without heat treatment.	Without heat treatment.	From 5 upto 300	27.0	12.0	15.0
AM 5	Annealed.	Annealed.	From 5 upto 300	25.0	11.0	10.0
			From 5 upto 300	27.0	12.0	15.0

Contd.

(1) (2) (3) (4) (5) (6) (7)

Without heat treatment. Without heat treatment. From 5 upto 300 Above 300 upto 400

15.0

16.0

32.0

From 5 upto 300

Without heat treatment.

Without heat treatment.

11.0

12.0

29.0

Above 300 upto 400

Without heat treatment.

Without heat treatment.

AMG 6

15.0

16.0

32.0

From 5 upto 300

Without heat treatment.

Without heat treatment.

14.0

-

18.0

From 5 upto 300

Without heat treatment.

Without heat treatment.

12.0

-

30.0

From 5 upto 300

Without heat treatment.

Without heat treatment.

14.0

-

18.0

From 5 upto 100

Without heat treatment.

Without heat treatment.

AV

12.0

-

30.0

From 5 upto 100

Without heat treatment.

Without heat treatment.

12.0

22.0

38.0

From 5 upto 130

Without heat treatment.

Without heat treatment.

DI

10.0

20.0

36.0

Above 130 upto 300

Without heat treatment.

Without heat treatment.

291

(1)	(2)	(3)	(4)	(5)	(6)	(7)
D1	Hardened and naturally aged.	Hardened and naturally aged.	From 5 upto 100	38.0	22.0	12.0
		Hardened and naturally aged.	From 5 upto 22	40.0	28.0	10.0
	Without heat treatment.		Above 22 upto 130	43.0	30.0	10.0
			Above 130 upto 300	42.0	28.0	8.0
B16			Above 300 upto 400	40.0	25.0	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
	Without heat treatment.	Hardened and artificially aged.	From 5 upto 22	50.0	40.0	6.0
B85			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

2991

(1)	(2)	(3)	(4)	(5)	(6)	(7)
V95	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 36.0	- -	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

(1)	(2)	(3)	(4)	(5)	(6)	(7)
AKB	Without heat treatment.	Hardened and artificially aged.	From 5 upto 150 Above 150 upto 300	46.0 44.0 -46.0	- - -	10.0 8.0 10.0
	Hardened and artificially aged.	" "	From 5 upto 100	-46.0	-	10.0
		Hot extruded with natural aging for 30-35 days.	From 5 upto 15	35.0	20.0	10.0
1915	Without heat treatment.	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 Above 130 upto 200	38.0 36.0	25.0 25.0	8.0 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	39.0	25.0	8.0

AL (NK)

EXTRUDED BARS FROM ALUMINIUM AND ALUMINIUM ALLOYS.

COST 21488-76
Page No. 21 No. of Pages 42

(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.	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 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
	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

1925

NOTE : Mechanical properties of bars of diameter above 300 mm. from aluminium of grades AD0, AD1 and from aluminium alloys of grades AD31, AD33, 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, scraper or emery paper on fabric base having grain size not above no. 6 (GOST 5009-75).

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.

AL (NK)

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 σ_s , kg/mm ² .	Percentage elongation δ_5 .
(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
	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

Minimum.

AL (NK)

EXCLUDED BARS FROM ALUMINIUM AND ALUMINIUM ALLOYS.

COST 21488-76

Page No. 25 No. of Pages 42

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 .	
							(1)	(2)	(3)	(4)	(5)	(6)	(7)
					Minimum.		
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 6 upto 100	46.0	33.0	8.0	

(1)	(2)	(3)	(4)	(5)	(6)	
V55	Without heat treatment.	Hardened and artificially aged.	From 5	52.0	41.0	7.0
			upto 22			
			Above 22	56.0	44.0	6.0
			upto 130			
V55	Hardened and artificially aged.	Hardened and artificially aged.	Above 130	54.0	44.0	5.0
			upto 300			
			From 5	52.0	41.0	7.0
			upto 22			
AK6	Without heat treatment.	Hardened and artificially aged.	Above 22	56.0	44.0	6.0
			upto 100			
			From 5	38.0	27.0	10.0
			upto 300			
AK8	Without heat treatment.	Hardened and artificially aged.	From 5	38.0	27.0	10.0
			upto 100			
			From 5	47.0	34.0	8.0
			upto 300			
AK8	Without heat treatment.	Hardened and artificially aged.	Above 100	47.0	34.0	8.0
			upto 100			
			From 5	47.0	34.0	8.0
			upto 100			

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 AlMg5, of size above 0.5 mm. in quantity of 5 nos., and on bars made from alloy of grade AlMg6 - 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 occurrence does not exceed :

- 3 mm. - for bars from alloys of grades V95, D1 and D1G;
- 5 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. Surficial 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.

1. 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 AD0, AD1 and from aluminium alloys of grades AM₁₅, AD31, AD33, and also mechanical properties of bars, without heat treatment, from aluminium alloys of grades AV, D1, D16, V95, AK6, AK8 are not checked by the manufacturing plant.

On customer's request bars, without heat treatment, from alloys of grades AV, D1, D16, V95, AK6, AK8 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 AM₁₅S, AM₂, AM₃, AM₅, AM₆, AK4, AK4-1, 1915, 1925 in all material conditions, and also bars from alloy of grades AV, D1, D16, V95, AK6, AK8 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.

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 GOST 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

10 cm³ distilled water and 25 cm³ sulphuric acid of density 1.84 gm/cm³ are added to 0.5 gm. diphenylamine on the bar surface.

After dissolution of diphenylamine the volume of solution is brought upto 100 cm³ by adding sulphuric acid (density 1.84 gm/cm³). 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 10 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;
- 1) 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	AM18	-	0.958
" " " " "	AM19	-	0.958
" " " " "	AD31	-	0.950
" " " " "	AD33	-	0.951
" " " " "	AM42	-	0.940
" " " " "	AM43	-	0.937
" " " " "	AM45	-	0.930
" " " " "	AM46	-	0.926
" " " " "	AV	-	0.947
" " " " "	D1	-	0.982
" " " " "	D16	-	0.976
" " " " "	AK4	-	0.972
" " " " "	AK4-1	-	0.982
" " " " "	AK6	-	0.961
" " " " "	AK8	-	0.982
" " " " "	1915	-	0.972
" " " " "	1925	-	0.972

APPENDIX - 2.

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

No. of minimum or maximum size.	Material condition.	Code denotations.
(1)	(2)	(3)

ROUND BARS.

180	Without heat treatment.	18 1161 1190 9
181	- " -	18 1161 1490 7
182	- " -	18 1461 1190 8
183	- " -	18 1461 1590 9
184	- " -	18 1361 3190 9
	Hardened and naturally aged.	18 1361 3131 9
	Hardened and artificially aged.	18 1361 3132 1
1833	Without heat treatment.	18 1361 3390 4
	Hardened and naturally aged.	18 1361 3331 4
	Hardened and artificially aged.	18 1361 3332 5
182	Without heat treatment.	18 1561 2190 8
183	- " -	18 1561-3190 1
	Annealed.	18 1561 3110 7
185	Without heat treatment.	18 1561 5190 9
	Annealed.	18 1561 5110 4
186	Without heat treatment.	18 1561 6390 8
	Annealed.	18 1561 6310 3
	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 8
	Hardened and naturally aged.	18 1261 1231 8
D16	Without heat treatment.	18 1261 6190 3
	Hardened and naturally aged.	18 1261 6131 3
W65	Without heat treatment.	18 1961 5190 4
	Hardened and artificially aged.	18 1961 5132 5
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
D15	Without heat treatment.	18 1961 1890 0
	Hardened and naturally aged.	18 1961 1531 0
D25	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 8
AD1	- " -	18 1162 1490 1
AD1S	- " -	18 1462 1190 2
AD1SC	- " -	18 1462 1590 3
AD11	- " -	18 1362 3190 3

Contd..../-

(1)	(2)	(3)
	Hardened and artificially aged.	18 1362 3132 4
AD33	Without heat treatment.	18 1362 3190 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 5190 3
	Annealed.	18 1562 5110 9
AM63	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 8
D1	Without heat treatment.	18 1262 1290 2
	Hardened and naturally aged.	18 1362 1231 2
D16	Without heat treatment.	18 1262 6190 8
	Hardened and naturally aged.	18 1262 6131 8
W95	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 5
	Hardened and artificially aged.	18 1362 6132 5
AK8	Without heat treatment.	18 1362 8190 1
	Hardened and artificially aged.	18 1362 8132 2

1622

Contd..../-

(1)	(2)	(3)
1915	Without heat treatment.	18 1962 1590 5
	Hardened and naturally aged.	18 1962 1531 5
1925	Without heat treatment.	18 1962 2590 9
	Annealed.	18 1962 2510 4
	Hardened and naturally aged.	18 1962 2531 9

HEXAGONAL BARS.

AD0	Without heat treatment.	18 1163 1190 8
AD1	- " -	18 1163 1490 6
AD12	- " -	18 1463 1590 8
AD12S	- " -	18 1463 1590 8
AD31	- " -	18 1363 3190 8
	Hardened and naturally aged.	18 1363 3131 8
	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
AD42	Without heat treatment.	18 1563 2190 7
AD43	- " -	18 1563 3190 0
	Annealed.	18 1563 3110 6
AD45	Without heat treatment.	18 1563 5190 8
	annealed.	18 1563 5110 3
AD46	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

G. 321

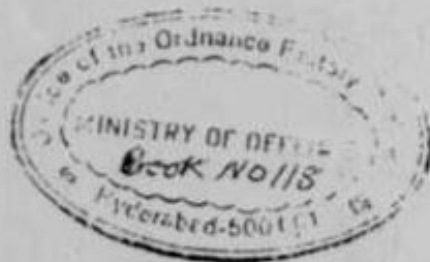
Contd..../-

(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
W95	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

R. 221

Other standards referred to in this standard :

- (1) GOST 11069-74.
- (2) GOST 5009-75.
- (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 9.011-72.



G.321

49.

DEF-151
March, 1965

14



MINISTRY OF DEFENCE

DEFENCE SPECIFICATION

DEF-151

**ANODIZING OF ALUMINIUM AND
ALUMINIUM ALLOYS**

LONDON: HER MAJESTY'S STATIONERY OFFICE

1965

PRICE 2s. 6d. NET

Received under contract 45/20 9/65

50

Page

Parts anodized by Type 1 process	9, 10
(a) Appearance	9
(b) Dyeing test	9
(c) Thickness of anodic coating	10
(d) Dyed parts	10
(e) Sealed parts	10
(f) Miscellaneous properties	10
(i) Abrasion resistance	10
(ii) Electrical resistance	10
(iii) Reflectivity	10
(iv) Infra-red reflectivity	10
Parts anodized by Type 2 process	10
(a) Appearance	10
(b) Dyeing test	10
(c) Dyed parts	10
(d) Surfaces to be in contact or near-contact with explosives	10
(e) Electrical resistance	10
Parts anodized by Type 3 process	10, 11
(a) Thickness of coating	10
(b) Abrasion resistance	11
(c) Electrical resistance	11
Appendix A. Analysis of sulphuric acid electrolyte	11
Appendix B. Analysis of chromic acid electrolyte	12, 13
Appendix C. Low voltage electrical test for continuity of anodic coating	13
Appendix D. Method of determining the average thickness of coating	14
Appendix E. Electrical breakdown test	14
Appendix F. Stripping solutions for the removal of anodic coatings	14
1. Maximum aluminium content of sulphuric acid electrolytes (at 15°C)	15
2. Maximum permissible temperature of operation of sulphuric acid electrolytes	15

in the test

SECTION 1 — GENERAL

1. SCOPE

This specification applies to standards to be met by anodic coatings on aluminium and aluminium alloys, and also covers details of processing so far as is necessary to ensure correct treatment.

It covers three types of coating which are designated according to the anodizing process used:

- Type 1: Sulphuric acid process
- Type 2: Chromic acid process
- Type 3: Hard anodizing process.

Choice of process will be made according to the Design Requirements for the part in question, or, in the absence of any definitive requirements, the appropriate type from those described in clause 2 shall be chosen.

2. APPLICATION

(a) Type 1: Sulphuric acid process

This process is normally suitable for general protective purposes but its use may be restricted by the considerations noted below and in clause 2(b).

The process is capable of yielding a range of coating thicknesses on most aluminium alloys. It is not suitable for use on parts containing riveted, lap or folded joints.

The process shall be stipulated where normal protection is required for aluminium parts used in contact with concentrated hydrogen peroxide (HTP).

Unless otherwise stated in the specification or contract governing the manufacture of the part, the coating shall be of sufficient thickness (viz. 0.0003 to 0.0005 inch) to provide protection against corrosion for normal purposes and shall be sealed in a chromate solution.

(b) Type 2: Chromic acid process

This process yields relatively thin coatings (of the order of 0.0001 inch). It is the preferred process for treatment of castings of suitable composition (see clause 11(f)) and for providing a bonding surface for plastics materials.

The process shall be stipulated where anodizing is required and one or more of the following considerations is paramount:

- (i) Minimizing loss of fatigue strength due to anodizing.
- (ii) Treatment of components containing crevices or small blind holes from which electrolyte may be difficult to remove.
- (iii) Detection of flaws by subsequent seepage of the yellow electrolyte.
- (iv) Treatment of parts which are to be in contact or near contact with explosives.
- (v) Treatment of material less than 0.01 inch thick.

(c) Type 3: Hard anodizing process

This process may be used to produce harder and thicker coatings than are obtained by Type 1 or Type 2 process and to provide greater resistance to abrasion, corrosion and electrical breakdown. If used on parts liable to contact with concentrated hydrogen peroxide (HTP), the electrolyte shall consist of a simple sulphuric acid solution.

The coatings are generally 0.001 to 0.003 inch in thickness. The treatment may reduce the fatigue strength, as observed in rotating beam type tests, by about one half. The fatigue strength may largely be restored by sealing the coating in an aqueous dichromate solution, at the cost of some loss of abrasion resistance.

3. RELATED SPECIFICATIONS

Reference is made in this specification to the following:

- | | |
|-------------------|---------------------------------------------------------------------------------------------------------|
| B.S. 308, | 'Engineering drawing practice' |
| B.S. 871, | 'Abrasive papers and cloths for general purposes' |
| B.S. 1615 : 1961, | 'Anodic oxidation coatings on aluminium' |
| DEF-60, | 'Selection and treatment of aluminium base materials for use with concentrated hydrogen peroxide (HTP)' |
| D.T.D. 901, | 'Cleaning and preparation of metal surfaces' |
| D.T.D. 915, | 'Process for cleaning aluminium and aluminium alloy plating' |

Reference in this specification to a British Standard (undated), Defence Specification (without suffix letter) or other specification or document, means, in any tender or contract, the edition current at the date of such tender or contract.

B.S. Specifications may be obtained from British Standards Institution, 2 Park Street, London, W.1.

Defence Specifications and D.T.D. Specifications may be obtained from Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2.

MINISTRY OF DEFENCE

Defence Specification

DEF-151

(March 1965)

**ANODIZING OF ALUMINIUM AND
ALUMINIUM ALLOYS**

Amendment No. 1 (October, 1966)

Clause 6

Delete sub-clause (a)

Substitute new sub-clause (a) as follows:

- (a) Treatments other than those described in this specification may be used provided that the prior acceptance of the Design Authority or the Inspection Authority, as appropriate, has been received.

Printed in England for Her Majesty's Stationery Office
by Willsons (Printers) Ltd., Leicester

THREEPENCE NET

Dd. 127841 K20 10/66 WPL 455

77-9999

DEFINITIONS

- (a) *Aluminium*. Aluminium and aluminium-based alloys.
- (b) *Anodic coating*. A coating consisting largely of aluminium oxide formed on aluminium by electrochemical means.
- (c) *Sealing of anodic coatings*. An aqueous treatment applied after anodizing to reduce porosity and absorptivity of the coating, thus enhancing the protection against corrosion.
- (d) *Hard anodic coating*. A coating having abrasion and wear resistance as a primary characteristic.

INFORMATION TO BE SUPPLIED BY THE PURCHASER

The following information shall be given on the drawing and/or order:

- (a) Composition and form (e.g. cast or wrought) of material of the part
- (b) Type number of anodizing process to be used
- (c) Untreated areas (if required)*
- (d) Significant areas for hard anodizing (see clause 11 (d))
- (e) Thickness of coating (where appropriate)
- (f) Type of sealing (if required)
- (g) Special conditions of service of the part which may affect the processing, e.g. contact with explosives or concentrated hydrogen peroxide (HTP) (see clause 6(c))
- (h) Special properties† (if required), e.g. dyeing, reflectivity, electrical resistance.

GENERAL CONDITIONS

- (a) Processes other than those described in this specification may be used provided that the process selected is acceptable to the Design Authority or to the Inspection Authority, as appropriate.
- (b) In accordance with B.S. 308, the dimensions stated on the drawing shall be those of the part after anodizing and any honing or other finishing operation. Anodizing normally produces a growth amounting to approximately half the thickness of the coating and due allowance, determined by test if necessary, shall be made when anodizing is specified for close tolerance parts or thin sections.
- (c) Where parts are to be used in contact with concentrated hydrogen peroxide (HTP), simple sulphuric acid electrolytes only shall be used, Type 1 or Type 3 as required, and the special conditions of specification DEF-60 shall be observed.
- (d) The surface finish on parts to be anodized for electrical insulation purposes will affect the electrical resistance of the coating required. Where this is important it may be necessary to specify a good initial surface finish, e.g. better than 16 microinches.
- (e) Nothing in this specification shall relieve the contractor of his responsibility for the safety of his operations.
- (f) Attention is called to the fact that anodizing processes may be the subject of claims in patent specifications.

SECTION 2 — PROCESSING REQUIREMENTS**GENERAL**

The process to be used shall be one described in this specification or accepted under clause 6(a), and the complete treatment scheme shall be subject to the agreement of the Inspection Authority.

CONTROL

The process, including all preparatory and after-treatments, shall be operated in conjunction with a schedule of process control which has been agreed with the Inspection Authority. The complete treatment scheme consists of several stages which shall follow each other without delay.

SURFACE PREPARATION

All parts shall be cleaned before anodizing in accordance with the requirements of D.T.D. 901. All residues of cleaning materials shall be removed before anodizing.

SUSPENSION AND JIGGING

Parts shall be suspended by such means that good electrical contact is maintained throughout the treatment. Any metallic parts of a suspension device which makes contact with the electrolyte shall be of aluminium or

* A requirement for untreated areas involves additional processing and frequently a considerable increase in cost.
 † B.S. 1615 gives some information on special properties.

titanium. Suspension devices with spring or screw contacts are recommended. Loosely wired suspension as used in electroplating shall not normally be used. Rigid parts which are too small to be held in jigs may be packed in perforated canisters of aluminium or titanium for anodizing; such canisters shall incorporate means for maintaining electrical contact between the parts and shall permit adequate circulation of the electrolyte through their interiors. Parts with flat faces, such as washers, tend to nest together and cannot normally be effectively treated by this method unless adequately dispersed by treating them with other parts. Care shall be taken that parts undergoing treatment do not come into contact with the tank, stirrer, heating or cooling pipes, cathode plates, as this may cause breakdown of the film and damage to the parts.

11. ANODIZING

(a) General

The parts to be treated shall be immersed in the processing solution and connected as the anode to a suitable source of electricity which, for Type 3 processes, may have an a.c. component. The cathode material, solution composition, solution temperature and current density or applied voltage are specific to the process used and are detailed below. Oxygen is evolved at the surface of the work during the treatment. Where trapping of air or oxygen cannot be avoided multiple treatment shall be employed in order to ensure complete coating of the part.

(b) Type 1: Sulphuric acid process

The electrolyte shall consist of a solution of sulphuric acid within the range of 90 to 400 g/l. The concentration of free sulphuric acid in the electrolyte shall be maintained within 10 per cent of the nominal additions of sulphuric acid being made as necessary. Chloride in the electrolyte shall not exceed the equivalent of 0.20g NaCl per litre and the dissolved aluminium shall not exceed the amount corresponding with the sulphuric acid concentration as shown in Fig. 1. Methods for determining free sulphuric acid, chloride and dissolved aluminium are given in Appendix A.

The operational temperature of the electrolyte shall not exceed that indicated in Fig. 2.

The electrolyte shall be agitated by air or mechanical means sufficient to maintain a uniform temperature throughout the vat. The electrolyte should be kept clean and free from suspended matter by filtration or other means.

The treatment is preferably controlled by current density (normally 10 to 15 amp/ft² of anode surface) but may be controlled by voltage.

Treatment shall be continued for sufficient time to produce the required thickness of coating.

The cathode material should normally consist of lead or aluminium.

(c) Type 2: Chromic acid process

(i) *Standard process.* The electrolyte shall consist of a solution containing from 30 to 100g of chromic acid per litre. The purity of the chromic acid shall be not less than 99.5 per cent CrO₃. Chloride in the electrolyte shall not exceed the equivalent of 0.20g NaCl per litre as determined by the method given in Appendix A. Sulphate in the electrolyte shall not exceed the equivalent of 0.50g Na₂SO₄ per litre as determined by the method given in Appendix B. The free chromic acid content determined as in Appendix B shall not be allowed to fall below 30g/l. The electrolyte may be regenerated by the addition of chromic acid provided that the total chromium in solution does not exceed 100g/l calculated as CrO₃. The operational temperature of the electrolyte shall be within the range 38 to 42°C.

Current shall be applied so that the voltage across the bath is increased in steps of not more than 5 volts from 0 to 40 volts in the first 10 minutes, maintained at 40 volts for 20 minutes, gradually raised to 50 volts in the next 5 minutes and maintained at 50 volts for 5 minutes. These times shall be regarded as minima.

The cathode shall be mild steel or stainless steel in the form of plates, or the tank itself. The anode to cathode area ratio is not critical, but less chromic acid is consumed at the higher ratios. Values varying from 5 : 1 to 10 : 1 are generally suitable. Where the tank acts as the cathode, the sides and bottom may, if desired, be partially covered by glass or other chemically inert insulating materials.

(ii) *Alternative process for castings.* The temperature and voltage conditions given in sub-clause (i) may be unsuitable for the anodizing of castings of certain aluminium alloys (see clause 11(f)) and where necessary the following alternative conditions may be used:—

The temperature of the electrolyte shall be in the range 25 to 30°C. Bath voltage shall be increased in steps of not more than 5 volts from 0 to 40 volts in 10 minutes and the voltage maintained at 40 volts for 30 minutes.

(d) Type 3: Hard anodizing

(i) Any suitable electrolyte may be used, e.g. a 10 per cent solution by volume of sulphuric acid in water. The chloride content of the electrolyte shall not exceed the equivalent of 0.20g NaCl per litre. It is necessary to maintain a low temperature at the surface of the work and this is normally achieved by providing a rapid flow of the cooled electrolyte over all surfaces undergoing treatment. The electrolyte is usually maintained at a temperature between -5 and +5°C.

(e) Anodizing of Aluminium Sinter

Methods of chemical analysis of a sulphuric acid electrolyte are detailed in Appendix A. The cathodes shall consist of lead, carbon or other suitable conducting material which is substantially insoluble in the electrolyte. Good electrical contact to the cathode must be ensured. Auxiliary cathodes may be necessary for parts having deep recesses. The process may be operated with direct current or with a combination of direct and alternating currents. The current density in a typical sulphuric acid electrolyte may vary from about 25 to 400 amp/ft² depending on the process employed and the alloy being treated; likewise the final voltage may vary from about 40 to 120 volts, depending largely on the thickness of coating required and the alloy.

(ii) *Conditions of anodizing.* The conditions of anodizing shall be chosen by the anodizer to suit the material being treated and the thickness of coating required. Sample parts of the material shall be supplied to the anodizer for trials. When a sample has been hard anodized to the satisfaction of the Inspection Authority, the method of the treatment, i.e. electrolyte, temperature, agitation, current, voltage, time, suspension and sealing treatment, shall be recorded in detail and the batch then hard anodized under the same conditions as the sample. Particular attention shall be given to maintaining the required degree of agitation. The temperature of the electrolyte, measured under similar conditions to those employed in the approved anodizing procedure, shall be within 2 deg C, i.e. $\pm 2^{\circ}\text{C}$, of the nominal value.

(iii) Hard anodizing may impair the surface finish; surfaces to be treated should have a finish superior to that required on the finished part, unless a final smoothing operation is to be employed. In order to obtain sound coatings and to reduce possible damage to the coating, edges of parts should be radiused; a minimum of 0.03 inch is recommended.

(iv) Where design considerations permit, parts may be hard anodized all over. In other circumstances non-significant areas may be anodized by Type 1 or Type 2 process (unless required to be left untreated). This shall be done by one of the following methods:—

Mask with suitable lacquer or wax the surfaces to be hard anodized.

Anodize by Type 1 or Type 2 process.

Remove the masking from the untreated surfaces.

Apply masking to the treated surfaces.

Finally anodize by Type 3 process.

Remove masking.

Anodize whole part by Type 1 or Type 2 process.

Mask the areas not to be hard anodized.

Strip anodic coating from the unmasked area.

Finally anodize by Type 3 process.

Remove the masking.

Mask all except significant areas.

Anodize by Type 3 process.

Remove masking.

Mask hard anodized areas.

Anodize by Type 1 or Type 2 process.

Remove the masking.

The following method, which is particularly useful when the hard anodizing produces a coating about 0.001 inch thick and causes no significant deterioration of the initial Type 1 coating, may be used where suitable. The Type 1 coating should not be less than 0.0005 inch thick and should be thoroughly sealed.

Mask the surfaces to be hard anodized.

Anodize by Type 1 process.

Seal in accordance with clause 14(c).

Remove masking.

Anodize by Type 3 process.

(e) *Anodizing of assemblies containing metals other than aluminium*

Aluminium parts of composite articles containing other metals should preferably be anodized before assembly. Where this is not possible the non-aluminium parts shall be masked.

(f) *Anodizing of castings*

The suitability of a casting for anodizing, and to some extent the type of process used, will depend on the alloy.

Note: Type 2 process is preferred because of the innocuous nature of any electrolyte which may be retained in the pores of the casting. Type 1 process will, however, treat a somewhat wider range of alloys. Since zinc and magnesium contents have no marked effect on the suitability for anodizing but certain other alloying elements, notably copper, nickel and iron, may cause difficulty. In general, castings containing more than a total of 7 per cent of the latter elements or more than 5 per cent copper are unsuitable for treatment by Type 2 process and castings containing more than 7 per cent copper are unsuitable for treatment by Type 1 process. Although the nominal composition of a casting may make it appear to be suitable for anodizing, segregation of the constituents may render it unsuitable. In borderline cases, operation of the process at the lowest permissible temperature and voltage, and the use of adequate agitation will be important.

Normally Type 2 process shall be used but in some cases Type 1 process may be used subject to the requirements of clauses 2(a) and 2(b). Where castings are to be impregnated to seal pores this should be done after the anodizing process has been completed. Surfaces machined after anodizing and impregnation shall not be re-anodized.

(g) *Re-anodizing*

Parts which are to be re-anodized shall have the anodic coating removed before re-treatment. The method of removal shall be agreed with the Inspection Authority. Mechanical methods shall not involve the use of metallic grit. Chemical methods suitable for most purposes are given in Appendix F. Where the dimensions of parts have to be kept within close limits or where parts of thin section, e.g. less than 0.01 inch, are involved, re-anodizing shall only be done with the approval of the Inspection Authority and the stripping solution given in Appendix F, clause 1 shall be used. Where only a portion of the part is to be re-anodized, the original coating on the remaining surface may be retained by masking the area.

12. WASHING

- (a) Immediately after removal from the anodizing vat all parts shall be washed to remove electrolyte.
- (b) Parts which have been anodized by Type 1 process shall be washed thoroughly in clean cold running water.
- (c) Parts which have been anodized by Type 2 process other than for flaw detection, dyeing, painting or bonding shall be washed in clean cold running water. Unless otherwise agreed by the Inspection Authority they shall then be immersed for 10 minutes in distilled or demineralized water adjusted to pH 5.5 to 6.5 by the addition of H₂SO₄ or NaOH as necessary and maintained at not less than 96°C. The use of this bath shall be restricted to parts anodized by the Type 2 process. Similar treatment of parts anodized by other processes requires the use of a separate bath. Parts anodized for flaw detection purposes or parts which are to be dyed shall be washed in cold water only. For parts anodized for flaw detection purposes the wash shall be brief in order to avoid removal of the chromic acid from defects. Parts anodized as a preparation for bonding or for painting shall be washed in cold water and then in clean hot water at a temperature not exceeding 60°C.
- (d) Particular attention shall be given to the thorough washing of castings and of parts to be used in contact or near contact with explosives.
- (e) Where maximum abrasion resistance is required hard anodized parts shall be washed in clean cold running water only.

13. DYEING

Dyeing should normally be done immediately after washing and without allowing the parts to dry. After dyeing the parts shall be washed in clean cold running water.

14. SEALING

- (a) Parts anodized by Type 1 process, other than those dyed or liable to be used in contact with concentrated hydrogen peroxide (HTP) (see clause 6(c)), shall be sealed by immersion in one of the following solutions:—

Solution A.	Potassium dichromate (K ₂ Cr ₂ O ₇)	...	...	...	...	70-100g
or	Sodium dichromate (Na ₂ Cr ₂ O ₇ ·2H ₂ O)	...	...	...	...	70-100g
	Sodium carbonate (Na ₂ CO ₃)	...	...	...	...	18g
or	Caustic soda (NaOH)	...	...	...	...	13g
	Water	...	...	...	...	1 litre
	pH (glass electrode)	...	...	...	...	6.3-7.4
or	pH (bromo thymol blue)	...	...	...	...	6.3-7.4

Solution B.	Potassium dichromate ($K_2Cr_2O_7$)	...	...	...	...	40-60g
or	Sodium dichromate ($Na_2Cr_2O_7 \cdot 2H_2O$)	...	...	...	...	40-60g
	Water	...	...	...	...	1 litre
	pH (glass electrode)	...	...	...	...	5-6-6-0
or	pH (bromo cresol purple)	...	...	...	...	5-9-6-4

The solutions shall be maintained at not less than 96°C. Parts shall be immersed for 5-10 minutes in solution A or, alternatively, for the same time as the anodic treatment in Solution B. The pH value of the solution shall be maintained by the addition of chromic acid or caustic soda as necessary. After sealing, the parts shall be washed in clean cold running water.

- (b) Parts anodized by Type 2 process and washed in cold water and immersed in hot water as in clause 12(c) do not require further sealing.
- (c) Parts anodized for flaw detection, dyeing, painting or bonding purposes shall not be sealed.
- (d) Dyed anodized parts and parts anodized by Type 1 process and required, exceptionally, to retain the natural anodized colour or to avoid contact with chromate solution shall be sealed by immersion in distilled or demineralized water at not less than 96°C and at pH of 5-5-6-0 for not less than 10 minutes.
- (e) Sealing of parts anodized by Type 3 process may be carried out by the methods in clause 14(a) or 14(c) if required. Some softening of the coating is produced but sealing may largely restore the loss of fatigue strength resulting from hard anodizing.

15. DRYING

After washing, parts anodized for flaw detection shall be allowed to dry naturally. Parts anodized for bonding or painting shall be dried at a temperature not exceeding 60°C. Other parts may be dried at a temperature not exceeding 110°C. Drying by means of chlorinated solvents containing surface active agents shall not be used.

SECTION 3 — INSPECTION AND TESTING

6. GENERAL

(a) Processing

The processing methods employed, the process control and the results obtained shall be to the satisfaction of the Inspection Authority.

(b) Frequency of Testing

Visual examination shall be applied to all parts. All other tests shall be carried out on not less than 2 per cent of the parts represented with a minimum of one part per anodizing batch. In exceptional circumstances, e.g. the treatment of single large parts or large numbers of small parts, the frequency of such tests may be modified at the discretion of the Inspection Authority. In suitable instances coupon samples of the same material, form (i.e. cast or wrought) and surface finish as the parts concerned may be used.

(c) Appearance

- (i) All similar parts in a batch shall be uniform in appearance but variations in appearance that do not arise from unsatisfactory processing may be acceptable. Iridescent coatings are unacceptable except on certain cast alloys anodized by the Type 2 process.
- (ii) The anodic coating shall appear to be dense and continuous. A powdery outer layer will not be acceptable but slight surface bloom which can be readily removed by a wipe with a dry cloth shall not be cause for rejection.

(d) Continuity of coating

Sealed anodic coatings, other than Type 2 coatings on aluminium-copper alloys, shall, if required by the Inspection Authority, be subjected to the test described in Appendix C. No current indications of discontinuities shall be obtained.

7. PARTS ANODIZED BY TYPE 1 PROCESS

(a) Appearance

All parts, except those which have been dyed and those which are required to retain the natural anodized colour or to be used in contact with concentrated hydrogen peroxide (HTP), shall have a yellow colour indicating that chromate sealing has been carried out. The colour may be affected by alloying constituents.

(b) Dyeing test

Immediately after washing and drying but before any sealing process, the anodic film shall be such that, when dyed with methyl violet dye, vigorous rubbing with a damp cloth shall not produce any appreciable loss of colour. The dye shall be applied either by using violet endorsing ink on a rubber pad or by

a copying pencil rubbed over the moistened anodized surface. This test shall not be applied to parts to be used in contact with concentrated hydrogen peroxide (HTP).

(c) *Thickness of anodic coating*

The average thickness of anodic coating in the sealed, or dyed and sealed, condition shall be between 0.0003 and 0.0005 inch or such other thickness as is stipulated on the drawing or order. The thickness of coatings to be dyed may be increased to 0.0007 inch. The thickness shall be determined by the method given in Appendix D unless specific approval for the use of an alternative method has been given by the Inspection Authority.

(d) *Dyed parts*

(i) *The colour* shall match that of an agreed standard or sample. Minor variations in colour shall not normally be cause for rejection.

(ii) *Resistance to leaching*.—The samples of dyed and sealed anodized parts shall be immersed for 24 hours in a gently boiling solution of 0.1 per cent borax. They shall then show no perceptible loss of colour when compared with an untested sample from the same batch of anodized parts.

(iii) *The fastness to light*, when required, shall conform to the requirements of clause 8 of B.S. 1615 : 1961.

(e) *Sealed parts*

Undyed coatings sealed by the method given in clause 14(c) shall be tested by Method D of B.S. 1615 : 1961 and shall remain unmarked. The test is not required for other sealed coatings.

(f) *Miscellaneous properties*

The following methods of test for special properties shall be used:

(i) *Abrasion resistance*—Method 0 of B.S. 1615 : 1961 or as agreed with the Inspection Authority. The standard of acceptance shall be stated on the drawing or order.

(ii) *Electrical resistance*—when tested by the method given in Appendix E the breakdown voltage shall not be less than 200 volts or such higher value as is stipulated on the drawing or order.

(iii) *Reflectivity*—Clause 9 of B.S. 1615 : 1961.

(iv) *Infra-red reflectivity*—Clause 11 of B.S. 1615 : 1961.

18. PARTS ANODIZED BY TYPE 2 PROCESS

(a) *Appearance*

The undyed coating is usually light grey but may be dark grey or black on some alloys and is opaque white on some aluminium-magnesium alloys. With the exception given in clause 18(d), yellow staining which may occur at crevices, blind holes, or at surface porosity in castings, is normally acceptable provided that the stain is not due to soluble chromic acid.

(b) *Dyeing test*

Immediately after washing and drying, but before any sealing process, the anodic film shall be such that when dyed with methyl violet dye, vigorous rubbing with a damp cloth shall not produce any appreciable loss of colour. The dye shall be applied either by using violet endorsing ink on a rubber pad or by a copying pencil rubbed over the moistened anodized surface.

(c) *Dyed parts* shall conform to the requirements of clause 17(d).

(d) *Surfaces to be in contact or near contact with explosives*

These shall be free from yellow stain. Examination for staining shall take place not less than 72 hours after anodizing.

(e) *Electrical resistance*

Where specially required, parts may be subjected to the test method given in Appendix E, when the breakdown voltage shall be not less than 50 volts or such other value as may be stipulated on the drawing or order.

19. PARTS ANODIZED BY TYPE 3 PROCESS

(a) *Thickness of coating*

The thickness shall be not less than that stipulated on the drawing or order and shall be tested by the method given in Appendix D or by any other method acceptable to the Inspection Authority.

* It should be noted that yellow stains of this type may indicate the presence of material defects.

54.

shall not be applic
d sealed, condition sh
on the drawing or order
ness shall be determined
alternative method has be

ion resistance
shall be carried out by one of the methods given below or by a method agreed with the Inspection
city. Tests shall be made at one or more positions as specified on the drawing or order.
1: The surface shall be rubbed two or three times with emery paper or cloth to B.S. 871, Grade
00, using medium finger pressure. The paper or cloth shall not abrade the surface but shall
skid over the surface and shall not show more than a trace of whitening on the surface.
2: Method 0 of B.S. 1615 : 1961. The standard of acceptance shall be that stated on the draw-
ing or order.

Minor variations in colour
anodized parts shall be in
They shall then show no
same batch of anodized par
quirements of clause 8 of B

cal resistance
ating shall be tested by the method given in Appendix E. The breakdown voltage shall be not less
00 volts or such higher figure as may be stipulated on the drawing or order.

APPENDIX A

Analysis of sulphuric acid electrolyte

pure reagents and distilled or deionized water shall be used throughout.

Sulphuric acid

all be tested by Method D
ther sealed coatings.

Sodium hydroxide	...	...	...	1 N solution
Thymol blue indicator	...	...	...	0.1 per cent w/v in ethanol
Potassium fluoride	...	...	...	solid reagent

ed:
agreed with the Inspection
er.
ppendix E the breakdown
the drawing or order.

ure
a 50 ml sample of the electrolyte to 250 ml in a calibrated flask. To 10 ml of the diluted sample
50 ml conical flask, add 90 ml of water, 1 g of potassium fluoride and 1 ml of thymol blue indicator.
the solution with sodium hydroxide (1 N) to a permanent blue end-point.
ml be the amount of sodium hydroxide solution required.

ation of results
uric acid (w/v) g/l = 24.5 A

or black on some alloys
given in clause 18(d), y
in castings, is normally

m

Nitric acid	...	...	...	1 N solution
Sodium hydroxide	...	...	...	1 N solution
Thymol blue indicator	...	...	...	0.1 per cent w/v in ethanol

rocess, the anodic film sha
mp cloth shall not produc
et endorsing ink on a rubb

ure
a 50 ml sample of the electrolyte to 250 ml in a calibrated flask. Add 25 ml of the diluted solu-
an excess (B ml) of sodium hydroxide (1 N) contained in a 250 ml conical flask. Add 1 ml of
blue indicator and titrate the solution with nitric acid (1 N) to a yellow end-point.
ml be the amount of nitric acid solution required and let A ml be the free acid titre from 1

ation of results
nium (g/l) = 1.8 (B - C) - 4.5 A

shall take place not less

Nitric acid	...	...	...	d* 1.42
Nitric acid wash water	...	...	...	diluted nitric acid (1 + 50)
Silver nitrate	...	...	...	1.0 per cent w/v solution

od given in Appendix E, v
as may be stipulated on

ure
0 ml of the electrolyte contained in a 300 ml flask add 10 ml nitric acid. Heat the solution to boil-
int, add 50 ml of the silver nitrate and agitate the solution vigorously to coagulate the precipitate.
the silver chloride to settle, filter on a weighed Gooch crucible, transferring the precipitate com-
l. Wash with hot dilute nitric acid 1 + 50 v/v, dry and weigh.
g be the weight of the silver chloride.

ing or order and shall be
to the Inspection Author

ation of results
de (as NaCl) g/l = 4.1 D.

material defects.

d is used here, and subsequently in these appendices for specific gravity.

APPENDIX B
Analysis of chromic acid electrolyte

Chemically pure reagents and distilled or deionized water shall be used throughout.

1. Total chromium

(a) Reagents

Diluted sulphuric acid	(1 + 3)
Ferrous ammonium sulphate	0.1 N solution Dissolve 80 g ferrous ammonium sulphate in 600 ml diluted sulphuric acid (1 + 3) and dilute to 2 litres.
Potassium dichromate	0.1 N solution Dissolve 9.807 g potassium dichromate in 500 ml water and dilute to 2 litres.
Silver nitrate	3 per cent w/v solution
N-phenylanthranilic acid indicator	0.1 per cent w/v in 0.1 per cent w/v solution of sodium carbonate.
Ammonium persulphate	solid reagent

(b) Procedure

(i) Standardization of ferrous ammonium sulphate

Measure exactly 25 ml of potassium dichromate (0.1 N) into a 500 ml conical flask containing 200 ml water and 45 ml diluted sulphuric acid (1 + 3). Add 5 drops N-phenylanthranilic acid indicator and titrate with ferrous ammonium sulphate (0.1 N) until the reddish-purple tints turn to green. Towards the end-point the ferrous ammonium sulphate solution should be added drop-wise allowing a few seconds to elapse between additions. Let *A* ml be the amount of ferrous ammonium sulphate required.

(ii) Determination of total chromium

Dilute 20 ml of the electrolyte to 250 ml in a calibrated flask. Measure exactly 25 ml of the diluted solution into a 500 ml conical flask, containing 150 ml of water and 45 ml of dilute sulphuric acid (1 + 3). Add 10 ml of silver nitrate (3 per cent w/v) and 2 g of ammonium persulphate; heat the solution to boiling point and boil for 20 minutes, to decompose the excess ammonium persulphate. Cool to room temperature, add 5 drops of N-phenylanthranilic acid indicator and titrate with ferrous ammonium sulphate as described in (i) above.

Let *B* ml be the amount of ferrous ammonium sulphate required.

(c) Calculation of results

$$\text{Total chromium (as CrO}_3\text{) g/l} = \frac{125}{3} \times \frac{B}{A}$$

2. Free chromic acid (used electrolyte)

(a) Reagent

Sodium carbonate	0.5 N solution
-------------------------	----------------

(b) Procedure

To 100 ml of water in a 250 ml conical flask add 10 ml of the electrolyte and titrate with sodium carbonate (0.5 N solution) to the first appearance of a distinct permanent turbidity.

Let *C* ml be the amount of sodium carbonate solution required.

(c) Calculation of results

$$\text{Free chromic acid (as CrO}_3\text{) g/l} = 5 C.$$

3. Free chromic acid (fresh electrolyte)

(a) Reagents

Diluted sulphuric acid	(1 + 3)
Ferrous ammonium sulphate	0.1 N solution prepared as in clause 1 above
N-phenylanthranilic acid indicator	0.1 per cent w/v prepared as in clause 1 above

(b) Procedure

Dilute 25 ml of the electrolyte to 250 ml in a calibrated flask. To 45 ml of diluted sulphuric acid (1 + 3) and 200 ml of water contained in a 500 ml conical flask add 50 ml of the diluted electrolyte and 5 drops of N-phenylanthranilic acid indicator and titrate with ferrous ammonium sulphate as described in clause 1 (b) (i) above.

Let D ml be the amount of ferrous ammonium sulphate solution required.

(c) Calculation of results

$$\text{Free chromic acid (as CrO}_3\text{) g/l} = \frac{50}{3} \times \frac{D}{A}$$

Chloride

Determine as described in Appendix A.

Sulphate**(a) Reagents**

Hydrochloric acid, d 1.16

Glacial acetic acid

Barium chloride

10 per cent w/v solution

Ethanol—pure ethanol or sulphur-free methylated spirit.

(b) Procedure

To 100 ml of filtered electrolyte in a 400 ml beaker (squat form) add 10 ml of hydrochloric acid, 25 ml of glacial acetic acid and 20 ml of ethanol and boil the solution gently for 15 minutes to expel aldehydes and excess ethanol. Dilute to about 200 ml and raise the solution to boiling point. Add slowly 10 ml of barium chloride solution (10 per cent w/v), boil gently for about 15 minutes and allow the precipitate to settle overnight.

Filter the precipitate on a small ashless paper pulp, wash well with warm water and transfer the pulp and precipitate to a weighed crucible. Ignite and weigh as barium sulphate.

Let E be the weight in grammes of the barium sulphate.

(c) Calculation of results

$$\text{Sulphate (as Na}_2\text{SO}_4\text{) g/l} = 6.1 E.$$

APPENDIX C**Low voltage electrical test for continuity of anodic coating****Equipment**

- A source of constant voltage 10 volt d.c. supply.
- A brush type electrode consisting of a freshly cut piece of 14/0076 copper wire cable with the insulation cut back for about $\frac{1}{2}$ inch and the exposed wire strands opened out slightly.
- A pointed probe which can be attached to the part to make effective electrical contact.
- A current flow indicator (i.e. a d.c. ammeter, lamp or buzzer)
- A variable resistor.

Procedure

- Connect the brush electrode, the d.c. source, the indicator, the variable resistor and the pointed probe in series.
- Connect the brush electrode and the contact probe and adjust the current to approximately one ampere. Connect the pointed probe to the anodized part.
- Pass the brush electrode lightly and slowly over the anodized surface of the part. Any discontinuity found in the coating is indicated by the passage of current.

Results

In all instances, indications of discontinuities in the coating on edges should be disregarded unless such edges have been generously rounded (e.g. 0.05 inch or more radius) and smoothed. An almost continuous current indication denotes an unsatisfactory coating due to its being thin and tenuous or loose and powdery.

APPENDIX D

Method of determining the average thickness of coating

1. Stripping solution

This shall consist of:

Phosphoric acid (<i>d</i> 1.75)	3.5 per cent v/v
Chromic acid (analytical reagent)	2.0 per cent w/v

and shall be used gently boiling.

2. Sample

The sample comprising one or more parts shall have a total anodized surface area of not less than 5 in².

3. Procedure

Weigh the clean and dried anodized sample to the nearest milligramme and immerse in the stripping solution until constant weight is attained; this usually takes not more than 10 minutes. Wash the sample in hot, distilled water, dry and re-weigh. Complete removal of the coating should be checked by re-immersion for a further 2 minutes. The loss in weight shall be taken as the weight of the anodic coating.

4. Calculation

$$T = \frac{W}{44 \times A}$$

where *T* = average thickness of anodic coating in inches

W = weight of anodic coating in grammes

and *A* = surface area of anodizing in square inches

The formula is based on an assumed density of 2.7g/cm³ for anodic coating sealed in aqueous solution. For purpose of this specification the thickness of coating shall be taken to be that obtained by the above method stripping and calculation.

APPENDIX E

Electrical breakdown test

The test will not be applied on edges, unless these have been generously rounded, or on wire of less than 0.01 in diameter.

The test will only be applied to dry sealed anodic coatings except that it may be applied to dry unsealed coatings.

The test shall be according to Method L of B.S. 1615 : 1961 carried out at a relative humidity not exceeding 10 per cent. For tests on anodized wire the contact electrode shall be a 1/8 in diameter polished hard metal cylinder.

APPENDIX F

Stripping solutions for the removal of anodic coatings

1. Preferred solution

Phosphoric acid (<i>d</i> 1.75)	3.5 per cent v/v
Chromic acid	2.0 per cent w/v

Used gently boiling.

2. Alternative solutions

(a) Sulphuric acid (<i>d</i> 1.84)	15 per cent v/v
Chromic acid (CrO ₃)	5 per cent w/v
Water	Remainder

Used at about 50°C.

(b) Sulphuric acid (<i>d</i> 1.84)	10 per cent v/v
Potassium fluoride	4 per cent w/v

Used at room temperature.

(c) Sulphuric acid (<i>d</i> 1.84)	10 per cent v/v
Hydrofluoric acid, commercial (50/60% HF) ...	1 per cent v/v

Used at room temperature.

Note Solutions 2(a), (b) and (c) cause slightly greater attack of the basis metal.

56.

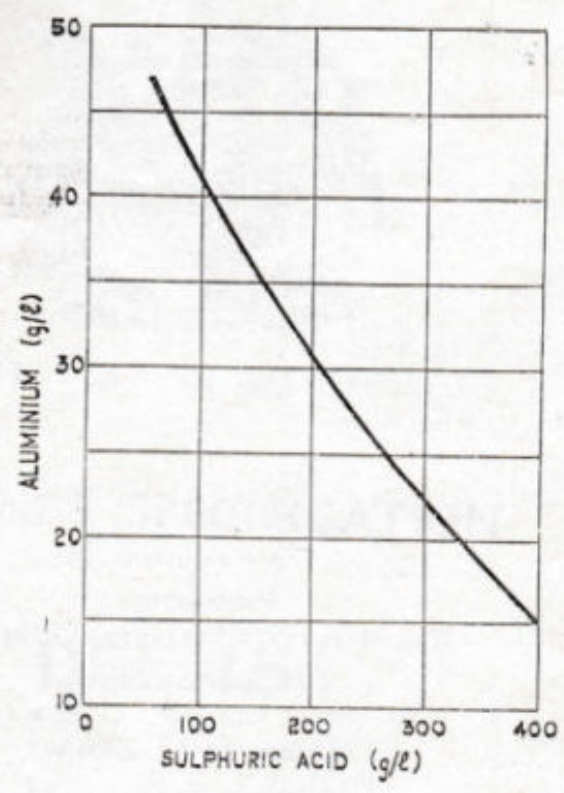


Fig. 1. MAXIMUM ALUMINIUM CONTENT OF SULPHURIC ACID ELECTROLYTES (AT 15°C)

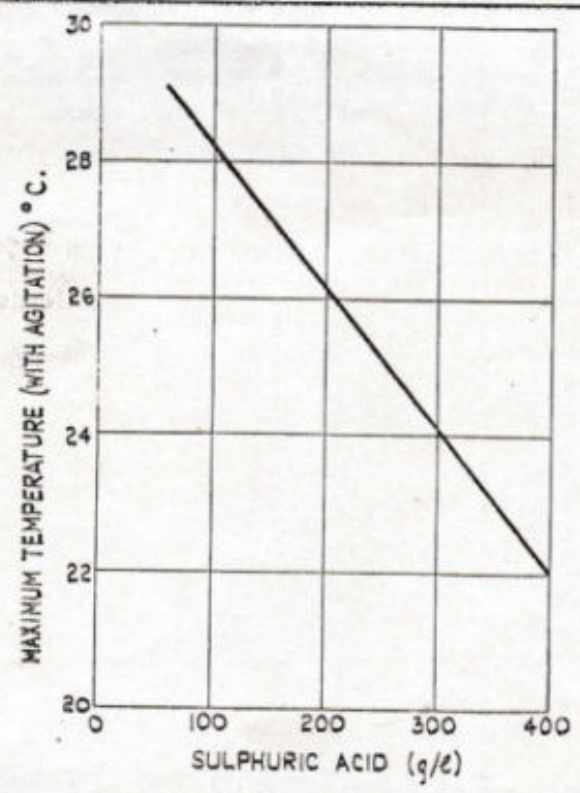


Fig. 2. MAXIMUM PERMISSIBLE TEMPERATURE OF OPERATION OF SULPHURIC ACID ELECTROLYTES.

Printed in England for Her Majesty's Stationery Office
by Willsons (Printers) Ltd., Leicester

W708
W50

1.
2.
3.
4.

© Crown copyright 1965

Published by

HER MAJESTY'S STATIONERY OFFICE

To be purchased from

York House, Kingsway, London W.C.2

423 Oxford Street, London W.1

13A Castle Street, Edinburgh 2

109 St. Mary Street, Cardiff

39 King Street, Manchester 2

50 Fairfax Street, Bristol 1

35 Smallbrook, Ringway, Birmingham 5

80 Chichester Street, Belfast 1

or through any bookseller

APPROVED <i>Wm. S. 8-85</i>		CHECKED <i>W/S 2/8/85</i>		TYPED <i>26.8.85</i>	
SHEET		No. OF SHEETS		ALL SHEET NO. OF	SIGNATURE
15		15			

PROTECHNIC ARTICLES.
 COMPONENTS AND ASSEMBLY UNITS
 GENERAL TECHNICAL REQUIREMENTS.
 OST B 84 - 186 - 80.

BRANCH STANDARD

SECRET

147
~~147~~

12
 12
 12/81

12

BRANCH STANDARD

OST B 84 - 186 - 80

PYROTECHNIC ARTICLES

COMPONENTS AND ASSEMBLY

UNITS - GENERAL TECHNICAL

REQUIREMENTS.

This Standard pertains to components and assembly units for pyrotechnic articles.

The standard establishes general technical requirements:

- to metal components manufactured by machining and

cold stamping;

- to components made of felt, rubberized asbestos

fabric, sheet rubber and sheet polymeric materials

manufactured by cutting off, cutting out, piercing;

- to assembly units manufactured by soldering, welding

riveting.

The Standard does not pertain to components made of

pyrotechnic compounds and assembly units containing them.

Supplementary requirements may be specified in design

documents to ensure the quality and reliability of components.

and assembly units.

I. TECHNICAL REQUIREMENTS

1.1. Requirements to materials.

1.1.1. Materials used to manufacture components and assembly units

should comply with the Standards in force or specifications for

these materials. Quality of materials used should be confirmed

ALT	SECRET	No. OF DOCUMENT	SOURCE	DATE

OST B 84 - 186 - 80

2

SECRET

051 B 84 - 186 - 80					

- by accompanying documents.
- 1.1.2. If a range of materials used is not specified in design documents, components and assembly units may be manufactured of any range of products technologically suitable for the manufacturing plant.
- 1.1.3. Materials and completing articles should be subjected to an incoming inspection as per GOST B . 20. 57. 501 - 77.
- 1.2. General Requirements to components.
- 1.2.1. Components should be manufactured in compliance with the requirements of the standard, design and technological documents approved in the established order.
- 1.2.2. Mass without limit deviations specified in design documents is 'for reference'.
- 1.2.3. Components should be cleaned, dried and degreased (if necessary) before assembly.
- 1.3. Requirements to metal components.
- 1.3.1. Components burrs should be dressed. Sharp ribs should be blunted upto radii 0.1 to 0.5 mm or chamfers 0.1 to 0.5 mm at an angle of $45^\circ \pm 15^\circ$. Curling up the burrs is not allowed.
- Sharp ribs of structural elements of components less than 0.5 mm thick and ribs of internal surfaces may be not blunted.
- 1.3.2. Dimensions of internal radii unspecified in design documents should not exceed 0.5 mm.
- 1.3.3. The following defects are not allowed on component surfaces:
- a) corrosion, cracks, fissures and laminations;
 - b) tool marks, traces, inflicted by technological

4	05T B 64 - 186 - 80	SIGNATURE	DATE	SHEET No. OF DOCUMENT	SHEET	ALL
5						

equipment, foreign impurities, nicks, cavities, blisters etc.

If the defects lead to exceeding the unit deviations for component dimensions, at the check, dressing or not comply with degree of roughness of machined surfaces should not exceed the surface roughness of source material.

1.3.5. Dimensions of threads and their shapes should comply with GOSTs in force.

1.3.6. Surface roughnesses of threads should not exceed Rz 20. Flares and chippings off - threads are not allowed, if their depth exceeds the limits of pitch diameters or their length exceeds 8% of total thread length along helical line and 1/3 of one turn length for rough degree of accuracy (as per GOST 16093 - 70) or 5% of total thread length along helical line and 1/4 of one turn length for a medium degree of accuracy, unless otherwise specified in design documents.

1.3.8. Crests of rolled thread profiles may be rounded off, and crests of starting ^{the} final turns of thread may be bent if causes no obstruction for a screwing/'go' gauge on.

1.3.9. Dents on three final turns of thread (for both sides of through thread) and dents hindering the 'go' gauge passage are not allowed on thread surfaces.

1.3.10. Wash threads, grooves, chamfers should be carried out in compliance with the requirements of GOST 10549 - 69.

5	OST B 84 - 186 - 80	SHEET NO. OF DOCUMENT	SIGNATURE	DATE
5				

1.3.11. The following defects of components manufactured by cold stamping are not allowed:

a) corrugations, dents, traces of technological transitions which influence the assembly and operational state of the articles;

b) thinning (thickening) of metal more than by 25% of minimum (maximum) thickness established by Standard Technical Documents in drawing, bending, ^{press}rolling, moulding, rotary drawing etc.

1.3.12 Shape and dimensions of cut surfaces in cutting out and piercing are not restricted.

1.3.13 Metal and non-metal inorganic coatings should comply with requirements of design documents, OST 9.301 - 78 and OST B 84 - 1097 - 75.

1.3.14 Paint and varnish coatings should comply with requirements of design documents and OST B 84 - 1384 - 76. Coating designation as per OST B 84 - 1152 - 75.

1.4. Requirements to non metal components.

1.4.1. Dimensional limit deviations of components produced by cutting out, cutting off rubber, polyurethane foam, felt and so forth should not be more accurate than 15 degree of accuracy for thickness upto 3 mm; 16 degree of accuracy for thickness more than 3 mm.

1.4.2. Shape and dimensions of cut surface in cutting out, piercing, cutting off are not restricted.

1.4.3. Components, manufactured from coiled materials are not to be subjected to creasing, unless otherwise specified in design documents.

6	OSI B 84 - 186 - 00				
6					

The following is allowed:

- 1.4.4. Fuzziness along the contour of cutting out, piercing or cutting off is allowed for components made of rubberized asbestos fabric, felt and materials similar to them.
- 1.4.5. Burrs along the contour of cutting out or piercing are allowed for components made of celluloid (disks, rings), chipplings to the depth more than 1/3 of material thickness are not allowed.
- 1.4.6. Thinning of components along the contour of cutting out resulted from material sticking together is allowed for components made of polyurethane foam.
- 1.5. Requirements to Assembly Units.
 - 1.5.1. Components delivered to assembly should be accepted by the Quality Inspection Department (QID) and if assigned by design documents by the customer's representative.
 - 1.5.2. Scuffings of protective coating resulted from contact with technological equipment are allowed on surfaces of assembly units.
 - 1.5.3. Damages of protective coating viewed as tool marks and scratches and caused during assembly process, are allowed on surfaces of assembly units to be subjected to subsequent paint coating.
- Design documents should specify a kind of protection of places of damaged protective coating which are not to be subjected to subsequent paint coating.
- 1.5.4. Welded joints should comply with the requirements of OSI 3 - 4001 - 77.
- 1.5.5. Blisters and lack of solder penetration are not allowed in a soldered joint.

ALL SHEETS	NO. OF COMPONENTS	SHEET NO.	DATE

1.6. Requirements to Dimensions.

1.6.1. Limit deviations of dimensions of components and assembly units should be assigned according to standards for tolerances and fits, in force.

1.6.2. Limit deviations for dimensions of notches, seats to fit the heads of screws, rivets and so forth should be as follows:

- $\pm \frac{IT_{15}}{2}$ as per OST 84 - 254 - 79.

1.6.3. Unspecified limit deviations of rectangular, angular and radial grooves should be carried out with the following limit deviations.

- For dimensions from 0.3 to 0.6 mm

- Female dimensions - + 0.2 mm, Male dimensions - 0.2 mm
 others - + 0.1 mm

1.5.7. Length of rivets, size of rivet heads and diameters of holes to fit the rivets should comply with OST 14802 - 75.

1.5.6. Surfaces of rivet heads should be free of foreign bodies, cracks, fissures, metal spalls and other mechanical damages.

1.5.6. a) Variation in colour and unevenness of tin coating (without damage of main metal coating) in soldered places.

b) Presence of spots of flux

c) Lack of nodic coating on soldered seams

d) Remnants of acidless fluxes, in hardly accessible places, if they do not impair proper operation of the article.

e) Temper colours in places of soldering, scaliness of seam surface, flabbiness due to shrinkage, uneven tinge of solder

2.1. To check compliance of components and assembly units with the requirements of this standard and design documents, acceptance

2. ACCEPTANCE RULES

carried out according to 14 degree of accuracy as per OSI 84 - 254 - 79.

1.6.10 Dimensions with unspecified limit deviations should be

as per GOST 10356-63.

1.6.9. Deviations of shape and position of holes should be assigned

should be ensured by tool or technological process.

1.6.8. Dimensions specified in points 1.6.2, 1.6.3, 1.6.4, 1.6.5, 1.6.7,

than those specified in design documents.

1.6.7. Dimensions with a sign \approx should be not less than

1.6.6. Dimensions of knurling should comply with GOST 21474 - 75.

drawing should be according to 17 degree of accuracy.

1.6.5. Limit deviations of angular dimensions unspecified in the

Radius or Chamfer	mm	Limit deviations
Upto 0.2	0.2	± 0.1
Above 0.2 to 0.4	0.4	± 0.2
Above 0.4 to 1	1	± 0.3
Above 1 to 3	3	± 0.5
Above 3 to 7	7	± 1
Above 7 to 18	18	± 2
Above 12-18	18-30	± 3
Above 18-30	30	± 4
Above 30		± 5

TABLE - 1

1.6.4. Unspecified limit deviations or rounding off and chamfer radii should comply with those specified in Table - 1.

for dimensions from 0.6 to 1 mm; ± 0.3 mm & ± 0.5 mm & ± 0.15 mm respectively.

shop to reveal causes of defects, to take measures to eliminate defects
 QID's test, the whole batch should be returned to the manufacturing
 the requirements of this standard and design documents, during the
 2.5. If though one component or assembly unit fails to meet
 also specified in design documents.

of the sampling should be 3% of the batch (Minimum) unless other-
 Acceptance inspection should be performed at random. Amount
 and tests.

per OST B 84 - 214 - 80, to the QID to perform acceptance inspection
 or assembly units, being packed and accompanied by a certificate as
 2.4. The manufacturing shop presents the batch of components
 and according to parameters established by technological documents.
 the requirements of this Standard and design documents, in scope
 process should be subjected to in-site check for compliance with
 2.3. Components and assembly units during manufacturing
 design documents.

Supplementary requirements to the batch are established by
 necessary).

with the consulting plant and the customer's representative (if
 established according to an agreement of the manufacturing plant
 quantity of components and assembly units in batch is
 item, according to the same technological document.
 material, or two batches of metal, the same sort of semi finished
 units of the same designation, manufactured of the same goods of
 in batches. The batch should consist of components and assembly

2.2. Components and assembly units are presented for acceptance
 tests and approval tests (when it is necessary) are to be established.

10	OST B 84 - 186 - 80	SIGNATURE	NO. OF COPIES	SHEET	REV.
10					

and their cause to conduct the expected complete inspection for rejected parameters and to present the batch subsequently to the QID.

2.6. Repeated random inspection is performed with double quantity of components and assembly units. When non-compliance through of one component or assembly unit with the requirements of this standard and design documents is revealed, the batch should be rejected.

2.7. The batch of components or assembly units accepted by the QID, packed in compliance with design documents is presented to the customer's representative, if assigned by design documents. Simultaneously, documents, confirming compliance of basic materials with the requirements of standards and specifications, test records, certificate as per OST B 84 - 214 - 80, notification as per OST B 20.57.106-77 or OST B 20.57.302 - 76 are presented.

2.8. The customer's representative is to perform acceptance tests of the presented batch, in accordance and according to parameters established by design documents.

2.9. If the customer's representative reveals non-compliance with the requirements of design documents and this standard, the batch should be returned to the QID.

The QID presents the batch for the second time, as accompanied with a notification provided with the description for second acceptance.

The notification is presented together with a statement as per OST B 20.57.302.76 - or OST B 20.57.106-77 confirming elimination of defects and containing the list of undertaken measures. The customer's representative performs the repeated testing with double quantity of components and assembly units.

If the repeated test reveals that through one component or

REV	DATE	DESCRIPTION	BY
11			
OST B 84 - 186 - 80			
DIRECT			

- 3.1. Design and dimensions of components and assembly units should be inspected by comparing, with drawings and testing of dimensions by check and measuring tools, providing accuracy of manufacture required by drawing.
- 3.2. Appearance of components and assembly units and requirements according to points 1.2.2, 1.2.3, 1.2.4, 1.2.7, 1.2.8, 1.2.11, 1.2.14, 1.3.5, 1.3.6 should be inspected visually.
- When testing the appearance, a reference standard may be established in compliance with the reference standard established regulations, adopted at the manufacturing plant.
- 3.3. Roughness of surfaces should be inspected by comparing with surface finish standards or by means of measuring devices.
- 3.4. Dimensions provided with 'min' or 'max' inscriptions should be inspected by single limit gauges as per OST 1219.
- 3.5. Diameters of knurled surfaces specified with limit deviations should be inspected before knurling.
- 3.6. Dimensions of metric threads should be inspected by gauges

3. METHODS OF TESTING

- 2.10. When the technological process is stable and statistically controlled, the testing by the QID and the customer's representative is conducted as per OST B 84 - 612 - 79.
- 2.11. The customer's representative makes a statement concerning accepted batch of components and assembly units and signs its certificate as per OST B 84 - 214 - 80.
- assembly unit fails to meet the requirements of design documents and the standard, the entire batch is to be rejected.

as per CQST 18465 - 73 or CQST 18466 - 73.

3.7. Quality of marking, sizes of frames and their position should be inspected visually.

3.8. Inspection of metal and non-metal coatings should be

performed as per CQST 9.302 - 79.

3.9. Inspection of varnish and paint coatings should be performed

as per OST 8 84 - 1384 - 76.

3.10. Testing of welds should be performed as per OST 3 - 4001 - 77.

4. MARKING, PACKING, TRANSPORTATION AND STORAGE

4.1. Marking, branding, packing of components and assembly units

should be performed in compliance with the requirements of design

documents, but if the requirements are not specified - according to

the practice at the manufacturing plant.

4.2. Packing should ensure the quality of component and

assembly units during storage and transportation, for periods of time

established by this standard or design documents.

4.3. Containers with packed components or assembly units should

be sealed by the QID and (if assigned by design documents) the customer's

representative as well, when transporting to another plant. Imprints

of seals shall be specified in the certificate.

4.4. Marking containing the following information should be

applied on outer surface of containers used for transportation to another

plant:

- name or designation, or trade mark of the manufacturing plant.

- name, designation and number of drawing of component

or assembly unit.

№

SHEET

№ OF SHEETS

SIGNATURE

DATE

OST 8 84 - 186 - 80

12

SHEET

NO	REV	DATE	DESCRIPTION	BY

OST B 84 - 186 - 80

13

4.9. Storage of tin plated components and assembly units should be conducted in conditions complying with those of the heated store houses. Documents for these materials.

4.8. Storage conditions for components made of foil and non-metal materials should comply with those established by Standard Technical storage are not specified in design documents.

performed by the QID or the customer's representative if other terms of and 1 year in unheated ones, as estimated since the date of acceptance

COST B 9. 003 . 72. Storage life is 1.5 year in heated store houses corrosion factors, with those in heated or unheated store houses, as per are assembled in conditions which comply according to level of packing of the manufacturing plant till the pyrotechnic articles

4.7. Components and assembly units made of corrosion - proof materials and materials protected by coatings should be stored in the design documents.

4.6. Transportation of packed components or assembly units is carried out by any kind of transport, if otherwise not specified in their quality.

4.5. The batch of components or assembly units should be provided with the certificate as per OST B 84 - 214 - 80 concerning

- batch numbers
- year of manufacture
- quantity of components or assembly units
- gross weight.

SUPPLEMENT
(Reference)

LIST OF DOCUMENTS SPECIFIED IN STANDARD

Designation of document

1. Name of document
2. Sheet
3. OST B . 20 . 57 . 501 - 77. Incoming control of materials, semi finished items and completing articles, General.
4. OST 16093 - 70 - Metric thread for diameters from 1 to 600 mm tolerances.
5. OST 10549 - 69 - Screw thread run out.
6. Without threads, total thread run out, under cuts and chamfers.
7. OST 9.301 - 78 - Metal and Non Metal Inorganic coatings. Technical requirements.
8. OST 9 84 - 1097 - 75 - Metal and Non metal Inorganic coatings. Requirements to choose type and thickness.
9. OST B 84 - 1384 - 76 - Paint and varnish coatings - General Technical requirements - Acceptance rules - Methods of checking.
10. OST B 84 - 1152 - 75. Varnish and paint coatings. Selection and designation.
11. OST B - 4001 - 77 . welded joints . General technical requirements to manufacture and methods of checking.
12. OST 14802 - 75. Selection of lengths, dimensions of points and diameters of holes, for rivets.
13. OST 21474 - 75. Straight and diamond knurl. Form and basic Dimensions.
14. OST 10356 - 63. Deviations of form and position of surfaces. Basic definitions. Limit deviations.

OST B 84 - 186 - 80

14

SHEET

ALL	SHEET	NO. OF DOCUMENT	SIGNATURE	DATE

NO.	SHEET	NO. OF DOCUMENT	ISSUANCE DATE	051 B 64 - 106 - 80

- 24. 051 B 64 - 214 - 80. Pyrotechnic articles. Standard forms of log books, certificates and labels.
- 23. 051 B 64 - 254 - 75. Tolerance zones and recommended fits. Unspecified limit deviations.
- 22. 051 B.9.003-72. General system of rust and ageing protection. Military techniques. General Requirements to storage conditions.
- 21. 051 18466 - 73. Gauges for metric thread above 68 to 200 mm. Required dimensions.
- 20. 051 18465 - 73. Gauges for metric thread from 1 to 68 mm. Required dimensions.
- 19. 051 1219. Plain limit gauges for shafts and holes of 5 accuracy class. Tolerances.
- 18. 051 9.302 - 79. Metal and non-metal inorganic coatings. Acceptance rules and control methods.
- 17. 051 B 64 - 612 - 79. Complex system of quality inspection, statistical methods of inspection of linear parameters and physical properties according to alternative system.
- 16. 051 B.20.57.302-76. Complex system of quality inspection. Instruments, devices, fixtures and equipment of military purpose. General technical requirements, methods of inspection and tests. Rules of testing and acceptance of specimens and serial products.
- 15. 051 B. 20 - 57 - 106 - 77. Complex system of quality inspection. Test and acceptance of serial products of military techniques. General.

RTZ/81

1171

7 102

STANDARD / SPECIFICATION

NUMBER

GOST 21488-76

EXTRUDED BARS FROM ALUMINIUM AND ALUMINIUM ALLOYS

SUPERSEDES

SHT 1 OF 42

COPY-3

GOST 4783-68 except points 5.1-5.7, 5.9, 5.10, GOST 13890-68 and GOST 7857-73.

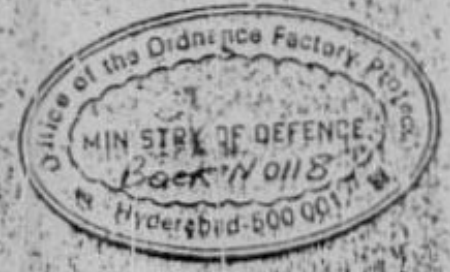
This standard pertains to extruded bars from aluminium of grades ADO, AD1 and from aluminium alloys of grades AM 12, AM 13, AD31, AD33, AMa2, AMa3, AMa5, AMa6, AV, DL, D16, V95, AK4, AK4-1, AK6, AK8, 1915 and 1925.

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 - kr,
 - square - kv,
 - hexagonal - SH ;
- b) as per manufacturing accuracy :
 - of normal accuracy - N ;
 - of high accuracy - P ;



FOR REFERENCE ONLY

APPROVED	<i>M. Srinivas</i>	18-75	MATL/SPECN.			
ENGINEER/OP. INCHARGE	<i>[Signature]</i>	12-75	HEAT TREAT			
CHECKED	<i>[Signature]</i>	17-75	FINISH			
DRAWN				ISS. NO.	ISSD. BY.	APRD.

S.F. 10

c) as per material condition :

without heat treatment (hot extruded) - denoted by alloy grade without additional symbols (AD0, AD1, AM_{1S}, AM_{2S}, AD31, AD33, AM₂, AM₃, AM₅, AM₆, AV, D1, D16, V95, AK4, AK4-1, AK6, AK8, 1915, 1925); annealed - M (AM_{3M}, AM_{5M}, AM_{6M}, 1925M);

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);

d) 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 AM_{1S}, AM₂, AM₃ 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 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:		Cross-sectional area, cm ² .	Linear density of 1 m. bar, kg/m.
	Normal (N)	High (P)		
(1)	(2)	(3)	(4)	(5)
5			0.196	0.056
6	-0.48	-0.30	0.283	0.081
7			0.385	0.110
8			0.503	0.143
9	-0.58	-0.36	0.636	0.181
10			0.785	0.224
11			0.950	0.271
12			1.131	0.322
13			1.327	0.378
14			1.539	0.439
15	-0.70	-0.43	1.767	0.504
16			2.011	0.573
17			2.270	0.647
18			2.545	0.725
19			2.835	0.808
20			3.142	0.895
22			3.801	1.083
23			4.155	1.184
24			4.524	1.289
25	-0.84	-0.52	4.909	1.399
26			5.309	1.513
27			5.726	1.632
28				

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	3.581
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			28.274	8.058
65	-1.20	-0.74	33.183	9.457
70			38.485	10.968
75			44.179	12.591
80			50.265	14.326
85			56.745	16.172
90			63.617	18.131
95			70.882	20.201
100			78.540	22.384
105	-1.40	-1.00	86.590	24.678
110			95.033	27.084
115			103.869	29.603
120				

Contd.../-

(1)	(2)	(3)	(4)	(5)
			122.719	34.975
125				
			132.732	37.820
130				
			143.139	40.795
135				
			153.938	43.872
140				
			165.130	47.062
145				
			176.715	50.364
150				
	-1.60	-	188.692	53.777
155				
			201.062	57.303
160				
			213.825	60.940
165				
			226.980	64.689
170				
			240.529	69.551
175				
			254.469	72.524
180				
			268.803	76.609
185				
<hr/>				
			283.529	80.806
190				
			314.159	89.535
200				
			346.361	98.713
210				
			380.133	108.338
220	-2.00	-		
			415.476	118.411
230				
			425.389	128.931
240				
			490.874	139.899
250				
<hr/>				
			530.929	151.315
260				
			572.557	163.178
270				
			615.752	175.489
280	-2.50	-		
			660.521	188.249
290				
			706.858	201.455
300				

G. 321

Contd..../-

(1)	(2)	(3)	(4)	(5)
310			754.769	215.109
320			804.250	229.211
330			855.301	243.761
340	-1.00	-	907.922	258.758
350			962.115	274.203
360			1017.878	290.095
370			1075.213	306.436
380			1134.118	323.231
390	-6.00	-	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			0.64	0.182
9	-0.53	-0.36	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	0.641
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	1.937
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)
			27.04	7.706
52				
			30.25	8.621
55				
			33.64	9.537
58		-0.74		
			36.00	10.260
60	-1.20			
			42.25	12.041
65				
			49.00	13.965
70				
			56.25	16.031
75				
			64.00	18.240
80		-1.00		
			72.25	20.591
85				
			81.00	23.085
90				
			100.00	28.500
100	-1.40			
			121.00	34.485
110				
			144.00	41.040
120				
			169.00	48.165
130				
			196.00	55.860
140	-1.60			
			225.00	64.125
150				

12

RTE/81

12

SECRET

~~145~~

147

BRANCH STANDARD

PYROTECHNIC ARTICLES,
COMPONENTS AND ASSEMBLY UNITS
GENERAL TECHNICAL REQUIREMENTS.

OST B 84 - 106 - 80.

ALL SHEETS	NO. OF DOCUMENT	SIGNATURE	DATE		
TYPED -	28		28.0.85		
CHECKED	MP/SG		29.9.85	SHEET	No. OF SHEETS
APPROVED			29.9.85	1	15

equipment, foreign inclusions, nicks, cavities, blisters etc.

If the defects lead to exceeding the unit deviations for component dimensions, at the check, dressing or not comply with reference standards.

1.3.4. Component surfaces of roughness R_a may be machined within a tolerance zone for source material. In this case the degree of roughness of machined surfaces should not exceed the surface roughness of source material.

1.3.5. Dimensions of threads and their shapes should comply with GOSTs in force.

1.3.6. Surface roughnesses of threads should not exceed $R_z 20$.

1.3.7. Flaws and chippings off threads are not allowed, if their depth exceeds the limits of pitch diameter or their lengths exceeds 8% of total thread length along helical line and 1/3 of one turn length for rough degree of accuracy (as per GOST 16093 - 70) or 5% of total thread length along helical line and 1/4 of one turn length for a medium degree of accuracy, unless otherwise specified in design documents.

1.3.8. Crests of rolled thread profiles may be rounded off, and crests of starting and final turns of thread may be bent if the ^{the} cause no obstruction for a ^{the} 'go' gauge on.

1.3.9. Dents on three final turns of thread (for both sides of through thread) and dents hindering the 'go' gauge passage are not allowed on thread surfaces.

1.3.10. Verrish threads, grooves, chamfers should be carried out in compliance with the requirements of GOST 10549 - 69.

				GOST B 84 - 186 - 80		Part
APP	SHEET	NO. OF SHEETS	SIGNATURE	DATE		*

1.4.4. Fuzziness along the contour of cutting out, piercing or cutting off is allowed for components made of rubberized asbestos fabric, felt and materials similar to them.

1.4.5. Burrs along the contour of cutting out or piercing are allowed for components made of cellulose (ulaka, rings). Chippings to the depth more than 1/3 of material thickness are not allowed.

1.4.6. Thinning of components along the contour of cutting out resulted from material sticking together is allowed for components made of polyurethane foam.

1.5. Requirements to Assembly Units.

1.5.1. Components delivered to assembly should be accepted by the Quality Inspection Department (QID) and if assigned by design documents, by the customer's representative.

1.5.2. Scuffings of protective coating resulted from contact with technological equipment are allowed on surfaces of assembly units.

1.5.3. Damages of protective coating viewed as tool marks and scratches and caused during assembly process, are allowed on surfaces of assembly units to be subjected to subsequent paint coating.

Design documents should specify a kind of protection of places of damaged protective coating which are not to be subjected to subsequent paint coating.

1.5.4. Welded joints should comply with the requirements of OST 3 - 4001 - 77.

1.5.5. Blisters and lack of solder penetration are not allowed in a soldered joint.

The following is allowed:

№	№ OF DOCUMENT	SIGNATURE	DATE	OST 8 24 - 186 - 80	№
01					6

- for dimensions from 0.8 to 1 mm;
- 0.3 mm & 0.3 mm, ± 0.15 mm respectively.

1.6.4. Unspecified limit deviations or rounding off and chamfer radii should comply with those specified in Table - 1.

TABLE - 1

Radius or Chamfer mm	Upto 0.2	Above 0.2 to 0.4	Above 0.4 to 1	Above 1 to 3	Above 3 to 7	Above 7 to 18	Above 12-18	Above 18-30	Above 30
Limit deviations mm.	± 0.1	± 0.2	± 0.3	± 0.5	± 1	± 2	± 3	± 4	± 5

1.6.5. Limit deviations of angular dimensions unspecified in the drawing should be according to 17 degree of accuracy.

1.6.6. Dimensions of threading should comply with GOST 21474 - 75.

1.6.7. Dimensions with a sign \approx should be not less less than those specified in design documents.

1.6.8. Dimensions specified in points 1.6.2, 1.6.3, 1.6.4, 1.6.5, 1.6.7, should be ensured by tool or technological process.

1.6.9. Deviations of shape and position of holes should be as per GOST 10356 - 63.

1.6.10 Dimensions with unspecified limit deviations should be carried out according to 14 degree of accuracy as per DST 84 - 254 - 79.

2. ACCEPTANCE RULES

2.1. To check compliance of components and assembly units with the requirements of this standard and design documents, acceptance

ALL SHEET	NO. OF SHEETS	SIGNATURE	DATE	GST 8 84 - 185 - 80	5
-----------	---------------	-----------	------	---------------------	---

tests and approval tests (when it is necessary) are to be established.

2.2. Components and assembly units are presented for acceptance in batches. The batch should consist of components and assembly units of the same designation, manufactured of the same grade of material, or two batches of metal, the same sort of semi finished item, according to the same technological document.

Quantity of components and assembly units in batch is established according to an agreement of the manufacturing plant with the consuming plant and the customer's representative (if necessary).

Supplementary requirements to the batch are established by design documents.

2.3. Components and assembly units during manufacturing process should be subjected to in-site check for compliance with the requirements of this Standard and design documents, in scope and according to parameters established by technological documents.

2.4. The manufacturing shop presents the batch of components or assembly units, being packed and accompanied by a certificate as per OST B 84 - 214 - 80, to the QID to perform acceptance inspection and tests.

Acceptance inspection should be performed at random. Amount of the sampling should be 3 % of the batch (Minimum) unless otherwise specified in design documents.

2.5. If though one component or assembly unit fails to meet the requirements of this standard and design documents, during the QID's test, the whole batch should be returned to the manufacturing shop to reveal causes of defects, to take measures to eliminate defects.

ALL SHEETS OF DOCUMENT	SIGNATURE	DATE	OST B 84 - 186 - 80	2000
				2

assembly unit fails to meet the requirements of design documents and this standard, the entire batch is to be rejected.

3.10 When the technological process is stable and statistically controlled, the testing by the QID and the customer's representative is conducted as per OST B 84 - 612 - 73.

3.11 The customer's representative makes a statement concerning accepted batch of components and assembly units and signs its certificate as per OST B 84 - 214 - 80.

3. METHODS OF TESTING

3.1 Design and dimensions of components and assembly units should be inspected by comparing, with drawings and testing of dimensions by check and measuring tools, providing accuracy of manufacture required by drawing.

3.2 Appearance of components and assembly units and requirements according to points 1. 2.2, 1.2.3, 1.2.4, 1.2.7, 1.2.8, 1.2.11, 1.2.14, 1.3.5, 1.3.6 should be inspected visually.

When testing the appearance, a reference standard may be established in compliance with the reference standard established regulations, adopted at the manufacturing plant.

3.3 Roughness of surfaces should be inspected by comparing with surface finish standards or by means of measuring devices.

3.4 Dimensions provided with 'min' or 'max' inscriptions should be inspected by single limit gauges as per OST 1219.

3.5 Diameters of knurled surfaces specified with limit deviations should be inspected before knurling.

3.6 Dimensions of metric threads should be inspected by gauges

				OST B 84 - 186 - 80	11
№	DATE	BY	CHECKED		

15. GOST B. 20-57-106-77. Complex system of quality inspection. Test and acceptance of serial products of military techniques. General.
16. GOST B.20.57.302-76. Complex system of quality inspection. Instruments, devices, fixtures and equipment of military purpose. General technical requirements, methods of inspection and tests. Rules of testing and acceptance of specimens and serial products.
17. GOST B 84 - 612 - 79. Complex system of quality inspection, statistical methods of inspection of linear parameters and physical properties according to alternative system.
18. GOST 9,302 - 79. Metal and non-metal inorganic coatings. Acceptance rules and control methods.
19. GOST 12194. Plain limit gauges for shafts and holes of 5 accuracy class. Tolerances.
20. GOST 18465 - 73. Gauges for metric thread from 1 to 68 mm. Required dimensions.
21. GOST 18466 - 73. Gauge for metric thread above 68 to 200 mm. Required dimensions.
22. GOST B.9.003-72. General system of rust and ageing protection. Military techniques. General Requirements to storage conditions.
23. GOST B - 254 - 75. Tolerance zones and recommended fits. Unspecified limit deviations.
24. GOST B 84 - 214 - 80. Pyrotechnic articles. Standard forms of log books, certificates and labels.

№	№	№	№	№