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Ceylon Standard Specification for wrought aluminium sheet and strip used in the manufacture of utensils

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BUREAU OF CEYLON STANDARDS

CEYLON STANDARD SPECIFICATION FOR WROUGHT ALUMINIUM SHEET AND STRIP USED IN THE MANUFACTURE OF UTENSILS

C. S. 68: 1969
(Attached AMD 43)

Gr. 4

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BUREAU OF CEYLON STANDARDS
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COLOMBO 3

Ceylon Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This Standard does not purport to include all the necessary provisions of a contract

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CEYLON STANDARD SPECIFICATION FOR WROUGHT ALUMINIUM SHEET AND STRIP USED IN THE MANUFACTURE OF UTENSILS

FOREWORD

This Ceylon Standard for wrought aluminium sheet and strip used in the manufacture of utensils has been prepared by the Drafting Committee on Aluminium hollow-ware. It was approved by the Mechanical Engineering Divisional Committe of the Bureau of Ceylon Standards and was authorised for adoption and publication by the Council of the Bureau on 4th March, 1969.

This Standard is a revision of the Tentative Ceylon Standard CS 36: 1961 — 'Wrought aluminium and aluminium alloy utensils' prepared by the Standards Advisory Council of the then Department of Industries.

In the preparation of this Standard, the Indian and British Specifications were consulted and the assistance gained therefrom is acknowledged.

1. SCOPE

This Specification covers the chemical composition and mechanical properties of wrought aluminium sheet and strip to be used for the manufacture of aluminium utensils.

2. DEFINITIONS

2.1 **Gauge length** — At any moment during the test, the prescribed part of the test piece on which elongation is measured. In particular, distinction should be made between the following:

2.1.1 The original gauge length (L). Gauge length before the test piece is strained, and

2.1.2 The final gauge length. Gauge length after the test piece has been fractured and the fractured parts have been carefully fitted together so that they lie in a straight line.

2.2 **Stress** – At any moment during the test, load divided by the original cross-sectional area of the test piece.

2.3 **Strain** – A measure of the change in size or shape of a body, due to force, referred to its original size or shape.

2.4 **Tensile strength** — Maximum load divided by the original cross sectional area of the test piece, i.e. stress corresponding to the maximum load.

2.5 **Elongation** — The increase in length of a tensile test piece when stressed. The elongation at fracture is usually expressed as a percentage of the original gauge length.

3. MATERIAL

3.1 **Grades** — Wrought aluminium intended for the manufacture of utensils shall comply with the requirements of one of the following grades:—

3.1.1 **Grade I** — Aluminium of not less than 99.0 per cent purity.

3.1.2 **Grade II** — Non heat-treatable aluminium alloy.

3.2 **Chemical composition** — The chemical composition of the grades specified in Clause 3.1 shall be as given below. In both cases the lead content shall not exceed 0 05 per cent.

3.2.1 Grade I

Aluminium not less than	99.0%
Copper not more than	0.10%
Silicon not more than	0.5%
Iron not more than	0.7%
Manganese not more than	0.1%
Zinc not more than	0.10%
Provided that the total copper + silicon + iron + manganese + zinc does not exceed	0.95%
Lead not more than	0.05%

3.2.2 Grade II

Copper not more than	0.1%
Silicon not more than	0.6%
Iron not more than	0.7%
Manganese not less than	1.0%
not more than	1.5%

Zinc not more than	0.2%
Lead not more than	0.05%
Aluminium the reminder	

Note: Titanium and/or other grain refining elements may be present in the material at the option of the supplier provided that the total content does not exceed 0.20 per cent.

3.3 **Condition and mechanical properties** — The material may be either annealed or tempered and its mechanical properties shall be as given in Tables 1,2,3 and 4.

TABLE 1. TENSILE STRENGTH OF ALUMINIUM OF GRADE I

Condition	Tensile strength				Elongation on 2 in (50 mm) Gauge length
	Tonf/in²		Kg f/mm²		
	Min.	Max.	Min.	Max.	per cent
Annealed	—	6·50	—	10·2	30
¼ Hard	6·00	7·50	9·4	11·8	12
½ Hard	7·00	8·50	11·0	13·4	7
¾ Hard	8·00	9·50	12·6	15·0	5
Hard	9·00	—	14·2	—	3

TABLE 2. TENSILE STRENGTH OF ALUMINIUM OF GRADE II

Condition	Tensile strength				Elongation 2 in (5o mm) Gauge length
	Tonf/in²		kgf/mm²		
	Min.	Max.	Min.	Max.	per cent
Annealed	—	7·50	—	11·8	30
¼ Hard	7·50	9·50	11·8	15·0	12
½ Hard	9·00	11·00	14·2	17·3	7
¾ Hard	10·50	12·50	16·5	19·7	5
Hard	11·50	—	18·1	—	3

TABLE 3. 180° BEND TEST FOR ALUMINUM OF GRADE I.

Condition	Radius of bend t = thickness of material
Annealed	Close
¼ Hard	Close
½ Hard	½ t
¾ Hard	½ t
Hard	t

TABLE 4. 180° BEND TEST FOR ALUMINIUM OF GRADE II

Condition	Radius of bend t = thickness of material
Annealed	Close
¼ Hard	Close
½ Hard	½ t
¾ Hard	t
Hard	3t

4. SAMPLING

4.1 **Lot** — Sheet or strip of the same grade, tempered condition and thickness shall constitute a lot.

4.2 **Test samples** — Two test samples of adequate size shall be taken at random for every lot of 5 tons or part thereof.

5. TESTS

5.1 The following tests shall be made on test samples taken as in Clause 4.2.

5.1.1 Chemical analysis.

5.1.2 Tensile test and elongation.

5.1.3 Bend test.

For the tensile and bend tests, test pieces shall be prepared as in Clause 6.

6. PREPARATION OF TEST PIECES

6.1 Tensile Test

6.1.1 Test pieces shall be cut from the transverse margins of the sheets.

6.1.2 The test pieces taken from the sheet or strip shall not be annealed or mechanically worked (except machining the test piece) before being tested.

6.1.3 The test piece (see Fig. 1) shall be of rectangular cross-section and shall have the dimensions given in Table 5.

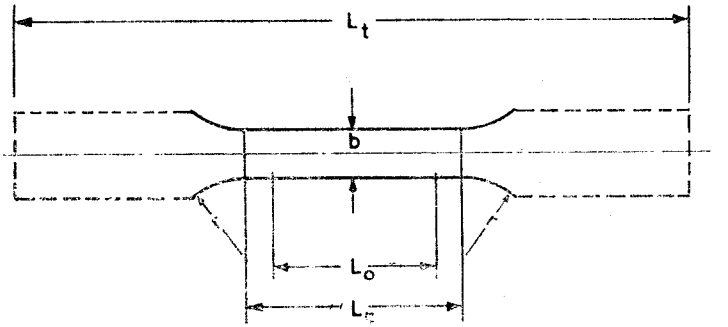

Fig. 1 Test piece of rectangular corss-section.

TABLE 5. DIMENSIONS OF TEST PIECE

	in	mm
Width b ..	$\frac{1}{2}$	12.5
Gauge length L_o ..	2	50
Parallel length (min) L_c ..	$2\frac{1}{2}$	67.5
Radius at shoulder (min) r ..	1	25.0
Approximate total length L_t ..	8	200

6.1.4 The test piece shall be separated from the sample by a method which causes minimum deformation and minimum heating. The best method is usually sawing.

6.1.5 Sharp edges shall be slightly rounded and transverse tool marks and undercuts avoided, particularly at the tangent point of the parallel length and the transition radius.

6.1.6 The cross-sectional area shall be calculated from measurement of the appropriate dimensions with an error not more than ± 0.5 per cent in each dimension.

Alternatively, the test length between gauge marks may be cut accurately after the test piece has broken, weight of the two portions determined and divided by the original gauge length and density (known to an accuracy of ± 1 per cent).

6.1.7 Each end of the gauge length may be marked by means of a fine punch dot or a scribed line. An alternative method is to paint the specimen with a quick drying ink and then to mark the gauge length by fine scribed lines. Incised markings are not recommended as premature failure may occur.

6.2 **Bend test** — The bend test piece shall be ½ in (12.5 mm) wide, of convenient length and cut with its longer axes transverse to the direction of rolling for the sheet or strip. The longer edges shall be carefully rounded and smoothed longitudinally, so that the cross section of the test piece has approximately semi-circular ends.

7. METHODS OF TESTS

7.1 Tensile test

7.1.1 The tensile strength of test pieces prepared as in Clause 6 from samples taken as in Clause 4.2 shall be determined by a tensile testing machine.

7.1.2 For gripping the ends of the specimen, an apparatus speciallly meant for thin sheet and strip such as a pin wedge or a form of grip illustrated in Fig. 2 shall be used.

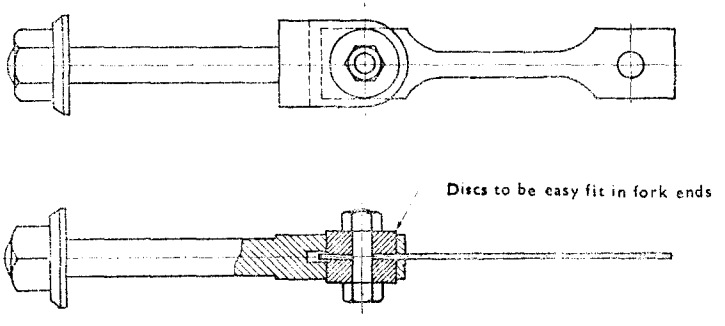

Fig. 2 GRIP FOR THIN TEST PIECES

7.1.3 The test piece shall be held in such a way that the load is applied axially.

7.1.4 The speed of the machine shall be so regulated that rate of loading will not exceed 0.5 tonf/in^2 (0.8 kgf/mm^2) per second. No value is fixed for lower limit of this rate.

The load shall be measured to an accuracy of $\pm$ 1 per cent of the applied load.

7.1.5 The elongation measurement shall apply only to material thicker than 0.104 in (2.5 mm).

Note: 0.104 in = 12 S.W.G.

7.2 Bend test

7.2.1 Test pieces prepared as in Clause 6.2 from samples taken as in Clause 4.2 shall not crack when bent through 180° round a former of specified radius (see Tables 3 and 4).

7.2.2 For thin material, the test piece may be bent by hand to a U-form and the piece thus obtained shall consequently be closed in a vice until the inner surfaces of the bent test piece are twice the specified radius apart (see Tables 3 and 4) or are in general contact if the test piece is to be closed flat. It shall not crack when subjected to this test.

8. CONFORMITY TO STANDARD

If the samples taken in accordance with Clause 4.2 comply with the requirements of chemical composition, tensile strength and bend test, the lot represented by them shall be deemed to comply with the requirements of this Standard.

9. RE-TESTS

9.1 Should the above samples fail to comply with any of the tests, two further samples from the same lot shall be taken for testing, one of which shall be from the sheet or strip from which the original test pieces were taken.

9.2 Should the test pieces from both these additional test samples pass the test, the lot represented by the test samples shall be deemed to comply with the requirements of this Standard. Should a test piece from either of these test samples fail, the lot represented by these samples shall be deemed not to conform to the requirements of this Standard.

AMENDMENT NO.1 APPROVED ON 1981-07-28.

CS 68:1969 SPECIFICATION FOR WROUGHT ALUMINIUM SHEET AND STRIP USED IN THE MANUFACTURE OF UTENSILS.

Delete the existing tables and substitute the following tables.

TABLE 1 - Tensile strength of aluminium of grade I

Condition	Tensile strength (Mega pascals)		Elongation on 50 mm gauge length
	Min.	Max.	
Annealed	-	100	30
¼ Hard	93	116	12
½ Hard	108	131	7
¾ Hard	124	147	5
Hard	139	-	3

TABLE 2 - Tensile strength of aluminium of grade II

Condition	Tensile strength (Mega pascals)		Elongation on 50 mm gauge length
	Min.	Max.	
Annealed	-	116	30
¼ Hard	116	147	12
½ Hard	139	170	7
¾ Hard	162	193	5
Hard	178	-	3

Page 8 Clause 4.2 Test samples

Delete '5 tons' and substitute '5 tonnes' in the second line.

Table 5 Dimensions of test pieces

Delete column 1 of the table.

Page 10 Clause 6.2 Bend test

Delete '½ in (12.5 mm)' and substitute '12.5 mm' in the first line.

Page 11 Clause 7.1.4

Delete '0.5 ton f/in^2 (0.8 kgf/mm^2)' and substitute 7.7 MPa in the second line.

Clause 7.1.5

Delete '0.104 in (2.5 mm)' and substitute '2.5 mm' in the second line.

Delete the entire note.

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