



DRAFT TANZANIA STANDARD

**Wrought aluminium and aluminium alloys for manufacture of
cookware – Sheets, strips and plates – Specification**

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The Mechanical Engineering Divisional Standards Committee (MEDC) under whose supervision, this Tanzania Standard was prepared, consists of representatives from the following organizations:

- *University of Dar es Salaam, College of Engineering and Technology
- *National Development Corporation (NDC)
- Weights and Measures Agency (WMA)
- Tanzania Industrial Research Development Organization (TIRDO)
- *Aluminium Africa
- National Institute of Transport (NIT)
- Ministry of Works

The organizations marked with an asterisk (*) in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this Tanzania Standard:

- Tanzania Automotive Technology Centre (TATC)
- National Development Corporation (NDC)
- M.M. Investment Steel Mills Limited
- Trans Auto Parts Company Limited (TAPCO)
- Dar Es Salaam Institute of Technology (DIT)

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0 Foreword

This Tanzania Standard has been prepared by Metals and Structures Technical Committee (MEDC 02) under the supervision of Mechanical Engineering Standards Divisional Committee (MEDC).

The main objective of this Tanzania Standard is to protect the consumer with regards to health and safety of household cooking utensils.

In the preparation of this Tanzania Standard, assistance was drawn from the following publications:

BS EN 573-3:2019, *Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition.*

BS EN 602:2004, *Aluminium and aluminium alloys - Wrought products - Chemical composition of semi products used for the fabrication of articles for use in contact with food.*

BS EN 485-2:2016+A1:2018, *Aluminium and aluminium alloys. Sheet, strip and plate -Part 2: Mechanical properties.*

DIN EN 515:2017, *Aluminium and aluminium alloys – Wrought products – Temper designations.*

IS 737:2008 (Reaffirmed 2018), *Wrought Aluminium and Aluminium Alloy Sheet and Strip for General Engineering Purposes - Specification*

IS 21:1992 (Reaffirmed 2017), *Wrought Aluminium and Aluminium Alloys for Manufacture of Utensils – Specification*

IS 5052:1993 (Reaffirmed 2003), *Aluminium and its alloys - Temper designations*

This second edition cancels and replaces the first edition TZS 684:2002 which is technically revised.

Wrought Aluminium and Aluminium Alloys for Manufacture of Utensils – Sheets, Strips and Plates – Specification

1 Scope

This Tanzania Standard specifies requirements for wrought aluminium and aluminium alloys sheets, strips and plates for the manufacture of cooking utensils used for catering and domestic purposes.

2 References

For the purpose of the Tanzania Standard, the following references shall apply:

TZS 4: 1979, *Rounding off numerical values*.

TZS 642: 2000, *Metallic materials – Tensile strength test*.

3 Terminology

For the purpose of this Tanzania Standard the following definitions shall apply:

3.1 Plate

A rolled product rectangular in cross section and form, over 6 mm in thickness with either sheared or sawed edges, supplied flat and with less control of surface finish than applies to sheet. The plate may be hot-rolled or cold-rolled.

3.2 Sheet

A rolled product rectangular in cross section and form, over 0.2 mm in thickness but not exceeding 6 mm thickness and supplied flat. The sheet may be hot – rolled or cold – rolled.

3.3 Strip

A cold-rolled product of rectangular cross section and form over 0.2 mm in thickness but not exceeding 3 mm thickness and supplied in coil. The strip shall be cold – rolled.

4 Material requirements

4.1 Wrought aluminium or aluminium alloys used for the manufacture of utensils shall comply with the requirements of one of the following aluminium grades: 19000, 19500, 19600, 31000, 31500, 40800, 51000-A, 51000-B and 64430 specified in Table 1 and Table 2.

4.2 The chemical composition and mechanical properties of the grades referred in **4.1** shall comply with the requirements in Tables 1 and Table 2 respectively. In addition, the lead content of the material shall not exceed 0.05 percent.

4.3 Condition

4.3.1 The material shall be supplied in the condition as specified by the purchaser. While specifying the condition, the temper designation as laid down in Annex C shall be followed.

4.3.2 The temper designations are based on the sequence of basic treatments used to produce the tempers. Basic temper designations consist of letters. If subdivisions of basic tempers are required, they are indicated by a digit, following the letter of the basic temper. Only those treatments or operations which significantly influence the product characteristics are recognized

Table 1: Chemical Composition of Wrought Aluminium and Aluminium Alloys for Manufacture of Utensils

(Composition limits are in percent maximum unless shown otherwise)

Designation	Aluminium	Copper	Magnesium	Silicon	Iron	Manganese	Zinc	Titanium and/or Other Grain Refining Elements	Chromium	Remarks
19000	99.0, Min	0.1	0.2	0.5	0.7	0.1	0.1	—	—	Cu+Mg+Si+Fe+Mn+Zn = 1.0
19500	99.5, Min	0.05	—	0.3	0.4	0.05	0.05	—	—	Cu+Si+Fe+Mn+Zn = 0.5
19600	99.6, Min	0.05	—	0.25	0.35	0.03	0.06	—	—	Cu+Si+Fe+Mn+Zn = 0.4
31000	Remainder	0.1	0.1	0.6	0.7	0.8 - 1.5	0.2	0.2	0.2	—
31500	Remainder	0.2	0.6 - 1.3	0.4	0.7	1.0 - 1.5	0.2	0.2	—	—
40800	98.0, Min	0.2	0.1	0.6 - 0.95	0.6 - 0.95	0.1	0.2	0.2	—	—
51000-A	Remainder	0.2	0.5 - 1.1	0.6	0.7	0.2	0.25	—	0.1	—
51000-B	Remainder	0.2	1.1 - 1.8	0.6	0.7	0.2	0.25	—	0.1	—
64430	Remainder	0.1	0.4 - 1.2	0.6 - 1.3	0.6	0.4 - 1.0	0.1	0.2	0.25	—

NOTES

1. The lead content of the material shall not exceed 0.05%.
2. Other elements not specified in the chemical composition, the maximum content for each shall not exceed 0.05% because of insufficient knowledge about behavior in contact with food. Higher limits may be introduced when more information is available.
3. It is the responsibility of the supplier to ensure that any element not specifically limited, is not present in any amount such as is generally accepted as having an adverse effect on the product. If a purchaser's requirements necessitate limits for any element not specified, it should be agreed between the purchaser and the supplier.

Table 2: Mechanical Properties of Wrought Aluminium and Aluminium Alloy Sheet and Strip for Manufacture of Utensils

Designation	Condition	0.2 Proof stress MPa	Tensile Strength, MPa		Elongation on 50 mm Gauge Length, Percent, For Thickness in mm				Bend Test, Radius of Bend
			Min	Min	Max	$0.5 \leq t \leq 0.8$	$0.8 < t \leq 1.3$	$1.3 < t \leq 2.6$	$2.6 < t \leq 6.3$
19000	O	—	70	110	20	25	29	30	Close
	Hx2	—	90	130	5	6	8	8	Close
	Hx4	—	105	140	3	4	5	5	1/2t
	Hx6	—	125	150	2	3	4	4	1/2t
	Hx8	—	140	—	2	2	3	3	1t
19500	O	—	55	95	22	25	29	30	Close
	Hx4	—	100	135	4	5	6	6	1/2t
	Hx8	—	125	—	3	3	4	4	1t
19600	O	—	—	95	25	25	29	32	Close
	Hx4	—	95	125	4	5	6	6	1/2t
	Hx8	—	125	—	3	3	4	4	1t
31000	O	—	90	130	20	23	24	24	Close
	Hx2	—	115	150	5	6	7	8	Close
	Hx4	—	130	180	3	4	5	5	1/2t
	Hx6	—	150	195	2	3	4	4	1t
	Hx8	—	170	—	2	2	3	3	3t
31500	O	—	125	165	16	16	18	20	Close
	Hx2	—	150	210	5	5	6	8	Close
	Hx4	—	190	245	3	4	5	5	1/2t
	Hx6	—	215	275	2	2	3	4	1/2t
	Hx8	—	245	—	1	1	1	2	1t
40800	O	—	85	120	20	23	25	30	Close
	Hx2	—	105	140	5	6	7	8	Close
	Hx4	—	125	160	3	4	5	5	1/2t
	Hx6	—	150	180	2	3	4	4	1t
	Hx8	—	175	—	2	2	3	3	3t
51000-A	O	—	105	150	18	18	18	22	Close
	Hx2	85	120	160	3	4	5	6	Close
	Hx4	105	140	180	2	3	4	4	1/2t
	Hx6	125	160	200	1	2	2	2	1t
	Hx8	—	185	—	1	2	2	2	3t

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51000-B	O	—	125	170	18	18	18	19	Close
	Hx2	110	155	195	3	4	5	6	1/2t
	Hx4	140	175	215	2	3	4	4	1t
	Hx6	155	190	225	1	2	2	2	3t
	Hx8	—	200	—	1	2	2	2	—
64430	O	—	—	175	14	16	16	17	Close
	T4	115	200	—	12	15	15	15	2t
	T6	250	295	—	5	5	5	6	3t

NOTES

1. $1\text{MPa} = 1\text{ N/mm}^2 = 1\text{ MN/m}^2 = 0.102\text{ kgf/mm}^2 = 144.4\text{ psi}$.
2. t is the thickness of the test piece.
3. For thickness 2.6 mm and less, elongation values are for guidance only and not guaranteed. For this purpose bend test as specified in 7.2 may be carried out.

5 Freedom from defects

The manufacturing process shall leave the material smooth, free from tool marks or splits and flow lines.

6 Dimensions

6.1 Thickness tolerances for hot-rolled plate and sheet shall not vary by more than the respective permissible tolerances prescribed in table 3.

6.2 Thickness tolerances for cold-rolled plate, sheet and strip shall not vary by more than the respective permissible tolerances prescribed in table 4.

Table 3: Thickness tolerances for hot - rolled plate and sheet

Thickness, mm	Width w, mm					
	≤1250	1250<w≤1750	1750<w≤2000	2000<w≤3000	2500<w≤3000	3000<w≤3500
	Tolerance in ± mm					
3 - 4	0.23	0.30	0.35	0.45	0.55	-
5	0.25	0.38	0.40	0.50	0.63	-
6	0.28	0.38	0.43	0.50	0.63	0.78

Table 4: Thickness tolerances for cold - rolled plate and sheet

Thickness, mm	Width w, mm						
	≤500	500<w≤1000	1000<w≤1250	1250<w≤1500	1500<w≤1750	1750<w≤2000	2000<w≤2500
	Tolerance in ± mm						
1.6	0.08	0.09	0.10	0.15	0.18	0.21	-
1.8	0.09	0.10	0.12	0.16	0.20	0.23	-
2.0	0.10	0.11	0.13	0.16	0.20	0.24	-
2.5	0.11	0.12	0.14	0.17	0.22	0.26	-
3.0	0.11	0.13	0.15	0.18	0.24	0.28	-
4.0	0.13	0.15	0.18	0.21	0.25	0.30	0.38
5.0	0.14	0.17	0.20	0.23	0.27	0.40	0.47
6.0	0.15	0.19	0.23	0.25	0.29	0.44	0.46

7 Tests**7.1 Tensile test:**

The tensile test shall be done in accordance with Tzs 642. The test piece shall be taken in the long transverse direction for material of 300 mm wide and over and in longitudinal direction for material under 300 mm wide.

The results obtained shall comply with the requirements specified in tables 2.

7.2 Bend test

Unless otherwise stated, the bend test piece shall be not less than 15 mm wide, of convenient length, and cut with its longer axis transverse to the direction of rolling. The longer edges shall be carefully rounded and smoothened longitudinally so that the cross-section of the test piece has approximately semi-circular ends.

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7.2.1 The test piece may be bent by hand to a U-form, and the piece thus obtained shall subsequently be closed in a vice until the inner surfaces of the test piece are twice the specified radius apart (in Table 2).

7.2.2 When tested in accordance with **7.2.1**, the outer surface of the bend shall not show any visible crack.

8 Re-Tests

8.1 If a test does not give the specified results, two additional samples from the same batch shall be selected for testing, one of which shall be from the sheet or strip from which the original test sample was taken, unless that sheet or strip has been withdrawn by the supplier. Both retests shall conform to the requirements of this standard; otherwise, the lot shall be rejected.

8.2 Unless otherwise agreed, the supplier shall have the discretion to re-heat treat the material (heat-treatable alloys), not exceeding 2 re-heat treatments, before the two further samples are selected.

8.2.1 If a test does not give the specified results, two additional samples from the same batch shall be selected for testing. Both retests shall conform to the requirements of this standard, otherwise, the lot shall be rejected.

9 Selection of Test Samples

9.1 Sheet and Strip of Aluminium or Non-Heat Treatable Aluminium Alloy

Material of the same thickness, produced in the same way, and of the same nominal composition shall be grouped into batches of not more than 4000 kg. However, if a sheet or strip in a single coil exceeds 4000 kg in weight, it shall be deemed to represent one batch.

9.1.1 Mechanical tests shall be carried on to each batch for determining conformity of the material to this standard.

9.1.2 Before the test samples are cut off, they shall be marked to identify them with the batch they represent. The test sample shall be taken from the material as supplied and shall not be further annealed or mechanically worked. The test samples may be cut and prepared from the margins of the material before cutting it to size.

9.2 Sheet and Strip of Heat-Treatable Aluminium Alloys

One test sample shall be cut from a sheet or strip selected from each heat treatment batch. Before the test samples are cut off, they shall be marked to identify with the heat treatment batch they represent.

9.2.1 Unless otherwise agreed, the test samples shall be tested in the O, T4 or T6 conditions (that is in the same condition in which the material is to be supplied). The test sample, after heat treatment, shall not be mechanically worked before being tested.

9.2.2 Material in the 'O' condition, when heat-treated, may have properties of the order of 15 MPa less than the specified properties for the T4 or T6 conditions as appropriate.

9.2.2.1 Unless otherwise agreed, the tests shall be carried out either in T4 or in T6 condition. The test samples shall not be further heat-treated or mechanically worked (except for making the test piece) before being tested. The test samples may be cut from the margins of the material before cutting it to size.

10 Marking

Each package/coil of sheet(s) and strip(s) **may** be suitably marked for identification, with the following particulars:

- a) name of the manufacturer and/or trade mark,
- b) grade/designation,
- c) condition of the material and
- d) batch number.

ANNEX A

COMPARISON OF ISO AND IS DESIGNATIONS

ISO Designation	IS Designation
1200	19000
1050	19500
1060	19600
3103	31000
3004	31500
8011	40800
5005	51000A
5050	51000B
6531	64430

ANNEX B

CHARACTERISTICS AND TYPICAL USES OF ALUMINIUM AND ALUMINIUM ALLOYS

Designation	Characteristics	Available Forms	Typical Uses
19000	Commercially pure aluminium. Very ductile in annealed or extruded condition. Excellent resistant to corrosion.	Sheet, plate, extrusion, tube, wire and forgings	Paneling and moulding; refrigeration tubing equipment for chemical, food and brewing industries; packaging; cooking utensils. Sheet metal work, architectural and builder's hardware, spun/pressed hollowware, deep drawn parts, cladding welding wire and electrical appliances.
19600 and 19500	High purity resistant to other grades	Sheet, plate, extrusion, wire, rolled and forging	Corrosion resistant cladding on stronger alloys, impact extruded container; food, chemical brewing and processing equipment, tanks and pipes, marine fittings, reflectors, pressed and anodized utility items, jewelry, cable sheathing, pre-sensitized plates and cable wrap
31000	Stronger and harder than 19000 but has good workability, weldability and corrosion resistance	Sheet, plate, extrusion, wire, tube and forgings	General purpose alloy for moderate strength applications, pressure vessels, irrigation tubing, heat exchangers, utensils and presser cookers, roofing sheets, pilfer proof and detonator caps, air-conditioning ducting fan blades and vehicle paneling.
31500	Strength between 31000 and 52000. It has good formability, weldability corrosion resistance	Sheet and strip	General purpose sheet, roofing and siding, utensils, sheet metal work, vehicle paneling. Pressure vessels and lamp caps.
40800	Strength comparable to alloy 31000 and ductility comparable to alloy 19000. This alloy is fine grained and has excellent drawability	Sheet, strip and plate	Vehicle paneling, fan blades and other applications same as of alloys 19000 and 31000 except those for bright anodizing purposes, utensils hollowware containers, closures and cable wrap.
51000A	Stronger than alloy 31000, and has excellent finishing characteristics. It can be readily shaped by pressing and forming	Sheet, strip and plate	Appliances and utensils, architectural trims, consumer durables with attractive anodized finishes.

51000B	Strength greater than 51000A	Sheet, strip and plate	Architectural applications; high anodizing quality kitchenware and cooking utensils, consumer durables; bathroom fittings, auto rim, air conditioner and TV housing; chemical equipment, marine applications and refrigerator item.
64430	A medium strength alloy with good mechanical properties, Corrosion resistance and weldability.	Sheet, plate, extrusion, tube, wire and forgings	Structural application of all kinds, such as road and rail transport vehicles, bridges, cranes, roof trusses, rivets, etc. Cargo containers, milk containers and flooring.

COMMITTEE DRAFT FOR PUBLIC COMMENT

ANNEX C

TEMPERS DESIGNATION

COMPARISON OF IS TEMPERS WITH ISO TEMPERS

OLD IS TEMPERS	NEW IS TEMPERS	ISO TEMPERS
—	M	M
M	F	F
O	O	O
H	H	H
H1	H X 2	H X B
H2	H X 4	H X D
H3	H X 6	H X F
H4	H X 8	H X H
—	T1	TA
—	T2	TC
WD	T3	TD
W	T4	TB
P	T5	TE
WP	T6	TF
WS	T7	TM
WDP	T8	TH
WPD	T9	TL
—	T10	TG
PD	—	—
WR	—	—

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