



TANZANIA STANDARD

**MEDC 2 (5188) P3, Hot – Dip aluminium – Zinc coated plain,
corrugated and troughed steel sheets – Specification
(Revision TZS 1476:2012)**

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TANZANIA BUREAU OF STANDARDS

Hot – Dip aluminium – Zinc coated plain, corrugated and troughed steel sheets – Specification

0 Foreword

This Tanzania Standard regarding hot – dip aluminium – zinc (AZ) for coated plain, corrugated and troughed steel sheet has been found necessary due to the technological innovations and manufacturing facilities available in the country. Some manufacturers in the country are shifting from using zinc on the steel coating to AZ coating. In order to have a common way of producing and controlling the quality of the plain, corrugated and trough sheet for roofing, cladding and for general purposes, Tanzania Bureau of Standards came up with this Tanzania Standard.

During preparation of this Tanzania Standard, assistance was derived from the following publications:

EAS 410: 2005, *Hot-dip aluminium – Zinc coated plain and corrugated steel sheets Specification*, published by East African Community

BS EN 10215, *Steel sheet and strip – hot – dipped zinc – coated or aluminium/zinc coated*, published by British Standards.

TZS 353: 2001, *Galvanized corrugated sheets – Specification*

1 Scope

This Tanzania Standard specifies the requirements for continuous hot – dip aluminium – Zinc (AZ) coated plain, corrugated and troughed steel sheets ,for roofing, cladding, fabrication and general use.

The aluminium – Zinc alloy composition by mass is normally 55 % aluminium, 1.6 % silicon and balance zinc.

This Tanzania Standard does not cover the special purpose profile.

The product intended for application where the corrosion characteristics of aluminium coupled with those of zinc are most desired.

2 References

For the purpose of this Tanzania Standard the following references shall apply

TZS 1475: 2017, *Sheet wall covering - Aluminium alloy corrugated and troughed sheets*

ISO 2178: 1982, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness – Magnetic method*

ISO 3497: 2000, *Metallic coatings – Measurement of coating thickness – X-ray spectrometric methods*

3 Definitions

For the purpose of this Tanzania Standard, the following definitions shall apply;

3.1 AZ coated sheets

Steel sheets with a uniform coating of aluminium – zinc applied by the hot – dip process.

3.2 Corrugated sheets

AZ coated steel sheets, which are mechanically formed to obtain regular, sinusoidal profiles as shown in the figure 1.

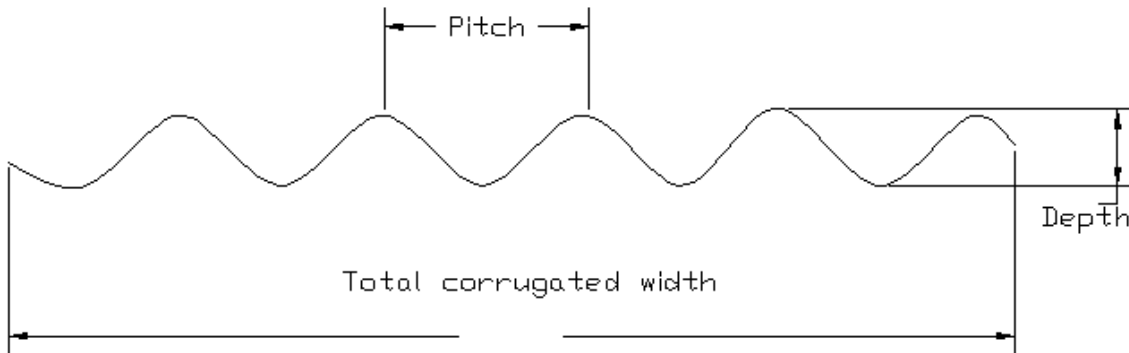


Figure 1 – Profile of corrugated sheets

3.3 Troughed sheets

AZ coated steel sheets, which are mechanically formed to obtain regular, sinusoidal profiles as stipulated in 4.2.3.

3.4 Thickness

a) **Base metal thickness**

The thickness of the sheet steel material without any coatings.

b) **Coating thickness**

The thickness of the steel sheet including any metallic coatings (i.e. zinc or aluminum-zinc alloy) and paint coatings.

3.5 Plain

The flat or even sheets without any relief forms.

3.6 Pitch

The distance between two corresponding and consecutive points on the corrugated and troughed steel sheet along its width.

4 General requirements

4.1 Dimensions

4.1.1 Width and length

The dimensions of width and length shall be expressed in millimetres.

4.1.2 Thickness

The thickness of AZ coated plain, corrugated and troughed sheets shall be expressed in gauge. When measured in accordance with clause 9.2.1, the corresponding thickness of base metal in millimetres shall be as specified in table 1

4.1.3 Width

The width of plain, corrugated AZ coated sheets when measured in accordance with 9.2.4 shall be as specified in table 2.

4.1.4 Length

When the length of sheets measured in accordance with 9.2.2 shall be as specified in table 3.

4.1.5 Squareness

When measured in accordance with 9.2.3 the distance between diagonally opposite corners of the sheet shall not differ by more than 10 mm.

4.2 Profile

4.2.1 Depth

The depth of corrugations shall be $18 \text{ mm} \pm 1.5 \text{ mm}$, when measured in accordance with 9.2.6.

4.2.2 Pitch

The pitch of the corrugations shall be $76 \pm 2 \text{ mm}$ when measured in accordance with 9.2.5.

4.2.3 The profile, pitch, width and depth of troughed sheets shall be as stipulated in TZS 1475 (see clause 2). The length of the troughed sheets shall be as per agreement between the customer and the supplier.

4.3 Tensile Strength

The tensile strength of plain, corrugated and troughed AZ coated sheets when determined in accordance with 9.2.7 shall be not less than 300 N/mm^2 . The yield strength shall be not less than 210 N/mm^2 .

4.4 Resistance to bending

When tested in accordance with 9.2.8 the sheet shall not crack, flatter or splinter.

4.5 Freedom from defects

The sheets shall be uniform, clean and free from defects that would adversely affect their use.

4.6 Finish

Unless otherwise desired by the purchaser, the AZ coated sheets shall have a normal spangle finish as a result of the unrestricted growth of alloy crystals during normal solidification of 'Mill Finish'.

Table 1 – Base metal thickness of plain, corrugated sheets

Gauge	Thickness in mm	Tolerance (\pm % Thickness)
32	0.2	12
30	0.25	10
28	0.32	10
26	0.4	10
24	0.5	10
22	0.63	5
21	0.7	5
20	0.8	5
19	0.9	5
18	1	5
16	1.2	5
14	1.5	5

NOTE 1, The minimum thickness required for making troughed sheets shall be gauge 28 (0.32 \pm 10 %)

NOTE 2, Due to the inter-metallic alloy layer in AZ coated steel sheets, subtract 0.01 mm from the thickness values in this to obtain the base metal thickness

NOTE 3, For roofing sheets, the minimum thickness is 0.25 \pm 10% i.e. 30 gauge

Table 2 – Width of plain and corrugated sheets

All dimensions in millimeters

Width of plain sheets before forming $\pm 5\%$	Number of corrugations	Total corrugated width $\pm 2.5\%$
1220	14	1100
1150	13	1025
1070	12	950
1000	11	875
914	10	800
845	9	725
762	8	645

Table 3 – Length of plain and corrugated sheets

All dimensions in millimeters

Length, mm, + 0.5 %, - 0%	
Plain Sheets	Corrugated Sheets
2 000	2 000
2500	2500
3 000	3 000

5 Aluminium - zinc coating process – Criteria of conformity

5.1 General requirement

The steel sheets shall be manufactured in accordance with cold roll process of mild steel. The sheets shall be true to size, homogeneous, with no trace of discontinuity of the aluminium-zinc coating. They shall also be free from holes, tears, twists, cambers and damaged edges and corners. Corrugations and troughs shall be parallel to the edges of the sheets.

5.2 Aluminium – zinc (AZ) coating

5.2.1 The coating shall be carried out by the hot-dip process in a coating bath containing about 55 % Aluminium, 1.6 % silicon and the balance zinc. The minimum mass of AZ coating on the two sides of sheet and the corresponding thickness of coating on each side shall conform to the minimum mass of coating given in table 4.

5.2.2 The coating mass shall conform to the requirements presented in table 4 for the specified coating designation when tested according to methods specified in 8.1. The coating mass is the total amount of the AZ alloy including both sides of the sheet expressed in grams per square metre (g/m^2). The coating mass is not equally distributed on both the product surfaces. However, it may be assumed that a coating mass of at least 40 % of the value given

in table 4 exists as minimum on each surface of the product.

5.2.3 AZ coating adherence shall be such that there shall be no flaking or splintering in the finished AZ plain or corrugated steel sheets, when tested in accordance with clause 8.2

5.3 Classification

AZ plain and corrugated steel sheets shall be classified into seven classes depending on the mass of AZ coating applied to meet different service and environmental conditions. The classes shall be as specified in table 4.

Table 4 – Classification of AZ coated plain and corrugated steel sheets.

Coating class			Minimum coating thickness on both sides (µm)
	Minimum coating mass on two sides by weight method (g/m ²)	Minimum coating mass on two sides by chemical method (g/m ²)	
AZ 85	85	71	19
AZ 100	100	85	23
AZ 120	120	102	27
AZ 150	150	130	35
AZ 165	165	140	38
AZ 185	185	160	43
AZ 200	200	170	46

Note – Values in column 4 of table 4 are for information only

6 Marking

6.1 Conforming sheets

Each AZ coated plain, corrugated or troughed steel sheet conforming to this Tanzania Standard shall be permanently and indelibly marked with the following:

- (i) Manufacturer's name and/or trade mark

- (ii) The thickness expressed in gauge with the word 'GAUGE' in full.
- (iii) The coating class of the sheet
- (iv) The batch identification.

6.2 Non-conforming sheets

For non-complying sheets with regards to this standards shall be punched four holes of not less than 12 mm. Two holes at a distance of 210 mm from the diagonal centre to the nearest/next ridge across the corrugation and two holes on the valley at a distance of 300 mm from the diagonal centre along the corrugation.

7 Sampling

The following sampling procedure shall be applied in determining whether a lot complies with the relevant requirements of this Tanzania Standard. The samples so taken shall be deemed to represent the lot.

7.1 Sample for inspection and dimensional tests

From the lot, take at random the number of sheets shown in column 2 of table 5 relative to the appropriate grouping in column 1.

7.2 Sample for other tests

From the sample taken in accordance with 7.1 take at random one sheet.

Table 5 – Sampling plan

Number of sheets	Sample for inspection and dimensional test, number of sheets
1-16	1
17-48	2
49-100	3
101-160	4
161-200	5
over 200	5 per 200 sheet

8 Testing for AZ coating

8.1 Mass of AZ coating

8.1.1 Weight method

The steel sheets shall be weighed before AZ coating. They shall then be passed through the AZ coating process and weighed again at the end of the process.

8.1.2 Chemical method

The method prescribed in annex A shall be used. The results, in g/m², shall meet the requirements shown in table 4.

NOTE – Coating mass may also be determined by converting coating thickness, measured with magnetic gauges or by spectrometry, into coating mass (see ISO 2178 and ISO 3497).

In case of a dispute, the method prescribed in annex A of this Tanzania Standard shall be used.

8.2 Coating adherence test

The test shall consist of subjecting the test piece to deformation by bending in one direction. The test piece shall either be bent mechanically or gripped in hand-operated device (mandrels may also be used) and bent until the two legs of the test piece are parallel to each other, i.e. through 180 degrees.

A second test piece shall be bent in the opposite direction.

The sheets shall be bent round a diameter of 38 mm.

9 Inspections and physical test

9.1 Inspection

The sample taken in accordance with clause 7 shall be inspected for compliance with 4.5, and 6.1.

9.2 Dimensions

9.2.1 Thickness

Using a micrometer screw gauge or a pair of calipers, measure to the nearest 0.01 mm the thickness of each sheet in the sample at any point at least 10mm from an edge and end of the sheet after removing the coating as described in A.4 of annex A.

9.2.2 Length

Place each sheet in the sample in turn on a flat rigid surface. Measure to the nearest 1 mm the length of each sheet in the sample along the centre line of the sheet.

9.2.3 Squareness

Place each sheet in the sample in turn on a flat rigid surface. Measure to the nearest 1 mm the distance between the diagonally opposite corners of each sheet in the sample and record to the nearest 1 mm any difference between the two measurements on a sheet.

9.2.4 Width

9.2.4.1 Plain sheets

Place each sheet in the sample in turn on a flat rigid surface. Measure to the nearest 1 mm across the width of the sheet.

9.2.4.2 Corrugated and troughed sheets

Place each of the sheets in the sample in turn on a flat rigid surface and measure to the nearest 1 mm across the width of the sheet. Choose at random a cross-section of the sheet and if, because of the spring nature of the sheet, the underside of the downwards corrugations or troughs are not all in contact with the supporting surfaces, apply sufficient pressure to the upper surfaces of the sheet to bring the lower surface into full contact with the supporting surface. Ensure that the application of pressure causes no deformation of the sheet other than that needed to bring the corrugations into contact with the rigid surface.

Place the width gauge appropriate to the type of sheet being tested across the sheet a chosen cross-section and at right-angles to the sides of the sheets and adjust the gauge to fit firmly over the outermost corrugations. Determine whether the width of the sheet complies with the requirements of 4.2.3 troughed and table 2 for corrugated sheets. Both edges of the corrugated and troughed sheet shall be turned upwards.

9.2.5 Pitch

With the sheet in contact with a flat surface, place a transparent graduated rule on edge across the sheet so that it rests perpendicularly on the crests of two adjoining corrugations or trough far from the points of contact, and read the distance between them to the nearest 1mm. Repeat the process to improve your results and take the average of five readings.

9.2.6 Depth of corrugations and troughed

With the initial rule lying flat across the corrugations or trough at the edge of the sheet, use another graduated rule or a pair of calipers to measure the perpendicular distance between the initial rule and the rigid support.

9.2.7 Tensile strength

From the sample taken in clause 7 prepare a tensile test specimen as described in annex A by cutting a strip of 30 mm x 80 mm, such that the length of the specimen is transverse to the direction of rolling of the sheet. The portion of sheet from which the test piece is cut shall be carefully flattened. Determine the tensile strength of the specimen as described annex A.

If the tensile strength of the test specimen fails the requirements of clause 4.3 prepare two further test specimens and determine their tensile strength. If both specimens comply with the requirements, discard the results of the first specimen, but if either of the additional specimen fails to meet the requirements, deem the sheet and the lot to be defective.

9.2.8 Bend test and coating adherence test

A test specimen selected in accordance with clause 7 and shall be prepared measuring 10 mm wide and 120 mm long. It shall be cut with its length transverse to the direction of rolling of the sheet.

Carefully bend the strip round a drum of diameter 38 mm (mandrels may also be used) until the edges of the specimen are approximately semi-circular. If the specimen flakes or cracks,

prepare and test two further specimens in the same way. If both these tests specimen comply with the requirements of 4.4 and 4.5, discard the results obtained on the first specimen, but if either of the two, crack at the bend, deem the sheet and lot to be defective.

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Annex A

Reference method for determination of the AZ coating mass

A.1 Principle

Using a specimen with a surface area of at least 5000 mm², the loss of mass in grams when the coating is dissolved, multiplied by 200, will represent the coating mass in grams per square meter of the product, (for both sides).

NOTE – To verify the mass of coating, three specimens shall be cut and tested, one from the mid-width position and one from each side, no closer than 25 mm from the side edge of a sample piece approximately 300 mm in length on the as coated width (see clauses 8.1.2.1 and 8.1.1.2)

A.2 Reagent and preparation of the solution

A.2.1 Reagent

Hydrochloric acid (HCl = 1.19 g/cm³).

Hexamethylenetetramine or Antimony tri-chloride

A.2.2 Preparation of the solution

The Hydrochloric acid is diluted with water (de-ionized or distilled) in the ratio of one part conc. HCl to one part water (50 % dilution).

Hexamethylenetetramine or Antimony tri-chloride is then added, stirring, 3.5 g per litre of dilute Hydrochloric acid solution.

This prepared solution permits the execution of numerous successive dissolutions under satisfactory conditions of attack of the coating, both from the point of view of speed and accuracy.

A.3 Apparatus

A balance capable of weighing samples to an accuracy of 0.01 g. For the test, use a takeoff device.

A.4 Procedure

The following operations are applied to each sample:

- a) If necessary, degrease the sample with an organic solvent, which will not attack the coating, then dry the sample;
- b) Weigh the sample to an accuracy of 0.01 g; (W_i)
- c) Place the sample in the hydrochloric acid solution with Hexamethylenetetramine or Antimony Chloride inhibitor at ambient temperature (20 °C to 25 °C).

Leave the sample immersed in the solution until release of hydrogen ceases or only a

few bubbles are released;

d) After the attack, wash the sample and brush under running water, dry with a cloth and then by heating to around 100 °C and cool or dry by blowing with warm air;

e) Weigh the sample again to an accuracy of 0.01 g; (W_2)

f) Determine the difference between the mass of the coated sample and that of the sample without its coating. This difference, calculated in grams, represents the mass (m) of the coating.

A.5 Calculation

The coating weight shall be obtained from the following formula. Method 1 shall be the reference method in-case of a dispute:

$$C = \left[\frac{w_1 - w_2}{A} \right] \times K \dots\dots\dots \text{Method 1}$$

$$C = \left[\frac{w_1 - w_2}{w_1} \right] \times \rho \times t \dots\dots\dots \text{Method 2}$$

- Where C = weight of test specimen (g/m^2)
- A = area of test specimen (length x Width)
- w_1 = piece before stripping, Weight (g) of test after stripping
- w_2 = weight of base metal
- t = thickness (mm) of test piece after stripping (base metal)
- K = 106 conversion factor (w is in g, t in mm, while C is in g/m^2)
- ρ = 7850 kg/m^3 density of steel

NOTE – Method 1 can be used for regular pieces of specimen (either square or rectangular). In cases where it's difficult to cut regular test pieces, e.g the heavier sheet gauges, method 2 may be used.

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