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Hot-dip aluminium-zinc coated plain and corrugated steel sheets — Specification

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This Draft Uganda Standard, DUS EAS 410:2020, *Hot-dip aluminium-zinc coated plain and corrugated steel sheets — Specification*, is identical with and has been reproduced from a Draft East African Standard, DEAS 410:2020, *Hot-dip aluminium-zinc coated plain and corrugated steel sheets — Specification*, and is being proposed for adoption as a Uganda Standard.

The committee responsible for this document is Technical Committee UNBS/TC 4, *Mechanical engineering and metallurgy*.

Wherever the words, "East African Standard" appear, they should be replaced by "Uganda Standard."



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DRAFT EAST AFRICAN STANDARD

**Hot-dip aluminium-zinc coated plain and corrugated steel sheets
Specification**

EAST AFRICAN COMMUNITY

Foreword

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Hot-dip aluminium-zinc coated plain and corrugated steel sheets

Specification

1 Scope

This Draft East African Standard specifies requirements, sampling and test methods for continuous hot-dip Aluminium-Zinc (AZ) coated plain and corrugated steel sheets for roofing, cladding, fencing, fabrication and general use.

This standard does not cover the special purpose profiles.

The Aluminium-Zinc alloy composition by mass is nominally 55% Aluminium, 1.6% Silicon and balance Zinc.

The product is intended for applications where the corrosion characteristics of Aluminium coupled with those of Zinc are most desired.

2 Definitions

For the purpose of this standard, the following definitions shall apply:

2.1

AZ Coated Sheets

Steel sheets with a uniform coating of Aluminium-zinc applied by the hot-dip process.

2.2.1

Corrugated Sheets

AZ coated steel sheets, which are mechanically profiled to obtain a regular shape which can either be sinusoidal as shown in Figure 1, or any other profile.

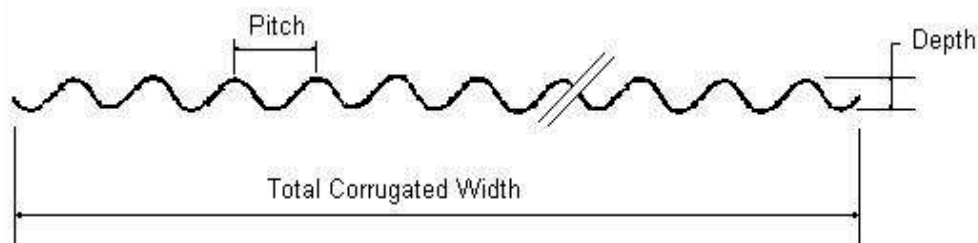


Figure 1 — Profile of corrugated sheets

2.4

Thickness

The thickness of base metal

2.4

Plain

The flat or even sheets without any relief forms

2.5

Pitch

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

2.6 Coating mass

This is the total amount of the AZ alloy including both sides of the sheet expressed in grams per square metre (g/m²)

3 General requirements

3.1 Dimensions

3.1.1 Expression of dimensions

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

3.1.1.2 Thickness — The thickness of AZ coated plain and corrugated sheets shall be expressed in gauge*. When measured in accordance with clause 8.2.1, the corresponding thickness of base metal in millimetres shall be as specified in Table 1

3.1.2 Width — The width of plain and corrugated AZ coated sheets when measured in accordance with 8.2.4 shall be as specified in Table 2.

3.1.3 Length — when measured in accordance with 8.2.2 the length of sheets shall be as specified in Table 3.

3.1.4 Squareness — when measured in accordance with 8.2.3 the distance between diagonally opposite corners of the sheet shall not differ by more than 10 mm.

3.2 Profile

3.2.1 Depth — The depth of corrugations shall be 18 ± 1.5 mm, when measured in accordance with 8.2.6.

3.2.2 Pitch — The pitch of the corrugations shall be 76 ± 2 mm when measured in accordance with 8.2.5.

3.3 Tensile Strength — The tensile strength of plain and corrugated AZ coated sheets when determined in accordance with 8.2.7 shall be not less than 300 N/mm^2 . The yield strength shall be not less than 210 N/mm^2 .

3.4 Resistance to Bending — When tested in accordance with 8.2.8 the sheet shall not crack, flatter or splinter.

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

3.6 Finish — Unless other wise 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'.

3.7 Coating adherence — The sheet shall not show any cracks when tested in accordance to 8.2.8

* Reference gauge in this standard is the BS American Brown and Shaper's gauge.

Table 1 — Base metal thickness of plain and corrugated sheets

GAUGE	THICKNESS (mm)	TOLERANCE (±%)
32	0.20	10
30	0.25	10
28	0.32	10
26	0.40	10
24	0.50	10
22	0.63	5
21	0.70	5
20	0.80	5
19	0.90	5
18	1.00	5
16	1.20	5
14	1.50	5

NOTE:
 1. Due to the inter-metallic alloy layer in AZ coated steel sheets, subtract 0.01mm from the thickness values in this table to obtain the base metal thickness.
 2. 32 Gauge Sheets to be marked NOT FOR ROOFING.

Table 2 — Width of plain and corrugated sheets

Width of plain sheets before corrugation(mm), ± 2.5%	Number of corrugations	Total corrugated width (mm) ± 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

LENGTH, mm, + 0.5 %, - 0 %	
Plain Sheets	Corrugated Sheets
2 000	2 000
2 500	2 500
3 000	3 000

Note: Other lengths may be used for special order only as agreed between the purchaser and the manufacturer.

4 Aluminium-zinc coating process -criteria of conformity

4.1 General Requirement

The steel sheets shall be manufactured in accordance with accepted current practice and shall be from rolled mild steel processed to meet the requirements of ISO 2566 or equivalent. 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 shall be parallel to the edges of the sheets.

4.2 Aluminium-Zinc (AZ) Coating

4.2.1 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.

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4.2.2 The coating mass shall conform to the requirements presented in table 4 for the specified coating designation when tested according to methods specified in 7.1.

4.2.3 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 7.2

4.3 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 mass on two sides by weight method (g/m ²)	Minimum coating mass on two sides by chemical method (g/m ²)	Minimum coating thickness on both sides (µm)
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

5 MARKING AND PACKAGING

5.1 Conforming Sheets

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

- Manufacturer's name and/or trade mark..
- The base metal thickness expressed in gauge with word "GAUGE" in full and millimetre.
- The coating class of sheet
- The batch identification.
- Gauge 32 sheets, should be clearly marked "not for roofing" font size 12 mm width in every 1m along the length.

5.2 Non-Conforming Sheets — All non-complying sheets shall be identified by cutting off all four corners at least by 75 mm along the edges diagonally and shall be marked "Rejected" with indelible ink.

5.3 Packaging

Where sheets and coils are packed, each package shall be legibly and indelibly marked with the following information:

- manufacturer's name and/or trade name;
- classified symbol (including shape symbol for profiled sheets);
- symbol indicating coating mass;
- dimensions; and number of sheets or mass where applicable.

6 Sampling

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

6.1 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.

6.2 Sample for other Tests — From the sample taken in accordance with 6.1 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

7 Testing for AZ coating

7.1 Mass of AZ Coating

7.1.1

7.1.2 Chemical method — The method prescribed in Annex A shall be used. The results, in g/m², shall meet the requirements shown in Table 4.

In case of a dispute, the method prescribed in Annex A of this standard shall be used.

NOTE Coating mass may also be determined by converting coating thickness, measured with magnetic gauges or by spectrometry, into coating mass. (See ISO 2178¹ and ISO 3497²)

7.2 Coating adherence test

8 Inspections and testing

8.1 Inspection — The sample taken in accordance with clause 6 shall be inspected for compliance with 3.5, and 5.1.

8.2 Dimensions.

8.2.1 Thickness — Using a micrometer screw gauge or a pair of callipers, 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.

8.2.2 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.

8.2.3 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 mm any difference between the two measurements on a sheet.

¹ ISO 2178:1982, Non magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method

² ISO 3497:2000, Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods

8.2.4 Width

8.2.4.1 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.

8.2.4.2 Corrugated 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 springy 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 rigid-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 Table 2. Both edges of the corrugated sheet shall be turned upwards.

8.2.5 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 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.

8.2.6 Depth of Corrugations

With the initial rule lying flat across the corrugations 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.

8.2.7 Tensile strength

From the sample taken in Clause 6, prepare a tensile test specimen as described in A.4 of Annex A by cutting a strip of 30mm x 80mm, 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 3.3 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.

8.2.8 Bend test and coating adherence test

A test specimen selected in accordance with clause 6 and shall be prepared measuring 10mm wide and length 120mm. 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 38mm (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 3.4 and 3.5, 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.

The test shall consist of subjecting the test piece of 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 38mm

Annex A — Reference method for determination of the AZ coating mass (Normative)

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 25mm from the side edge of a sample piece approximately 300mm in length on the as coated width (see clauses 7.1.2.1 and 7.1.1.2).

A.2 Reagent and preparation of the solution

Reagent

Hydrochloric acid (HCl = 1.19 g/cm³)

Hexamethylenetetramine or Antimony tri-chloride

Preparation of the solution

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

Hexamethylenetetramine or Antimony tri-chloride is then added, stirring, 3.5g 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 0.01g. For the test, use a take-off 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 0.01g; (W₁)
- 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 the 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 0.01g; (W₂)
- 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 formulae. Method 1 shall be the reference method in case of a dispute:

$$\text{Method 1} \quad C = \frac{(W_1 - W_2)}{A} \times 10^6$$

$$C = \frac{(W_1 - W_2)}{5000 \text{ mm}^2} \times 10^6 = 200(W - W) \text{ g / m}^2$$

$$\text{Method 2} \quad C_2 = \frac{(W_1 - W_2)}{W_2} \times t \times 7850$$

Where

C = Zinc coating in g/m²

A = area of test specimen (length x width),

W₁ = Weight (g) of test piece before stripping,

W₂ = Weight (g) of test after stripping (base metal)

t = thickness (mm) of test piece after stripping (base metal)

10⁶ = conversion factor (W is in g, t in mm, while C is in g/m²)

7850 = density of steel, kg/m³

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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