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DRAFT EAST AFRICAN STANDARD

Metal roofing tiles — Specification

EAST AFRICAN COMMUNITY

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Copyright notice

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 035, *Steel and steel products*

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

Metal roofing tiles — Specification

1 Scope

This Working Draft East African Standard specifies requirements, sampling, inspection and test methods for granulated metal roofing tiles, coated or uncoated, supplied in the form of carbon steel sheets or aluminium alloy sheets (each comprising a series of simulated tile units) and for trim sections designed for use in conjunction with tile units of the same material and of appropriate profile.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3575, *Continuous hot-dip zinc-coated carbon steel sheet of commercial and drawing qualities.*

ISO 4998, *Continuous hot-dip zinc-coated carbon steel sheet of structural quality.*

ISO 7253, *Paints and varnishes – Determination of resistance to neutral salt spray (fog).*

ISO 9227, *Corrosion tests in artificial atmospheres – Salt spray tests*.

ISO 9364, *Continuous hot-dip aluminium/zinc-coated steel sheet of commercial, drawing and structural qualities*.

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance and requirements*

ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 4892-4, *Plastics — Methods of exposure to laboratory light sources — Part 4: Open-flame carbon-arc lamps*

ISO 6361-2, *Wrought aluminium and aluminium alloys — Sheets, strips and plates — Part 2: Mechanical properties*

ISO 6361-5, *Wrought aluminium and aluminium alloys — Sheets, strips and plates — Part 5: Chemical composition*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org

3.1
acceptable
agreed upon to the parties concluding the purchase contract, but in relation to the requirements given by this standard.

3.2
defective
a tile unit or a trim section that fails in one or more respects to comply with the relevant requirements of the specification

3.3
lot
not less than 10 and not more than 500 units, of the same type, material, dimensions, and profile, uncoated or having the same coating, and bearing the same batch identification, from one manufacturer, submitted at any one time for inspection and testing

3.4
tile
a sheet comprising a series of simulated tile units

3.5
Unit
a full tile unit, a half tile unit, a hipping capping, a ridge capping, a sidewall flashing, or a gable trim section

3.6
base metal thickness (BMT)
a thickness of the steel substrate prior to any metallic coating, resin coating and paint film being added to the substrate.

3.7
granulated metal roofing tiles
metal roofing tiles with granules as a main finish coating, such granules may be from natural rocks, sand or other appropriate materials.

4 Requirements

4.1 Materials

Tile and trim section units shall be of the type and material and coated or uncoated, as specified by the purchaser.

4.1.1 Carbon steel sheet
Carbon steel sheets shall have a minimum base metal thickness of 0.35 mm.

4.1.2 Aluminium alloy sheets
The sheets shall comply with the requirements for chemical composition according to ISO 6361-5, mechanical properties according to ISO 6361-2, and shall have a nominal thickness of at least 0.60 mm.

4.1.3 Metallic coatings
For carbon steel sheets, the hot-dip zinc coating shall comply with the requirements for class Z 275 coatings as in ISO 4998 (see clause 2) or ISO 3575 (see clause 2), the hot-dip aluminium/zinc coating shall comply

with the minimum requirements for class AZ 150 coatings as in ISO 9364 (see clause 2) and the hot-dip zinc-aluminium-magnesium coating shall comply with the minimum requirements for class ZM100 coatings as specified in ISO 8353.

4.1.4 Granules
Granules shall have a colour and shall have an acceptable degree of resistance to weathering according to 4.9 when tested in accordance to 7.10.

4.2 Dimensions

The dimensions of a tile or trim section unit, determined in accordance with 7.3 shall be as follows:

a) The thickness shall be at least equal to be minimum given in 4.1.1 or 4.1.2, as relevant.
b) The actual length (see figure 1) shall not differ by more than ± 30 mm from the nominal value stated by the manufacturer, and the effective length (see figure 1) shall not differ by more than ± 3 mm from the nominal value stated by the manufacturer. The downturn (see figure 1) shall be at least 15 mm; and

The effective width of a tile unit (see figure 1) shall not differ by more than ± 3 mm from the nominal value stated by the manufacturer. The nose (see figure 1) shall not differ by more than ± 3 mm from the value stated by the manufacturer.

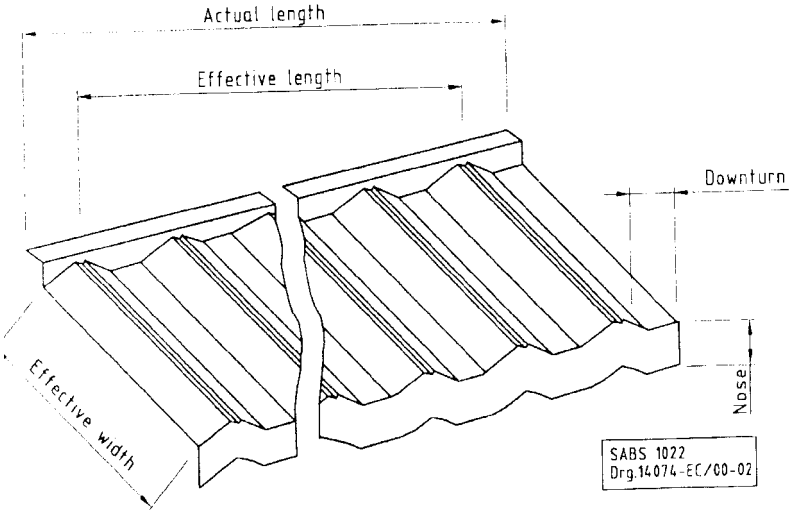

Figure 1 — Typical view of a metal roof tile

4.3 Hail resistance (all tiles)

After having been tested in accordance with 7.4 a tile unit shall be acceptably free from visible defects.

4.4 Profile strength (all tiles)

After having been tested in accordance with 7.5 a tile unit shall show no visible sign of permanent deflection.

4.5 Impact resistance (coated tiles)

After a coated tile unit has been tested in accordance with 7.6 the coating shall show no visible signs of loss of adhesion

4.6 Flexibility of coatings (coated units)

After having been tested in accordance with 7.7 a coated unit shall show no sign of flaking or loss of adhesion of the coating

4.7 Cold water resistance (coated units)

After a specimen cut from a coated unit has been immersed in water in accordance with 7.8, the coating on the part of the specimen that was immersed shall not

a) immediately after removal from the water, be wrinkled or blistered;
b) after a 2 h recovery period, be more than slightly affected; and
c) after a 24 h recovery period, show any whitening or differ more than very slightly in appearance from the coating on the part that was not immersed.

4.8 Salt fog resistance (coated tiles)

After having been tested in accordance with 7.9, a tile unit shall be free from rust, blistering discoloration, and loss of adhesion.

4.9 Accelerated weathering resistance (coated tiles)

After having been tested in accordance with 7.10, a tile unit shall be free from surface defects such as rust, blistering, loss of adhesion, chalking of the coating and discoloration.

4.10 Workmanship

The surfaces of a tile unit or trim section unit shall be free from defects that detract from the unit's serviceability or appearance or both.

5 Marking

Each unit shall be legibly marked with the following information:

a) The manufacturer's name or trade name or trade mark;
b) The date of manufacture;
c) The batch identification; and
d) The width and thickness of the base metal.

6 Sampling and compliance with the specification

6.1 Sampling

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

From the lot draw at random the number of units given in column 2 of table 1 relative to the appropriate lot size given in column 1.

Table 1: Sampling

1	2
Lot size, units	**Sample size, units**
10 – 50	3
51 – 90	5
91 – 150	8
151 – 280	13
281 – 500	20

6.2 Compliance with the specification

The lot shall be deemed to comply with the requirements of the specification if after inspection and testing of the sample taken in accordance with 6.1 no defective is found

7 Inspection and test methods

7.1 Inspection

Inspect each tile unit or trim section unit in the sample taken in accordance with 6.1 for compliance with the requirements of section 4 and 5.

7.2 Sequence of testing and test specimens

Submit the tile unit or trim section units in the sample taken in accordance with 6.1 to the applicable tests given in 7.3 – 7.10 in the order in which they are given. Use the same three units in the relevant tests given in 7.3 – 7.10 (inclusive).

7.3 Dimensions

7.3.1 *Length*

a) Tile units. Place each sample unit (in turn) on a flat, rigid surface, with the coated side uppermost and the front edge of the tile overhanging the supporting surface by not more than 10 mm.

   If, because of the spring of the tile, the undersides of the troughs are not all in contact with supporting surface, apply sufficient pressure to the upper surface of the tile to bring the undersides of the troughs into full contact with the supporting surface. Ensure that the application of pressure causes no deformation of the tile other than the minimum needed to bring the corrugations into contact with the rigid surface.

   Using a rule (or other suitable means) take measurements, to the nearest 1 mm, of the length of each tile at three positions (i.e. along the front and back edges and along the longitudinal center-line of the tile), and record the average of the three measurements as the length of the tile.

b) Trim section units: Record as the length of each trim section unit, the average of three measurements taken, to the nearest 1 mm, at three suitable positions on the unit.

7.3.2 *Width*

Using a rule (or other suitable means) measure, to the nearest 1 mm, the transverse distance between the upturned and down turned faces of each tile unit in the sample drawn in accordance with 7.1. Take the measurements at three positions on the underside of the tile unit (one at each end and one along the transverse center-line of the tile) and record the average of the three measurements as the width of the tile unit.

7.3.3 *Thickness*

Over an area of approximately 50 mm2 at each of three positions on each sample unit (one at each end and one in the center) that are at least 20 mm from an end or edge of the unit, carefully remove, by any acceptable means, the finish coatings other than, when relevant, the galvanized coatings.

Then, using a micrometer caliper, measure to the nearest 0.01 mm the thickness of each unit at the three prepared areas, and record the average of the three measurements as the thickness of the unit.

7.4 Hail resistance

7.4.1 Apparatus

A suitable gun that so fires (vertically downwards) a spherical ice missile) that the kinetic energy at impact of the missile with a test specimen (supported horizontally below the gun) is 10 ± 2 J

7.4.2 Test specimens

Use three tile units taken (when relevant, at random) from the sample (see 6.1). Secure each tile unit in the recommended manner to two battens of nominal width 38 mm, and of thicknesses such that the troughs in the coated surface are horizontal.

7.4.3 Procedure

Position a test specimen (with the battens on a solid, non-resilient, horizontal base, e.g. a concrete floor) so that impact will be made on the center of the crest of a ridge in the tile unit at a point approximately 40 mm away from the nearer batten, and fire the gun. After repeating the test on three other (similar) points on the tile unit, inspect the coated surface (from a distance of about 2m) for unacceptable defects. Test the remaining two test specimens in the same way. Reserve the test specimens for the applicable tests given in 7.5 – 7.10 (inclusive).

7.5 Profile strength

7.5.1 Apparatus

Two parallel horizontal bearers positioned at 1 m centers, and means for applying, through a bearing pad of size 225 mm x 90 mm. A force of 800 N at a point midway between the bearers.

7.5.2 Test specimens (see 7.4.2)

7.5.3 Procedure

Position a test specimen on, and at right angles to, the bearers so that the force will be applied to the centers of two crests of ridges on the tile unit, at a point midway between supporting battens. Centre the bearing pad on this point, with the 22 mm edges spanning two ridges, and apply, for a period of about 15 s, a force of 800 N, taking care to apply the load centrally and without shock. After removing the force, inspect (from a distance of approximately 2m) the tile unit for visible signs of permanent deflection. Conduct the test on the other two specimens in a similar way.

7.6 Impact resistance

7.6.1 *Apparatus*

7.6.1.1 *Mass-piece*
A cylindrical steel mass-piece of 900 g and of approximate length and diameter of 25 mm, having a hardened steel ball of diameter 12.7 mm mounted at its bottom end.

7.6.1.2 *Tube*
A slotted or split vertical tube graduated in millimetres, of length approximately 1.5 m and wide enough to enable the mass-piece to drop freely through it on the test panel on the base plate.

7.6.1.3 *Base plate*
A steel plate with a hole of diameter 16 mm. The plate and the tube are so assembled that the hole in the plate is concentric with and directly below the opening of the tube.

7.6.2 *Test specimen*

From each sample unit, so cut a test specimen of size 150 mm x 70 mm that the adhesion between the substrate and the coating is not impaired

7.6.3 *Procedure*

Place the test specimen, coated side up, flat on the base plate. Lift the mass-piece to a height of 640 mm (to give an impact of 5.65 J) and drop it onto the specimen. Examine the coating for visible signs of cracking of loss of adhesion.

7.7 Flexibility of coatings

7.7.1 *Apparatus*

A cylindrical mandrel of nominal diameter 25 mm, rigidly supported (at convenient height) in a horizontal position

7.7.2 *Test specimen*

From each tile specimen or from each of three trim section units (as relevant) so cut a test specimen of suitable size that the adhesion between the substrate and the coating is not disturbed.

7.7.3 *Procedure*

With the coated side outwards, rapidly bend the test specimen round the mandrel through 180° (taking about 1 s for the operation), and then examine the coating for signs of flaking or loss of adhesion (or both).

7.8 Cold water resistance

7.8.1 *Test specimen (As in 7.7.2)*

7.8.2 *Procedure*

Immerse the test specimen for 18 h in distilled water (maintained at 25 ± 2°C) so that two-thirds of the specimen is submerged. Inspect the specimen immediately after removal from the water, and again 2 h and 24 h after removal, for compliance with the requirements of 4.7.

7.9 Salt fog resistance

7.9.1 *Apparatus*
7.9.1.1 *Fog cabinet*
A fog cabinet shall have the following features;

a) Exposure chamber, the chamber shall be made from, or coated with a corrosion resistant material, and shall be so constructed that the spray circulates freely and equally about all test panels;

b) Racks for supporting the test panels the racks shall be made from, or coated with a corrosion resistant material and shall be so constructed that the test panels are held at an angle of 15° from the vertical, without touching each other or any other metal and without any salt solution dripping from one panel to another;

c) Salt solution reservoir, the reservoir shall be of adequate size and shall be made from, or coated with a corrosion resistant material. It shall be so constructed that no condensation products of the spray can drip into the reservoir;

d) Atomizing nozzles, the nozzles shall be made from a suitable plastic and shall be so designed that they will produce a finely divided salt solution spray. The apparatus shall be fitted with baffles to prevent the salt fog striking the test panels directly;

e) Air supply, the compressed air entering the atomizers shall be filtered to remove all impurities. Means shall be provided to humidify and heat the compressed air as required. The air pressure shall be constant to within ± 700 Pa and sufficient to provide a finely divided salt solution fog;

f) Heating of chamber and temperature control, the exposure chamber shall be suitably heated and its temperature controlled by means of a thermostat. The use of an immersion heater is not permitted.

7.9.2 Test specimen
A test specimen, of size at least 70 mm x 150 mm cut from each tile unit used in 7.6, and having suitable holes for suspending them from the racks. Test specimens that have already been used for tests involving corrosion of the panel shall not be re-used.

7.9.3 Test conditions in the exposure chamber
7.9.3.1 The temperature in the exposure chamber shall be maintained at 33 °C to 36 °C.
7.9.3.2 The degree of atomization shall be such that suitable fog collectors placed at any point in the exposure zone will collect, over an average running period of at least 16 h, from 0.5 mL to 3 mL of solution per hour for each 80 cm_2 of horizontal collecting area. The solution so collected shall have a pH value of 6.5 – 7.2 when measured electrometrically.

7.9.4 Procedure
7.9.4.1 Bring the exposure chamber to the test conditions. Mount the test specimens, by means of glass or plastic hooks, on the supporting racks according to 6.9.1.1 b) and insert the racks in the exposure chamber.

7.9.4.2 Close the exposure chamber and operate the cabinet continuously for a period of 1 000 h, using the test specimen in 6.9.1.2, ensuring that the impact point is within the borders of the test specimen. Then examine the coating on each specimen for defects (see 4.8).

7.10 Accelerated weathering resistance

Using the apparatus and procedure given in ISO 4892 (Part 1-4), weather, for a period of 2000 h, the same test specimens as used in 7.9. Then examine the coating on each specimen for defects (see 4.9).

Annex A

(Informative)

Notes to purchasers

A.1 Tender requirements

The following requirements must be specified in tender invitations and in each order or contract:

a) The type of unit;
b) The material (i.e. galvanized steel or aluminium alloy); and
c) Whether the units are to be coated or uncoated (see 4.1).

A.2 Precautions

The following precautions are to be taken at points of contact between aluminium alloy units and other building materials:

a) Cement concrete, mortars, and plasters. Units should be insulated from contact with these materials by painting the contact surfaces with two coats of bituminous aluminium paint or zinc chromate or barium chromate primer.

b) Masonry. Where practicable, untis should not be in contact with masonry because of the danger that corrosion may occur, particularly if the masonry contains chlorides or acid or alkaline compounds. If contact with masonry is unavoidable, the contact surfaces should be painted with two coats of bituminous aluminium paint or zinc chromate or barium chromate primer.

c) Timber. The use of timber that has been preservative-treated with a copper or mercury compound in contact with aluminium alloy units, is not recommended. Timber preservatives that are more compatible with aluminium (e.g. creosote or pentachlorophenol) should be used in preference, and the timber surfaces in contact with the units, should, in any case, be sealed with a bituminous aluminium or zinc chromate or barium chromate coating.

d) Steelwork. All steel surfaces in contact with the aluminium alloy units should be painted with a bituminous aluminium, zinc chromate, or other paint that does not contain lead. In severe atmospheric conditions (e.g. in marine or industrial environments) it is advisable to provide additional insulation in the form of chromate-impregnated or plastic tape or sheeting applied to the painted surface of the steelwork before the aluminium alloy units are fixed.

e) Lead. The use of lead washers, flashings, etc. in contact with aluminium alloy units is not recommended. Separate the contact surfaces with bituminous aluminium paint or other insulating material.

f) The use of lead-based paints on the units or on materials in contact with it should be avoided.

g) Zinc. Aluminium is not corroded by contact with zinc, but in severe atmospheric conditions the zinc may suffer attack. Contact surfaces between the units and zinc should be separated by a coating of a bituminous aluminium or of a zinc chromate or barium chromate primer.

h) Copper and copper alloys. Copper fastenings should under no circumstances be used to fix aluminium alloy units.

Contact between copper and aluminium results, in the presence of moisture, in very rapid corrosion of the aluminium. Even water running off copper should not be allowed to fall on or run over aluminium. Bare copper wire should not be suspended over aluminium roofing, and copper lightning conductors should not be erected on or over aluminium alloy roofs. Both finials and conductors should be of aluminium or an aluminium alloy. When they are clear of aluminium alloy units, the aluminium conductors may be connected to the final part of the earthing conductor, which may be of copper, provided that the joint is completely sealed by suitable means against the entry of moisture.

A.3 Earthing

Earthing of aluminium roofs is best achieved by bolting flat aluminium conductors to the underside of the eaves, the final earth connection being made as described in A.2 (g).

A.4 Coastal areas

Before using metal roofing tiles in coastal areas, it is recommended that the advice of the manufacturer be obtained on the suitability of using his tiles in such areas.

Bibliography

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[2] TZS 948:2022, *Metal roofing tiles — Specification*

[3] KS 2025:2006, *Metal roofing tiles — Specification*

[4] TZS 967:2007, *Metal roofing tiles — Test method — Resistance to laboratory artificial weathering of paint films*

[5] TZS 968:2007, *Metal roofing tiles — Test method — Resistance to salt fog of paint*