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DRAFT TANZANIA STANDARD

Metal roofing tiles — Specification

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Tanzania Bureau of Standards
P O Box 9524
Dar es Salaam
Phone: 022 2450206/2450949/2450298
Fax: 022 2450959
Email: info@tbs.go.tz

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0 Foreword

Metal roofing tiles are the products that are used for the roofing construction. Currently these products are available at different levels of quality and performance. Therefore, in order to meet performance and quality that required for ensuring the public safety, health and welfare in private, commercial and industrial buildings the draft standard has been prepared.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a measurement or test shall be rounded off in accordance with TZS 4, *Rounding off numerical values*.

This second edition cancels and replaces the first edition (TZS 948: 2007) which is technically revised

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

> SABS 1022:2013, published by the South African Bureau of Standards *Metal roofing tiles — Specification*.
>
> SANS 5146:2005, *Paints and vanishes — Resistance to impact of paint film*, published by the South African Bureau of Standards.

1 Scope

This specification covers requirements for 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 (of the same materials) designed for use in conjunction with tile units of the same material and of appropriate profile.

2. Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below.

ASTM G 153, *Standard practice for operating enclosed carbon arc light apparatus for exposure of non-metallic materials*.

SANS 903, *Aluminium alloy corrugated and troughed sheets*.

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.*

SANS 5146, *Paints and varnishes – Resistance to impact of paint films*.

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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*.

3. Definitions

For the purposes of this Tanzania Standard, the following definitions shall apply:

3.1 Acceptable

Acceptable to the parties concluding the purchase contract, but in relation to the requirements given by this Tanzania 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 Materials

3.7 Carbon steel sheet

Carbon steel sheets shall have a minimum base metal thickness of 0.36 mm (26G).

3.8 Aluminium alloy sheets

The sheets shall comply with the requirements for chemical composition, tensile strength, and resistance to bending of TZS 956 (see clause 2), and shall have a nominal thickness of at least 0.60 mm.

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3.9 Coatings

A coating shall be of an acceptable colour and shall have an acceptable degree of resistance to weathering.

For carbon steel sheets, the hot-dip zinc coating shall comply with the requirements for class Z 275 coatings as in TZS 1061-ISO 4998 (see clause 2) or TZS 1059-ISO 3575 (see clause 2) and the hot-dip aluminium/zinc coating shall comply with the minimum requirements for class AZ 150 coatings as in TZS 1060-ISO 9364 (see clause 2).

4 Requirements

4.7 General

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

4.8 Dimensions

The dimensions of a tile or trim section unit, determined in accordance with 8.3 shall be as follows:

a) The thickness shall be at least equal to be minimum given in 4.1 or 4.2, 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

c) 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.

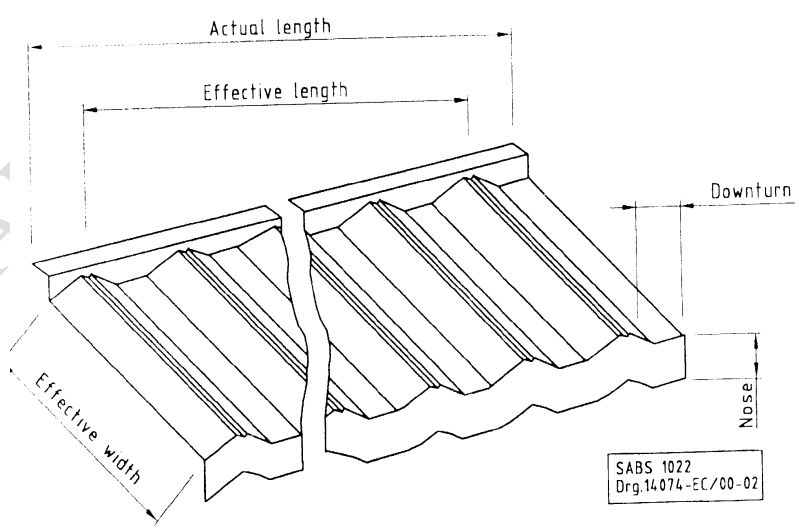

Figure 1 — Typical view of a metal roof tile

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4.9 Hail resistance (all tiles)

After having been tested in accordance with 8.4 a tile unit shall be acceptably free from visible defects.

4.10 Profile strength (all tiles)

After having been tested in accordance with 8.5 a tile unit shall show no visible sign of permanent deflection.

4.11 Impact resistance (coated tiles)

After a coated tile unit has been tested in accordance with 8.6 the coating shall show no visible signs of loss of adhesion

4.12 Flexibility of coatings (coated units)

After having been tested in accordance with 8.7 a coated unit shall show no sign of flaking or loss of adhesion of the coating

4.13 Cold water resistance (coated units)

After a specimen cut from a coated unit has been immersed in water in accordance with 8.8, 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.

4.14 Salt fog resistance (coated tiles)

After having been tested in accordance with 8.9, a tile unit shall be free from rust, blistering discoloration, and loss of adhesion.

4.15 Accelerated weathering resistance (coated tiles)

After having been tested in accordance with 8.10, a tile unit shall be free from surface defects such as rust, blistering, loss of adhesion, chalking of the coating and discoloration.

4.16 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.

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6 Sampling and compliance with the specification [1)]

7.1 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

7.2 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 7.1 no defective is found

8 Inspection and methods of test

8.1 Inspection

Inspect each tile unit or trim section unit in the sample taken in accordance with 7.1 for compliance with the requirements of 5.10 and section 6.

8.2 Sequence of testing and test specimens

Submit the tile unit or trim section units in the sample taken in accordance with 7.1 to the applicable tests given in 8.3 – 8.10 in the order in which they are given. Use the same three units in the relevant tests given in 8.3 – 8.10 (inclusive).

8.3 Dimensions

8.3.1 *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.

[1] This section applies to the sampling for inspection and testing before acceptance or rejection of single lots(consignments) in cases where no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of the lot. It is also used as the procedure for adjudicating in cases of dispute.

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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.

8.3.2 *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.

8.3.3 *Thickness*

Over an area of approximately 50 mm^2 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.

8.4 Hail resistance

8.4.1 *Apparatus*

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

8.4.2 *Test specimens*

Use three tile units taken (when relevant, at random) from the sample (see 7.1). Secure each tile unit in the recommended manner[3)] to two battens of nominal width 38 mm, and of thicknesses such that the troughs in the coated surface are horizontal.

8.4.3 *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

[2] A sphere of mass 195 g ± 10 g has been used in practice but this does not impose a restriction on the use of smaller or larger ice spheres.
[3] i.e. as recommended by the manufacturer.

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2 m) for unacceptable defects. Test the remaining two test specimens in the same way. Reserve the test specimens for the applicable tests given in 8.5 – 8.10 (inclusive).

8.5 Profile strength

8.5.1 *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.

8.5.2 *Test specimens (see 7.4.2)*

8.5.3 *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.

8.6 Impact resistance

8.6.1 *Apparatus*

Use the apparatus given in TZS 969:2007.

8.6.2 *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

8.6.3 *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.

8.7 Flexibility of coatings

8.7.1 *Apparatus*

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

8.7.2 *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.

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8.7.3 *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).

8.8 Cold water resistance

8.8.1 *Test specimen (As in 7.7.2)*

8.8.2 *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 5.7.

8.9 Salt fog resistance

Using the apparatus, salt solution, test conditions, and procedure given in TZS 968:2007, expose, for a period of 1 000 h, a test specimen, of size at last 70 mm x 150 mm, cut from each tile unit used in 7.6, ensuring that the impact point is within the borders of the test specimen, then examine the coating on each specimen for defects (see 5.8).

8.10 Accelerated weathering resistance

Using the apparatus and procedure given in TZS 967 (see clause 2), weather, for a period of 2 000 h, the same test specimens as used in 8.9. Then examine the coating on each specimen for defects (see 5.9).

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Annex A

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 5.1).

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.

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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.

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