



TANZANIA DRAFT STANDARD

MEDC2 (5190) P3, Metal roofing tiles - Specification.

(Rev. TZS 948: 2007)

DRAFT FOR PUBLIC COMMENTS

Metal roofing tiles

1. Scope

This standard covers the requirements for metal roofing tiles (coated or uncoated) supplied in the form of carbon steel sheets, aluminium alloy sheets or stainless steel 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. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

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.

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 standard, the following definitions apply.

3.1. Acceptable

Acceptable to the authority administering this standard, or to the parties concluding the purchase contract, as relevant

3.2. Metal roofing tile

Sheet that comprises a series of simulated concrete units

3.3. Trim section

Unit of the same material as tiles that joins different sections in a roof covering

3.4. unit

Full tile, half tile, hipping capping, ridge capping, sidewall flashing, or gable trim section

4. Requirements

4.1. General

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

4.2. Materials

4.2.1. Carbon steel sheet coatings

Carbon steel sheets shall be of either hot-dip zinc-coated or of hot-dip aluminium/zinc-coated steel, of minimum thickness 0.40 mm. The hot-dip zinc coating shall comply with all the minimum requirements for class Z200 coatings

ISO 4998 or ISO 3575 and the hot-dip aluminium/zinc coating shall comply with all the minimum requirements for class AZ150 coatings in SANS 9364.

4.2.2. Aluminium alloy sheets

Aluminium alloy sheets shall comply with the requirements in TZS 1475 for chemical composition, tensile strength, and resistance to bending, and shall have a nominal thickness of at least 0.60 mm.

4.2.3. Stainless steel sheets

Stainless steel sheets shall be of the type 3CR12. The international equivalent types and the chemical composition are given in annex D.

4.3. Coatings

A coating shall be of an acceptable colour and shall have an acceptable degree of resistance to weathering (see also 4.11).

4.4. Dimensions

The dimensions of a tile or trim section unit, determined in accordance with 6.3, shall be as follows:

- 4.4.1. The thickness shall be at least equal to the minimum given in 4.2.1 or 4.2.2, as relevant.
- 4.4.2. 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.
- 4.4.3. 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 nominal value stated by the manufacturer.

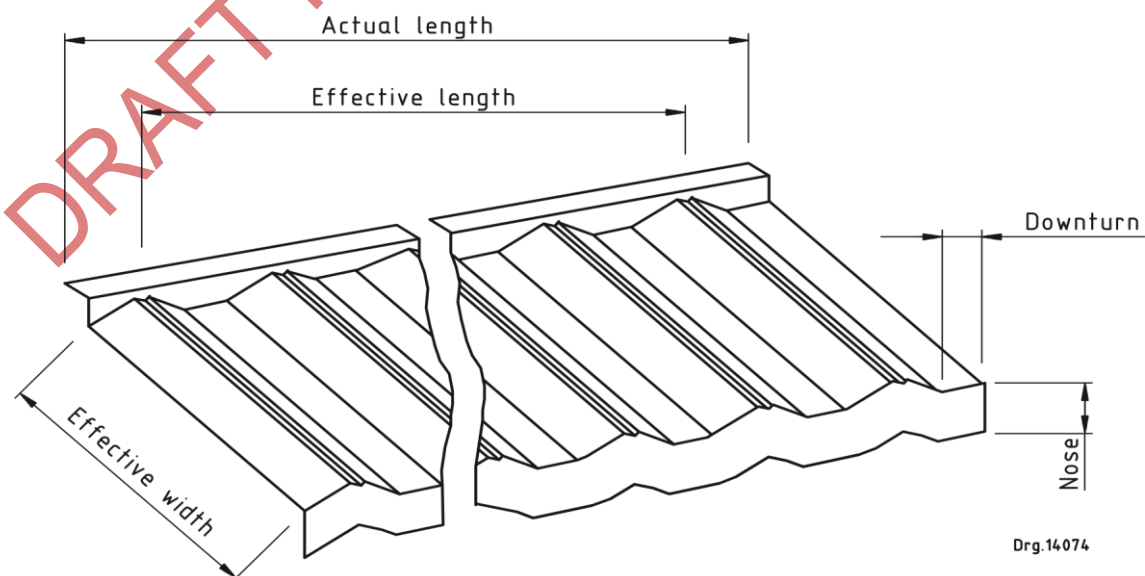


Figure 1 — typical view of a metal roof tile

4.5. Hail resistance (all tiles)

When tested in accordance with 6.4, a tile unit shall be acceptably free from visible defects.

NOTE: The requirement for a hail impact resistance of 10 J ensures that roofing material is resistant to mild hailstorms. For roof sheeting to be hail resistant, such sheets should have a hail resistance of 20 J. (A 45 mm diameter hailstone at terminal velocity in still air has a kinetic energy of approximately 15 J). Hailstorms tend to be more severe at higher altitudes and in the Summer Rainfall Areas. Buildings should generally be designed for the 10J requirement unless they are located in areas where severe hailstorms are a common occurrence (such as high altitude mountainous areas).

4.6. Profile strength (all tiles)

When tested in accordance with 6.5, a tile unit shall show no visible sign of permanent deflection.

4.7. Impact resistance (coated tiles)

When tested in accordance with 6.6, the coating shall show no visible sign of loss of adhesion.

4.8. Flexibility of coatings (coated units)

When tested in accordance with 6.7, a coated unit shall show no sign of flaking or loss of adhesion of the coating.

4.9. Cold water resistance (coated units)

When a specimen cut from a coated unit has been immersed in water in accordance with 6.8, 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, or
- 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.

4.10. Salt fog resistance (coated tiles)

When tested in accordance with 6.9, a tile shall be free from rust, blistering, discoloration, and loss of adhesion of the coating.

4.11. Accelerated weathering resistance (coated tiles)

The resistance of coated tiles to accelerated weathering shall comply with the requirements of ASTM G 153.

4.12. Workmanship

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

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; and
- c) The batch identification.

6. Inspection and methods of test

6.1. Inspection

Inspect each tile unit or trim section unit in a sample taken in accordance with an acceptable method, for compliance with the requirements of 4.12 and clause 5.

NOTE Annex B gives a recommended sampling plan.

6.2. Sequence of testing and test specimens

Submit the tile unit or trim section units in 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).

6.3. Dimensions

6.3.1. Length

a) Tile units

- i. 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.
- ii. If, because of the spring of the tile, the undersides of the troughs are not all in contact with the 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.
- iii. Ensure that the application of pressure causes no deformation of the tile other than the minimum required to bring the corrugations into contact with the rigid surface.

NOTE For precautions that should be taken at points of contact between aluminium alloy units and other building materials, see annex C.

- iv. Using a ruler (or other acceptable 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 centre line of the tile), and record the average of the three measurements as the length of the tile.
- v. Check for compliance with 4.4.

b) Trim section units

- i. Record as the length of each trim section unit, the average of three measurements taken, to the nearest 1 mm, at three acceptable positions on the unit.
- ii. Check for compliance with 4.4.

6.3.2. Width

- i. Using a ruler (or other acceptable means) measure, to the nearest 1 mm, the transverse distance between the upturned and downturned faces of each tile unit in the sample.
- ii. Take the measurements at three positions on the underside of the tile unit (one at each end and one along the transverse centre line of the tile) and record the average of the three measurements as the width of the tile unit.
- iii. Check for compliance with 4.4.

6.3.3. Thickness

- i. Over an area of approximately 50 mm at each of three positions on each sample unit (one at each end and one in the centre) 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.
- ii. Using a micrometre calliper, 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.
- iii. Check for compliance with 4.4.

6.4. Hail resistance

6.4.1. 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 as required (see annex A).

6.4.2. Test specimens

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

6.4.3. Procedure

- i. So position a test specimen (with the battens on a solid, non-resilient, horizontal base, for example, a concrete floor) that impact will be made on the centre 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.
- ii. After repeating the test on twelve (or less, if failure occurs) evenly distributed points on the tile unit, inspect the coated surface (from a distance of about 2 m) for unacceptable defects.
- iii. Test the remaining two test specimens in the same way.
- iv. Check for compliance with 4.6.
- v. Reserve the test specimens for the applicable tests given in 6.5 to 6.9 (inclusive).

6.5. Profile strength

6.5.1. Apparatus

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

6.5.2. Test specimens

Use the test specimens given in 6.4.2.

6.5.3. Procedure

- i. So position a test specimen on, and at right angles to, the bearers that the force will be applied to the centres of two crests of ridges on the tile unit, at a point midway between the supporting battens.
- ii. Centre the bearing pad on this point, with the 225 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.
- iii. After removing the force, inspect (from a distance of approximately 2 m) the tile unit for visible signs of permanent deflection.
- iv. Conduct the test on the other two specimens in a similar way.
- v. Check for compliance with 4.6.

6.6. Impact resistance

6.6.1. Apparatus

Use the apparatus given in TZX 969: 2007.

6.6.2. 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.

6.6.3. Procedure

- i. Place the test specimen, coated side up, flat on the base plate.
- ii. Lift the mass piece (see SANS 5146) to a height of 640 mm (to give an impact of 5, 65 J) and drop it onto the specimen.
- iii. Examine the coating for visible signs of cracking or loss of adhesion.
- iv. Check for compliance with 4.7.

6.7. Flexibility of coatings

6.7.1. Apparatus

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

6.7.2. Test specimen

From each tile specimen, or from each of three trim section units (as relevant), so cut a test specimen of minimum width 30 mm and minimum length 50 mm that the adhesion between the substrate and the coating is not disturbed.

6.7.3. Procedure

- i. With the coated side outwards, rapidly bend, by hand, the test specimen on the shorter side round the mandrel through 180° (taking about 1 s for the operation).
- ii. Examine the coating for signs of flaking or loss of adhesion (or both).
- iii. Check for compliance with 4.8.

6.8. Cold water resistance

6.8.1. Test specimen

Use the test specimens given in 6.7.2.

6.8.2. Procedure

- i. So immerse the test specimen for 18 h in distilled water maintained at $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ that two-thirds of the specimen is submerged.
- ii. Inspect the specimen immediately after removal from the water, and again 2 h and 24 h after removal.
- iii. Check for compliance with the requirements of 4.9.

6.9. Salt fog resistance

Using the apparatus, salt solution, test conditions, and procedure given in TZX 968: 2007, expose, for a period of 1000h, at test specimen, of size at least 70mm X 150mm, cut from each tile unit used in 6.6, 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).

Annex A

Notes to purchasers

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

- a) The type of unit (see 4.1)
- b) the material (i.e. galvanized steel, aluminium alloy or stainless steel) (see 4.2);
- c) whether the units are to be coated or uncoated (see 4.1); and
- d) The kinetic energy that the test specimen has to withstand (see 6.4.1).

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Annex B

Sampling and compliance with this standard B.1 Sampling

B.1.1 General

The sampling procedure in B.2 should be applied in determining whether a lot submitted for inspection and testing complies with the relevant requirements of this standard. The sample so taken should be deemed to represent the lot.

B.1.2 Definitions

B.1.2.1 Batch

Material from a single day's production

B.1.2.2 Defective

Tile unit or trim section that fails in one or more respects to comply with the relevant requirements of this standard.

B.1.2.3 Lot

Not less than 10 units 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

B.2 Sample for inspection

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

Table B.1 sampling table

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

B.3 Compliance with this standard

The lot should be deemed to comply with the requirements of this standard if, after inspection and testing of the sample taken in accordance with B.2, no defective is found.

Annex C

Precautions to be taken at points of contact between aluminium alloy units and other building materials

C.1 Materials

C.1.1 Cement concrete, mortars, and plasters

Aluminium alloy units should be insulated from contact with these materials. The contact surfaces should be painted with two coats of bituminous aluminium paint or zinc chromate or barium chromate primer.

C.1.2 Masonry

Where practicable, aluminium alloy units should not be in contact with masonry because of the danger that corrosion might 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.1.3 Timber

Timber that has been preservative treated with a copper or mercury compound should not be used in contact with aluminium alloy units. Timber preservatives that are more compatible with aluminium (for example, 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.

C.1.4 Steelwork

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

C.1.5 Lead

Lead washers, flashings, etc. should not be used in contact with aluminium alloy units. The contact surfaces shall be separated by bituminous aluminium paint or other insulating material.

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

C.1.6 Zinc

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

C.1.7 Copper and copper alloys

Copper fastenings shall not, under any circumstances, be used to fix aluminium alloy units.

Contact between copper and aluminium, in the presence of moisture, results 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 acceptable means against the entry of moisture.

C.2 Earthing

Earthing of aluminium roofs is best achieved by bolting flat aluminium conductors to the underside of the eaves. The final earth connection should be made as described in C.1.7.

C.3 Coastal areas

Before metal roofing tiles are used in coastal areas, the advice of the manufacturer should be obtained on the suitability of the use of his tiles in such areas.

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Annex D Stainless steel

D.1 Stainless

Steel type 3CR12 is a Ferritic stainless steel and the international equivalents are Werkstoff No. 1.4003, and AISI type 410S.

D.2 The typical chemical composition (expressed as a percentage) is given in table D.1.

Table D.1 — Typical chemical composition

1	2
Element	Typical chemical composition%
Carbon (C)	0,03 max
Manganese (Mn)	2,0 max
Phosphorus (P)	0,040 max
Sulphur (S)	0,015 max
Silicon (Si)	1,0 max
Chromium (Cr)	10,5 to 12,5
Nickel (Ni)	1,5 max
Titanium (Ti) 4(C+N) -	0,60
Iron (Fe)	the balance required to make 100 %

D.3 the typical mechanical properties, in the annealed condition, are given in table D.2.

Table D.2 — Typical mechanical properties

1	2
Properties	Values
Tensile strength	450 MPa to 630 MPa
0,2 % offset proof stress	320 MPa for material thicknesses ≤ 8mm, and 280 MPa for thicknesses > 8mm.
Elongation	20 % for material thicknesses ≤ 8mm, and 18 % for material thicknesses > 8mm

D.4 Stainless steel 3CR12 may be coated to suit the aesthetic requirements.