TBS/GTDC4 (5006) P3 – Aluminium foil for Packaging-Specification
1 Scope
This draft Tanzania standard specifies requirements, method of sampling and test for annealed aluminium alloy foil used for general packaging.

This specification covers annealed aluminium alloy foil containing 98.00 % minimum aluminum and in thicknesses 0.0064 mm up to 0.15 mm.

This draft standard does not cover the requirements of aluminium and aluminium alloy foil for pharmaceutical packaging applications.

2 Normative references

The following referenced documents are indispensable for the application 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 7271:2011 Aluminium and aluminum alloys-Foil and thin strip-Dimensional tolerances

3. Terms and definitions

For the purpose of this document, the following terms and definitions shall apply;

3.1 foil
rolled aluminium alloy sheet

3.2 aluminium Alloy
alloy based on aluminium to which other elements are added to bring about an improvement in mechanical, physical and/or chemical properties to meet particular end uses

4. Requirements

4.1 General Requirements

4.1.1 The material must be suitable for lamination purposes. The foil needs to be plain, free from streaks, unevenness and/or wrinkles, scratches, excessive pinholes, cracks, rust residuals, oil spots, oxidation and stains or from any other defects. Surface of the foil will be one side bright and one side dull, winding of the coils with bright side wound to the outside.

4.1.2 Rolls shall be wound firmly on the cores so as to prevent slipping or telescoping and to permit free unwinding without sticking or tearing.
4.1.3 Aluminium Foil

4.1.3.1 The aluminium foil used shall be plain or printed, soft or hard annealed and 0.006mm to 0.15 mm thick as specified by purchaser. It shall also comply with the requirements of chemical composition in Table 1.

4.1.3.2 The foil shall be produced with food grade rolling lubricant.

4.1.4 Odour

The aluminium foil shall not impart any detectable taste or objectionable odour or taint to foodstuffs.

4.2 Specific Requirements

4.2.1 Chemical Composition

The foil shall conform to the chemical composition limits in Table 1.

Table 1- Chemical Composition Limits

<table>
<thead>
<tr>
<th>Elements</th>
<th>Si</th>
<th>Fe</th>
<th>Ti</th>
<th>Cu</th>
<th>Mn</th>
<th>Mg</th>
<th>Zn</th>
<th>Others—total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition % maximum</td>
<td>0.50</td>
<td>0.70</td>
<td>0.20</td>
<td>0.20</td>
<td>0.10</td>
<td>0.10</td>
<td>0.20</td>
<td>0.15</td>
</tr>
<tr>
<td>Aluminium minimum composition %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>98</td>
</tr>
</tbody>
</table>

4.2.1.1 For applications involving food packaging, handling, or preservation the absolute amounts of lead, arsenic, and cadmium shall be less than 0.01 % each.

4.2.2 Foil thickness

4.2.2.1 Aluminium foil shall have a thickness ranging from 0.0064 mm to 0.15 mm.

4.2.3 Dimensional Tolerances

4.2.3.1 Rolls—Rolls shall be wound on core having an inside diameter of, but not limited to 33.3 ± 0.3 mm, 76.2 ± 0.4 mm or (152.4 ± 0.8 mm), as agreed between manufacturer and purchaser. For specified foil widths up through 305 mm the dimensional tolerance shall be 0.4 mm, and for widths over 305 mm it shall be 0.8 mm. The maximum outside roll diameter shall be as specified by the purchaser.

4.2.3.2 The dimensional tolerance for coreless rolls shall be as agreed between manufacturer and purchaser.

4.2.3.3 Flat Sheets—The nominal width (perpendicular to rolling direction) and length (parallel to rolling direction) of flat sheets shall be as specified by the purchaser and the permissible deviations from specified width and length shall be 1.6 mm.

4.2.4 Tensile strength and Elongation

4.2.4.1 The minimum tensile strength and elongation of aluminium foil shall be 250 N/mm² and 25% respectively when tested with accordance with Annex A.
4.2.5 Wettability

4.2.5.1 The foil must have a wettability A or A-C (see Figure 1), when tested with accordance with Annex C whereas the surface of the fully annealed foil is assessed according to its ability to be wetted by liquids, applied under clearly defined conditions.

4.2.5.2 The wettability index is shown by the shape of the trace given on the surface taken from the worst area of the foil. The wettability indices are defined from A to E in below figure 1.

![Figure 1: Wettability index of foil](image)

4.2.5 Covering Area

The covering area per kg shall be in accordance with the limits given in table 2 and shall be determined in accordance with Annex B clause 3.

Table 2 –Minimum, maximum and nominal covering areas

<table>
<thead>
<tr>
<th>Nominal thickness (mm)</th>
<th>Nominal Covering area (m²/kg)</th>
<th>Permissible range of covering area (m²/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>0.0064</td>
<td>63.0</td>
<td>64.8</td>
</tr>
<tr>
<td>0.0076</td>
<td>44.2</td>
<td>54.0</td>
</tr>
<tr>
<td>0.0089</td>
<td>37.8</td>
<td>46.4</td>
</tr>
<tr>
<td>0.0102</td>
<td>33.1</td>
<td>40.5</td>
</tr>
<tr>
<td>0.0114</td>
<td>29.4</td>
<td>36.0</td>
</tr>
<tr>
<td>0.0127</td>
<td>26.4</td>
<td>32.4</td>
</tr>
<tr>
<td>0.0140</td>
<td>24.2</td>
<td>29.4</td>
</tr>
<tr>
<td>0.0152</td>
<td>22.0</td>
<td>27.0</td>
</tr>
<tr>
<td>0.0165</td>
<td>20.3</td>
<td>24.9</td>
</tr>
<tr>
<td>0.0178</td>
<td>18.9</td>
<td>23.1</td>
</tr>
<tr>
<td>0.0190</td>
<td>17.6</td>
<td>21.6</td>
</tr>
<tr>
<td>0.0203</td>
<td>16.6</td>
<td>20.2</td>
</tr>
<tr>
<td>0.0216</td>
<td>15.6</td>
<td>19.1</td>
</tr>
<tr>
<td>0.0229</td>
<td>14.8</td>
<td>18.1</td>
</tr>
<tr>
<td>0.0241</td>
<td>13.9</td>
<td>17.1</td>
</tr>
<tr>
<td>0.0254</td>
<td>13.2</td>
<td>16.2</td>
</tr>
<tr>
<td>0.0381</td>
<td>8.84</td>
<td>10.8</td>
</tr>
<tr>
<td>0.0581</td>
<td>6.63</td>
<td>8.11</td>
</tr>
<tr>
<td>0.0762</td>
<td>4.42</td>
<td>5.40</td>
</tr>
<tr>
<td>0.1076</td>
<td>3.31</td>
<td>4.05</td>
</tr>
</tbody>
</table>
A range of the covering area based on the standard thickness tolerance of plus and minus 10% per roll or shipment.

5 Packing and marking

5.1 Packing

5.1.1 Each roll shall be banded with a layer of paper or other suitable material that is free from contaminants harmful to the foil.

5.2 Marking

Each packet or roll shall be marked with the following information

a) The name and/or registered trade mark of the manufacture;

b) Address of manufacturer or importer;

c) Size in thickness, length and width;

d) Instructions for disposal;

e) Month and year of manufacture.

6 Sampling

6.1 Unless otherwise agreed to between the purchaser and the manufacturer the following procedure and the criteria for conformity shall apply.

6.2 In a consignment the foils of same width and thickness and of the same surface condition and manufactured by a single firm under essentially similar conditions of production shall be grouped together to constitute a lot.

6.2.1 Tests for determining the conformity of the lot to the requirement of this standard shall be carried out on each lot separately. The number of rolls of foils to be selected for this purpose at random over the whole lot shall be in accordance with column 2 and column 3 of Table 3.

Table 3 Scale of Sampling and Permissible Number of Defectives (Clauses 6.2.1 and 6.2.2)

<table>
<thead>
<tr>
<th>Sn (1)</th>
<th>No. of Rolls in the Lot (2)</th>
<th>No. of Rolls to be Selected (3)</th>
<th>Permissible No of Defectives (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>Up to 5</td>
<td>All</td>
<td>0</td>
</tr>
<tr>
<td>ii.</td>
<td>6 to 100</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>iii.</td>
<td>101 to 300</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>iv.</td>
<td>301 to 500</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>v.</td>
<td>501 and over</td>
<td>20</td>
<td>3</td>
</tr>
</tbody>
</table>
6.2.2 All the rolls shall be individually examined for manufacturing defects, surface defects and dimensional tolerances. A sample failing to meet any one of these requirements shall be called defective. The lot shall be considered as conforming to the corresponding requirements of this standard if number of defectives satisfy the freedom from defects and dimensions in less than or equal to the permissible number given in column 4 of Table 3.
Annex A
(normative)
Tensile strength

A.1 Significance and use

Tension test provide information on the strength and ductility of the materials under uniaxial tensile stresses.

The results of tension tests from selected portions of a part or material may not totally the strength and ductility of the entire end product of its in-service behavior in different environments.

These test methods are considered satisfactory for acceptance testing of commercial shipments since the methods have been used extensively for these purposes.

Tensile test provide a means to determine the ductility of materials through the measurement either of elongation or reduction of area. However, as specimen thickness is reduced, tension tests may become less useful for the determination of ductility.

A.2 Apparatus

A.2.1 Testing machines

A.2.1.1 Gripping devices

A.2.1.1.1 General

Various types of gripping devices may be used to transmit the measured load applied by the testing machine to test the specimen. To ensure axial tensile stress within the gauge length, the axis of the test specimen must coincide with the center line of the testing machine. Any departure from this center line may introduce bending stresses that are not included in the usual stress computation (load divided by cross-section area).

A.2.1.1.2 Wedge grips

Testing machines usually are equipped with wedge grips. These wedge grips generally furnish a satisfactory means of gripping long of ductile materials in the thicker foil gauge. If, for any reason, one grip of a pair advances farther than the other as the grips tighten, an undesired bending stress may be introduced. When liners are used behind the wedges, they must be of the same thickness and their faces must be flat and parallel. For proper gripping, it is desirable that the entire length of the serrated face of each wedge be in contact with the specimen. A buffer material such as 320-grit silicon carbide paper may be inserted between the specimen and serrated faces to minimize tearing of specimens.

A.3 Calculation

Calculate the tensile strength by dividing the maximum load carried by the original cross-sectional area of the specimen.
Annex B
(normative)

Determination of thickness of Aluminium foil

B.1 Procedure

Prepare samples of aluminium foil of known area approximately 500 cm\(^2\) from flat uncreased sheets by cutting round a metal template with beveled edge by means of sharp knife. Clean the sample with suitable solvent to remove all coatings, inks, traces of impurities on foil. Dry the sample of foil to constant mass at 105\(^\circ\)C.

B.2 Calculation

Calculate the thickness of the foil as follows:

Thickness of the foil, in cm = \( \frac{m}{d \times a \times b} \)

Where

- \( m \) = mass, in g of the sample of foil;
- \( d \) = density, of aluminium (2.71 g/cm\(^3\));
- \( a \) = length, in cm of foil test piece;
- \( b \) = width, in cm of foil test piece.

B.3 The covering area shall be determined by means of a direct reading basis weight scale. In case of dispute, the covering area shall be determined by weighing to the nearest 1 mg a piece of unsliced foil not less than 10ft (3m) long and calculating the average area per gram by use of the following equation:

Coverage area, cm\(^2\)/g = \( \frac{453.6 \times \text{area of sample}}{\text{weight of sample}} \)
Annex C
(normative)

Wettability

C1 Principle of test
The test shall apply to aluminium foil in the gauge from 6 μm to 200 μm. The surface of the fully annealed foil is assessed according to its ability to be wetted by liquids applied under clearly defined conditions.

C2 General test conditions
Carry out the test at ambient temperature. Remove the outside wraps to reduce the coil build up by a minimum of 3mm in order to obtain a representative sample before performing the test. Perform the test on the matt side of the foil, where relevant.

The following liquids shall be used:
- distilled water; or
- distilled water mixed with an industrial alcohol to a concentration of 20% by volume.

Do not repeat tests on the same area of sample.

C3 Test methods

C3.1 Test by droplet

C3.1.1 Test procedure
Use a droplet bottle to drop 40 mg to 80 mg drops of liquid onto the horizontal metal surface at a rate of one drop every 5cm to 10 cm across the width of the web. Tilt the surface between 40° to 60° (see figure 2). Determine the wettability index from the tail left by the movement of the droplets across the surface.

Figure 2: Determination of the wettability index
C3.1.2 Acceptance criteria

If the test is performed with distilled water, the wettability is shown by the shape of the trace given on the surface taken from the worst area of the foil. The wettability indices are defined from A to E in figure 1. Wettability indices included between A to C are acceptable.

If the test is performed with the mixture of distilled water and an industrial alcohol the acceptable surface quality shall be comparable with wettability index A.

C3.2 Test by fine spray

C3.2.1 Test procedure

Position the metal surface at an angle approaching the vertical. Use a spray bottle to apply a fine spray mist across the width of the metal surface.

C3.2.2 Acceptance criteria

The whole surface under the liquid spray shall remain uniformly wetted by the applied liquid. The minimum acceptance criterion is that the distilled /industrial alcohol mixture shall uniformly wet the whole surface.

C3.3 Test by liquid stream

C3.3.1 Test procedure

Position the metal surface at an angle of between 40° to 60°. Using a spray bottle, apply a continuous stream of test liquid across the width.

C3.3.2 Acceptance criteria

The whole surface under the stream of liquid and its subsequent spread downwards shall remain uniformly wetted.

C4 Frequency of test

Random testing of sufficient frequency to verify control capability to the satisfaction of the purchaser shall be carried out.