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Jawaharlal Nehru
"Step Out From the Old to the New"

IS 15392 (2003): Aluminium and Aluminium Alloy Bare Foil for Food Packaging [MTD 7: Light Metals and their Alloys]
ALUMINIUM AND ALUMINIUM ALLOY BARE FOIL FOR FOOD PACKAGING — SPECIFICATION

ICS 77.150.10

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 2003

Price Group 3
FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Light Metals and Their Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

The aluminium and aluminium alloy foil plays an important role in packaging due to its unique physical properties that has translated into advantages over all other packaging mediums. Aluminium foil has excellent barrier properties and is almost 100 percent impermeable to gases and vapours, corrosion resistant, non-toxic. It imparts no detectable tastes or odour to food stuff. In addition, its surface can be printed or laminated or coated with wide range of papers, paper boards and polymers by Flexo, Gravure or Offset process and can be easily recycled. Aluminium foil plays an important role in flexible packaging for diverse products such as soups, snack foods, chocolate and chilled food, dairy product, tobacco and toiletries.

While formulating this standard, the assistance has been drawn from the following standards:

ASTM B 479 – 97 ‘Specification for annealed aluminium and aluminium alloy foil for flexible barrier, food contact and other applications’

ISO 7271:1982 ‘Aluminium and aluminium alloys — Foil and thin strip — Dimensional tolerances’

The composition of the Committee responsible for formulation of the standard is given in Annex A.

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 test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (revised)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.
Indian Standard

ALUMINIUM AND ALUMINIUM ALLOY BARE FOIL FOR FOOD PACKAGING — SPECIFICATION

1 SCOPE
This standard covers the requirements of annealed aluminium and aluminium alloy bare foil for food packaging. It is applicable for 0.011 mm (11μm) to 0.075 mm (75 μm) thickness.

2 REFERENCES
The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicted were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>737:1986</td>
<td>Wrought aluminium and aluminium alloy sheet and strip for general engineering purposes (third revision)</td>
</tr>
<tr>
<td>5047 (Part 1): 1986</td>
<td>Glossary of terms relating to aluminium and aluminium alloys: Part 1 Unwrought and wrought metals (second revision)</td>
</tr>
<tr>
<td>10259:1982</td>
<td>General conditions for delivery and inspection of aluminium and aluminium alloy products</td>
</tr>
<tr>
<td>13237:1991</td>
<td>Metallic foil — Tension testing</td>
</tr>
</tbody>
</table>

3 TERMINOLOGY
For the purpose of this standard, the following definitions in addition to those given in IS 5047 (Part 1) shall apply.

3.1 Bare Foil — A cold rolled product of rectangular cross-section, having thickness over 0.011 mm but not greater than 0.075 mm, may be either in straight length or in coil form.

3.2 Dry Annealed, A — Foil having a test dryness 100/0 free from residual rolling oil as determined by the water test.

3.3 Dry Annealed, B — Foil having a test dryness 90/10 having a slight film of residual rolling oil as determined by the water-alcohol test.

3.4 Dry Annealed, C — Foil having a test dryness 80/20, having a slight film of residual rolling oil as determined by the water-alcohol test.

3.5 Slick Annealed — Foil having a uniform film of residual rolling or applied oil as determined by the drop of water test.

4 MANUFACTURE
Unless otherwise specified, the production and manufacturing processes shall be left to the discretion of the manufacturer.

5 PINHOLE COUNT
Unless otherwise stated, the pinhole count per sq.m of aluminium foil area shall be as given in Table 1.

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Nominal Thickness</th>
<th>Pinhole Count No. per Sq. m</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>i)</td>
<td>≥ 25</td>
<td>0</td>
</tr>
<tr>
<td>ii)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>iii)</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>iv)</td>
<td>14</td>
<td>40</td>
</tr>
<tr>
<td>v)</td>
<td>11</td>
<td>60</td>
</tr>
</tbody>
</table>

6 FREEDOM FROM DEFECTS
The foil shall be well finished, uniform in quality, free from splits, slivers, wrinkles, ragged edges and oil staining.

7 MATERIAL
7.1 The material used for aluminium and aluminium alloy foil shall conform to the chemical composition of the Grades 19000, 19500, 19600, 31000 and 40800 of IS 737.

7.2 The material shall be supplied in fully annealed 'O' temper. If agreed by the purchaser the material may be supplied in any other tempers.

8 SUPPLY OF MATERIAL
General requirements relating to the supply of aluminium and aluminium alloy foil shall conform to IS 10259.

9 LUBRICANTS
9.1 Unless otherwise specified by the purchaser, the roll of foil shall be supplied in the pre-lubricated condition.
9.2 As the foils are to be used in food processing, food packaging and food preservation, etc, they shall be produced with rolling oils/lubricants which do not contain substances which are injurious to health or have any deleterious effect on the flavour, odour or appearance of food products.

9.3 The quality of the lubricants shall be such that surfaces of the foil will retain their brightness and shall not stick. The lubricants shall not dry up before two months of storage time from the date of manufacture.

10 PREFERRED THICKNESSES

Unless otherwise stated, the preferred thickness shall be as given in Table 2.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Nominal Thickness</th>
<th>Nominal Covering Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2) mm</td>
<td>(3) µm</td>
</tr>
<tr>
<td></td>
<td>(4) m²/kg</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>0.011</td>
<td>11</td>
</tr>
<tr>
<td>ii)</td>
<td>0.012</td>
<td>12</td>
</tr>
<tr>
<td>iii)</td>
<td>0.014</td>
<td>14</td>
</tr>
<tr>
<td>iv)</td>
<td>0.016</td>
<td>16</td>
</tr>
<tr>
<td>v)</td>
<td>0.018</td>
<td>18</td>
</tr>
<tr>
<td>vi)</td>
<td>0.020</td>
<td>20</td>
</tr>
<tr>
<td>vii)</td>
<td>0.022</td>
<td>22</td>
</tr>
<tr>
<td>viii)</td>
<td>0.025</td>
<td>25</td>
</tr>
<tr>
<td>ix)</td>
<td>0.028</td>
<td>28</td>
</tr>
<tr>
<td>x)</td>
<td>0.030</td>
<td>30</td>
</tr>
<tr>
<td>xi)</td>
<td>0.035</td>
<td>35</td>
</tr>
<tr>
<td>xii)</td>
<td>0.040</td>
<td>40</td>
</tr>
<tr>
<td>xiii)</td>
<td>0.045</td>
<td>45</td>
</tr>
<tr>
<td>xiv)</td>
<td>0.050</td>
<td>50</td>
</tr>
<tr>
<td>xv)</td>
<td>0.060</td>
<td>60</td>
</tr>
<tr>
<td>xvi)</td>
<td>0.070</td>
<td>70</td>
</tr>
<tr>
<td>xvii)</td>
<td>0.075</td>
<td>75</td>
</tr>
</tbody>
</table>

11 AVERAGE THICKNESS

11.1 The determination of average thickness shall be carried out using a method giving repeatable results.

11.2 In case of dispute, the average thickness may be determined by the gravimetric method, based on weighing a sample of 100 mm × 100 mm area, shall be dried and weighed on a balance, accurate to at least 0.5 mg.

\[
\text{Thickness of the foil, in mm} = \frac{W}{27.1}
\]

where \( W \) is the mass of the foil sample (100 mm × 100 mm) in g.

12 DIMENSIONS AND TOLERANCES

12.1 Unless otherwise agreed, the thickness tolerances shall be ± 8 percent.

12.2 Unless otherwise stated, the width tolerances shall be as given in Table 3.

<table>
<thead>
<tr>
<th>Form of Product</th>
<th>Tolerance on Width</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 1000</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Coil and Sheet</td>
<td>± 0.5</td>
</tr>
</tbody>
</table>

12.3 Unless otherwise agreed, the length tolerances shall be as given in Table 4.

13 TENSILE PROPERTIES

13.1 The tension testing shall be made in accordance with test method given in IS 13237. The foil shall be conforming to the tensile breaking loads as given in Table 5.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Nominal Thickness</th>
<th>Breaking Load, kg/cm of Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2) mm</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>0.011</td>
<td>0.50</td>
</tr>
<tr>
<td>ii)</td>
<td>0.012</td>
<td>0.54</td>
</tr>
<tr>
<td>iii)</td>
<td>0.014</td>
<td>0.63</td>
</tr>
<tr>
<td>iv)</td>
<td>0.016</td>
<td>0.72</td>
</tr>
<tr>
<td>v)</td>
<td>0.018</td>
<td>0.81</td>
</tr>
<tr>
<td>vi)</td>
<td>0.020</td>
<td>0.90</td>
</tr>
<tr>
<td>vii)</td>
<td>0.022</td>
<td>0.99</td>
</tr>
<tr>
<td>viii)</td>
<td>0.025</td>
<td>1.13</td>
</tr>
<tr>
<td>ix)</td>
<td>0.028</td>
<td>1.26</td>
</tr>
<tr>
<td>x)</td>
<td>0.030</td>
<td>1.35</td>
</tr>
<tr>
<td>xi)</td>
<td>0.033</td>
<td>1.58</td>
</tr>
<tr>
<td>xii)</td>
<td>0.040</td>
<td>1.80</td>
</tr>
<tr>
<td>xiii)</td>
<td>0.045</td>
<td>2.03</td>
</tr>
<tr>
<td>xiv)</td>
<td>0.050</td>
<td>2.25</td>
</tr>
<tr>
<td>xv)</td>
<td>0.060</td>
<td>2.70</td>
</tr>
<tr>
<td>xvi)</td>
<td>0.070</td>
<td>3.15</td>
</tr>
<tr>
<td>xvii)</td>
<td>0.075</td>
<td>3.45</td>
</tr>
</tbody>
</table>

13.2 Number of Tests

When the tensile breaking load is to be determined,
not less than two samples shall be selected from a shipment with each sample from a different roll of foil.

13.3 Test Specimens

All the test specimens shall be taken parallel to the direction of rolling and they shall be in accordance with Type A or Type B specimens as per IS 13237.

14 SURFACE CONDITION

14.1 Foil shall be tested for surface condition by spraying, as from a squeeze bottle, a continuous line of distilled water or distilled water-alcohol mixture across the web of foil inclined 30° from horizontal. Foil dryness is categorized by the distilled water or water-alcohol mixture that will support a continuous unbroken line of water or mixture across the web of the foil for 2 s (the unbroken line is the top of the hand of water or mixture across the web). To ensure an acceptable water-alcohol mixture the alcohol denaturant shall be methanol (Formula 30:10 parts of ethyl alcohol and one part methanol by volume) or equivalent.

14.2 Dry Annealed, A

Test dryness 100/0 foil shall support a continuous unbroken line using 100 percent distilled water. Alternatively, dry annealed (100/0) foil may be tested by a distilled water drop test in which case the drops shall spread evenly into a thin film.

14.3 Dry Annealed, B

Test dryness 90/10 foil shall support a continuous unbroken 90 percent distilled water and 10 percent alcohol mixture.

14.4 Dry Annealed, C

Test dryness 80/20 foil shall support a continuous unbroken line using 80 percent distilled water and 20 percent alcohol mixture.

14.5 Slick Annealed

Foil shall exhibit no areas wettable by a distilled water drop test, that is, the drops shall remain as spherical drops.

15 SAMPLING

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

15.2 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.

15.2.1 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 col 2 and 3 of Table 6.

Table 6 Scale of Sampling and Permissible Number of Defectives

<table>
<thead>
<tr>
<th>SI No.</th>
<th>No. of Rolls of Foils in the Lot</th>
<th>No. of Rolls of Foils to be Selected</th>
<th>Permissible No. of Defectives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>i</td>
<td>Up to 15</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>ii</td>
<td>16 to 25</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>iii</td>
<td>26 to 50</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>iv</td>
<td>51 to 100</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>v</td>
<td>101 to 300</td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td>vi</td>
<td>Above 300</td>
<td>50</td>
<td>5</td>
</tr>
</tbody>
</table>

15.2.2 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 col 4 of Table 6.

15.3 Number of Tests for Tensile Properties

15.3.1 From each lot, the number of rolls of foils, to be subjected to, tension test shall be one for lots weighing 250 kg or less, and shall be in proportion of one per 250 kg or part thereof for lots weighing more than 250 kg. For the selection, the sample selected in 15.2.1 may be made use of.

15.3.2 In case of lot weighing more than 250 kg one sample shall be taken from each lot, to provide the necessary test pieces.

15.3.3 The test pieces required for various tests shall be cut off from each of the sample selected as in 15.3.1 when cold and shall receive no further heat treatment before being tested.

15.3.4 Re-test

15.3.4.1 If any sample fails to comply with any of the requirements/tests, then two additional samples from the same roll or sheet shall be selected, one of which shall be from the material from which the original test sample was taken, unless that roll or sheet has been withdrawn by the supplier.

15.3.4.2 Should both the additional samples satisfy the requirement/tests, then the lot represented by these samples shall be deemed to comply with this standard.
IS 15392 : 2003

Should either of the two samples fails, then the lot represented shall be deemed not to comply with this standard.

15.4 Criteria for Conformity
A lot shall be considered to have conformed to the requirements of the standard, if 15.2.1 to 15.3.4 are satisfied.

16 ORDERING INFORMATION
The order shall include the following information:

a) Quantity, in pieces or kg;
b) Nominal thickness;
c) Sheet size;
d) Dimensions of rolls (lengths, in m and outside diameter, in mm);
e) Type and inside diameter of the core in mm (with or without slot); length of core (if different from the width of the rolls);
f) In case of thickness less than 15 µm winding direction of the roll shall have to be indicated that is either dull side or bright side out;
g) Surface condition; and
h) Lubrication requirements.

17 MARKING
17.1 Each package of aluminium and aluminium alloy bare foil may be suitably marked for identification with the name of manufacturer, grade, condition of the material, batch No. and date of manufacture.

17.1.1 The foil package may also be marked with the Standard Mark.

17.1.1.1 The use of the Standard Mark is governed by the provision of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.
ANNEX A
(Foreword)

COMMITTEE COMPOSITION

Light Metals and Their Alloys Sectional Committee, MTD 7

**Organization**

- Aluminium Association of India, Bangalore
- Aeronautical Development Establishment, Bangalore
- Aluminium Association of India, Bangalore
- Bajaj Auto Ltd, Pune
- Bharat Aluminium Co Ltd, Korba
- Bharat Heavy Electricals Ltd, Bhopal/Hyderabad
- Central Power Research Institute, Bangalore
- Defence Research & Development Laboratory, Hyderabad
- Development Commissioner (SSI), New Delhi
- DRDO, CEMILAC, Ministry of Defence, Bangalore
- Heat Treaters and Engineers, Mumbai
- Hindalco Industries Ltd, Renukoot
- Hindalco Industries Ltd (Foils & Wheels Division), Silvassa
- Hindustan Aeronautics Ltd, Bangalore
- ISRO (VSSC), Thiruvananthapuram
- India Foils Ltd, Kolkata
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- Indian Institute of Packaging, Mumbai
- Institute of Indian Foundrymen, New Delhi
- J.I.N. Aluminium (R&D) and Design Centre, Nagpur
- Jindal Aluminium Ltd, Bangalore
- Ministry of Defence (DGQA), New Delhi
- Ministry of Defence, CQA (Met), Ichapur
- Ministry of Defence (DMRL), Hyderabad
- Ministry of Defence (OFB), Ambermouth
- National Aerospace Laboratory, Bangalore

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  - SHRI KISHORA SHETTY (Alternate)
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(Continued on page 6)
(Continued from page 5)

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National Metallurgical Laboratory, Jamshedpur

National Thermal Power Corporation, Noida

RDSO, Lucknow

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This Indian Standard has been developed from Doc : No. MTD 7 (4402).

Amendments Issued Since Publication

<table>
<thead>
<tr>
<th>Amend No.</th>
<th>Date of Issue</th>
<th>Text Affected</th>
</tr>
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