

**BS EN 485-1:2016**

# **Aluminium and aluminium alloys – Sheet, strip and plate**

Part 1: Technical conditions for inspection and delivery

**National foreword**

This British Standard is the UK implementation of EN 485-1:2016. It supersedes BS EN 485-1:2008+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NFE/35, Light metals and their alloys.

A list of organizations represented on this committee can be obtained on request to its secretary.

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**Amendments issued since publication**

Date	Text affected
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English Version

## Aluminium and aluminium alloys - Sheet, strip and plate - Part 1: Technical conditions for inspection and delivery

Aluminium et alliages d'aluminium - Tôles, bandes et  
tôles épaisses - Partie 1: Conditions techniques de  
contrôle et de livraison

Aluminium und Aluminiumlegierungen - Bänder,  
Bleche und Platten - Teil 1: Technische  
Lieferbedingungen

This European Standard was approved by CEN on 12 June 2016.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
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## European foreword

This document (EN 485-1:2016) has been prepared by Technical Committee CEN/TC 132 “Aluminium and aluminium alloys”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by January 2017.

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

This document supersedes EN 485-1:2008+A1:2009.

EN 485 comprises the following parts under the general title “*Aluminium and aluminium alloys — Sheet, strip and plate*”:

- *Part 1: Technical conditions for inspection and delivery*
- *Part 2: Mechanical properties*
- *Part 3: Tolerances on dimensions and form for hot-rolled products*
- *Part 4: Tolerances on shape and dimensions for cold-rolled products*

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## 1 Scope

This document specifies the technical conditions for inspection and delivery of wrought aluminium and wrought aluminium alloy sheet, strip and plate for general applications. It also includes provisions for ordering and testing.

It applies to products with a thickness over 0,20 mm up to and including 400 mm.

For many special applications of aluminium strip, sheet and plate, specific European Standards exist, where different or additional requirements are formulated and the appropriate alloys and tempers are selected: see Annex A. Most of these special European Standards refer to provisions of this document.

The selection of the relevant special European Standards is under the responsibility of the purchaser.

Whenever the application involves special properties, such as corrosion resistance, toughness, fatigue strength, surface appearance and welding properties, the user should consult the supplier and consider the relevant special European Standard, as applicable.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 485-2, *Aluminium and aluminium alloys - Sheet, strip and plate - Part 2: Mechanical properties*

EN 485-3, *Aluminium and aluminium alloys - Sheet, strip and plate - Part 3: Tolerances on dimensions and form for hot-rolled products*

EN 485-4, *Aluminium and aluminium alloys - Sheet, strip and plate - Part 4: Tolerances on shape and dimensions for cold-rolled products*

EN 515, *Aluminium and aluminium alloys - Wrought products - Temper designations*

EN 541, *Aluminium and aluminium alloys - Rolled products for cans, closures and lids - Specifications*

EN 573-3, *Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3: Chemical composition and form of products*

EN 602, *Aluminium and aluminium alloys - Wrought products - Chemical composition of semi-finished products used for the fabrication of articles for use in contact with foodstuff*

EN 603 (all parts), *Aluminium and aluminium alloys — Wrought forging stock*

EN 683-1, *Aluminium and aluminium alloys - Finstock - Part 1: Technical conditions for inspection and delivery*

EN 851, *Aluminium and aluminium alloys - Circle and circle stock for the production of culinary utensils - Specifications*

EN 941, *Aluminium and aluminium alloys - Circle and circle stock for the production of general applications - Specifications*

EN 1386, *Aluminium and aluminium alloys - Tread plate - Specifications*

EN 1396, *Aluminium and aluminium alloys - Coil coated sheet and strip for general applications - Specifications*

- EN 1669, *Aluminium and aluminium alloys - Test methods - Earing test for sheet and strip*
- EN 2004-1, *Aerospace series - Test methods for aluminium and aluminium alloy products - Part 1: Determination of electrical conductivity of wrought aluminium alloys*
- EN 10204, *Metallic products - Types of inspection documents*
- EN 12258-1, *Aluminium and aluminium alloys - Terms and definitions - Part 1: General terms*
- EN 12392, *Aluminium and aluminium alloys - Wrought products and cast products - Special requirements for products intended for the production of pressure equipment*
- EN 12482-1, *Aluminium and aluminium alloys - Reroll stock for general applications - Part 1: Specifications for hot rolled reroll stock*
- EN 12482-2, *Aluminium and aluminium alloys - Reroll stock for general applications - Part 2: Specifications for cold rolled reroll stock*
- EN 13195, *Aluminium and aluminium alloys - Specifications for wrought and cast products for marine applications (shipbuilding, marine and offshore)*
- EN 13981-2, *Aluminium and aluminium alloys - Products for structural railway applications - Technical conditions for inspection and delivery - Part 2: Plates and sheets*
- EN 14121, *Aluminium and aluminium alloys - Sheet, strip and plate for electrotechnical applications*
- EN 14242, *Aluminium and aluminium alloys - Chemical analysis - Inductively coupled plasma optical emission spectral analysis*
- EN 14286, *Aluminium and aluminium alloys - Weldable rolled products for tanks for the storage and transportation of dangerous goods*
- EN 14287, *Aluminium and aluminium alloys - Specific requirements on the chemical composition of products intended to be used for the manufacture of packaging and packaging components*
- EN 14361, *Aluminium and aluminium alloys - Chemical analysis - Sampling from metal melts*
- EN 14392, *Aluminium and aluminium alloys - Requirements for anodised products for use in contact with foodstuff*
- EN 15088, *Aluminium and aluminium alloys - Structural products for construction works - Technical conditions for inspection and delivery*
- EN ISO 6892-1, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1)*
- EN ISO 7438, *Metallic materials - Bend test (ISO 7438)*
- EN ISO 20482, *Metallic materials - Sheet and strip - Erichsen cupping test (ISO 20482)*
- ISO 9591, *Corrosion of aluminium alloys — Determination of resistance to stress corrosion cracking*
- ASTM G34, *Standard Test Method for Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)*



ASTM G47, *Standard Test Method for Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products*

ASTM G66, *Standard Test Method for Visual Assessment of Exfoliation Corrosion Susceptibility of 5XXX Series Aluminum Alloys (ASSET Test)*

ASTM G67, *Standard Test Method for Determining the Susceptibility to Intergranular Corrosion of 5XXX Series Aluminum Alloys by Mass Loss After Exposure to Nitric Acid (NAMLT Test)*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12258-1 and the following apply.

**3.1 sheet/plate**  
flat rolled product of rectangular cross-section with uniform thickness between 0,20 mm and 6 mm for sheet or above 6 mm for plate, supplied in straight lengths (i.e. flat) usually with trimmed or sawn edges

Note 1 to entry: For sheet, the thickness does not exceed one-tenth of the width.

Note 2 to entry: Corrugated, embossed (with patterns, for example grooves, ribs, checkers, tears, buttons, lozenges), coated, edge conditioned and perforated products in this general form when derived from sheet as defined above are classified as sheet.

Note 3 to entry: Flat sheets and plates material between 3 mm and 15 mm are sometimes called “shate”.

**3.2 strip**  
flat rolled product of rectangular cross-section with uniform thickness over 0,20 mm, supplied in coils usually with trimmed edges

Note 1 to entry: The thickness does not exceed one-tenth of the width.

Note 2 to entry: Corrugated, embossed (with patterns, for example grooves, ribs, checkers, tears, buttons, lozenges), coated, edge conditioned and perforated products in this general form when derived from sheet as defined above are classified as sheet.

Note 3 to entry: “Strip” is sometimes called “coil”.

**3.3 order document**  
document or set of documents agreed between supplier and purchaser at the time of ordering

Note 1 to entry: An order document can be an order of the purchaser confirmed by the supplier or a quotation of the supplier confirmed by the purchaser.

### 4 Ordering information

The order document shall contain the following:

- a) form and type of product:
  - form of the product (sheet, strip, plate, etc.);

- designation of the aluminium or aluminium alloy;
- b) temper of the material for delivery according to EN 515 and, if different, the temper for use;
- c) reference to this European Standard;
- d) specification of mechanical properties, if additional to or different from EN 485-2 or as disclosed in any application standard (see Annex A);
- e) reference to the standard for tolerances of form and dimensions (e.g. EN 485-3, EN 485-4 or as disclosed in any application standard (see Annex A));
- f) dimensions of the product:
  - thickness;
  - width;
  - length of sheet and plate, as applicable (in the rolling direction);
  - internal and external diameters of the coil, or dimension and type of the core, as applicable.

NOTE 1 Unless otherwise agreed, the length is the largest dimension of the sheet or plate and corresponds to the rolling direction.

- g) quantity:
  - mass or number of pieces;
  - quantity tolerances if required;
- h) any requirements for inspection documents;
- i) any other test, in addition to chemical analysis and tensile testing;
- j) any additional requirements, such as:
  - quality assurance;
  - specific inspection schemes;
  - marking of products;
  - references of drawing, etc.;
  - special packing requirements;
- k) for products intended for decorative anodizing by the purchaser, the order document shall also contain the following:
  - statement that the product is intended to be anodized;
  - intended particular surface treatment (according to the relevant standard);

- whether a decorative appearance after anodizing is required for both sides and, if only one side, its position with respect to the strip (inside or outside of the coil) or the sheet or plate (upside or downside).

Products intended to form a specific area after anodizing (such as a façade) should be ordered in a single batch.

The order document should indicate the intended application.

NOTE 2 The codification scheme specified in EN 573-5 will preferably be used.

## 5 Requirements

### 5.1 Responsibilities of the supplier and manufacturer

The supplier shall be responsible that all inspections and tests required by the relevant standard and/or the particular specification have been performed, prior to shipment of the product.

Unless otherwise specified in the order document, the production and manufacturing processes shall be left to the discretion of the manufacturer. Unless it is explicitly stated in the order document, no obligation shall be placed on the manufacturer to use the same processes for similar and subsequent orders.

### 5.2 Requirements on product properties

#### 5.2.1 Chemical composition

The chemical composition shall comply with the requirements as specified in EN 573-3.

If the purchaser requires content limits for elements not specified in the above standard, these limits shall be stated in the order document.

#### 5.2.2 Mechanical properties

The mechanical properties determined by the tensile test shall be in conformity with those specified in EN 485-2, if not otherwise stated in the order document. Other properties such as hardness, bending ability, isotropy, etc. can be specified in the order document.

#### 5.2.3 Corrosion behaviour

Products made of 5xxx alloys with nominal magnesium content equal to or higher than 3 % in the H116 and H321 tempers shall be capable of exhibiting no exfoliation corrosion susceptibility according to ASTM G66 accelerated test and inter-granular corrosion susceptibility according to ASTM G67. The release criteria for these tests are described in EN 13195.

Plate exhibit made of alloys EN AW-7010 and EN AW-7075 in the T73 and T7351 tempers and over 25 mm in thickness, shall exhibit no evidence of stress-corrosion cracking when tested in accordance with ASTM G47 or in ISO 9591.

Products made of alloys EN AW-7010 and EN AW-7075 in the tempers T76 and T7651 shall be capable of exhibiting no evidence of exfoliation corrosion in excess of grade EB, as defined in ASTM G34, when subjected to the test specified in 6.10.2.

#### 5.2.4 Freedom from defects

The product shall be free from defects prejudicial to its suitable and proper use.

It shall have a smooth and clean surface. However small surface imperfections such as light scratches, indentations, laminations, stripes, roll marks, discolorations and non-uniform surface appearance resulting

from heat treatment, etc., which cannot always be totally avoided, are generally permitted on both sides of the product.

Whilst an operation designed to mask a defect is not permitted, superficial defects may be eliminated, provided that the dimensional tolerances and material properties continue to meet the specifications.

For products intended for decorative anodizing, the superficial imperfections (discolouration, mechanical or structural imperfections) may not be so extensive as to impair the decorative appearance after the agreed surface treatment. Limiting samples can be agreed between supplier and purchaser.

### **5.2.5 Tolerances on dimensions and form**

The dimensions and form tolerances shall be in conformity with EN 485-3 and EN 485-4, unless otherwise agreed upon between supplier and purchaser and stated in the order document. Unless otherwise agreed upon, the purchaser may reject only those products having dimensions not complying with the specified tolerances.

## **6 Test methods**

### **6.1 General**

If the purchaser wishes to inspect the product at the supplier's works, the purchaser shall notify the supplier at the time of placing the order.

### **6.2 Chemical analysis**

Sampling shall be carried out at the time of casting according to EN 14361. The average content accuracy to each sample shall be within the specification for the chemical composition.

NOTE 1 EN 14361 includes criteria how to determine number, volume and shape of sample, about time and location of sampling and about the design and maintenance of the tools, in order to make sure that the average chemical composition of the sample is representative of the average chemical composition of the whole melt.

The range of application and accuracy of the test procedure used shall be validated and proved by the supplier.

NOTE 2 For the fast determination of the chemical composition different spectral analysis methods are used (e.g. S-OES, XRF, GDOES). For S-OES see EN 14726.

In case of dispute concerning the chemical composition, an additional analysis shall be carried out in accordance with EN 14242.

### **6.3 Tensile test**

#### **6.3.1 General**

The tensile test shall be carried out in accordance with EN ISO 6892-1, the testing method shall be agreed between the supplier and the purchaser.

Specimens shall be taken from the sample after completion of all the mechanical and thermal treatments that the product has to undergo prior to delivery, and which can influence the mechanical properties of the metal. In cases where this is not possible, the specimens may be taken at an earlier stage, but they shall be subjected to the same treatment as that to which it is intended to submit the product concerned.

Cutting shall be carried out in such a manner that it does not change the characteristics of the part of the specimen from which the test pieces are to be prepared. Thus, the dimensions of the specimens shall provide an adequate machining allowance to permit removal at the zone affected by cutting.

Specimens shall not be machined or treated in any way by which their mechanical properties can be altered. Any straightening required shall be carried out with great care, preferably by hand.

If the purchaser intends to convert the material to a final temper which is different from the "as supplied" temper, then additional testing should be agreed between supplier and purchaser, in order to ensure that the material is capable to meet the specified properties of the final temper.

It is only necessary for the supplier to confirm that selected samples, heat-treated using supplier laboratory conditions, meet the properties specified for the final temper required by the purchaser.

### **6.3.2 Number of specimens**

Unless otherwise specified in the order document, one specimen shall be taken from each inspection lot of 10 000 kg or part thereof or from each treatment batch or lot.

For single plates or for coils weighing more than 10 000 kg each, only one specimen per plate or coil shall be taken.

### **6.3.3 Location and size of specimens**

Specimens shall be taken from samples in such a way that it is possible to orientate the test pieces in relation to the product.

The specimens shall be large enough to allow the manufacture of sufficient test pieces for the required tests in the specified orientation, and for any retests which can be required.

In the case of solution heat treated plate, the specimens shall be taken after having cut off the quenched end of the plate. The cut off distance on length shall be at least one half of the thickness or 150 mm, whichever is the larger, e.g. a 400 mm thick plate would require 200 mm to be cut off the length before the specimen is taken.

In the case of stretched sheet or plate, a sufficient length has to be cut off before the specimen is taken, in order to avoid bias due to inhomogeneous deformation during stretching.

Specimens shall be taken from the half-width or one-third-width position on the strip, sheet or plate. The first and the following specimens shall be taken at same location.

### **6.3.4 Identification**

Each test pieces and specimens shall be marked in such a manner that, after removal, it is always possible to identify the product from which it is taken and its location and orientation. If, during the course of subsequent operations, removal of the markings cannot be avoided, new markings, marked envelopes label shall be made before the originals are removed.

Each test piece shall be marked in such a manner that it is possible to identify the inspection lot from which it was taken and, if required, its location and orientation in the product.

If a test piece is marked by stamping, this shall not be in a place or manner which can interfere with subsequent testing.

Where it is not convenient to mark a test piece, an identification tag may be attached<sup>1)</sup>.

### **6.3.5 Shape, dimensions and orientation of test pieces**

Normally the test pieces shall be taken with their length transverse (longitudinal transverse) to the principal direction of rolling. If the width of the product is less than 300 mm, then test in the longitudinal direction is

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<sup>1)</sup> Alternative methods, such as specially designed boxes, may be used for the purpose of test piece identification.

permitted. In both cases the mechanical property limits specified in EN 485-2 or any other application standard shall apply.

For specified thicknesses up to and including 10 mm the test piece shall have a rectangular (or square) cross section (flat test piece). Its reduced section shall be 12,5 mm wide and its thickness equal to the full thickness of the product. The test piece shall be prepared so that both rolled surfaces are included undisturbed.

For specified thicknesses from 10 mm up to and including 12,5 mm the test piece may have a circular or a rectangular cross-section.

For specified thicknesses exceeding 12,5 mm the test piece shall have a circular cross section with a recommended diameter of 10 mm for its reduced section (round test piece).

For specified thicknesses up to and including 40 mm, the longitudinal axis of the round test pieces shall be located at a distance from the surface equal to half the thickness.

For specified thicknesses over 40 mm, the longitudinal axis of the round test pieces shall be located at a distance from one of the surfaces equal to one quarter of the thickness.

Machined test pieces of rectangular or circular cross-section (as applicable) shall be used.

Recommended shapes for rectangular and round test pieces are shown in Figures 1 and 2 and further specified in EN ISO 6892-1.

NOTE The properties measured in the longitudinal direction are different from those measured in the transverse direction.

### 6.3.6 Machining of test pieces

Any machining necessary shall be carried out in such a manner that it does not change the characteristics of the metal in the test piece.

### 6.3.7 Number of test pieces

One test piece shall be taken from each specimen.

### 6.3.8 Procedure

During a test to determine proof stress, the rate of stress application shall not exceed 12 MPa/s. After removal of the extensometer the rate of straining may be increased but it shall not exceed 50 % of the length of the reduced section per minute.

For determination of compliance, proof stress and tensile strength values shall be rounded to the nearest 1 MPa and elongation values to the nearest 1 % using the rounding rules specified in EN 485-2.

Elongation for rectangular (or square) test pieces shall be measured using an original gauge length of 50 mm.

Elongation for round test pieces shall be measured using an original gauge length equal to  $5 D$  where  $D$  is the diameter of the reduced section.

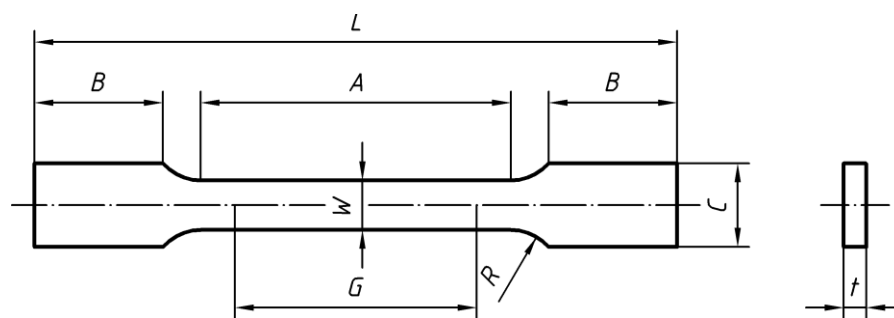
## 6.4 Bend test

Sheet, strip and plate shall be capable of being bent cold through an angle of 90° or 180°, as applicable, around a pin having a radius equal to  $k$  times the thickness  $t$  of the sheet, strip or plate (e.g.  $2,5 t$ ) without cracking. Recommended values of the minimum bend radii for different alloys, tempers and thicknesses are given for instance in EN 485-2. Compliance with these values and/or conduct of the test is only required when so specified on the order.

The test shall be carried out in accordance with EN ISO 7438, particular attention being paid to the following:

- bend test shall be carried out on a specimen taken adjacent to the tensile test specimen;
- test piece shall be taken in the transverse direction, the bend axis being parallel to the rolling direction. For material less than 150 mm wide, the test piece may be taken in the rolling direction;
- width of the test piece shall be at least 20 mm and preferably 40 mm to 50 mm. For material less than 20 mm wide, the width of the test piece shall be the full width of the material;
- edges of the test piece may be machined when practical. They may be rounded to a radius of approximately 2 mm.

Dimensions in millimetres



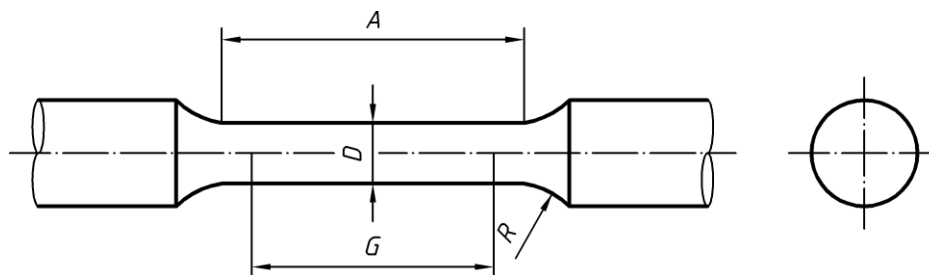
Standard test piece

**Key**

Nominal width	12,5
<i>G</i> - gauge length	50,0 ± 0,5
<i>W</i> - width	12,5 ± 0,10
<i>t</i> - thickness	thickness of material
<i>R</i> - radius of fillet, min.	12,5
<i>L</i> - overall length, min.	200
<i>A</i> - length of reduced section, min.	57
<i>B</i> - length of grip section, min.	50
<i>C</i> - width of grip section, approximate	20

**Figure 1 — Standard rectangular tensile test piece**

Dimensions in millimetres



Key

	Standard test piece				Small-size test pieces proportional to standard			
	10	8	6	4	8	6	4	2
Nominal diameter	10	8	6	4	8	6	4	2
<i>G</i> - gauge length	50,0 ± 0,5	40,0 ± 0,5	30,0 ± 0,5	20,0 ± 0,5	40,0 ± 0,5	30,0 ± 0,5	20,0 ± 0,5	10,0 ± 0,5
<i>D</i> - diameter	10,0 ± 0,10	8,0 ± 0,10	6,0 ± 0,10	4,0 ± 0,05	8,0 ± 0,10	6,0 ± 0,10	4,0 ± 0,05	2,0 ± 0,05
<i>R</i> - radius of fillet, min.	9	8	6	4	8	6	4	2
<i>A</i> - length of reduced section, min.	60	48	36	24	48	36	24	12

**Figure 2 — Standard 10 mm tensile test piece with 50 mm gauge length and examples of small size proportional test pieces**

## 6.5 Hardness test

Hardness test can be a convenient means for checking the homogeneity of a lot; it can also be used for a quick semiquantitative check of the thermal treatment to which the material has been submitted or, as a first approach, for material identification purpose. However its accuracy is generally less than can be expected from a tensile test which it cannot replace.

NOTE Hardness can be measured at different locations, e.g. on the surface of the product or on the tensile specimen. For some materials, results can be different.

The values disclosed for instance in EN 485-2 are typical Brinell hardness (HBW) values for a test carried out according to EN ISO 6506-1 with a 2,5 mm diameter steel ball. They are given for information only.

If the Brinell hardness test is not possible (because of thin thickness or soft temper) then Vickers hardness test, according to EN ISO 6507-1, may be used. In that case the values will be approximately 10 % above the stated Brinell values.

Table 1, given for convenience, shows for several HBW values the minimum thickness down to which the hardness measurement remains valid, according to the rules stated in EN ISO 6506-1, using a 2,5 mm diameter steel ball and a load of 612,9 N.



**Table 1 — Minimum material thickness and Brinell hardness values**

<b>Brinell hardness (HBW)</b>	30	40	50	60	70	80	90	100
<b>Minimum thickness (mm)</b>	2,1	1,6	1,3	1,1	0,9	0,80	0,71	0,64
<b>Brinell hardness (HBW)</b>	110	120	130	140	150	160	170	180
<b>Minimum thickness (mm)</b>	0,58	0,53	0,4	0,45	0,4	0,40	0,37	0,35

## 6.6 Electrical conductivity

Electrical conductivity measurements are required for lot acceptance purposes, in the case of alloys EN AW-7010 and EN AW-7075 in the tempers T73, T7351, T76 and T7651, in order to assess the resistance to stress corrosion cracking or the exfoliation-corrosion resistance of the material as applicable.

The specimen for electrical conductivity testing shall be taken adjacent to the tensile test specimen.

The measurement shall be carried out by the eddy current method as specified in EN 2004-1. The reference blocks to be used shall be agreed between supplier and purchaser. The results shall be rounded to the nearest 0,1 MS/m, using the rounding rules.

The acceptance criteria are shown in relevant tables of EN 485-2.

## 6.7 Dimensions

The dimensions shall be measured by means of measuring instruments which are of the accuracy required by the dimensions and the dimensional tolerances as specified in EN 485-3 and EN 485-4 or as disclosed in any application standard.

All dimensions shall be checked at the ambient temperature of the workshop or laboratory, and, in case of dispute, at a temperature between 15 °C and 25 °C.

## 6.8 Surface finish

Unless otherwise specified, examination of surface appearance, if required, shall be carried out without the assistance of magnifying apparatus on products before delivery.

For products intended to be anodized, anodizing test should be carried out by the supplier on the products before delivery. The frequency and the conditions of the test shall be agreed between supplier and purchaser.

## 6.9 Stress corrosion resistance

For the purpose of this standard the following provisions shall apply:

- minimum of three adjacent replicate test pieces shall be taken from each specimen and submitted to the test;
- exposure shall be carried out by alternate immersion in a 3,5 % by mass sodium chloride solution in water;
- test pieces shall be stressed in the short transverse direction with a stress level of 75 % of the specified proof stress;
- no stress-corrosion related rupture shall be observed after a minimum exposure time of 20 days.

The method of stressing (bending, uniaxial loading, C-ring, etc.), the shape and dimensions of the test pieces and the frequency of the test are left to the discretion of the manufacturer, who shall maintain records of all

lots so tested and make them available for examination at the manufacturer facility for not less than five years.

For lot acceptance-purposes resistance to stress corrosion cracking for each lot of material shall be established by testing the previously selected tensile test specimens to the criteria shown in relevant tables of EN 485-2.

## **6.10 Exfoliation and inter-granular corrosion resistance (5xxx and 7xxx series alloys)**

### **6.10.1 5xxx alloys**

For 5xxx series alloys in which the magnesium content is 3 % nominal or more and for marine applications, specific sampling and testing conditions are disclosed in EN 13195.

### **6.10.2 7xxx series alloys**

For lot acceptance-purposes, resistance to exfoliation corrosion for each lot of material shall be established by testing the previously selected tensile test specimens to the criteria shown in the relevant tables of EN 485-2.

When carried out, for monitoring purposes, the test shall be in accordance with ASTM G34, and the following additional requirements shall apply:

- specimens for test shall be selected at random from material considered acceptable in accordance with the lot acceptance criteria shown in the relevant tables of EN 485-2, for each thickness range listed in these tables;
- test pieces shall be a minimum of 50 mm × 100 mm with the 50 mm dimension parallel to the direction of final rolling. They shall include the full-section thickness of the material, except that for material 2,5 mm or more in thickness, 10 % of the thickness shall be removed by machining the test surface. For machined test pieces, the machined surface shall be evaluated by exposure to the test solution;
- frequency of the test is left to the discretion of the producer, who shall maintain records of all lots so tested and make them available for examination at the manufacturer facility for not less than five years.

## **6.11 Other tests**

If other mechanical or physical tests are required, these shall be agreed between the supplier and the purchaser. These tests shall be carried out either in accordance with the existing European or International Standards or agreed upon by the supplier and the purchaser. If not otherwise agreed between supplier and purchaser, the following standards shall be used:

- Earing test: the test shall be carried out according to EN 1669;
- Erichsen test: the test shall be carried out according to EN ISO 20482.

## **6.12 Retest**

### **6.12.1 Mechanical properties**

If any one of the test pieces first selected fails to meet the requirements for the mechanical tests, the following procedure shall be applied:

- if an error is clearly identified, either in the test piece preparation or in the test procedure, then the corresponding result shall be disregarded and the testing carried out as initially required;

- if this not the case, then two further specimens shall be taken from the same lot, at least one being from the same unit of product (sheet, strip, etc.) from which the original specimen was taken, unless that piece of product has been withdrawn by the supplier. The additional samples shall be taken adjacent to the failed specimen or from the same location if one sample is taken from another unit of product from the same lot.

If both test pieces from these additional specimens meet the requirement, the lot which they represent shall be deemed to comply with the requirements of this European Standard.

Should one test piece fail:

- lot shall be deemed not to comply with the requirements of this European Standard;
- or, where applicable, the lot may be submitted to additional thermal treatment(s) and then retested as a new lot.

### **6.12.2 Other properties**

The retests of other properties shall be agreed upon between supplier and purchaser.

## **7 Inspection document**

When requested by the purchaser and agreed upon by the supplier, the supplier shall provide the appropriate inspection document in accordance with EN 10204.

## **8 Marking of products**

Marking of products shall be undertaken when agreed upon between supplier and purchaser and stated on the order. Marking shall not adversely affect the final use of the product.

Each shipping container shall be marked with the purchase order number, products size, specification or standard number, alloy and temper, gross and net weights, and the supplier / manufacturer name or trademark.

## **9 Packaging**

Unless otherwise specified in European Standard relating to special products or specified in the order document, the method of packaging shall be determined by the supplier who shall take all suitable precautions to ensure that, under the usual conditions of handling and transportation, the products will be delivered in a condition suitable for use, while meeting any packaging regulation in countries through which the product will pass.

Each package shall contain only one size, alloy and temper of material, unless otherwise agreed upon between supplier and purchaser.

## **10 Complaints of non conformity**

In cases of dispute concerning conformity with the requirements of this European Standard or specification cited on the order, before rejecting the products, testing and examination shall be carried out by an arbitrator chosen by mutual agreement between purchaser and supplier.

The arbitrator's decision shall be final.

**Annex A**  
(normative)

**European Standards for strip, sheet and plate of special form and for special applications**

For many special applications of aluminium strip, sheet and plate, specific European Standards exist; see Table A.1, where different or additional requirements are specified and the appropriate alloys and tempers are selected.

**Table A.1 — European Standards for strip, sheet and plate of special form and for special applications**

<b>Form of product</b>	<b>Application</b>	<b>Relevant European Standard</b>
Reroll stock	All, mainly foil	EN 12482-1 and EN 12482-2
Finstock	Heat exchangers	EN 683-1
Tread plate	General	EN 1386
Sheet and strip	Cans, closures and lids	EN 541
Coil coated strip and sheet	General	EN 1396
Sheet, strip and plate	Marine	EN 13195
Sheet, strip and plate	Aerospace	To be specified by the purchaser
Sheet and plate	Railway	EN 13981-2
Sheet, strip and plate	Electrical conductors	EN 14121
Plate	Forging stock	EN 603
Sheet, strip and plate	Structural products for construction works	EN 15088
Circle and circle stock	General	EN 941
Circle and circle stock	Culinary	EN 851
Sheet and plate	Tanks for dangerous goods	EN 14286
Sheet and plate	Pressure vessels	EN 12392
Sheet and strip	Packaging	EN 14287
Sheet, strip and plate	Contact with foodstuff	EN 602
Sheet, strip and plate, anodised	Contact with foodstuff	EN 14392

## Bibliography

EN 573-5, *Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 5: Codification of standardized wrought products*

EN 14726, *Aluminium and aluminium alloys - Chemical analysis - Guideline for spark optical emission spectrometric analysis*

EN ISO 6506-1, *Metallic materials - Brinell hardness test - Part 1: Test method (ISO 6506-1)*

EN ISO 6507-1, *Metallic materials - Vickers hardness test - Part 1: Test method (ISO 6507-1)*



