

# Aluminium and aluminium alloys — Rolled products for cans, closures and lids — Specifications

The European Standard EN 541:2006 has the status of a  
British Standard

ICS 77.150.10

## National foreword

This British Standard was published by BSI. It is the UK implementation of EN 541:2006. It supersedes BS EN 541:1995 which is withdrawn.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 NFE/35 can be obtained on request to its secretary.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 January 2007

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ISBN 978-0-580-49934-0

### Amendments issued since publication

Amd. No.	Date	Comments

English Version

## Aluminium and aluminium alloys - Rolled products for cans, closures and lids - Specifications

Aluminium et alliages d'aluminium - Produits laminés pour  
boîtes, capsules rigides et couvercles - Spécifications

Aluminium und Aluminiumlegierungen - Walzerzeugnisse  
für Dosen, Verschlüsse und Deckel - Spezifikationen

This European Standard was approved by CEN on 16 November 2006.

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## Foreword

This document (EN 541:2006) 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of an identical text or by endorsement, at the latest by June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

This document supersedes EN 541:1995.

Within its programme of work, Technical Committee CEN/TC 132 entrusted CEN/TC 132/WG 7 "Sheet, strip and plates" to revise EN 541:1995.

The following technical changes have been made:

- General: Normative references updated
- Table 1: New alloy added — EN AW-5006
- Clause 8: Amended
- Annex D: Added
- Bibliography: Added

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.

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## 1 Scope

This document specifies the technical conditions for inspection and delivery, mechanical properties, dimensional tolerances and other requirements for rolled products made from wrought aluminium and wrought aluminium alloys with thicknesses from 0,150 mm to 0,500 mm for manufacturing rigid cans, closures, lids and tabs.

## 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.

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

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

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 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10204, *Metallic products — Types of inspection documents*

EN 14242, *Aluminium and aluminium alloys — Chemical analysis — Inductively coupled plasma optical emission spectral analysis*

EN 14361, *Aluminium and aluminium alloys — Chemical analysis — Sampling from metal melts*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **sheet**

flat rolled product of rectangular cross section with uniform thickness, supplied in straight lengths (i.e. flat) with trimmed edges

### 3.2

#### **length of sheet**

length is always the dimension in the rolling direction

### 3.3

#### **width of sheet**

width is always the dimension at right angles to the rolling direction

NOTE See 6.2.2, Figure 1.

### 3.4

#### **strip**

flat rolled product of rectangular cross section with uniform thickness, supplied in coils usually with trimmed edges

NOTE Strip is sometimes called "coil".

**3.5****master coil**

coil produced from one ingot

**3.6****inspection lot**

consignment, or part thereof, submitted for inspection, comprising products of the same grade or alloy, form, temper, size, shape, thickness or cross section and processed in the same manner

**3.7****sample**

one or more products taken from an inspection lot

**3.8****specimen**

one or more pieces taken from each product in the sample, e.g. for the purpose of producing test pieces

**3.9****test piece**

piece taken from a specimen and suitably prepared for testing

**3.10****test**

operation to which the test piece is subjected in order to measure or classify a property

**3.11****order document**

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

NOTE 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 Technical conditions for inspection and delivery****4.1 Ordering information**

The order document shall define the product required and shall contain the following information:

## a) type and form of the product:

- form of the product (sheet or strip);
- surface finish (see Clause 7);
- application;
- designation of the aluminium or aluminium alloy in accordance with EN 573-3;

## b) metallurgical temper of the material:

- temper designation in accordance with EN 515 (see also Annex C);
- for H1x tempers: delivery in accordance with Table 1 and/or Table 2;

## c) number of this standard or a specification number or, where none exists, the properties agreed between the supplier and purchaser;

## d) dimensions of the product, (in millimetres):

- thickness (to three decimal places);
- width;
- length;

## EN 541:2006 (E)

- internal and external diameters of the coil or reel;
- core size and type;

For the further processing of the sheet, usually one dimension is critical, demanding a tight tolerance. As the width tolerance is usually the tighter one, the purchaser shall state the critical dimension as the width of the sheet.

Designation of the sheet dimension shall always be in the following sequence: thickness × width × length.

It is recommended that the width be indicated by a *W* after the actual dimension if the width is greater than the length, (see 6.2.2, Figure 1).

EXAMPLE     0,300 mm × 750 mm × 1 000 mm  
                  0,300 mm × 1 000 mm (*W*) × 750 mm

- e) quantity:
  - mass, area or number of pieces;
- f) any requirements for inspection documents;
- g) any special requirements for packaging:
  - mass per coil and per packaging unit;
  - number of sheets per stack;
  - position of coil axis (vertical or horizontal);
  - direction of winding (see Clause 10);
  - design of pallet;
- h) any special requirements agreed between supplier and purchaser:
  - marking of products;
  - flagging of joints.

## 4.2 Requirements

### 4.2.1 Production and manufacturing processes

Unless otherwise specified in the order, the production and manufacturing processes shall be left to the discretion of the manufacturer. Any changes in the processes for subsequent and similar orders which significantly affect the properties of the product, whether or not specified in this standard, shall be agreed by the purchaser.

### 4.2.2 Quality control

The supplier shall be responsible for the performance of all inspection and tests required by this European Standard and/or the particular specification prior to the shipment of the product.

### 4.2.3 Chemical composition

The chemical composition shall comply with the requirements as specified in EN 573-3 and for alloy EN AW-5006 as specified in Annex D and EN 602.

### 4.2.4 Freedom from defects

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

## 4.3 Test procedure

### 4.3.1 Sampling

#### 4.3.1.1 Samples for chemical analysis

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

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

#### 4.3.1.2 Specimens for mechanical testing

##### 4.3.1.2.1 Number of specimens

Unless otherwise specified, at least one specimen shall be taken from each master coil of an inspection lot.

##### 4.3.1.2.2 Location and size

Specimens shall be taken from samples in such a way that it is possible to orientate the test pieces parallel with the rolling direction (longitudinal direction).

The specimens shall be sufficiently large enough to allow the manufacture of the test pieces necessary to carry out the required tests and shall include sufficient metal to allow the manufacture of test pieces for any retests required.

##### 4.3.1.2.3 Identification of specimens

Each specimen shall be marked in such a way that, after removal, it is still possible to identify the product from which it was taken and its location and orientation.

#### 4.3.1.3 Test pieces for tensile testing

##### 4.3.1.3.1 Number of test pieces

One test piece shall be taken from each specimen for the tensile test. The shapes and dimensions for tensile test pieces shall comply with EN 10002-1.

##### 4.3.1.3.2 Identification of the test pieces

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.

##### 4.3.1.3.3 Machining

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.

#### 4.3.1.4 Test pieces for other tests

For any other tests (e.g. earing, thickness or weight of coatings, lubricants) the procedures shall be agreed between the supplier and purchaser.

### **4.3.2 Test methods**

#### **4.3.2.1 Chemical composition**

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

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

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

#### **4.3.2.2 Tensile test**

The tensile test shall be carried out in accordance with EN 10002-1 on test pieces with a reduced section 12,5 mm wide taken parallel with the rolling direction (longitudinal direction). The elongation shall be measured on an original gauge length of 50 mm. Mechanical properties after simulated lacquer stoving shall be determined after heat treating the test pieces at 205 °C for 20 min in a laboratory furnace.

For determination of compliance, yield strength and tensile strength values shall be rounded to the nearest 1 MPa and elongation values to the nearest 0,1 % using the rounding rules given in Annex B.

#### **4.3.2.3 Measurement of dimensions**

The dimensions shall be measured by measuring instruments that are accurate to 1/5 of the relevant tolerance.

All dimensions shall be checked at the ambient temperature of the workshop or laboratory, and, in case of dispute, at a temperature of  $(20 \pm 2)$  °C.

#### **4.3.2.4 Earing test (anisotropy)**

The earing test shall be carried out either in accordance with the relevant European Standard or as agreed between the supplier and purchaser.

#### **4.3.2.5 Other tests**

If other mechanical or physical tests are required (e.g. thickness of coatings, lubricants), these tests shall be carried out either in accordance with the relevant European Standards or as agreed between supplier and purchaser.

### **4.3.3 Retests**

#### **4.3.3.1 Mechanical properties**

If any of the test pieces first selected fail 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 resumed as initially required.
- If this is not the case, then two further specimens shall be taken from the same lot, one being from the same unit of the product (sheet, strip, etc.) from which the original specimen was taken, unless that piece of product has been withdrawn by the supplier.

If both test pieces from these additional specimens comply with the requirement, the lot which they represent shall be deemed to comply with this standard.

Should one test piece fail:

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

#### 4.3.3.2 Other properties

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

## 5 Mechanical properties

### 5.1 Tensile

When ordering materials in the cold rolled condition, the supplier and purchaser shall agree upon delivery either in accordance with Table 1 and/or Table 2.

**NOTE** All sheet and strip conforming to this standard are preferably supplied in the materials and with the mechanical properties specified in Tables 1 and 2. Materials which are delivered with an uncoated surface are generally coated by the purchaser (except tab stock). The mechanical properties of these materials can change as a result of stoving conditions (temperature and time), depending on the temper of the material.

In general, only materials in the cold rolled condition show a significant drop in strength values. In the partially annealed condition the mechanical properties undergo only minor changes during lacquer stoving and remain within the listed range after simulated stoving treatment of 205 °C for 20 min.

Processing the material and stability of the final product depends on the mechanical properties after lacquer stoving. Table 2, therefore, shows for the "cold rolled" materials of Table 1 and the guaranteed mechanical properties after a simulated stoving treatment of 205 °C for 20 min. This thermal treatment approximates most of the real lacquering conditions in use today in sheet lacquering and decorating.

### 5.2 Earing

If required, limiting values for earing shall be agreed between the supplier and purchaser.

Table 1 — Mechanical properties

Alloy designation	Temper	Metal thickness mm	$R_m$ MPa		$R_{p0,2}$ MPa		Elonga- tion $A_{50\text{ mm}}$ % min.	Application <sup>a</sup>	Notes on condition
			min.	max.	min.	max.			
EN AW-3003 EN AW-Al Mn1Cu	H14	0,18 to 0,30	145	185	125	165	2	closures can bodies	cold rolled
	H24/ H44	0,18 to 0,30	145	185	115	155	4	closures can bodies	partially annealed lacquered
	H16	0,15 to 0,26	160	200	150	190	1	closures	cold rolled
EN AW-3004 EN AW-Al Mn1Mg1	H24/ H44	0,18 to 0,30	225	265	175	215	4	can bodies	partially annealed lacquered
	H25/ H45	0,18 to 0,30	230	270	205	245	3	can bodies lids	partially annealed lacquered
	H19	0,18 to 0,50	290	330	270	310	2	DWI-cans <sup>b</sup> lids	cold rolled
EN AW-3104 EN AW-Al Mn1Mg1Cu	H19	0,25 to 0,50	290	330	270	310	2	DWI-cans <sup>b</sup>	cold rolled
EN AW-3005 EN AW-Al Mn1Mg0,5	H25/ H45	0,18 to 0,30	180	220	160	200	4	closures can bodies	partially annealed lacquered
	H26/ H46	0,18 to 0,30	190	230	170	210	3	closures can bodies	partially annealed lacquered
	H28/ H48	0,18 to 0,30	210	250	190	230	2	can bodies	partially annealed lacquered
	H19	0,18 to 0,30	240	290	215	265	2	can bodies	cold rolled
EN AW-3105A EN AW-Al Mn0,5Mg0,5(A)	H24/ H44	0,18 to 0,30	150	190	120	160	3	closures can bodies	partially annealed lacquered
	H16	0,18 to 0,26	170	210	150	190	1	closures	cold rolled
	H26/ H46	0,18 to 0,30	165	205	135	175	2	lids can bodies	partially annealed lacquered
	H28/ H48	0,18 to 0,30	190	240	170	220	2	lids can bodies	partially annealed lacquered
EN AW-3207 EN AW-Al Mn0,6	H27/ H47	0,20 to 0,30	170	210	150	190	1	lids can bodies	partially annealed lacquered
	H28/ H48	0,20 to 0,30	180	230	160	210	1	lids can bodies	partially annealed lacquered
	H19	0,20 to 0,30	200	240	190	230	1	lids	cold rolled

Table 1 (continued)

Alloy designation	Temper	Metal thickness mm	$R_m$ MPa		$R_{p0,2}$ MPa		Elonga- tion $A_{50\text{ mm}}$ % min.	Application <sup>a</sup>	Notes on condition
			min.	max.	min.	max.			
EN AW-5006 EN AW-Al Mg1Mn0,5	H29/ H49	0,15 to 0,30	210	260	190	240	2	can bodies lids	partially annealed lacquered
EN AW-5042 EN AW-Al Mg3,5Mn	H24/ H44	0,25 to 0,50	280	320	230	280	6	tabs lids	partially annealed lacquered
	H48	0,25 to 0,50	330	370	280	320	5	tabs	lacquered
	H18	0,25 to 0,50	330	380	300	350	3	tabs	cold rolled
	H19	0,25 to 0,33 0,34 to 0,50	350 340	390 380	320 310	370 360	4 4	tabs, lids tabs, lids	cold rolled cold rolled
EN AW-5052 EN AW-Al Mg2,5	H22/ H42	0,18 to 0,30	215	265	170	225	7	can bodies lids	partially annealed lacquered
	H24/ H44	0,18 to 0,30	240	280	190	240	6	can bodies lids	partially annealed lacquered
	H14	0,18 to 0,30	240	280	215	255	3	can bodies	cold rolled
	H25/ H45	0,18 to 0,30	250	290	205	245	6	can bodies lids	partially annealed lacquered
	H16	0,18 to 0,30	260	300	230	270	3	can bodies lids	cold rolled
	H26/ H46	0,18 to 0,30	260	300	215	260	6	lids	partially annealed lacquered
	H47	0,18 to 0,30	270	310	240	280	6	lids	lacquered
	H28/ H48	0,18 to 0,30	280	330	260	310	5	can bodies lids	partially annealed lacquered
H19	0,18 to 0,30	300	360	280	330	2	lids	cold rolled	
EN AW-5182 EN AW-Al Mg4,5Mn0,4	H48	0,20 to 0,35	355	400	310	350	5	lids	lacquered
	H19	0,20 to 0,35	370	430	330	390	4	lids	cold rolled
EN AW-8011A EN AW-Al FeSi(A)	H22/ H42	0,18 to 0,26	105	145	90	135	3	closures	partially annealed lacquered
	H14/ H44	0,18 to 0,26	125	165	110	150	2	closures	cold rolled
	H24/ H44	0,18 to 0,26	120	160	100	140	2	closures	partially annealed lacquered

<sup>a</sup> Applications shown in this column are intended only as examples of where the alloy and temper has been or is being used.

<sup>b</sup> Drawn and wall-ironed cans.

Table 2 — Mechanical properties after simulated lacquer stoving

Alloy designation	Temper	Metal thickness mm	$R_m$ MPa		$R_{p0,2}$ MPa		Elonga- tion $A_{50\text{ mm}}$ % min.	Application <sup>a</sup>	Notes on condition
			min.	max.	min.	max.			
EN AW-3003 EN AW-Al Mn1Cu	H14	0,18 to 0,30	120	160	100	140	6	closures can bodies	cold rolled
	H16	0,15 to 0,26	140	180	120	160	4	closures	cold rolled
EN AW-3004 EN AW-Al Mn1Mg1	H19	0,25 to 0,50	260	300	245	295	3	DWI-cans <sup>b</sup> lids	cold rolled
	H19	0,25 to 0,50	270 <sup>c</sup>	310 <sup>c</sup>	250 <sup>c</sup>	290 <sup>c</sup>	3 <sup>c</sup>	DWI-cans <sup>b</sup>	cold rolled
EN AW-3104 EN AW-Al Mn1Mg1Cu	H19	0,25 to 0,50	260	300	245	295	3	DWI-cans <sup>b</sup>	cold rolled
	H19	0,25 to 0,50	270 <sup>c</sup>	310 <sup>c</sup>	250 <sup>c</sup>	290 <sup>c</sup>	3 <sup>c</sup>	DWI-cans <sup>b</sup>	cold rolled
EN AW-3005 EN AW-Al Mn1Mg0,5	H19	0,18 to 0,30	210	250	190	230	2	can bodies	cold rolled
EN AW-3105A EN AW-Al Mn0,5Mg0,5(A)	H16	0,18 to 0,26	150	190	120	160	3	closures	cold rolled
EN AW-3207 EN AW-Al Mn0,6	H19	0,20 to 0,30	180	230	160	210	1	lids	cold rolled
EN AW-5042 EN AW-Al Mg3,5Mn	H19	0,25 to 0,50	315	345	265	300	4	tabs lids	cold rolled
EN AW-5052 EN AW-Al Mg2,5	H14	0,18 to 0,30	215	265	170	225	7	can bodies	cold rolled
	H16	0,18 to 0,30	240	280	190	240	6	can bodies lids	cold rolled
	H19	0,18 to 0,30	280	330	260	310	5	tabs lids	cold rolled
EN AW-5182 EN AW-Al Mg4,5Mn0,4	H19	0,20 to 0,35	350	390	310	340	5	lids	cold rolled
EN AW-8011A EN AW-Al FeSi(A)	H14	0,18 to 0,26	110	150	90	130	3	closures	cold rolled

a Applications shown in the column are intended only as examples of where the alloy and temper has been or is being used.

b Drawn and wall-ironed cans.

c Mechanical properties after simulated lacquer stoving at 200 °C for 10 min.

## 6 Tolerances on dimensions and form

### 6.1 Thickness

For body stock (DWI-cans) up to a thickness of 0,41 mm, the tolerance shall be  $\pm 0,0075$  mm.

For all other cases, the tolerances shall comply with the values given in Table 3.

**Table 3 — Thickness tolerance**

Dimensions in millimetres

Thickness		Tolerance
over	up to	
—	0,350	$\pm 0,010$
0,350	0,500	$\pm 0,015$

The nominal thickness is the thickness of the sheet or strip in the bare condition, i.e. without lacquer.

The average thickness shall not differ from the nominal thickness by more than  $\pm 2,5$  %. The procedure for determining the average thickness shall be agreed between the supplier and purchaser.

### 6.2 Length and width

#### 6.2.1 Strip

The tolerance on strip width shall comply with the values given in Table 4.

**Table 4 — Width tolerance of strip**

Dimensions in millimetres

Width $W$		Tolerance
over	up to	
—	100	$\begin{matrix} +0,2 \\ 0 \end{matrix}$
100	400	$\begin{matrix} +0,4 \\ 0 \end{matrix}$
400	1 100	$\begin{matrix} +0,6^a \\ 0 \end{matrix}$
1 100	1 600	$\begin{matrix} +1,6 \\ 0 \end{matrix}$
1 600	2 000	$\begin{matrix} +0,2 \\ 0 \end{matrix}$

<sup>a</sup> Tolerance for body stock (DWI-cans) is  $\begin{matrix} +1,0 \\ 0 \end{matrix}$  mm.

#### 6.2.2 Sheet

The tolerances apply to the width,  $W$  and length,  $L$  of sheet as defined in 3.2 and 3.3 (see Figure 1).

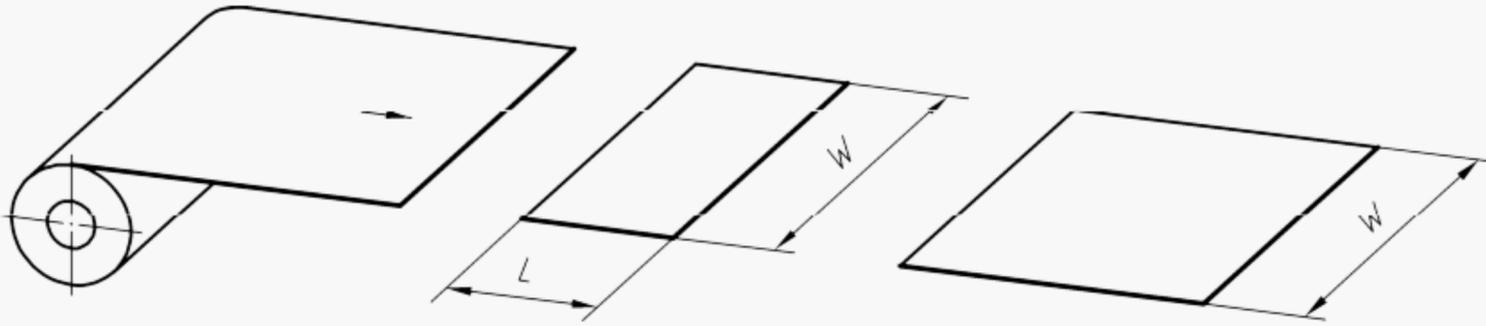


Figure 1 — Width and length of sheet

Tolerances on sheet width  $W$  and length  $L$  shall comply with the values given in Table 5 and Table 6 respectively.

Table 5 — Width tolerance of sheet

Dimensions in millimetres

Width $W$		Tolerance
over	up to	
—	1 100	+0,6 0

Table 6 — Length tolerance of sheet

Dimensions in millimetres

Length $L$		Tolerance
over	up to	
—	1 000	+1,5 0
1 000	1 250	+2,0 0

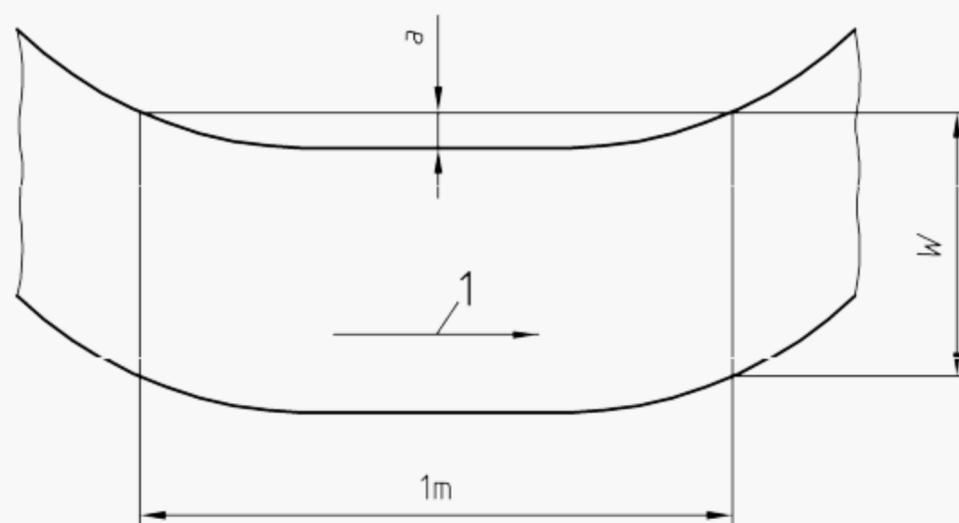
### 6.3 Straightness of the longitudinal edge (sheet and strip)

The deviation in straightness,  $a$ , shall be determined on a measured length of 1 m (see Figure 2). The permissible deviations are given in Table 7.

Table 7 — Straightness tolerance

Dimensions in millimetres

Width $W$		Straightness tolerance $a_{\max}$
over	up to	
—	100	2,0
100	300	1,0
300	2 000	0,5

**Key**

1 rolling direction

**Figure 2 — Straightness tolerance**

For sheet length less than 1 m, the tolerance on straightness shall be:

$$a'_{\max} = L \times a_{\max} \quad (1)$$

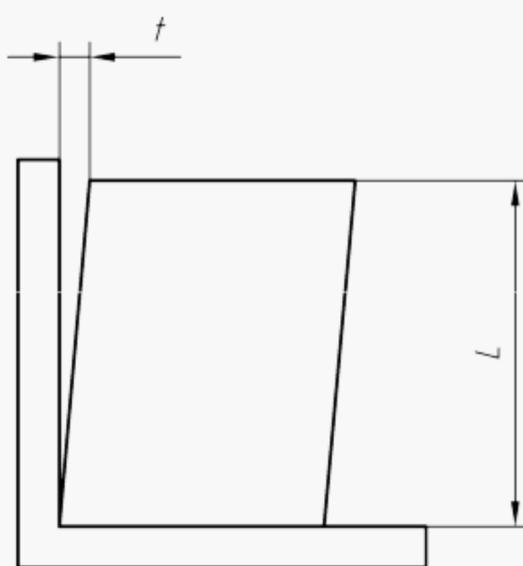
where

$L$  is the length of the sheet in metres;

$a_{\max}$  is the straightness tolerance on 1 m for the relevant width given in Table 7.

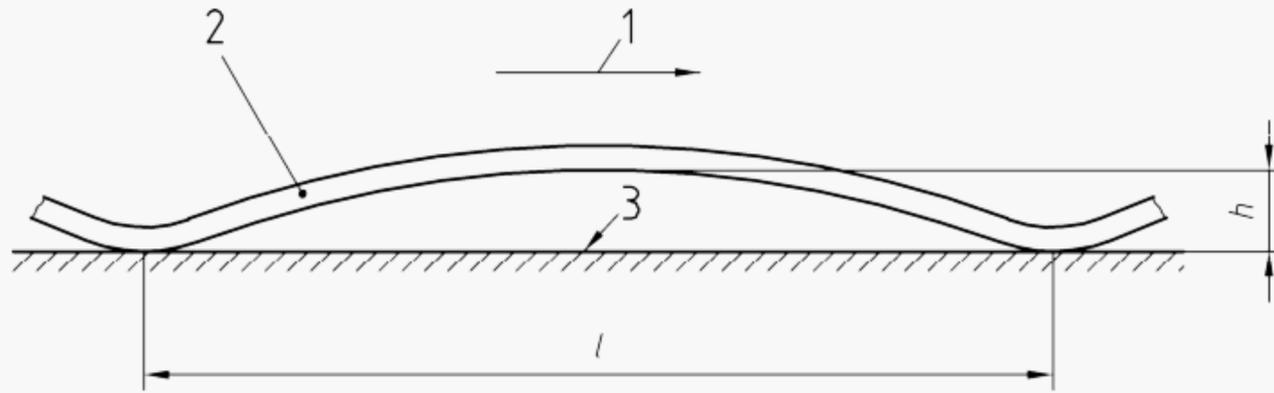
**6.4 Squareness of sheet**

The permissible deviation for squareness,  $t$  shall be less than 0,08 % of the length  $L$  (see Figure 3).

**Figure 3 — Deviation from squareness****6.5 Flatness**

The specifications of this paragraph do not apply to strip for the manufacture of drawn and wall-ironed cans and tabs.

Deviation from flatness shall be measured by placing the strip section or the sheet on a flat base (see Figure 4).



**Key**

- 1 rolling direction
- 2 sheet or strip
- 3 flat base

- h* height of wave
- l* length of wave

**Figure 4 — Deviation from flatness**

Two types of deviation from flatness are defined: edge waves and centre waves (pockets).

The permissible amplitude *h* of a wave shall either be, *n* % of the wavelength or, *h* max. (as given in Table 8), whichever is the smaller.

**Table 8 — Flatness tolerance for sheet and strip**

Dimensions in millimetres

Width <i>W</i>		Flatness tolerance			
		Sheet		Strip	
over mm	up to mm	<i>n</i> %	<i>h</i> <sub>max</sub> mm	<i>n</i> %	<i>h</i> <sub>max</sub> mm
100	400	—	—	0,6	2
400	1 100	0,6	2	0,9	4
1 100	2 000	—	—	0,9	5

Edge waves on a sheet shall not extend more than 150 mm from the edge.

The deterioration of flatness of a delivered sheet during lacquering and decoration under approved stoving conditions shall not cause any subsequent manufacturing problems.

**6.6 Longitudinal curvature (longitudinal bow)**

**6.6.1 Strip**

There are no fixed tolerances for strip material. However, the curvature shall be consistent in the direction over the length of a coil.

NOTE A certain amount of longitudinal curvature is inherent to strip material and can be removed by an appropriate levelling operation in line with cutting to the length operation.

## 6.6.2 Sheet

The longitudinal curvature of a sheet shall be measured by holding the sheet in a vertical position parallel to a flat vertical surface, and moving it towards the vertical surface until it comes into contact with the sheet. The furthest distance,  $c$  between the vertical surface and the sheet shall not exceed 2,5 % of the sheet length,  $L$  (see Figure 5).

Deterioration of the longitudinal curvature during lacquering and decoration under approved stoving conditions shall not cause any subsequent manufacturing problems.

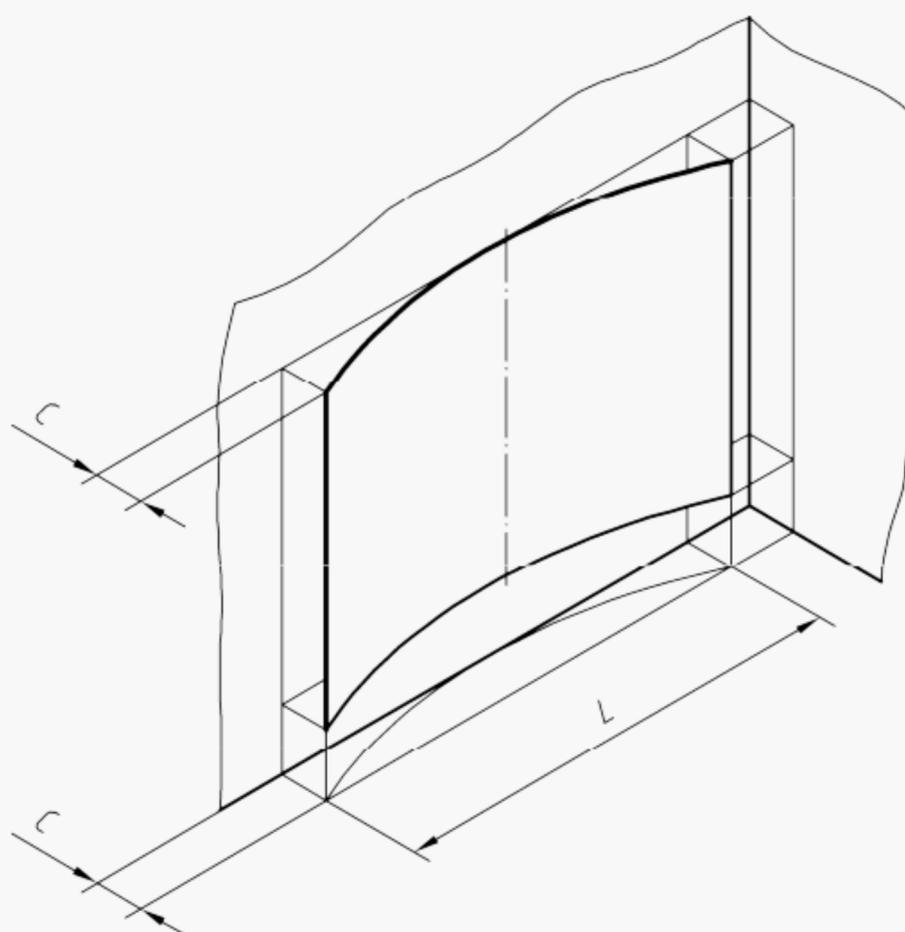


Figure 5 — Longitudinal curvature of sheet

## 7 Surface finish

### 7.1 Surface condition

The type of surface treatment, if any, shall be agreed between the supplier and purchaser.

NOTE Sheet and strip are normally supplied in the following surface conditions:

- rolled (not cleaned);
- rolled (not cleaned), lubricated;
- rolled, cleaned;
- rolled, cleaned, re-lubricated;
- pre-treated (not re-lubricated);
- pre-treated, re-lubricated;
- lacquered;
- lacquered, lubricated.

The pre-treatment is achieved by a chemical or an electrochemical process and produces a surface which is suitable for the envisaged lacquering and printing operation.

## **7.2 Lacquering**

Where sheet and strip are to be supplied in lacquered condition (on either one side or both sides), the lacquers used (type, properties and thickness) shall be agreed between the supplier and purchaser. The purchaser shall specify which lacquer is to be applied to each side of the strip.

## **7.3 Lubricants**

Type of lubricants, applied quantities and properties shall be agreed between the supplier and purchaser. Distribution of lubricants on the surface shall be uniform.

## **7.4 Food and health legislation**

Materials (e.g. metal, lacquers, pretreatment, lubricants) in contact with foodstuff have to comply with the relevant regulations.

## **7.5 Surface roughness**

Surface roughness values and the test method shall be agreed between the supplier and purchaser.

## **7.6 Surface appearance**

Sheet and strip shall have a uniform surface appearance. Mechanical defects such as scratches, stripes, indentations and other faults shall not adversely affect the envisaged use of the product.

NOTE Limiting samples can be agreed between the supplier and purchaser.

## **8 Inspection documents**

When requested by the purchaser and agreed upon by the supplier, the supplier shall provide the appropriate inspection documents in accordance with EN 10204 or other inspection documents such as a certificate of conformity.

## **9 Labelling**

Labels shall be affixed inside and outside the coils or sheets wrapping to give the following information:

- supplier;
- order number;
- production batch details;
- date of packing;
- dimensions;
- alloy and temper;
- gross and net mass;
- number of sheets or length of coil (if required).

## 10 Packaging

The mode of packaging shall be determined by the supplier who shall take all suitable precautions to ensure that, under the usual conditions of transportation and handling, the products will be delivered in a condition suitable for use.

NOTE For coils packed eye to the sky, when observed from the top, the winding direction is defined as clockwise or counter-clockwise as shown in Figure 6.

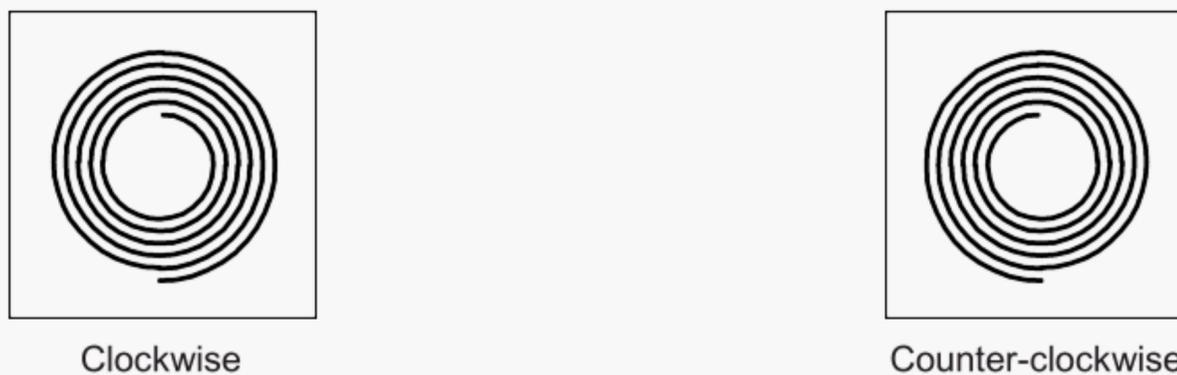


Figure 6 — Winding direction

## 11 Arbitration

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

## Annex A (normative)

### List of aluminium and aluminium alloys

Preferably the aluminium and the aluminium alloys listed in Table A.1 are used for the production of cans, closure lids and tabs. They are divided into two classes A and B:

- Class A: Aluminium and aluminium alloys produced in large volumes for the relevant field of application and for which the mechanical properties are specified in this European Standard.
- Class B: Aluminium and aluminium alloys for which the volume of production for the relevant field of application is more limited and/or which are used for special applications not covered by an European standard. The mechanical properties of these alloys are not specified in this European Standard.

**Table A.1 — List of aluminium and aluminium alloys**

Alloy designation	Possible application	Class
EN AW-1050A [Al 99,5]	wide jar closures	B
EN AW-3003 [Al Mn1Cu]	closures	A
EN AW-3103 [Al Mn1]	closures	B
EN AW-3004 [Al Mn1Mg1]	can bodies, lids, DWi-cans	A
EN AW-3104 [Al Mn1Mg1Cu]	can bodies, DWi-cans	A
EN AW-3005 [Al Mn1Mg0,5]	can bodies	A
EN AW-3105A [Al Mn0,5Mg0,5(A)]	closures, can bodies, lids	A
EN AW-3207 [Al Mn0,6]	can bodies, lids	A
EN AW-3017 [Al Mn1Cu0,3]	closures	B
EN AW-5006 [Al Mg1Mn0,5]	can bodies, lids	A
EN AW-5042 [Al Mg3,5Mn]	tab stock	A
EN AW-5050 [Al Mg1,5(C)]	can bodies, lids	B
EN AW-5251 [Al Mg2]	can bodies	B
EN AW-5052 [Al Mg2,5]	can bodies, lids	A
EN AW-5352 [Al Mg2,5(A)]	can bodies, lids	B
EN AW-5082 [Al Mg4,5]	tab stock	B
EN AW-5182 [Al Mg4,5Mn0,4]	beverage can-ends	A
EN AW-8011A [Al FeSi(A)]	closures, wide jar closures	A
EN AW-8211 [Al FeSi(C)]	closures	B
EN AW-8018 [Al FeSiCu]	closures	B

## **Annex B**

(normative)

### **Rules for rounding**

In recording test results, the number representing the result of a test to determine a given property shall be expressed to the same number of decimal places as the corresponding number in this standard; except for elongation for which one more decimal place shall be recorded.

The following rounding rules shall be used for determination of compliance with this standard.

- a) When the figure immediately after the last figure to be retained is less than five, the last figure to be retained remains unchanged.
- b) When the figure immediately after the last figure to be retained is greater than five, or equal to five and followed by at least one figure other than zero, the last figure to be retained is increased by one.
- c) When the figure immediately after the last figure to be retained is equal to five and followed by zeros only, the last figure to be retained remains unchanged if even and is increased by one if odd.

## Annex C (informative)

### Temper designations

The temper designations for aluminium and aluminium alloys are standardized in EN 515.

The following is an extract from EN 515.

The temper designations used in this European Standard consist of the letter H followed by two digits.

The letter H is the code for the basic temper designation.

#### **H — Strain-hardened**

This designation applies to products subjected to the application of cold work after annealing (or after hot forming), or to a combination of cold work and partial annealing or stabilizing, in order to secure the specified mechanical properties. The letter H is always followed by at least two digits, the first indicating the type of thermal processing and the second indicating the degree of strain-hardening (a third digit is used in some cases to identify special processing techniques).

#### **Subdivision of H (strain-hardened) temper designations**

The first digit following the letter H indicates the specific combination of basic operations as follows:

##### **H1x Strain-hardened only**

These designations apply to products which are strain-hardened to obtain the desired strength without supplementary thermal treatment.

##### **H2x Strain-hardened and partially annealed**

These designations apply to products which are strain-hardened more than the desired final amount and then reduced in strength to the desired level by partial annealing. For alloys that age-soften at room temperature, the H2x tempers have the same minimum ultimate tensile strength as the corresponding H3x tempers. For other alloys, the H2x tempers have the same minimum ultimate tensile strength as the corresponding H1x tempers and slightly higher elongation.

H4x Strain-hardened and lacquered or painted.

These designations apply to products which are strain-hardened and which may be subjected to some partial annealing during thermal curing which follows the painting or lacquering operation.

The second digit following the letter H indicates the final degree of strain-hardening.

- Numeral 8 has been assigned to the hardest tempers normally produced;
- Numeral 4 designates tempers whose ultimate tensile strength is approximately midway between that of the O temper and that of the Hx8 tempers;
- Numeral 2 designates tempers whose ultimate tensile strength is approximately midway between that of the O temper and that of the Hx4 tempers;
- Numeral 6 designates tempers whose ultimate tensile strength is approximately midway between that of the Hx4 tempers and that of the Hx8 tempers;
- Numerals 1, 3, 5 and 7 designate, similarly, tempers intermediate between those defined above;
- Numeral 9 designates tempers whose minimum ultimate tensile strength exceeds that of the Hx8 tempers by 10 MPa or more.

## Annex D (normative)

### Chemical composition of aluminium alloy EN AW-5006

The chemical composition of aluminium alloy EN AW-5006 is specified in percentage by mass in Table D.1. Limits are expressed as a maximum unless shown as a range or a minimum.

**Table D.1 — Chemical composition of aluminium alloy EN AW-5006**

Alloy designation		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Ga	V	Remarks	Others <sup>a</sup>		Aluminium min.
Numerical	Chemical symbols													Each	Total <sup>b</sup>	
EN AW-5006	EN AW-A1 Mg1Mn0,5	0,40	0,8	0,10	0,40 - 0,8	0,8 - 1,3	0,10	—	0,25	0,10	—	—	—	0,05	0,15	Remainder

<sup>a</sup> "Others" includes listed elements for which no specific limit is shown as well as unlisted metallic elements. The producer may analyze samples for trace elements not specified in the registration or specification. However, such analysis is not required and may not cover all metallic "other" elements. Should any analysis by the producer or the purchaser establish that an "others" element exceeds the limit of "Each" or that the aggregate of several "others" elements exceeds the limit of "Total", the material shall be considered non-conforming.

<sup>b</sup> The sum of those "Others" metallic elements 0,010 % or more each, expressed to the second decimal place before determining the sum.

## Bibliography

- [1] EN 515:1993, *Aluminium and aluminium alloy — Wrought products — Temper designations*
- [2] EN 14726, *Aluminium and aluminium alloys — Chemical analysis — Guideline for spark optical emission spectrometric analysis*



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