BRITISH STANDARD

BS EN
1386 : 1997

Aluminium and aluminium alloys — Tread plate — Specifications

The European Standard EN 1386 : 1996 has the status of a British Standard

ICS 77.150.10

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee NFE/35, Light metals and their alloys, to Subcommittee NFE/35/5, Wrought aluminium and aluminium alloys, upon which the following bodies were represented:

Aluminium Federation
Aluminium Stockholders' Association
Association of Light Alloy Refiners Limited
Magnesium Industry Council
Ministry of Defence

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Association of British Welded Aluminium Tube Makers
Institution of Structural Engineers
Metal Packaging Manufacturers' Association

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on
15 July 1997

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference NFE/35/5
Draft for comment 94/300907 DC

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Contents

National foreword

This British Standard has been prepared by Technical Committee NFE/35 and is the English language version of EN 1386 : 1996, *Aluminium and aluminium alloys — Tread plate — Specifications*, published by the European Committee for Standardization (CEN).

Cross-references

Publication referred to	Corresponding British Standard
EN 485-1	BS EN 485-1 : 1994 *Aluminium and aluminium alloys — Sheet, strip and plate — Technical conditions for inspection and delivery*
EN 515	BS EN 515 : 1993 *Aluminium and aluminium alloys — Wrought products — Temper designations*
EN 573-3	BS EN 573-3 : 1995 *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Chemical composition*
EN 10002-1	BS EN 10002-1 : 1990 *Tensile testing of metallic materials — Method of tests and ambient temperature*
ISO 7438	BS 1639 : 1964 *Methods for bend testing of metals*

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 16, an inside back cover and a back cover.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1386

December 1996

ICS 77.120.10; 77.140.90

Descriptors: Aluminium, aluminium alloys, metal plates, metal strips, rolled products, thickness, specifications, delivery, orders : sales documents, mechanical properties, dimensional tolerances, inspection, tension tests, bend tests, corrosion resistance, tread plate

English version

Aluminium and aluminium alloys — Tread plate — Specifications

Aluminium et alliages d'aluminium — Tôles relief — Spécifications

Aluminium und Aluminiumlegierungen — Bleche mit eingewalzten Mustern — Spezifikationen

This European Standard was approved by CEN on 1996-11-24. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard 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 1997, and conflicting national standards shall be withdrawn at the latest by June 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

1 Scope

This European Standard specifies the technical conditions for inspection and delivery, mechanical properties, tolerances on dimensions and other requirements for wrought aluminium and aluminium alloy sheets, strips and plates, rolled flat with a raised pattern on one side and a smooth surface on the other side.

It applies to sheets, strips and plates 1,2 mm to 20 mm in thickness and up to and including 2 500 mm in width, and to sheets and plates up to 12 500 mm in length.

Products in accordance with this standard are mainly used as floor plating, e.g. in vehicle construction, shipbuilding and metallic structures.

This standard is applicable in conjunction with EN 485-1 which specifies the technical conditions for inspection and delivery for wrought aluminium and aluminium alloy sheets, strips and plates.

The chemical composition limits for these materials are specified in EN 573-3.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 485-1	*Aluminium and aluminium alloys — Sheet, strip and plate —* Part 1: *Technical conditions for inspection and delivery*
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 10002-1	*Metallic materials — Tensile testing —* Part 1: *Method of test* (including amendment 1 : 1990)
ISO 7438	*Metallic materials — Bend test*
ASTM G66-86	*Visual assessment of exfoliation corrosion susceptibility of 5xxx series aluminium alloys (ASSET test)*

3 Definitions

Sheet, strip, plate are defined in EN 485-1.

For the purposes of this standard, the following definitions apply.

3.1 raised pattern

Geometrical modification of one side of the surface of a flat rolled product obtained by submitting such product to a final rolling operation using a specially prepared roll engraved with an appropriate pattern.

The raised pattern may be obtained either by cold-rolling or hot-rolling.

3.2 nominal thickness

Thickness of the product outside the raised areas. It does not include the height of the raised pattern.

3.3 pattern types

The most common patterns and their standard designations are shown in figures 1 to 5 (pattern illustrations are about half actual size). However, other patterns and designations may exist.

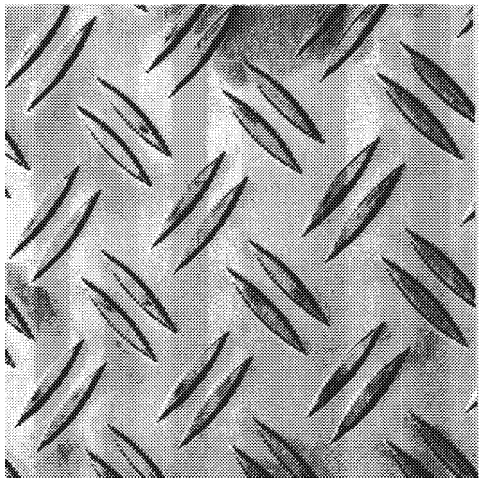


Figure 1. Two bar

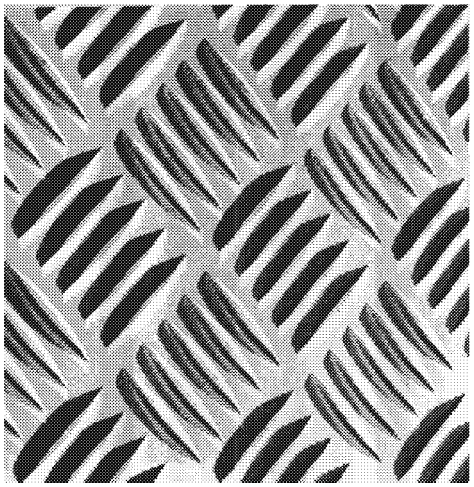


Figure 2. Five bar

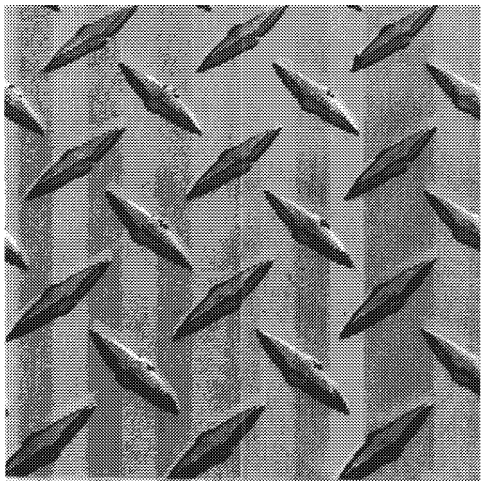


Figure 3. Diamond

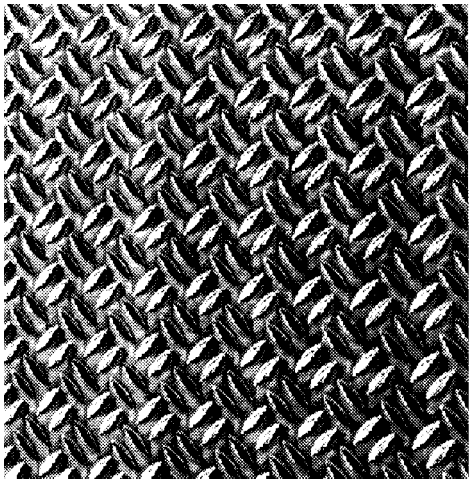


Figure 4. Barley seed

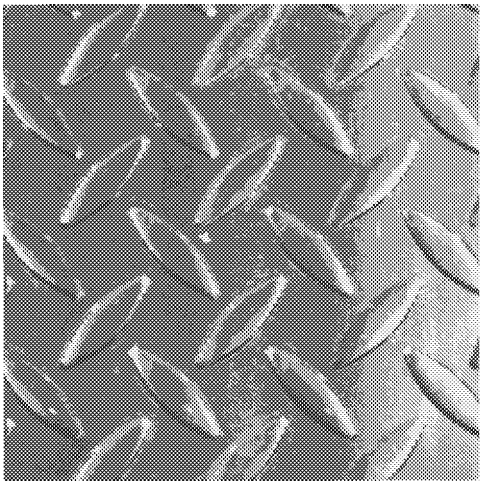


Figure 5. Almond

4 Technical conditions for inspection and delivery

4.1 Orders or tenders

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

a) the form and type of product:

– the form of the product (sheet, strip, plate);

– the type of pattern by reference to a drawing or a designation code agreed between producer and purchaser;

– the designation of the aluminium or aluminium alloy in accordance with EN 573-3;

– the customer application;

b) the metallurgical temper of the material for delivery in accordance with EN 515;

c) the number of this European Standard or a specification number, or where none exists, the properties agreed between producer and purchaser;

d) the dimensions and shape of the product (as applicable):

– nominal thickness (not including the height of the raised pattern);

– width;

– length (in the rolling direction) of the sheet;

NOTE. Unless otherwise agreed, the length is the largest dimension.

– internal and external diameters of the coil;

e) quantity:

– mass or number of pieces;

– tolerances on quantity if required;

f) any requirements for inspection documents;

g) any special requirements agreed between producer and purchaser:

– marking of products;

– reference to drawings, etc.

4.2 Freedom from defects

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

Whilst an operation designed to mask a fault is not permitted, the elimination of a superficial fault is permissible, provided that the dimensional tolerances and material properties continue to meet the specifications.

NOTE. Reverse side can show ripples, due to partial penetration of pattern during levelling.

4.3 Other conditions

All other provisions of EN 485-1 shall apply except for mechanical properties and tolerances on dimensions and form which are specified respectively in clauses **5** and **6** below.

5 Mechanical properties

5.1 Tensile test

The products shall conform to the tensile properties specified in table 1.

The selection, preparation and number of specimens and test-pieces, are specified in EN 485-1.

The test shall be carried out in accordance with EN 10002-1, and the following additional requirements:

– normally the test-pieces shall be taken with their length transverse (or long 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 permitted. In both cases the mechanical property limits specified in table 1 shall apply;

– machined test-pieces of rectangular or circular cross-section (as applies) shall be used;

– for specified thicknesses up to and including 12,5 mm the test-piece shall have a rectangular (or square) cross-section. Its reduced section shall be 12,5 mm wide and its thickness equal to the full thickness of the product after removal of the raised pattern by machining. Unless otherwise specified, rectangular test-pieces may also be tested without the removal of the raised pattern;

– for specified thicknesses from 8,0 mm up to and including 12,5 mm a round test-piece may be used. However, in case of dispute, a rectangular test-piece shall be used;

– 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;

– recommended shapes for rectangular and round test-pieces are shown in figures 6 and 7;

– 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;

– 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 $5D$ where D is the diameter of the reduced section;

– 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 set out in annex A.

Table 1. Mechanical properties

Alloy	Temper	Specified thickness t mm		R_m MPa		$R_{p0,2}$ MPa		Elongation, min. %		Recommended min. bend radius at 90°
		over	up to	min.	max.	min.	max.	A_{50mm}	A	
EN AW-1050A [Al 99,5]	F	≥ 1,2	20,0	—	—	—	—	—	—	—
	H244	≥ 1,2	1,5	105	145	75	—	2	—	1t
		1,5	3,0	105	145	75	—	3	—	1,5t
		3,0	6,0	105	145	75	—	4	—	2t
		6,0	20,0	105	145	75	—	5	8	—
EN AW-3003 [Al Mn1Cu]	F	≥ 1,2	20,0	—	—	—	—	—	—	—
	H224	≥ 1,2	1,5	120	180	80	—	3	—	1t
		1,5	3,0	120	180	80	—	4	—	1,25t
		3,0	6,0	120	180	80	—	5	—	2t
		6,0	20,0	120	180	80	—	6	10	—
	H244	≥ 1,2	1,5	140	200	115	—	2	—	1t
		1,5	3,0	140	200	115	—	3	—	1,25t
		3,0	6,0	140	200	115	—	4	—	2t
		6,0	20,0	140	200	110	—	5	7	—
EN AW-3103 [Al Mn1]	F	≥ 1,2	20,0	—	—	—	—	—	—	—
	H224	≥ 1,2	1,5	115	175	75	—	3	—	1,25t
		1,5	3,0	115	175	75	—	4	—	1,5t
		3,0	6,0	115	175	75	—	5	—	2,5t
		6,0	20,0	115	175	75	—	6	10	—
	H244	≥ 1,2	1,5	140	195	110	—	2	—	1,25t
		1,5	3,0	140	195	110	—	3	—	1,5t
		3,0	6,0	140	195	110	—	4	—	2,5t
		6,0	20,0	140	195	110	—	5	7	—
EN AW-5052 [Al Mg2,5]	F	≥ 1,2	20,0	—	—	—	—	—	—	—
	H114	≥ 1,2	1,5	170	240	65	—	8	—	1t
		1,5	3,0	170	240	65	—	10	—	1t
		3,0	6,0	170	240	65	—	12	—	1,75t
		6,0	20,0	165	240	65	—	14	15	—
	H224	≥ 1,2	1,5	210	270	130	—	4	—	1,5t
		1,5	3,0	210	270	130	—	6	—	2t
		3,0	6,0	210	270	130	—	8	—	2t
		6,0	20,0	210	270	130	—	9	10	—
	H244	≥ 1,2	1,5	230	290	150	—	2	—	2t
		1,5	3,0	230	290	150	—	3	—	2,5t
		3,0	6,0	230	290	150	—	4	—	3t
		6,0	20,0	230	290	150	—	6	7	—

Table 1. Mechanical properties (*continued*)

Alloy	**Temper**	**Specified thickness** t mm		R_m MPa		$R_{p0,2}$ MPa		**Elongation, min.** %		**Recommended min. bend radius at 90°**
		over	**up to**	**min.**	**max.**	**min.**	**max.**	A_{50mm}	A	
EN AW-5754 [Al Mg3]	F	≥ 1,2	20,0	—	—	—	—	—	—	—
	H114	≥ 1,2	1,5	190	260	80	—	8	—	1,5t
		1,5	3,0	190	260	80	—	10	—	2t
		3,0	6,0	190	260	80	—	12	—	2t
		6,0	20,0	190	260	80	—	14	15	—
	H224	≥ 1,2	1,5	220	275	130	—	4	—	2t
		1,5	3,0	220	275	130	—	6	—	2,5t
		3,0	6,0	220	275	130	—	8	—	2,5t
		6,0	20,0	220	275	130	—	9	10	—
	H244	≥ 1,2	1,5	240	295	160	—	2	—	2,5t
		1,5	3,0	240	295	160	—	3	—	3t
		3,0	6,0	240	295	160	—	4	—	3,5t
		6,0	20,0	240	295	160	—	6	7	—
EN AW-5083 [AlMg4, 5Mn0,7]	H114	≥ 1,2	1,5	275	350	125	—	6	—	2t
		1,5	3,0	275	350	125	—	8	—	2t
		3,0	6,0	275	350	125	—	10	—	2,5t
		6,0	20,0	275	350	125	—	12	14	—
	H116[1)]	≥ 1,2	1,5	305	—	215	—	3	—	3,5t
		1,5	3,0	305	—	215	—	4	—	4t
		3,0	6,0	305	—	215	—	5	—	4,5t
		6,0	20,0	305	—	215	—	6	7	—
	H224	≥ 1,2	1,5	305	380	215	—	3	—	3,5t
		1,5	3,0	305	380	215	—	4	—	4t
		3,0	6,0	305	380	215	—	5	—	4,5t
		6,0	20,0	305	380	215	—	6	7	—
	H244	≥ 1,2	1,5	340	400	250	—	2	—	4t
		1,5	3,0	340	400	250	—	2	—	4,5t
		3,0	6,0	340	400	250	—	3	—	5,5t
		6,0	20,0	340	400	250	—	4	5	—

Table 1. Mechanical properties (*continued*)

Alloy	Temper	Specified thickness t mm		R_m MPa		$R_{p0,2}$ MPa		Elongation, min. %		Recommended min. bend radius at 90°
		over	up to	min.	max.	min.	max.	A_{50mm}	A	
EN AW-5086 [Al Mg4]	H114	≥ 1,2	1,5	240	310	100	—	6	—	2t
		1,5	3,0	240	310	100	—	8	—	2t
		3,0	6,0	240	310	100	—	10	—	2,5t
		6,0	20,0	240	310	100	—	12	16	—
	H116[1)]	≥ 1,2	1,5	275	—	195	—	3	—	3,5t
		1,5	3,0	275	—	195	—	4	—	4t
		3,0	6,0	275	—	195	—	5	—	4,5t
		6,0	20,0	275	—	195	—	6	9	—
	H224	≥ 1,2	1,5	275	340	185	—	3	—	3,5t
		1,5	3,0	275	340	185	—	4	—	4t
		3,0	6,0	275	340	185	—	5	—	4,5t
		6,0	20,0	275	340	185	—	6	9	—
	H244	≥ 1,2	1,5	300	360	220	—	2	—	4t
		1,5	3,0	300	360	220	—	2	—	4,5t
		3,0	6,0	300	360	220	—	3	—	5,5t
		6,0	20,0	300	360	220	—	4	5	—
EN AW-6061 [Al Mg1 SiCu]	O	≥ 1,2	1,5	—	150	—	85	6	—	2t
		1,5	3,0	—	150	—	85	8	—	2t
		3,0	6,0	—	150	—	85	10	—	2t
		6,0	20,0	—	150	—	85	12	13	—
	T4	≥ 1,2	1,5	205	—	110	—	6	—	4t
		1,5	3,0	205	—	110	—	8	—	4t
		3,0	6,0	205	—	110	—	10	—	4t
		6,0	20,0	205	—	110	—	12	13	—
	T6	≥ 1,2	1,5	290	—	240	—	3	—	—
		1,5	3,0	290	—	240	—	4	—	—
		3,0	6,0	290	—	240	—	6	—	—
		6,0	20,0	290	—	240	—	8	8	—

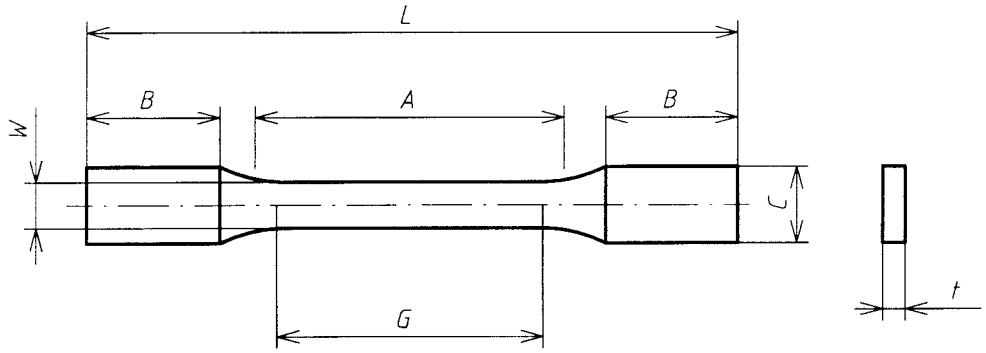
Table 1. Mechanical properties (*continued*)

Alloy	Temper	Specified thickness t mm		R_m MPa		$R_{p0,2}$ MPa		Elongation, min. %		Recommended min. bend radius at 90°
		over	up to	min.	max.	min.	max.	A_{50mm}	A	
EN AW-6082 [Al Si1 MgMn]	O	≥ 1,2	1,5	—	150	—	85	6	—	2t
		1,5	3,0	—	150	—	85	8	—	2t
		3,0	6,0	—	150	—	85	10	—	2t
		6,0	20,0	—	150	—	85	12	12	—
	T4[2)]	≥ 1,2	1,5	205	—	110	—	6	—	4t
		1,5	3,0	205	—	110	—	8	—	4t
		3,0	6,0	205	—	110	—	10	—	4t
		6,0	20,0	205	—	110	—	12	12	—
	T6	≥ 1,2	1,5	310	—	260	—	2	—	—
		1,5	3,0	310	—	260	—	3	—	—
		3,0	6,0	310	—	260	—	4	—	—
		6,0	20,0	310	—	260	—	6	6	—
	T61[2)]	≥ 1,2	1,5	280	—	205	—	3	—	7t
		1,5	3,0	280	—	205	—	4	—	7t
		3,0	6,0	280	—	205	—	6	—	7t
		6,0	20,0	280	—	205	—	9	9	—
EN AW-7020 [Al Zn4,5 Mg]	O	≥ 1,2	1,5	—	220	—	140	6	—	3t
		1,5	3,0	—	220	—	140	8	—	3t
		3,0	6,0	—	220	—	140	10	—	3t
		6,0	20,0	—	220	—	140	12	12	—
	T4[2) 3)]	≥ 1,2	1,5	320	—	210	—	4	—	6t
		1,5	3,0	320	—	210	—	6	—	6t
		3,0	6,0	320	—	210	—	8	—	6t
		6,0	20,0	320	—	210	—	10	12	—
	T6	≥ 1,2	1,5	350	—	280	—	3	—	—
		1,5	3,0	350	—	280	—	4	—	—
		3,0	6,0	350	—	280	—	6	—	—
		6,0	20,0	350	—	280	—	8	8	—

[1)] Material supplied to that temper shall be capable of exhibiting no evidence of exfoliation corrosion when subjected to ASTM G66-86 accelerated exfoliation corrosion susceptibility test (see **5.3**).

[2)] Appreciably smaller cold bend radii can be achieved immediately after solution heat-treatment.

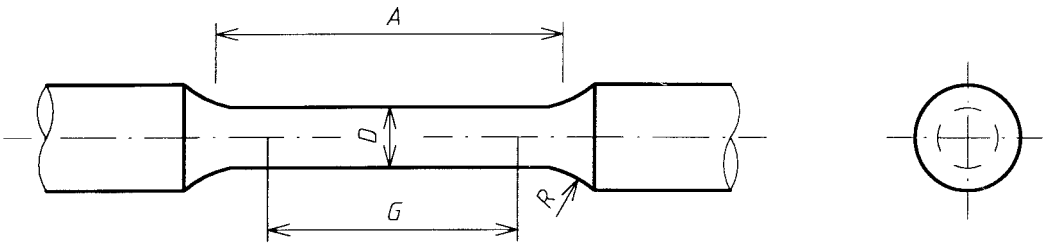
[3)] Use of this alloy in the T4 temper for finished products should be avoided.



Dimensions in millimetres

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

Figure 6. Standard rectangular tensile test-piece



Dimensions in millimetres

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

Figure 7. Standard 10 mm tensile test-piece with 50 mm gauge length and examples of small-size proportional test-pieces

5.2 Bend test

Sheet, strip and plate shall be capable of being bent cold through an angle of 90°, around a pin having a radius equal to k times the specified thickness t of the sheet, strip or plate (e.g. 2,5t) without cracking. The values of the minimum recommended bend radii for different alloys, tempers and thicknesses are specified in table 1.

Compliance with the specified values and/or conduct of the test is only required when so specified on the order.

For the conduct of the test the provisions of ISO 7438 shall apply with the following additional requirements:

– the bend test shall be carried out on a specimen taken adjacent to the tensile test specimen;

– the test-piece shall be taken in the transverse direction, the bend axis being parallel to the rolling direction;

– the width of the test piece shall be at least 20 mm and preferably between 40 mm and 50 mm. Its thickness shall be the full thickness of the material (including the raised pattern);

– the edges of the test-piece may be machined when practical. They may be rounded to a radius of approximately 2 mm;

– the pattern side shall be on the outside of the bend.

5.3 Exfoliation corrosion resistance (5xxx series alloys)

5.3.1 Products made of alloys EN AW-5086 and EN AW-5083 in the H116 temper shall be capable of exhibiting no evidence of exfoliation corrosion when subjected to ASTM G66-86 accelerated exfoliation corrosion susceptibility test.

When conducted, the test shall be carried out on full thickness test-pieces. Both surfaces shall be submitted to the test and evaluated.

5.3.2 For lot-acceptance purposes, the acceptability of each lot of material mentioned in **5.3.1** shall be determined by the producer, by metallographic examination of one specimen per lot selected from midsection at one end of a random sheet, plate or coil, using the following procedure:

– a section perpendicular to the rolling surface and parallel to the rolling direction shall be polished (preferably electrolytic polish) and then microetched for 3 min, using a solution of 40 ml 85 % phosphoric acid in 60 ml distilled water, at 35 °C ± 5 °C;

– the metallographic examination shall be carried out at 500 times magnification;

– the revealed microstructure shall be predominantly free of a continuous grain boundary network of aluminium-magnesium precipitate (Al_3Mg_2).

Acceptability shall be determined by comparison to producer-established reference photomicrographs of acceptable material. If the microstructure shows evidence of Al_3Mg_2 precipitates in excess of the relevant reference, the lot is either rejected or subjected to the ASTM G66-86 test.

Reference photomicrographs shall be established on acceptable material (according to ASTM G66-86), for each thickness range specified in table 1. Production practices shall not be changed after establishment of the references.

Significant changes in production practices that alter the microstructures of the alloy shall require the establishment of new reference photomicrographs as described above.

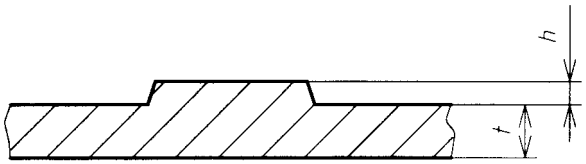
The producer shall maintain at the producing facility all records relating to the establishment of reference photomicrographs and production practices.

Table 2. Tolerances on pattern height

Dimensions in millimetres

Pattern type	Range of thickness t	Raised pattern	
		Nominal height h	Maximum permissible deviation on nominal height h
Figure 4	1,2 to 3,5	0,5	± 0,2
Figure 1, 2 and 3	1,2 to 1,5	0,5	± 0,3
	> 1,5 to 2,5	1,0	± 0,4
	> 2,5 to 20,0	1,5	± 0,6
Figure 5 Standard height	2,5 to 20,0	2,5	± 0,6
Figure 5 Reduced height	2,5 to 20,0	1,0	± 0,4

NOTE. For sheet of a thickness between 2 mm and 2,5 mm a height of the raised pattern of 1,5 mm ± 0,6 mm may be agreed between supplier and purchaser.



where
h is the height of raised pattern;
t is the specified thickness.

Figure 8. Cross section

6 Tolerances on dimensions and form

6.1 Height of the raised pattern

The raised pattern height is the difference, h, between the maximum thickness reading to the top of the figure and the thickness of an adjacent non raised area (see figure 8). The nominal heights and the tolerances on nominal height of the raised pattern are specified in table 2.

6.2 Specified thickness

The maximum permissible deviations on the nominal thickness are given in table 3.

Table 3. Tolerances on specified thickness

Dimensions in millimetres

Range of nominal thickness t	Maximum permissible deviation for nominal width	
	up to and including 1600	over 1600 up to and including 2500
>1,2[1)] to 2,5	± 0,20	± 0,30
>2,5 to 3,5	± 0,30	± 0,40
>3,5 to 6,5	± 0,40	± 0,50
>6,5 to 12,5	± 0,50	± 0,60
>12,5 to 20,0	± 1,0	± 1,0

[1)] Including nominal thickness 1,2 mm.

6.3 Width and length

6.3.1 Tolerances on length for strip are not specified.

6.3.2 Tolerances on width (sheet, strip and plate) and length (sheet and plate) are specified in table 4.

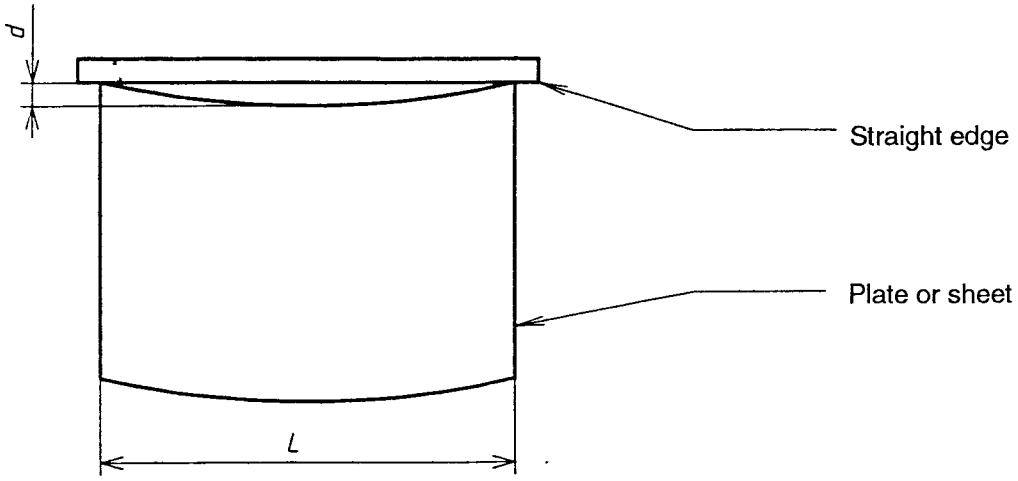
6.4 Straightness of the longitudinal edge

6.4.1 The maximum deviation from straightness, d, for strip with width up to and including 2500 mm shall not exceed 5 mm, where d is measured as indicated in figure 9, for a length L of 2000 mm, from one end of the strip, while the strip is resting on a horizontal base plate.

6.4.2 The maximum deviation from straightness, d, for sheet and plate, shall not exceed 0,2 % of the specified length, where d is measured as indicated in figure 9, while the sheet or plate is resting on a horizontal base plate.

Table 4. Width and length tolerances

Nominal thickness t	Width				
	up to and including 1500	over 1500 up to and including 2500	up to and including 2000	over 2000 up to and including 5000	over 5000
$1{,}2 \leq t \leq 3$	$^{+8}_{0}$	$^{+8}_{0}$	$^{+8}_{0}$	$^{+10}_{0}$	$^{+12}_{0}$
$3 < t \leq 8$	$^{+8}_{0}$	$^{+10}_{0}$	$^{+8}_{0}$	$^{+10}_{0}$	$^{+12}_{0}$
$t > 8$	$^{+5}_{0}$	$^{+8}_{0}$	$^{+6}_{0}$	$^{+8}_{0}$	$^{+10}_{0}$



where
d is the deviation from straightness;
L is the length of the sheet or plate.

Figure 9. Lateral curvature of sheet or plate of length L

6.5 Flatness

6.5.1 Flatness tolerances for strip are not specified.

6.5.2 Flatness tolerances for sheet and plate are specified in table 5 and are expressed as a percentage of the length L and/or the width W.

Deviation from flatness, f, resulting from arching or buckling is measured as shown in figures 10 and 11, using a lightweight straightedge and a feeler gauge, dial gauge or scale, while the sheet or plate is resting on a horizontal base plate concave side upwards.

Other procedures for measuring flatness may be used. However, in case of dispute, the preceding method shall be used.

6.6 Squareness

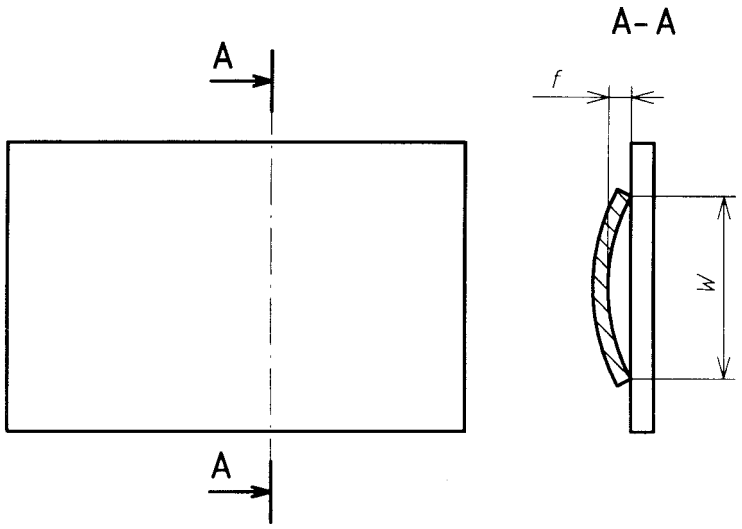
Squareness tolerances for sheets and plates are specified in table 6.

The squareness tolerance is expressed as the maximum allowable difference in length of diagonals AA and BB as shown in figure 12.

Table 5. Flatness tolerances for sheets and plates

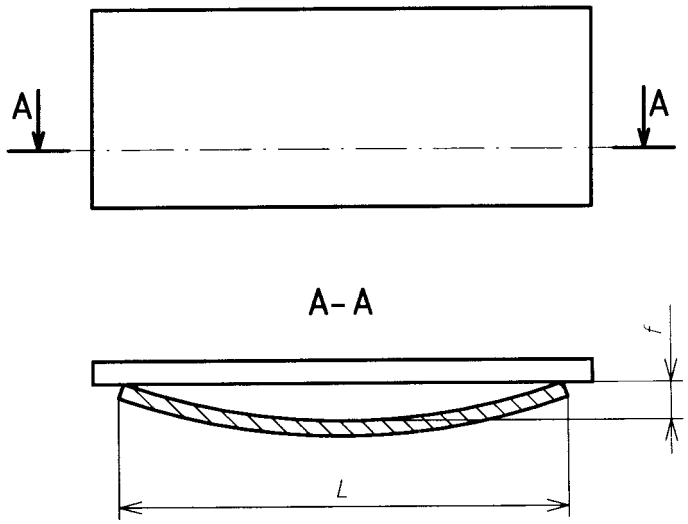
Dimensions in millimetres

Nominal thickness t	Maximum total deviation	
	on length *fIL*	on width *fIW*
$1{,}2 \leq t \leq 3$	0,4 %	0,5 %
$3 < t \leq 8$	0,3 %	0,4 %
$t > 8$	0,2 %	0,4 %



where
d is the deviation from flatness;
W is the width of the sheet or plate.

Figure 10. Transverse arch



where
d is the deviation from flatness;
L is the length of the sheet or plate.

Figure 11. Longitudinal arch

Table 6. Squareness tolerances for sheets and plates

Dimensions in millimetres

Nominal length		Squareness tolerance for nominal width			
Over	Up to and including	up to and including 1000	over 1000 up to and including 1500	over 1500 up to and including 2000	over 2000 up to and including 2500
—	2000	6	7	8	—
2000	3000	7	7	9	10
3000	3500	7	8	10	10
3500	5000	8	10	10	12
5000	—	12	12	15	15

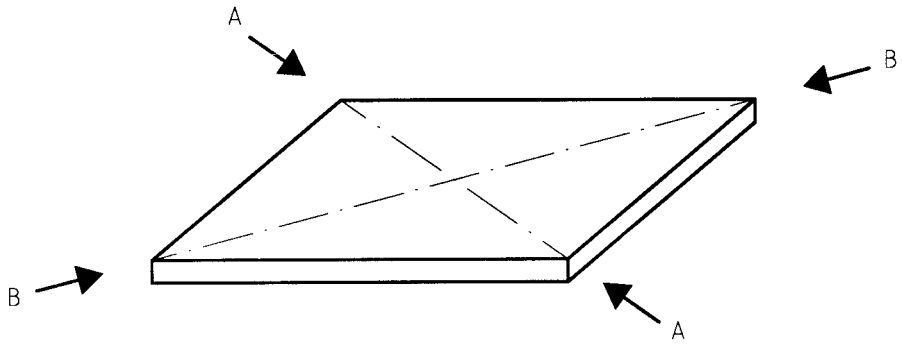


Figure 12. Measurement of squareness

Annex A (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.

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 5, the last figure to be retained remains unchanged;

b) when the figure immediately after the last figure to be retained is greater than 5, or equal to 5 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 5 and followed by zeros only, the last figure to be retained remains unchanged if even and is increased by one if odd.

List of references

See national foreword.

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