



SLOVENSKI STANDARD

SIST EN 4400-1:2019

01-junij-2019

Nadomešča:

SIST EN 2070-1:2001

SIST EN 2070-1:2001/A1:2001

SIST EN 2070-2:2001

Aeronavtika - Aluminij in aluminijeve in magnezijeve zlitine - Tehnične specifikacije - 1. del: Aluminij in aluminijeve zlitine

Aerospace series - Aluminium and aluminium- and magnesium- alloys - Technical specification - Part 1: Aluminium and aluminium alloy plate

(standards.iteh.ai)

Luft- und Raumfahrt - Aluminium und Aluminium- und Magnesiumlegierungen - Technische Lieferbedingungen - Teil 1: Platten aus Aluminium und Aluminiumlegierungen

<https://standards.iteh.ai/catalog/standards/sist/8465e37d-8c1e-4aae-ba61-1d631bb8fa68/sist-en-4400-1-2019>

Série aérospatiale - Aluminium et alliages d'aluminium et magnésium - Spécification technique - Partie 1 : Tôles épaisses en aluminium et alliages d'aluminium

Ta slovenski standard je istoveten z: EN 4400-1:2019

ICS:

49.025.20	Aluminij	Aluminium
77.120.10	Aluminij in aluminijeve zlitine	Aluminium and aluminium alloys

SIST EN 4400-1:2019

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 4400-1:2019](#)

<https://standards.iteh.ai/catalog/standards/sist/8465e37d-8c1e-4aae-ba61-1d631bb8fa68/sist-en-4400-1-2019>

EUROPEAN STANDARD

EN 4400-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2019

ICS

Supersedes EN 2070-1:1989, EN 2070-2:1989

English Version

Aerospace series - Aluminium and aluminium- and magnesium- alloys - Technical specification - Part 1: Aluminium and aluminium alloy plate

Série aérospatiale - Aluminium et alliages d'aluminium
et magnésium - Spécification technique - Partie 1 :
Tôles épaisses en aluminium et alliages d'aluminium

Luft- und Raumfahrt - Aluminium und Aluminium- und
Magnesiumlegierungen - Technische
Lieferbedingungen - Teil 1: Platten aus Aluminium und
Aluminiumlegierungen

This European Standard was approved by CEN on 28 August 2017.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents

	Page
European foreword	3
Introduction	4
1 Scope.....	4
2 Normative references.....	4
3 Terms and definitions.....	6
4 Wording of order.....	7
5 Health and safety.....	7
6 Technical requirements	7

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 4400-1:2019](https://standards.iteh.ai/catalog/standards/sist/8465e37d-8c1e-4aae-ba61-1d631bb8fa68/sist-en-4400-1-2019)

<https://standards.iteh.ai/catalog/standards/sist/8465e37d-8c1e-4aae-ba61-1d631bb8fa68/sist-en-4400-1-2019>

European foreword

This document (EN 4400-1:2019) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

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 September 2019, and conflicting national standards shall be withdrawn at the latest by September 2019.

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 2070-1:1989, EN 2070-1/A1:1993, EN 2070-2:1989.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

ITEH STANDARD PREVIEW

(standards.iteh.ai)

SIST EN 4400-1:2019

<https://standards.iteh.ai/catalog/standards/sist/8465e37d-8c1e-4aae-ba61-1d631bb8fa68/sist-en-4400-1-2019>

Introduction

This European Standard is part of the series of EN metallic material standards for aerospace applications. The general organization of this series is described in EN 4258.

1 Scope

This European Standard defines the requirements for the ordering, manufacture, testing, inspection and delivery of aluminium and aluminium alloy plate, clad or unclad, supplied in the as-rolled or machined condition. It shall be applied when referred to and in conjunction with the EN material standard unless otherwise specified on the drawing, order or inspection schedule.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2002-001, *Aerospace series — Metallic materials — Test methods — Part 001: Tensile testing at ambient temperature*

EN 2002-6, *Aerospace series — Metallic materials — Test methods — Part 6: Bend testing* ¹⁾

EN 2002-8, *Aerospace series — Metallic materials — Test methods — Part 8: Micrographic determination of grain size* ¹⁾

EN 2002-22, *Aerospace series — Metallic materials — Test methods — Part 22: Plane strain fracture toughness test* ²⁾

EN 2002-23, *Aerospace series — Test methods for metallic materials — Part 23: Sharp-notch tension testing* ¹⁾

EN 2004-1, *Aerospace series — Test methods for aluminium and aluminium alloy products — Part 1: Determination of electrical conductivity of wrought aluminium alloys*

EN 2004-10, *Aerospace series — Test methods for aluminium and aluminium alloy products — Part 10: Preparation of micrographic specimens for aluminium alloys* ¹⁾

EN 2007, *Aerospace series — Test methods for aluminium and aluminium alloy products — Metallographic determination of cladding thickness and copper diffusion in the cladding for rolled products* ¹⁾

EN 2021, *Aerospace series — Metallic materials — Test methods — Shear testing for thin flat product* ¹⁾

EN 2032-001, *Aerospace series — Metallic materials — Part 001: Conventional designation*

¹⁾ Published as ASD-STAN Prestandard at the date of publication of this standard by AeroSpace and Defence industries Association of Europe - Standardization (ASD-STAN), <http://www.asd-stan.org>

²⁾ In preparation at the date of publication of this standard.

- EN 2032-2, *Aerospace series — Metallic materials — Part 2: Coding of metallurgical condition in delivery condition*
- EN 2078, *Aerospace series — Metallic materials — Manufacturing schedule, inspection schedule, inspection and test report — Definition, general principles, preparation and approval*
- EN 2716, *Aerospace series — Test method — Determination of susceptibility to intergranular corrosion — Wrought aluminium alloy products — AL-P2XXX- series, AL-P7XXX- series and aluminium-lithium alloys ¹⁾*
- EN 2720, *Aerospace series — Test method for metallic materials — Testing of susceptibility to exfoliation corrosion in 2XXX and 7XXX series wrought aluminium alloy products for aerospace constructions ¹⁾*
- EN 3874, *Aerospace series — Test methods for metallic materials — Constant amplitude force-controlled low cycle fatigue testing ¹⁾*
- EN 3987, *Aerospace series — Test methods for metallic materials — Constant amplitude force-controlled high cycle fatigue testing*
- EN 3988, *Aerospace series — Test methods for metallic materials — Constant amplitude strain-controlled low cycle fatigue testing ¹⁾*
- EN 4050-4, *Aerospace series — Test method for metallic materials — Ultrasonic inspection of bars, plates, forging stock and forgings — Part 4: Acceptance criteria*
- EN 4258, *Aerospace series — Metallic materials — General organization of standardization — Links between types of EN standards and their use*
- EN 4259, *Aerospace series — Metallic materials — Definition of general terms ¹⁾*
- EN 4268, *Aerospace series — Metallic materials — Heat treatment facilities — General requirements*
- EN 4522, *Aerospace series — Metallic materials — Test methods — Pin-type bearing test of yield strength ¹⁾*
- EN 4523, *Aerospace series — Metallic materials — Test methods — Compression testing ¹⁾*
- EN 4524, *Aerospace series — Metallic materials — Test methods — Measurement of fatigue crack growth rates ¹⁾*
- EN 4525, *Aerospace series — Aluminium and aluminium alloys — Test methods — Shear testing ¹⁾*
- EN 4527, *Aerospace series — Aluminium and aluminium alloy products — Test methods — Determining susceptibility to stress-corrosion cracking ¹⁾*
- EN 6018, *Aerospace series — Test methods for metallic materials — Determination of density according to displacement method*
- EN 6019, *Aerospace series — Test methods for metallic materials — Recommended practice for R-Curve and K_{Ic} determination ¹⁾*
- EN 6072, *Aerospace series — Metallic materials — Test methods — Constant amplitude fatigue testing*
- EN 9100, *Quality Management Systems — Requirements for Aviation, Space and Defence Organizations*

EN 4400-1:2019 (E)

EN 9133, *Aerospace series — Quality Management Systems — Qualification Procedure for Aerospace Standard Products*

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

EN 12258-1, *Aluminium and aluminium alloys – Terms and definitions — Part 1: General terms*

TR 2410, *Aerospace series — Metallic materials — Relationship between dimensional standards and material standards* ³⁾

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 4259 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

For definitions of temper designation, see EN 515.

For definitions specific to aluminium alloys, see EN 12258-1 and with the following additions for aluminium alloy plate:

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3.1 batch

as defined in EN 4259 with the following additions: <https://standards.iteh.ai/catalog/standards/sist/8465e37d-8c1e-4aae-ba61-417118081006>

- for solution heat treatment using a continuous furnace, a continuous run of $t \leq 8$ h may be considered as the same heat treatment charge;
- for tensile testing only, the special provision in Table 1, line 8.1, "Batch size for testing" applies.

3.2 controlled stretching

stretching performed after solution heat treatment and quenching for the purpose of reducing internal stresses and/or deviation from flatness

Note 1 to entry: The stretching is defined by a minimum and maximum permanent elongation stated in the material standard.

Note 2 to entry: In certain cases controlled stretching is critical to the achievement of the specified mechanical properties.

3.3 machined plate

product with 1 (one) or more of its major surfaces machined

³⁾ Published as ASD-STAN Technical Report at the date of publication of this standard by AeroSpace and Defence industries Association of Europe - Standardization (ASD-STAN), <http://www.asd-stan.org>

3.4

parent plate

product which has undergone the same operations over its whole length (including solution heat treatment, controlled stretching, ageing) before being cut

4 Wording of order

The order shall clearly indicate:

- a) quantities to be supplied;
- b) dates of delivery;
- c) material standard number;
- d) delivery condition;
- e) dimensions and tolerances or reference to an appropriate dimensional standard;
- f) forwarding address;
- g) nature and type of packing, if required;
- h) surface protection, if appropriate;
- i) definition and frequency of any special tests and their retest procedures, if required.

5 Health and safety

SIST EN 4400-1:2019

<https://standards.iteh.ai/catalog/standards/sist/8465e37d-8c1e-4aae-ba61->

Products in the delivery condition shall fulfil the health and safety laws of the area of the country when and where they are to be delivered.

A product safety data sheet shall be available.

6 Technical requirements

6.1 General

The product shall be manufactured in accordance with the requirements of the relevant material standard and the applicable requirements of this technical specification. A manufacturing schedule shall be established and applied in accordance with EN 2078.

The product shall satisfy the requirements of the material standard and/or order and shall be free from irregularities prejudicial to the subsequent manufacture or use of this product. Notwithstanding previous acceptance complying with the material standard and this technical specification, any product that is found, at a later stage, to contain such defects shall be rejected.

Unless otherwise specified, the requirements in Tables 1 and 2 shall apply in conjunction with those of the relevant material standard. Table 1 relates to lines 1 to 29 (inclusive) of the material standard and Table 2 relates to lines 30 onwards in which the sub-line format is also used. Lines 2 to 98 may also be opened in line 100 if the material standard details specific qualification requirements. If a specific line number is not shown in Tables 1 and 2, the requirement is stated in the material standard and/or order.

The requirements of the order and/or material standard shall over-ride the requirements of this technical specification.

EN 4400-1:2019 (E)

6.2 Qualification requirements

Qualification requirements when invoked by the material standard and/or order are detailed in Tables 1 and 2. Unless otherwise agreed between the manufacturer and purchaser the qualification phase shall be as shown below:

Qualification phase	
Starting	Intermediate
1 st , 2 nd and 3 rd batches	4 th and 5 th batches

6.3 Release requirements

6.3.1 Release tests

Release testing shall be the responsibility of the manufacturer.

The purchaser reserves the right to perform any of the inspections and/or tests required by the material standard and/or order.

The test samples shall be representative of the product.

When required, the manufacturer shall inform the purchaser of the planned dates for extraction of samples and release testing in order that these operations may be witnessed.

Tables 1 and 2 detail the requirements for each line of the material standard. Unless otherwise specifically requested by the purchaser, a particular inspection and/or test for release shall be carried out if corresponding acceptance criteria and/or values are stated in the applicable material standard, but see also 6.3.5 "Capability clause".

6.3.2 Replacement/Retests

If any requirement is not met, replacement or retests shall be carried out under the following conditions unless otherwise stated in the material standard or order.

Replacement:

If the test procedure or test piece preparation is faulty, testing shall be re-applied at the original frequency after rectification of the original cause of failure on a test sample located near the original.

Retests:

When failure cannot be attributed to faulty testing, or test piece preparation, further test samples shall be selected at twice the original frequency from the product, 1 (one) of which shall be that on which the original results were obtained unless already withdrawn by the manufacturer after suitable identification of the cause of failure. If all retest results are satisfactory, the batch shall be accepted. If 1 (one) or more tests are unsatisfactory, the batch shall be:

- rejected, or
- 100 % retested and the conforming products accepted, or
- partially or fully re-heat treated if heat treatment can rectify the cause of the failure and tested as a completely new batch except for chemical composition. The re-heat treatment shall be stated on the inspection and test report. No product or test sample shall be re-heat treated more than twice.

6.3.3 Rejection

Any failure to meet the requirements of the material standard shall be cause for rejection.

6.3.4 Special tests

Special tests may be required by the purchaser. In such cases, the nature of the test, method, frequency and technical requirements shall be specified on the order or inspection schedule and shall be mutually agreed by the manufacturer and the purchaser.

6.3.5 Capability clause

Where this is invoked and where sufficient evidence exists, the test will not normally be carried out for release purposes unless specifically requested by the purchaser. However, this in no way reduces the obligations of the manufacturer to fulfil the requirements. If subsequent testing indicates that the product does not comply with the requirements, the batch shall be rejected.

If sufficient evidence does not exist, the test shall be carried out at a frequency agreed between the manufacturer and purchaser.

6.3.6 Statistical process control

Reduction in the extent of release testing, other than that defined in 6.3.5 above may be negotiated with the purchaser on the basis of appropriate statistical process control and/or statistical data.

6.3.7 Inspection and test report

The manufacturer shall furnish, with each delivery, a report conforming to the requirements of EN 2078 stating the following:

- a) manufacturer's name and address and, if appropriate, identification of the plant ;
- b) order number;
- c) the following statement: "This product has been tested according to EN 4400-1";
- d) material standard number;
- e) delivery condition and metallurgical code of the product;
- f) quantity and dimensions;
- g) manufacturing and inspection schedule reference, if appropriate;
- h) cast and batch number;
- i) batch and/or test sample heat treatment, if required by the purchaser;
- j) results of all tests and chemical analysis and re-tests, if any.

6.4 Traceability

Each product shall be traceable to the cast, production batch and/or heat treatment batch at all stages of manufacture, testing and delivery.

Table 1 — Technical requirements for lines 1 to 29, where appropriate (1 of 8)

Material standard line reference		Requirements	Frequency of testing		
			Qualification phase		Release
No.	Title		Starting	Intermediate	
1	Material designation	See EN 2032-001.	–	–	–
2	Chemical composition	The test samples used for chemical analysis shall be representative of the product and shall be taken from the molten metal. Any subsequent analytical checks taken from the solid product shall take into consideration the heterogeneity normal to the alloy. The method of chemical analysis shall be at the discretion of the manufacturer unless otherwise stated in the material standard or order. In cases of dispute, the method of chemical analysis shall be agreed between the manufacturer and purchaser. The measured chemical composition shall meet the requirements of the material standard and shall be stated in the inspection and test report.	1 (one) per cast	1 (one) per cast	1 (one) per cast
3	Method of melting	At the discretion of the manufacturer or unless otherwise stated in the material standard.	–	–	–
4.1	Form	Plate	–	–	–
4.2	Method of production	Rolling The product shall satisfy the requirements of the relevant order, material standard and this technical specification. The manufacturer shall define the raw materials, processes and inspection requirements in a manufacturing schedule in accordance with EN 2078 and EN 9133. The manufacturer shall make this available to the purchaser upon request. Changes to any manufacturing schedule agreed during qualification and which may adversely affect the quality of the product shall be advised by the manufacturer and shall be subject to written approval of the purchaser. Each product shall be traceable to the cast, production batch and/or heat treatment batch at all stages of manufacture, testing and delivery. For machined plate, the minimum depth of metal removal shall correspond to the ultrasonic dead zones, unless otherwise agreed between the purchaser and manufacturer. Witness of the removed metal shall be given by the following method or 1 (one) agreed upon between the manufacturer and purchaser: <ul style="list-style-type: none"> • 10 mm diameter circles shall be hard stamped on the four edges of the product, tangential to the face(s) to be machined. On each edge, at least 3 (three) circles shall be stamped, 1 (one) at each end and at the middle of the length. • After machining, the remainder of the circles give witness of the metal removed. 	–	–	–
4.3	Limit dimension(s)	Minimum and/or maximum size of the product expressed as nominal thickness, a . See also line 96.	–	–	–
5	Technical specification	Reference to this technical specification EN 4400-1. In cases of conflict, the requirements of the material standard shall take precedence over those of this technical specification. See also EN 4258.	–	–	–

Table 1 — Technical requirements for lines 1 to 29, where appropriate (2 of 8)

Material standard line reference		Requirements	Frequency of testing											
No.	Title		Qualification phase		Release									
			Starting	Intermediate										
6.1	Delivery condition (1 of 2)	<p>The product shall be supplied in the delivery condition specified in this line in the material standard and/or as stated on the order.</p> <p>When required, semi-finished product designations shall conform to the requirements of the order.</p> <p>Marking:</p> <p>The method of marking used shall not cause corrosion, crack initiation, contamination or unacceptable deformation. The marking shall remain permanently visible after handling and contact with protective products.</p> <p>Unless otherwise specified, the nature and colour of marking ink and type of marking characters shall be left to the discretion of the manufacturer. The marking inks shall be removable with cleaning products which do not leave a residue which could affect further processing. The cleaning products shall not give rise to corrosion.</p> <p>All products shall be marked legibly as indicated in the following table:</p> <table border="1" data-bbox="519 766 1579 1193"> <thead> <tr> <th>Continuous marking ^{a, b} (Ink or similar product)</th> <th colspan="2">End marking ^c (Ink or similar product or hard stamping)</th> </tr> </thead> <tbody> <tr> <td>Material standard. Dimensional standard. Delivery condition and code. Manufacturer and plant identification. Nominal product thickness (mm)</td> <td>$a < 12$ mm: On the face in a corner or on the edge</td> <td>Batch number or product number. Inspection stamp.</td> </tr> <tr> <td></td> <td>$a \geq 12$ mm: On the edge</td> <td>Product number. Inspection stamp.</td> </tr> </tbody> </table> <p>^a All indications shall be visible on any separate piece of 300 mm × 300 mm.</p> <p>^b Continuous marking shall be in the rolling direction on 1 (one) major face.</p> <p>^c If required by the purchaser and specified on the order.</p>	Continuous marking ^{a, b} (Ink or similar product)	End marking ^c (Ink or similar product or hard stamping)		Material standard. Dimensional standard. Delivery condition and code. Manufacturer and plant identification. Nominal product thickness (mm)	$a < 12$ mm: On the face in a corner or on the edge	Batch number or product number. Inspection stamp.		$a \geq 12$ mm: On the edge	Product number. Inspection stamp.	–	–	–
Continuous marking ^{a, b} (Ink or similar product)	End marking ^c (Ink or similar product or hard stamping)													
Material standard. Dimensional standard. Delivery condition and code. Manufacturer and plant identification. Nominal product thickness (mm)	$a < 12$ mm: On the face in a corner or on the edge	Batch number or product number. Inspection stamp.												
	$a \geq 12$ mm: On the edge	Product number. Inspection stamp.												