



**SLOVENSKI STANDARD**  
**SIST EN 2858-2:2001**  
**01-januar-2001**

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**Aerospace series - Titanium and titanium alloys - Forging stock and forgings -  
Technical specification - Part 2: Forging stock**

Aerospace series - Titanium and titanium alloys - Forging stock and forgings - Technical  
specification - Part 2: Forging stock

Luft- und Raumfahrt - Titan und Titanlegierungen - Schmiedevormaterial und  
Schmiedestücke - Technische Lieferbedingungen - Teil 2: Schmiedevormaterial

Série aérospatiale - Titane et alliages de titane - Produits destinés a la forge, pieces  
forgées et pieces matricées - Spécification technique - Partie 2: Produits destinés a la  
forge

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**ICS:**

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EUROPEAN STANDARD

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**Aerospace series - Titanium and titanium alloys -  
Forging stock and forgings - Technical  
specification - Part 2: Forging stock**

Série aéronautique - Titane et alliages de titane - Produits destinés à la forge, pièces forgées et pièces matriçées - Spécification technique - Partie 2: Produits destinés à la forge

Luft- und Raumfahrt - Titan und Titanlegierungen - Schmiedevormaterial und Schmiedestücke - Technische Lieferbedingungen - Teil 2: Schmiedevormaterial

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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.

The European Standards exist 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.

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# CEN

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

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

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## Foreword

## iTeh STANDARD PREVIEW (standards.iteh.ai)

This European Standard has been prepared by the European Association of Aerospace Manufacturers (AECMA).

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

This standard was submitted for Formal Vote, and the result was positive.

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 October 1994, and conflicting national standards shall be withdrawn at the latest by October 1994.

According to the CEN/CENELEC Internal Regulations, 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, United Kingdom.

## 1 Scope

This standard specifies the particular requirements for forging stock of grades 1 <sup>1)</sup> and 2 <sup>2)</sup> intended to be used for the manufacture of titanium and titanium alloy forgings.

Unless otherwise specified, the requirements for grade 2 shall apply.

This standard shall be used in conjunction with EN 2858-1.

Bars and sections to EN 3544-3 may be used as forging stock provided that an agreement has been established between the forging stock manufacturer <sup>3)</sup> and the purchaser to ensure that the requirements of this standard are met.

## 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.

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|-----------|--|
| EN 2002-1 | Aerospace series - Test methods for metallic materials - Part 1: Tensile testing at ambient temperature <sup>4)</sup>  |
| EN 2002-2 | Aerospace series - Test methods for metallic materials - Part 2: Tensile testing at elevated temperature <sup>4)</sup>   |
| EN 2002-5 | Aerospace series - Test methods for metallic materials - Part 5: Uninterrupted creep and creep rupture testing <sup>4)</sup>   |
| EN 2003-8 | Aerospace series - Test methods for products in steel, titanium, titanium alloys, aluminium alloys and heat resisting alloys - Part 8: Ultrasonic inspection of billets, bars, plates and forgings <sup>5)</sup> |
| EN 2858-1 | Aerospace series - Titanium and titanium alloys - Forging stock and forgings - Technical specification - Part 1: General requirements  |
| EN 2954-2 | Aerospace series - Macrostructure of titanium alloy wrought products - Part 2: Macrostructure of bar, section, forging stock and forgings <sup>5)</sup>  |
| EN 2955   | Aerospace series - Recycling of titanium and titanium alloy scrap  |
| EN 2957   | Aerospace series - Method of preparation of forged samples <sup>4)</sup>   |
| EN 3114   | Aerospace series - Test methods for titanium $\alpha$ + $\beta$ products - Micrographic examination <sup>5)</sup>  |
| EN 3544-3 | Aerospace series - Titanium and titanium alloys - Wrought products - Technical specification - Part 3: Bar and section <sup>5)</sup>   |

1) Corresponds to Disc Quality (DQ) in European Titanium Technical Committee (ETTC) Publication No. 5, February 1983

2) Corresponds to Standard Quality (STQ) in European Titanium Technical Committee (ETTC) Publication No. 5, February 1983

3) Hereafter called "manufacturer"

4) Published as AECMA Prestandard at the date of publication of this standard

5) In preparation at the date of publication of this standard

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### 3 Manufacture

#### 3.1 Raw materials

##### 3.1.1 General requirements for grades 1 and 2 forging stock

Raw materials shall be only purchased from suppliers approved by the manufacturer and registered in his list of approved suppliers.

Approval of suppliers shall be made in accordance with written procedures contained within the quality assurance system of the manufacturer.

##### 3.1.2 Titanium sponge and alloying elements

The requirements shall be specified by the manufacturer who shall also establish the following procedures for :

- titanium sponge: level of impurities, particle size, freedom from surface contamination;
- alloying elements: chemical composition including level of impurities, particle size, freedom from foreign particles.

##### 3.1.3 Recycling of scrap

Requirements for processing and categorization of scrap are defined in EN 2955.

The categories of scrap which may be used by the manufacturer are given in table 3.

Foundry scrap, castings or used components shall not be used.

The manufacturer shall maintain a list of his approved scrap processors. The list shall indicate the categories of scrap for which the processors are approved.

Each order shall refer to EN 2955, specify the sub-category of the scrap and, in the case of turnings, the limits for O<sub>2</sub>, C and H<sub>2</sub>.

##### 3.1.4 Additional requirements for grade 1 forging stock

Recycling procedures and the raw materials suppliers shall have been approved by the forger and the purchaser of the forgings.

Any modifications shall be the subject of prior agreement by the forger and the purchaser of the forgings.

All incoming supplies shall be quarantined until the acceptance requirements have been satisfactorily completed. A manufacturing schedule for forging stock shall be established. It shall indicate the sub-category and the maximum of approved scrap to be used in the melt and shall be approved by the purchaser of the forgings.

#### 3.2 Electrodes

##### 3.2.1 General requirements for grade 1 and 2 forging stock

3.2.1.1 The melter shall establish procedures for the charge make up of each type of electrode which shall include :

- scrap categories to be used;
- distribution of scrap along the electrode;
- electrode build-up and welding;
- requirement for recording the constitution of each charge.

The scrap shall be of the same alloy. Unalloyed titanium scrap may also be used provided individual pieces do not exceed approximately 20 g.

Build-up of electrodes and attachment to their stubs shall be carried out under vacuum or inert gas in accordance with the procedure defined by the manufacturer.

### 3.2.1.2 Welding

- Primary electrode :

The welding methods to be used are : MIG, plasma or electron beam.

- Electrode for remelting :

The welding methods to be used for joining electrodes are : plasma in a chamber under argon or electric arc in a vacuum furnace.

- Stub :

The welding methods to be used are : MIG, plasma in a chamber under argon or electric arc in a vacuum furnace.

Welds shall be visually examined to verify the absence of unacceptable colouring in accordance with the standard defined by the manufacturer.

### 3.2.2 Additional requirements for grade 1 forging stock

All welding shall be carried out in a vacuum chamber with leak rate control, or in a chamber under argon overpressure, with continuous checking of oxygen content.

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### 3.3 Melting <https://standards.iteh.ai/catalog/standards/sist/a9a3d267-8791-4ba0-a577-5a57649a0206/sist-en-2858-2-2001>

#### 3.3.1 General requirements for grades 1 and 2 forging stock

Scrap may only be used during the first melt, except for striking the arc.

The forging stock shall be vacuum melted at least twice.

The final melt shall use a consummable electrode.

The stub weld interface shall not be melted unless the stub is of the same alloy and same grade and the weld has been made without filler metal, in a vacuum or argon environment.

Arc breaks during the final melting operation shall not exceed 60 s.

An appropriate system shall be provided for the control, checking and verification for the current, voltage, pressure and melting rate.

The manufacturer shall establish written procedures which define :

- the cleaning of furnace and ingot-moulds;
- the purity of the argon used, the current, the voltage and the maximum allowed pressure during melting;
- the maximum allowed leak rate in the furnace;
- the hot topping cycle at the end of the final melt;
- the inspection of the stub weld interface.

### 3.3.2 Additional requirements for grade 1 forging stock

Only melting furnaces which are designated in the manufacturing schedule shall be used.

A minimum of two consummable electrode remelting cycles under vacuum shall be applied.

In case of triple melting, the first operation may be a non consummable electrode vacuum melting with the agreement of the purchaser of the forgings.

Each electrode weld shall be subjected to a minimum of two melting operations.

Arc breaks during the final melting operation shall not exceed 30 s.

An appropriate system shall be provided for the control, checking and verification of each operation.

Any modification to the procedure shall be the subject of prior agreement by the forger and the purchaser of the forgings.

### 3.4 Mechanical hot-working

#### 3.4.1 General requirements for grades 1 and 2 forging stock

Unless otherwise specified in the order or the manufacturing schedule, all forging stock shall be worked by drawing and/or upsetting with a minimum cross-section ratio 3 : 1.

The ratio may be obtained by several methods, including upsetting ; in this case, the final ratio shall be the product of each individual ratio. (standards.iteh.ai)

The manufacturer shall establish procedures for the homogenization, preheating, transfer and mechanical working of ingots, which shall include the time periods.

All forging stock shall be finally machined or ground to remove surface contamination and to a finish which will allow the satisfactory performance of the inspection operation specified.

#### 3.4.2 Additional requirements for grade 1 forging stock

Any modification to the mechanical working procedures shall be the subject of prior agreement by the forger and the purchaser of the forgings.

### 4 Dimensions and tolerances

Dimensions and tolerances shall be defined by the order.

The frequency of examination adopted by the manufacturer shall be sufficient to permit him to certify compliance with the requirements.



**5 Internal defects**

After surface preparation, the full volume of the forging stock shall be ultrasonically inspected in accordance with EN 2003-8 and table 1 :

Table 1

Thickness mm	Grade 1	Grade 2
	Class	
$D_e \leq 100$	6	5
$100 < D_e \leq 200$	5	4
$200 < D_e \leq 300$	5	3
$D_e > 300$	4	3

**6 External defects****6.1 General requirements for grades 1 and 2 forging stock**

The forging stock surface shall be free from defects considered as prejudicial to further working. If required by the forger, the forgeability shall be verified by forged samples (see 9).

Surface defects may be removed by local dressing up to 3% of the nominal thickness. Dressing shall be smoothly blended and shall allow an ultrasonic examination.

Each product shall be visually examined after etching.

**6.2 Additional requirements for grade 1 forging stock**

Local dressing is not permitted prior to ultrasonic testing. If ultrasonic testing of the full volume can be completed satisfactorily, local dressing up to a maximum of 3% of the nominal thickness is permitted after ultrasonic testing. If ultrasonic testing cannot be completed satisfactorily, the whole surface shall be machined.

**7 Alloy verification**

Each product shall be inspected to verify alloy type before dispatch.

The method used shall be at the discretion of the manufacturer.

**8 Metallographic examination**

Samples shall be etched and subjected to macrographic examination in accordance with EN 2954-2.

Additionally, for  $\alpha + \beta$  alloys, micrographic examination shall be carried out in accordance with EN 3114.

Transverse slices shall be taken from forging stock at locations corresponding to the top and the bottom of the original ingot.