SLOVENSKI STANDARD
SIST EN 2858-1:2001

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Aerospace series - Titanium and titanium alloys - Forging stock and forgings - Technical specification - Part 1: General requirements

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Luft- und Raumfahrt - Titan und Titanlegierungen - Schmiedestücke - Technische Lieferbedingungen - Teil 1: Allgemeine Anforderungen

Série aérospatiale - Titane et alliages de titane - Produits destinés a la forge, pieces forgées et pieces matricées - Spécification technique - Partie 1: Exigences générales

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This European Standard was approved by CEN on 1994-04-27. 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.

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.

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

Contents

Foreword

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

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of an identical text or by endorsement, at the latest by October 1994, and conflicting national standards shall be withdrawn at the latest by October 1994.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 general requirements for manufacture, inspection and testing of forging stock, hand forgings [1] including forged blocks and rings [1], die forgings and rolled rings [1] in titanium and titanium alloy.

The specific requirements are specified in EN 2858-2 and EN 2858-3.

The standards EN 2858-1, EN 2858-2 and EN 2858-3 specify the inspection level and the sampling frequencies to be applied unless otherwise specified on the drawing, order or inspection schedule.

This standard shall be applied in conjunction with the EN material standards unless otherwise specified on the drawing, order or inspection schedule.

By agreement between the manufacturer and the purchaser, it may also be applied to other materials or delivery conditions not covered by EN standards. The agreement shall be formalized by reference to this standard on the drawing, order or inspection schedule.

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 2000 Aerospace series - Quality assurance - EN aerospace products - Approval of the quality system of manufacturers

EN 2003-10 Aerospace series - Test methods for products in titanium and titanium alloys - Part 10: Sampling for determination of hydrogen content in titanium and titanium alloys [2]

EN 2078 Aerospace series - Metallic materials - Manufacturing schedule - Inspection schedule - Inspection and test report - Description and rules for use

EN 2858-2 Aerospace series - Titanium and titanium alloys - Forging stock and forgings - Technical specification - Part 2: Forging stock

EN 2858-3 Aerospace series - Titanium and titanium alloys - Forging stock and forgings - Technical specification - Part 3: Pre-production and production forgings

1) Hereafter described as forgings
2) In preparation at the date of publication of this standard

3 Definitions

For the application of this standard, the following definitions apply:

3.1 Purchaser

Body which purchases the products from a manufacturer or a stockist in accordance with the requirements of the user.

NOTE : The purchaser may also be the user.

3.2 User

See EN 2000.

3.3 Charge for melting

Different products put into a furnace to be melted together.

3.4 Cast

Mass of metal from the same final melting operation.

3.5 Campaign

A continuous production sequence using the same equipment without alteration to the operating conditions.

3.6 Batch

A batch consists of forging stock or forgings :

- of the same form and nominal dimensions or having the same drawing or part number;
- from the same cast;
- from the same forging campaign;
- in the same heat treatment condition;
- from the same heat treatment charge which shall be defined in the internal documentation of the manufacturer.

3.7 Pre-production forgings

Forgings produced to a particular design which qualify the method of manufacture, equipment configuration and, if appropriate, the forging stock source, which demonstrate that the requirements of the purchaser can be met.

3.8 Inspection schedule

See EN 2078.

3.9 Manufacturing schedule

See EN 2078.

3.10 Inspection and test report

See EN 2078.

3.11 "Capability clause"

Reference to "capability clause" signifies that sufficient evidence of a statistical nature with respect to the properties under consideration can be submitted to show that the requirements of the relevant standard may be met on the basis of a reduced amount of testing. Such action in no way reduces the obligations of the manufacturer to fulfill all requirements. If subsequent testing indicates that a product does not comply with the requirements, the batch shall be rejected.

4 Quality assurance

4.1 Approval of the quality system of manufacturers

See EN 2000.

4.2 Product qualification

See material standard.

5 Manufacture

5.1 Forgings shall be made from forging stock complying with the relevant material standard and with EN 2858-2.

5.2 Unless otherwise specified, the method of manufacture to be employed shall be at the discretion of the manufacturer.

5.3 If required, a manufacturing schedule shall be established and agreed for forging stock and forgings. After qualification of the forging stock and/or pre-production forgings no change in the manufacturing method shall be made without previous written approval of the purchaser.

5.4 The forging stock and forgings shall be supplied in the heat treatment condition specified in the material standard. If otherwise agreed, or if there is more than one heat treatment condition in the material standard, the condition of supply shall be specified on the order or on the drawing.

If a specific heat treatment temperature (value and tolerance) is stated, that temperature shall be mandatory.

If a temperature range is stated, a temperature within that range reduced by the furnace tolerances shall be selected.

Unless otherwise specified, the charge shall be maintained at the temperature, subject to the tolerances in the table 1, for the period stated.

Table 1

Selected temperature °C	Tolerances °C
$\theta < 600$	± 5
$600 \leq \theta \leq 1100$	± 10

6 Traceability

Each product shall be identifiable to its batch at all stages of manufacture and delivery.

7 Freedom from defects

All products shall be free from irregularities not complying with the requirements of the material standard or the order, or prejudicial to the subsequent manufacture or use of the product. Notwithstanding previous acceptance of products complying with this standard, any product that is found, at a later stage, to contain such defects may be rejected.

8 Testing

The tests required by the material standard, the order, the inspection schedule or the drawing shall be made in accordance with the requirements of the appropriate test standard. If no test standard exists, the method shall be agreed between the manufacturer and the purchaser.

Unless otherwise specified on the order, the frequency of testing shall be as specified in EN 2858-2 or EN 2858-3. Where necessary, the location and the direction of the test samples shall be specified on the order.

8.1 Chemical composition

It shall comply with the requirements of the relevant material standard and shall be determined on each cast.

The samples taken for analysis shall be representative of the cast. The method of analysis shall be selected by the manufacturer, but in case of dispute, the method set out in the relevant ISO standard shall be used. If no ISO standard exists, a fundamental method of chemical analysis shall be used. The hydrogen content determination shall be in accordance with EN 2003-10.

Tests shall be performed at a frequency of one per cast.

The results shall conform to the requirements of the relevant material standard.

8.2 Preparation of test samples and test pieces

8.2.1 Test samples for the tests required by the material standard shall be obtained by one or more of the following methods as agreed between the manufacturer and the purchaser and indicated on the drawing or the inspection schedule :

a) test samples cut from forgings;

b) test samples forged integrally with the forgings;

c) test samples forged separately from the same batch of forging stock as the forgings they represent.

8.2.2 The test samples and associated test pieces shall be marked in such a manner that their identity, location and orientation with respect to the forging stock, or forging and the batch are maintained.

8.3 Heat treatment of test samples

Unless otherwise specified on the order or in the inspection schedule, the heat treatment of the test samples from forging stock or forgings shall be in accordance with the reference heat treatment for forging stock or the heat treatment of use for forgings defined in the relevant material standard.

8.3.1 Unless otherwise agreed between the manufacturer and purchaser, test samples from forging stock or forgings or forged integrally with the forgings shall not be cut prior to heat treatment.

8.3.2 Separately forged test samples shall be heat treated with the batch they represent, regardless of its delivery condition.

8.3.3. Test samples cut from forgings in the finally heat treated condition shall not be further heat treated.

8.3.4. Test samples representing forgings supplied in other than the finally heat treated condition, shall be additionally heat treated in accordance with the requirements of the material standard.

8.4 Strain rate

The strain rate up to the proof stress shall be within the range of 0,3%/min to 0,7%/min. In cases of dispute a strain rate of 0,5%/min shall be used. After proof stress, the speed may be increased up to 5%/min or such that failure occurs within approximately one minute.

8.5 Re-tests

If any requirement is not met, re-tests shall be carried out under the following condition :

8.5.1 Tensile, impact, creep, and stress rupture testing

If the test procedure or the test piece preparation is faulty, testing shall be re-applied at the original frequency after identification of the cause of failure.

When failure cannot be attributed to a faulty test procedure or to test piece preparation, additional identical test samples shall be selected at twice the original frequency.

At least one of the samples shall be taken from the forging stock or forgings on which the incorrect result was obtained (unless already rejected by the manufacturer after suitable identification of the cause of the failure).

If all results are satisfactory, the batch shall be accepted.

If one or more results are unsatisfactory, the batch shall be :

- either rejected
- or partially or fully re-heat treated and tested as a completely new batch except for chemical composition.

8.5.2 Metallographic examination

If the examination or the test sample preparation is faulty, examination shall be re-applied at the original frequency after identification of the cause of failure.

When failure cannot be attributed to a faulty examination or to the test sample preparation, the batch shall be :

- either rejected
- or partially or fully re-heat treated (if the structure may be corrected by heat treatment) and then tested as a new batch except for the chemical composition and submitted to the purchaser for acceptance.