



SLOVENSKI STANDARD

SIST EN 4700-005:2011

01-maj-2011

Aeronavtika - Jeklo in zlitine, odporne proti vročini - Gneteni izdelki - Tehnična specifikacija - 005. del: Material za kovanje

Aerospace series - Steel and heat resisting alloys - Wrought products - Technical specification - Part 005: Forging stock

Luft- und Raumfahrt - Stahl und Hochwarmfesten Legierungen - Umgeformte Erzeugnisse - Technische Lieferbedingungen - Teil 005: Schmiede Vormaterial

Série aérospatiale - Aciers et alliages résistant à chaud - Produits corroyés - Spécification technique - Partie 005: Produits destinés à la forge

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ICS:

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EUROPEAN STANDARD

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English Version

Aerospace series - Steel and heat resisting alloys - Wrought products - Technical specification - Part 005: Forging stock

Série aérospatiale - Aciers et alliages résistant à chaud -
Produits corroyés - Spécification technique - Partie 005:
Produits destinés à la forge

Luft- und Raumfahrt - Stahl und Hochwarmfesten
Legierungen - Umgeformte Erzeugnisse - Technische
Lieferbedingungen - Teil 005: Schmiede Vormaterial

This European Standard was approved by CEN on 9 January 2010.

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 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 Management Centre has the same status as the official versions.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 4700-005:2010) 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 March 2011, and conflicting national standards shall be withdrawn at the latest by March 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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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 steel and heat resisting alloy forging stock. 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 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 ISO 3651-1, *Determination of resistance to intergranular corrosion of stainless steels — Part 1: Austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in nitric acid medium by measurement of loss in mass (Huey test) (ISO 3651-1:1998)*

EN ISO 3651-2, *Determination of resistance to intergranular corrosion of stainless steels — Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid (ISO 3651-2:1998)*

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EN ISO 3887, *Steels — Determination of depth of decarburization (ISO 3887:2003)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2005)*

EN ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507-1:2005)*

EN ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T) (ISO 6508-1:2005)*

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2009)*

prEN ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature (ISO/DIS 6892-2:2009)*

EN 2002-001, *Aerospace series — Metallic materials — Test methods — Part 001: Tensile testing at ambient temperature*

EN 2002-002, *Aerospace series — Metallic materials — Test methods — Part 002: Tensile testing at elevated temperature*

EN 2002-005, *Aerospace series — Test methods for metallic materials — Part 005: Uninterrupted creep and stress-rupture testing*

- EN 2002-16, *Aerospace series — Metallic materials — Test methods — Part 16: Non-destructive testing — Penetrant testing*¹⁾
- EN 2032-1, *Aerospace series — Metallic materials — Part 1: Conventional designation*
- 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 2950, *Aerospace series — Test method — Wrought heat resisting alloys — Semi-finished products and parts — Conditions for macrographic and micrographic examination — Atlas of structures and defects*
- EN 2951, *Aerospace series — Metallic materials — Test method — Micrographic determination of content of non-metallic inclusions*¹⁾
- EN 3874, *Aerospace series — Test methods for metallic materials — Constant amplitude force-controlled low cycle fatigue testing*¹⁾
- EN 3987, *Aerospace series — Test method for metallic materials — Constant amplitude force-controlled high cycle fatigue testing*¹⁾
- EN 3988, *Aerospace series — Test methods for metallic materials — Constant amplitude strain-controlled low cycle fatigue testing*¹⁾
- EN 4050-1, *Aerospace series — Test method for metallic materials — Ultrasonic inspection of bars, plates, forging stock and forgings — Part 1: General requirements*¹⁾
- EN 4050-4, *Aerospace series — Test method for metallic materials — Ultrasonic inspection of bars, plates, forging stock and forgings — Part 4: Acceptance criteria*¹⁾
- 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 9100, *Quality Management Systems — Requirements for Aviation, Space and Defence Organizations*
- EN 9133, *Aerospace series — Quality management systems — Qualification procedure for aerospace standard parts*
- EN 10027-1, *Designation systems for steels — Part 1: Steel names*
- EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*
- EN 10079, *Definition of steel products*
- AMS 2315, *Determination of Delta Ferrite Content*²⁾
- AMS 2750, *Pyrometry*²⁾

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), (www.asd-stan.org).

2) Published by: SAE National (US) Society of Automotive Engineers <http://www.sae.org/>

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ASTM A604, *Standard Practice for Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets* ³⁾

ASTM E709, *Standard Guide for Magnetic Particle Testing* ³⁾

ASTM E1444, *Standard Practice for Magnetic Particle Testing* ³⁾

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 4259 apply. For definitions specific to steel, see EN 10079.

4 Wording of order

The order shall clearly indicate:

- quantities to be supplied;
- dates of delivery;
- material standard number;
- delivery condition and metallurgical code of products;
- dimensions and tolerances or reference to an appropriate dimensional standard;
- product designation, when required;
- forwarding address;
- nature and type of packing, if required;
- surface protection, if appropriate;
- definition and frequency of any special tests and their retest procedures, if required.

5 Health and safety

Products in the delivery condition shall fulfil the health and safety laws of the area of the country when and where it is 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 specification. A manufacturing schedule shall be established and applied in accordance with EN 2078.

3) Published by: ASTM National (US) American Society for Testing and Materials <http://www.astm.org/>

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 this material standard, 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 subline 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 the technical specification.

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 run on the first 3 batches, coming from at least 2 casts.

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 on the order, 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 in 6.3.5.

6.3.2 Retests

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

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 first one.

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, 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 one or more tests are unsatisfactory, the batch shall be:

- rejected, or
- 100 % retested and the conforming products accepted, or

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- 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 and cleanness inspection. The reheat treatment shall be stated on the release test certificate.

For cleanness inspection, if the material fails the requirement the product may be cut back before retesting.

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 purchaser.

6.3.5 Capability clause

Where the capability clause is invoked and where sufficient statistical evidence exists, the test need not be carried out (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.

6.3.6 Statistical process control

Reduction in the extent of release testing, other than that defined in 6.3.4 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:

- manufacturer's name and address and, if appropriate, identification of the plant;
- order number;
- material standard number;
- delivery condition and metallurgical code of the product;
- quantity and dimensions;
- manufacturing and inspection schedule reference;
- cast and batch number;
- batch and/or test samples heat treatment conditions;
- results of the tests and retests 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

Material standard line reference		Requirements	Frequency of testing	
No.	Title		Qualification	Release
1	Material designation	EN 2032-1 and EN 10027-1 if applicable	–	–
2	Chemical composition	<p>The chemical composition of the alloy shall comply with requirements of the material standard.</p> <p>The samples taken for analysis shall be representative of the melt.</p> <p>The method of analysis shall be at the option of the manufacturer, but in cases of dispute, the reference method set out in the relevant EN or ISO standard shall be used. If no EN or ISO standard exists, a fundamental and agreed method of chemical analysis calibrated against accepted reference standards shall be used.</p> <p>In the case of remelted material, samples shall be taken from positions as follows:</p> <p>a) <i>Vacuum arc remelted (VAR) ingots</i>: the bottom of each ingot or ingot product.</p> <p>b) <i>Electroflux or electroslag remelted (ESR) ingots</i>: the top and bottom ends of each ingot or ingot product.</p> <p>An analysis shall be made of each sample and certificates of analysis shall be supplied to the purchaser. The elements to be determined shall be as required by the material standard or as agreed between the manufacturer and the purchaser.</p> <p>Elements not quoted in the material standard shall not be intentionally added to the alloy without the agreement of the purchaser, except for the purpose of finishing the heat (e.g. addition of deoxidant); reasonable precautions shall be taken to prevent their inclusion during manufacture. The purchaser, in agreement with the manufacturer, may set a limit to the amount of one or more such elements and may require the amount of such elements to be stated in the certificate of analysis.</p> <p>The specified ranges of chemical composition are based on cast analyses. Any subsequent analytical checks shall take into consideration the heterogeneity normal to the alloy.</p> <p>Additionally for remelted products, the samples shall be representative for the remelted ingot, taking into account any macro segregation.</p>	<p>a) 1 per cast in the case of air melted or vacuum induction melted product</p> <p>b) 2 per VAR or ESR ingot representing top and bottom positions</p>	<p>a) 1 per cast in the case of air melted or vacuum induction melted product</p> <p>b) 1 on one ingot or ingot product in case of VAR or ESR products</p>
3	Method of melting	<p>1 General</p> <p>The alloy shall be made by the process required by the material standard, unless otherwise agreed between the manufacturer and purchaser. If the material standard permits alternative processes, the manufacturer shall decide which of them shall be used unless the purchaser states a particular preference on his order. In all instances, the process by which the alloy was made shall be indicated on the release note.</p> <p>2 Consumable electrode remelted material</p> <p>2.1 Except as provided in 2.3 or 2.4 at no time during remelting shall material of any other composition or type be introduced into the melting chamber, i.e. starter material and electrode stub-ends shall be of the same composition as the material being remelted.</p>	–	–

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