SLOVENSKI STANDARD
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Aerospace series - Aluminium alloy forging stock and forgings - Technical specification - Part 3: Pre-production and production forgings

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Luft- und Raumfahrt - Schmiedevormaterial und Schmiedestücke aus Aluminiumlegierungen - Technische Lieferbedingungen - Teil 3: Ausfallmuster- und Serienschmiedestücke

Série aérospatiale - Produits destinés a la forge, pieces forgées et pieces matricées en alliages d'aluminium - Spécification technique - Partie 3: Pieces types et pieces de série

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English version

Aerospace series
Aluminium alloy
forging stock and forgings
Technical specification
Part 3 : Pre-production and production forgings

Série aérospatiale
Produits destinés à la forge, pièces forgées et pièces matricées en alliages d'aluminium
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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN 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 CEN 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 Bréderode 2, B—1000 Bruxelles

Brief history

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.

According to the Common CEN/CENELEC Rules, the following countries are bound to implement this European Standard : Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

Contents

1 Scope and field of application

This standard specifies the particular requirements for aluminium alloy pre-production and production forgings produced from forging stock complying with EN 2082-2. It shall be used in conjunction with EN 2082-1.

2 References

EN 2002-1, Aerospace series - Test methods for metallic materials - Part 1 - Tensile testing at ambient temperature 1)

EN 2002-7, Aerospace series - Test methods for metallic materials - Part 7 - Hardness tests 1)

EN 2002-16, Aerospace series - Test methods for metallic materials - Part 16 - Dye penetrant testing 1)

EN 2002-22, Aerospace series - Test methods for metallic materials - Part 22 - Plane strain fracture toughness test 1)

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 1)

EN 2004-2, Test methods for aluminium and aluminium alloy products - Part 2 - Ultrasonic testing of plates, forgings and extrusions - Aerospace series

EN 2004-4, Aerospace series - Test methods for aluminium and aluminium alloy products - Part 4 - Stress corrosion cracking test

EN 2082-1, Aerospace series - Aluminium alloy forging stock and forgings - Technical specification - Part 1 - General requirements

EN 2082-2, Aerospace series - Aluminium alloy forging stock and forgings - Technical specification - Part 2 - Forging steck

EN 2101, Aerospace series - Chromic acid anodizing of aluminium and wrought aluminium alloys.

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1) In preparation

3 Pre-production forgings

3.1 General

3.1.1 The following requirements shall be specified in the order, drawing and/or inspection schedule in addition to those specified by EN 2082-1 :

- Number of forgings,
- Who shall perform the examination,
- Heat treatment condition of these forgings,
- Type and number of tests and inspections necessary to evaluate and qualify the manufacturing process (dimensions, mechanical and metallurgical properties, etc ...).

3.1.2 The inspection and testing on pre-production forgings shall be carried out and the inspection and test conditions shall be recorded to allow the definition of the optimum techniques to be used for production forgings, including, where appropriate, the ultrasonic test method (probe, frequency, angle of incidence ...).

3.1.3 The inspection and tests carried out on pre-production forgings shall include those which will be carried out on production forgings.

3.2 Inspection report

In addition to the information required by EN 2082-1, the inspection and test report on the pre-production forgings shall provide all technical information to evaluate the quality of these parts, e.g. photographs taken during macro- and microscopic examination, results of dimensional measurements ...

3.3 Acceptance of pre-production forgings

When all inspection and test results relative to pre-production forgings have been reported and considered as satisfactory by the manufacturer and the purchaser, the purchaser shall give his written agreement or order for series production.

The inspection schedule and if required the manufacturing schedule shall be agreed between the manufacturer and the purchaser.

4 Manufacture of production forgings

4.1 At the start of production (particularly at the start of series production), the manufacturing schedule may be completed to allow the manufacturer to guarantee the reproducibility of the product with more certainty.

All information, no matter how minor, shall be recorded in the manufacturing schedule.

4.2 When a manufacturing schedule has been agreed, no change in manufacturing method shall be made without the written approval of the purchaser.

When changes are necessary, the purchaser shall decide if new pre-production forgings shall be manufactured and tested.

The manufacturing schedule and the inspection schedule shall be modified if necessary.

4.3 Any change of the forging requiring a revised drawing may require at the purchaser's or manufacturer's request :

- Manufacturing of new pre-production forgings, or

- Modification of the manufacturing schedule and/or the inspection schedule.

4.4 Manufacturing schedules and inspection schedules, which are modified during production shall be subjected to the same approval process as the original documents.

4.5 Straightening operations in the fully heat treated condition shall be the subject of an agreement between the manufacturer and the purchaser and stated in the manufacturing schedule.

5 Inspection and testing of production forgings

Inspection and testing shall be carried out on production forgings under the same conditions as applied to pre-production forgings.

5.1 Non destructive tests

5.1.1 External defects

A visual examination shall be carried out on all surfaces of each forging after :

- Etching, or
- Etching and chromic acid anodizing followed by coldwater rinse conforming with EN 2101, or
- Etching and penetrant flaw detection in conformity with EN 2002-16.

The test method shall be indicated in the order or the inspection schedule.

The surface of forgings shall be free from harmful defects, such as cracks, laps, etc.

Local dressing may be carried out by the manufacturer provided the dimensions of the product remain within the tolerance limits.

5.1.2 Internal defects

When required by the drawing or the inspection schedule, the forgings shall be submitted to an ultrasonic inspection in accordance with EN 2004-2 and the method defined during evaluation of the pre-production forgings. The areas to be inspected shall be defined by the drawing or the inspection schedule.

Unless otherwise stated by the purchaser, the acceptance conditions shall be those of class A as defined by EN 2004-2.

Where the shape does not permit inspection at the final stage of fabrication, it may be carried out at an earlier stage by agreement between manufacturer and purchaser.

The test frequency is given in the table.

5.1.3 Batch uniformity

Unless otherwise specified by the purchaser the batch uniformity of forgings supplied in the T... [1] condition shall be ensured by one of the three following methods a, b_1 or b_2 to demonstrate that the material has been properly heat treated and that the batch is uniform.

The measurements shall be carried out at the locations indicated by the drawing or inspection schedule.

Method "a" for 7... [1] series alloys in T 7... [1] tempers

Electrical conductivity measurement and hardness testing on each forging.

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1) "Aluminum Association" designations

Method "b" for other alloys or tempers

The choice between b_1 and b_2 shall be at the discretion of the manufacturer.

- b_1 : Electrical conductivity measurement on each forging, and 10 % of them including the forgings having the lowest and highest conductivity, shall be hardness tested or,

- b_2 : Hardness testing on each forging, and 10 % of them including the forgings having the lowest and highest hardness, shall be conductivity tested.

5.1.3.1 Electrical conductivity measurement

The conductivity measurement shall be carried out in accordance with EN 2004-1. The values obtained shall conform to the requirements of the material standards and the maximum variations shall be as follows :

- 1,5 MS/m per forging,
- 2 MS/m per batch.

If no values are stated in the material standard, the electrical conductivity shall demonstrate that the material has been properly heat treated and the above mentioned maximum variations shall apply.

5.1.3.2 Hardness testing

Hardness shall be determined in conformance with EN 2002-7 and the recorded values shall meet the requirements of the material standards.

5.1.4 Dimensions and tolerances

The dimensions and tolerances shall conform with the drawing or the inspection schedule.

The dimensions specially indicated by the purchaser shall be checked on every forging. For other dimensions the frequency of examination adopted by the manufacturer shall be sufficient to permit him to certify compliance with the requirements.