



# SLOVENSKI STANDARD SIST EN 3685:2008

01-julij-2008

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Aerospace series - Bolts in heat resisting steel FE-PA2601 (A286) - Classification: 1 100 MPa/650 °C - Technical specification

Luft- und Raumfahrt - Schrauben aus hochwarmfestem Stahl FE-PA2601 (A286) - Klasse: 1 100 MPa/650 °C - Technische Lieferbedingungen

Série aérospatiale - Vis en acier résistant à chaud FE-PA26HT (A286) - Classification: 1 100 MPa/650 °C - Spécification technique

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Ta slovenski standard je istoveten z: EN 3685:2008

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## ICS:

49.030.20 Sorniki, vijaki, stebelni vijaki Bolts, screws, studs

**SIST EN 3685:2008**

**en**

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ICS 49.030.20

English Version

## Aerospace series - Bolts in heat resisting steel FE-PA2601 (A286) - Classification: 1 100 MPa/650 °C - Technical specification

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This European Standard was approved by CEN on 21 December 2007.

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.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, 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 United Kingdom.

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## Foreword

This document (EN 3685:2008) 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 October 2008, and conflicting national standards shall be withdrawn at the latest by October 2008.

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, 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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## 1 Scope

This standard specifies the technical, qualification and quality assurance requirements for bolts in material FE-PA2601 (A286) of tensile strength class 1 100 MPa at room temperature, maximum test temperature of material 650 °C.

Primarily for aerospace applications it is applicable to such bolts when referenced on the product standard or definition document.

## 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.

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection.*

ISO 3452, *Non-destructive testing — Penetrant inspection — General principles.*

ISO 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture.*

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 7961, *Aerospace — Bolts — Test methods.*

ISO 9000, *Quality management systems — Fundamentals and vocabulary.*

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

EN 3041, *Aerospace series — Propulsion standard parts — Manufacturing process change procedure for qualified parts.* <sup>2)</sup>

EN 3761, *Aerospace series — Heat resisting alloy FE-PA2601 — Softened and cold worked — Bar for forged fasteners —  $D \leq 50$  mm —  $1\ 100\ \text{MPa} \leq R_m \leq 1\ 300\ \text{MPa}$ .* <sup>1)</sup>

EN 9133, *Aerospace series — Quality management systems — Qualification procedure for aerospace standard parts.*

TR 3040-1, *Aerospace series — Quality Assurance — EN aerospace products — Part 1: List of approved manufacturers.* <sup>3)</sup>

ASTM E 112-96, *Standard Test Methods for Determining Average Grain Size.* <sup>4)</sup>

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1) Published as ASD Prestandard at the date of publication of this standard.

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

3) Published as ASD Technical Report at the date of publication of this standard.

4) Published by: American Society for Testing and Materials (ASTM), 1916 Race street, Philadelphia, PA 19103-1187, USA.

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1

##### **production batch**

quantity of finished parts fabricated by the same process from a single material cast (single heat of alloy), having the same basic part number and diameter, heat treated together to the same specified condition and produced as one continuous run

#### 3.2

##### **inspection lot**

quantity of parts from a single production batch of the same part number which completely defines the parts

#### 3.3 Surface discontinuities

##### 3.3.1

##### **crack**

rupture in the material which may extend in any direction and which may be intercrystalline or transcrystalline in character

##### 3.3.2

##### **seam**

longitudinal surface defect in the form of an unwelded open fold in the material

##### 3.3.3

##### **lap**

surface defect caused by folding over metal fins or sharp corners and then rolling or forging them into the surface

##### 3.3.4

##### **inclusion**

non-metallic particles originating from the material making process. They may exist as discrete particles or strings of particles extending longitudinally.

#### 3.4

##### **test temperature**

ambient temperature, unless otherwise specified

#### 3.5

##### **simple random sampling**

the taking of  $n$  items from a population of  $N$  items in such a way that all possible combinations of  $n$  items have the same probability of being chosen

#### 3.6

##### **critical defect**

a defect that according to judgement and experience, is likely to result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the considered product, or that is likely to prevent performance of the function of a major end item

#### 3.7

##### **major defect**

a defect other than critical, that is likely to result in a failure or to reduce materially the usability of the considered product for its intended purpose

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**3.8  
minor defect**

a defect that is not likely to reduce materially the usability of the considered product for its intended purpose, or that is a departure from established specification having little bearing on the effective use or operation of this product

**3.9  
sampling plan**

a plan according to which one or more samples are taken in order to obtain information and possibly to reach a decision

**3.10  
limiting quality (LQ<sub>10</sub>)**

in a sampling plan, a quality limit which corresponds to a specified and relatively low probability of acceptance in this case 10 % probability of acceptance. It is the limiting lot quality characteristic that a lot of this if quality would occur.

**3.11  
acceptance quality limit (AQL)**

a quality limit which in a sampling plan corresponds to a specified but relatively high probability of acceptance

It is the maximum per cent defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average.

**3.12  
finished bolt**

a bolt ready for use, inclusive of any possible treatments and/or surface coatings, as specified in the dimensional standard or definition document

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**4 Certification and quality assurance**

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**4.1 Qualification**

**4.1.1 Purpose**

The purpose of qualification tests is to ensure that the bolt design and bolt manufacturing conditions allow the bolt to comply with the requirements of this standard.

**4.1.2 Conditions**

The qualification tests summarized in Table 3 shall be performed on each type and diameter of bolt. Proposed changes in manufacturing source or procedure shall be subject to the requirements of EN 3041.

25 bolts selected from a single inspection lot by simple random sampling shall be subjected to the qualification tests.

The number of bolts to be subjected to each test as well as the method(s) to be used are specified in Table 1.

The tests to be applied to each bolt are shown in Table 4.

The test programme may possibly be reduced, this decision will be based on the comparison of results obtained from parts of similar design, size and manufacturing conditions.

All or part of these tests may also be performed for production acceptance, when a reinforced inspection seems to be necessary, or to survey bolts that have not proved satisfactory in use.

In that case, the sample to be subjected to these tests is the same as that used for production acceptance tests.

#### 4.1.3 Qualification test requirements and procedures

The qualification test requirements and procedures shall be to the requirements of EN 9133.

#### 4.1.4 Qualified manufacturers

A list of qualified manufacturers for specific standard parts is listed in TR 3040-1.

### 4.2 Acceptance

#### 4.2.1 Purpose

The purpose of acceptance tests is to check, as simply as possible, by a method representative of actual use conditions, with the uncertainty inherent to statistical sampling, that the bolts constituting the batch satisfy the requirements of this standard.

#### 4.2.2 Conditions

Acceptance tests are summarized in Table 3. They shall be performed on each batch. Table 1 specifies the test method and sampling plan to be used for each test. Bolts from the batch to be tested shall be selected by simple random sampling.

Each bolt may be submitted to several tests.

The bolts to be subjected to destructive tests may be those on which non-destructive tests have been performed.

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### 4.3 Quality system certification

#### 4.3.1 Purpose

The purpose of quality system certification is to ensure that the manufacturer has demonstrated the acceptability of his quality system and his ability for continuing production of parts to this standard, to the required limit of quality.

#### 4.3.2 Requirements and procedure

The requirements and procedures for quality system certification shall be to the requirements of ISO 9000.

### 4.4 Responsibility for inspection and tests

The manufacturer is responsible for the performance of all inspection and test requirements as specified herein. Each manufacturer will use their own or exceptionally any other facilities approved in accordance with 4.1 and 4.2 for the implementation of these inspection and test requirements.

### 4.5 Inspection and test report

A test report showing actual numerical values shall be provided at the purchaser's option as part of the terms of the purchase order.

5 Technical requirements and test method

See Table 1.

Table 1

Clause	Characteristic	Requirement	Inspection and test method	Q/A <sup>a</sup>	Sample size
5.1	<b>Material</b>	Material FE-2601 to specification EN 3761 supplied by an approved source: shall be used for the manufacture of bolts to this standard.	As stated in the material specification.		
5.2	<b>Dimensions, tolerances of form and position, threads and quality</b>			Q	25
				A	Tables 6 and 7
5.2.1	<b>Dimensions</b>	The dimensions of the finished bolts shall conform to the product standard or drawing.	All dimensions shall be controlled by an approved system of gauging.		
5.2.2	<b>Tolerances of form and position</b>	Tolerances of form and position shall conform to the product standard or drawing.	Tolerances of form and position shall be controlled by an approved system of gauging.		
5.2.3	<b>Threads</b>	Threads shall conform to the product standard or drawing.	Threads shall be gauged by an approved system of gauging.		
5.3	<b>Manufacturing</b>				
5.3.1	<b>Forging</b>	The heads of the bolts shall be formed by hot or cold forging. If hot forged the forging temperature shall not exceed 1 150 °C and shall be air cooled or faster.  The heating equipment for forging shall be of a type which ensures a consistent temperature throughout the batch.	The method of forging shall be approved.		

continued

