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Aerospace series - Fasteners, externally threaded, in heat resisting nickel base alloy NI-PH2601 (Inconel 718) - Classification: 1 275 MPa/650 °C - Manufacturing method optional - Technical specification

STANDARD PREVIEW

Luft- und Raumfahrt - Verbindungselemente mit Außengewinde aus hochwarmfester Nickelbasislegierung NI-PH2601 (Inconel 718) - Klasse 1 275 MPa/650 °C - Herstellverfahren nach Wahl - Technische Lieferbedingungen

[SIST EN 3388:2009](https://standards.iteh.ai/catalog/standards/sist/561f2e8e-c1ed-409b-92a9-ba202d402020/en-3388:2009)

Série aérospatiale - Eléments de fixation filetés en alliage base nickel résistant à chaud NI-PH2601 (Inconel 718) - Classification: 1 275MPa/650 °C - Mode de fabrication non imposé - Spécification technique

Ta slovenski standard je istoveten z: EN 3388:2009

ICS:

49.060

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Aerospace electric
equipment and systems

SIST EN 3388:2009

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 3388

April 2009

ICS 49.030.20

English Version

**Aerospace series - Fasteners, externally threaded, in heat
resisting nickel base alloy NI-PH2601 (Inconel 718) -
Classification 1 275 MPa/650 °C - Manufacturing method
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Série aérospatiale - Eléments de fixation, filetés, en alliage
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Luft- und Raumfahrt - Verbindungselemente mit
Außengewinde aus hochwarmfester Nickelbasislegierung
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Herstellverfahren nach Wahl - Technische
Lieferbedingungen

This European Standard was approved by CEN on 5 October 2008.

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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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Foreword

This document (EN 3388:2009) 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 2009, and conflicting national standards shall be withdrawn at the latest by October 2009.

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1 Scope

This standard specifies the technical and quality assurance requirements for externally threaded fasteners in material NI-PH2601 (Inconel 718) of tensile strength class 1 275 MPa at room temperature, maximum test temperature of material 650 °C.

The externally threaded fasteners specified herein may be manufactured by machining from bar or by forging at the manufacturer's option, if forged there is no requirement for control of grainflow.

Primarily for Aerospace applications it is applicable to such externally threaded fasteners when referenced on the product standard or drawing.

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 3534:1977, *Statistics — Vocabulary and symbols*.

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 2952, *Aerospace series — Heat resisting alloy NI-PH2601 — Solution treated and cold worked — Bar for forged fasteners — $D \leq 50 \text{ mm}$ — $1\ 270 \text{ MPa} \leq R_m \leq 1\ 550 \text{ MPa}$. ¹⁾*

EN 2961, *Aerospace series — Heat resisting alloy NI-PH2601 — Solution treated — Bar for machined fasteners — $D \leq 50 \text{ mm}$ — $R_m \geq 1\ 270 \text{ MPa}$. ¹⁾*

EN 3219, *Aerospace series — Heat resisting nickel base alloy (Ni-P100HT) — Cold worked and softened — Bar and wire for continuous forging or extrusion for fasteners — $3 \leq D \leq 30 \text{ mm}$. ¹⁾*

EN 9100, *Aerospace series — Quality management systems — Requirements (based on ISO 9001:2000) and Quality systems — Model for quality assurance in design, development, production, installation and servicing (based on ISO 9001:1994)*.

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

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 part

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

[ISO 3534, see definition]

3.6

critical defect

defect that according to judgment 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

[ISO 3534, see definition]

3.7

major defect

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

[ISO 3534, see definition]

EN 3388:2009 (E)**3.8****minor defect**

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

[ISO 3534, see definition]

3.9**sampling plan**

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

[ISO 3534, see definition]

3.10**limiting quality (LQ₁₀)**

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 quality would occur

When expressed as a per cent defective, it may be referred to as a lot tolerance per cent defective.

[ISO 3534, see definition]

3.11**acceptable quality limit (AQL)**

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.

[ISO 3534, see definition]

3.12**finished part**

part ready for use, inclusive of any possible treatments and/or surface coatings, as specified in the dimensional standard or drawing

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4 Certification and quality assurance**4.1 Qualification****4.1.1 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.

4.1.2 Conditions

The 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.

4.2 Quality system certification

4.2.1 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.

4.2.2 Requirements and procedure

The requirements and procedures for quality system certification shall be to the requirements of ISO 9000 and EN 9100.

4.3 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 4.2 for the implementation of these inspection and test requirements.

4.4 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.

Table 1 — Technical requirements and test methods

Clause	Characteristic	Requirement	Inspection and test method	Q/A ^a	Sample size
5.1	Material	Material NI-PA2601 to 2009 specification EN 2952, EN 2961 or EN 3219 supplied by an approved source: shall be used for the manufacture of bolts to this standard.	As stated in the material specification.		
5.2	Dimensions, tolerances and tolerances of form and position; threads and quality			A	Tables 4 and 5
5.2.1	Dimensions	The dimensions of the finished parts shall conform to the product standard or drawing.	All dimensions shall be controlled by an approved system of gauging.		
5.2.2	Tolerances of form and position	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	Threads	Threads shall conform to the product standard or drawing.	Threads shall be gauged by an approved system of gauging.		
5.3	Manufacturing	Parts may be manufactured by machining from material EN 2961 or by forging from material EN 2952 or EN 3219.			

continued

Table 1 (continued)

Clause	Characteristic	Requirement	Inspection and test method	Q/A ^a	Sample size
5.3.1	Machined from bar parts	Parts manufactured from material in the softened, cold worked and solution treated condition shall be semi-finish machined and then precipitation heat treated per 5.3.3.2 prior to final machining, and thread rolling. Parts manufactured from material in the softened, cold worked, solution treated and precipitation treated condition shall be finish machined, thread rolled, etc. without further heat treatment.			
5.3.2	Forged parts	Forged parts may be formed by hot or cold forging. If hot forged, the forging temperature shall not exceed 1 150 °C and shall be air cooled. The heating equipment for forging shall be of a type which ensures a consistent temperature throughout the batch. The forged blanks shall be solution treated and precipitation treated.			
5.3.3	Heat treatment	The heat treatment medium or atmosphere shall not cause any surface contamination except as permitted by 5.5.2. Any scale which will not be removed by subsequent machining shall be removed by abrasive blasting.	The heat treatment equipment shall be approved. The equipment for abrasive blasting shall be approved.		
5.3.3.1	Solution heat treatment	Forged parts shall be solution treated at a temperature of 930 °C – 1 010 °C, holding at the selected temperature within ± 15 °C for not less than 1 hour, and air cool or faster.			

continued

Table 1 (continued)

Clause	Characteristic	Requirement	Inspection and test method	Q/A ^a	Sample size
5.3.3.2	Precipitation heat treatment	Before thread rolling the parts the parts shall be precipitation treated at $(720 \pm 5) ^\circ\text{C}$ holding at heat for 8 hours, furnace cooling at $(55 ^\circ\text{C} \pm 5) ^\circ\text{C}$ per hour to $(620 ^\circ\text{C} \pm 5) ^\circ\text{C}$, holding at $620 ^\circ\text{C}$ for 8 hours followed by air or faster. Instead of the $55 ^\circ\text{C}$ per hour cooling rate to $620 ^\circ\text{C}$, parts may be furnace cooled at any rate provided the time at $620 ^\circ\text{C}$ is adjusted to give a total precipitation time of approximately 18 hours.			
5.3.4	Removal of surface contamination	After solution and precipitation treatment the parts shall have all the shank and bearing surface of the head ground: a) for the removal of all surface contamination and oxide penetration, b) to obtain a clean, smooth surface.			
5.3.5	Threads	Threads shall be formed on the solution treated, precipitation treated and machined parts by a single thread rolling operation.			
5.3.6	Cold rolling	If specified on the product standard parts shall, after completion of solution, precipitation treatment and machining, have the fillet radius cold rolled sufficiently to remove all evidence of machining. Cold rolling the head to shank fillet radius may cause distortion of fillet area. Any such distortion shall be in accordance with the requirements of Figure 1 unless otherwise specified on the product standard or drawing. For parts with compound radii between head and shank, cold work only the radius that blends with the head, however it is acceptable for work to extend over the compound radius. The fillet shall not show evidence of seams or inclusions.	Dimensional check (see 5.5.2) and visual examination. See 5.5.3.1.	A	Tables 4 and 5

continued