SIST

SLOVENSKI STANDARD
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Aeronavtika - Vezni elementi z zunanjim navojem iz toplotnoodporne zlitine na nikljevi osnovi NI-PH1302 (Waspaloy) - Klasifikacija: 1 210 MPa/730 ĆC - Metoda izdelave po izbiri - Tehniļ na specifikacija

Aerospace series - Fasteners, externally threaded, in heat resisting nickel base alloy NI-PH1302 (Waspaloy) - Classification: 1 210 MPa/730 °C - Manufacturing method optional - Technical specification

Luft- und Raumfahrt - Verbindungselemente mit Außengewinde aus hochwarmfester Nickelbasislegierung NI-PH1302 (Waspaloy) - Klasse: 1 210 MPa/730 °C - Herstellverfahren nach Wahl - Technische Lieferbedingungen

Série aérospatiale - Éléments de fixation, filetés, en alliage base nickel résistant à chaud NI-PH1302 (Waspaloy) - Classification: 1 210 MPa/730 °C - Mode de fabrication non imposé - Spécification technique

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Foreword

This document (EN 3389:2009) 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of an identical text or by endorsement, at the latest by August 2009, and conflicting national standards shall be withdrawn at the latest by August 2009.

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1 Scope

This standard specifies the technical and quality assurance requirements for externally threaded fasteners in material NI-PH1302 (Waspaloy) of tensile strength class 1 210 MPa at room temperature, maximum test temperature of material 730 °C.

The externally threaded fasteners specified herein may be manufactured by machining from bar or by forging at the manufacturers 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.

EN 2959, *Aerospace series — Heat resisting alloy NI-PH1302 (NiCr20Co13Mo4Ti3Al) — Solution treated and cold worked — Bar for forged fasteners — 3 mm ≤ D ≤ 30 mm* [1]

EN 2960, *Aerospace series — Heat resisting alloy NI-P101HT — Cold worked and solution treated — Bar for machining for fasteners 3 ≤ D ≤ 50 mm* [1]

EN 3220, *Aerospace series — Heat resisting nickel base alloy (Ni-P101HT) — Cold worked and softened — Bar and wire for continuous forging or extrusion for fasteners — 3 ≤ D ≤ 30 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*

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 3452-1, *Non-destructive testing — Penetrant inspection — Part 1: General principles*

ISO 3453, *Non destructive testing — Liquid penetrant inspection — Means of verification*

ISO 3534, *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*

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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 transcrystallyne 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]

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
LQ_{10}
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

4 Certification and quality assurance

4.1.1 Qualification

4.1.2 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

4.1.3 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-P1302 (Waspaloy) to specification EN 2959, EN 2960 or EN 3220 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 2960 or by forging from material EN 2959 or EN 3220. NOTE It is possible to finish grind the diameter and under head, and cold roll the fillet radius of close tolerance parts after precipitation treatment. See also 5.3.3.3.			
5.3.1	**Machined from bar parts**	Machined from bar parts shall be finish machined, thread rolled prior to precipitation treatment (see 5.3).			

Table 1 *(continued)*

Clause	Characteristic	Requirement	Inspection and test method	Q/A [a]	Sample size
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 that ensures a consistent temperature throughout the batch.			
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 1 010 °C – 1 080 °C, holding at the selected temperature within ± 15 °C for not less than 1 hour, and gas quench or faster.			
5.3.3.2	**Stabilization heat treatment**	After thread forming according to 5.3.5 the solution heat treated blanks shall be stabilization heat treated at (850 ± 8) °C holding at heat for not less than 4 hours and air cool or faster.			
5.3.3.3	**Precipitation heat treatment**	After thread forming the parts shall be precipitation treated at (760 ± 8) °C holding at heat for not less than 16 hours and air cool or faster (see also 5.3).			
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, and machined parts by a single thread rolling operation.			

continued

Table 1 *(continued)*

Clause	Characteristic	Requirement	Inspection and test method	Q/A [a]	Sample size
5.3.6	**Cold rolling**	If specified on the product standard parts shall, after completion of machining and all heat treatment, have the fillet radius cold rolled sufficiently to remove all evidence of machining (see also 5.3). 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 2 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
5.3.7	**Surface roughness**	The surface roughness shall be as specified on the product standard or drawing prior to protective treatment.	The surface roughness of the thread shall be determined by visual comparator method, see ISO 4288.	A	Tables 4 and 5
5.3.8	**Surface coating**	Where applicable, all surfaces shall be coated as specified on the product standard or drawing.	See applicable coating specification.		Tables 4 and 5
5.4	**Mechanical properties**				
5.4.1	**Tensile strength**	The finished parts shall withstand the minimum tensile loads specified in Table 4.	Tensile tests are not applicable to the following: a) protruding head bolts of grip length less than 2 D; b) countersunk head bolts of overall length less than 3 D or bolts having an overall length less than 18 mm. In such cases, acceptability shall be based on the results from test bars of the same material heat treated within the same process cycle.		
5.4.1.1	**Ambient temperature tensile strength**		The parts shall be tested to destruction in accordance with ISO 7961, test 3.1.	A	Table 6 column B or Table 8

continued