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Aerospace — Bolts, with MJ threads, made of heat-resistant nickel-based alloy, strength class 1 550 MPa — Procurement specification

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This British Standard is the UK implementation of ISO 9154:2016. It supersedes BS A 363:2000 which is withdrawn.

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INTERNATIONAL STANDARD

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Aerospace — Bolts, with MJ threads, made of heat-resistant nickel-based alloy, strength class 1 550 MPa — Procurement specification

Aéronautique et espace — Vis à filetage MJ, en alliage résistant à chaud à base de nickel, classe de résistance 1 550 MPa — Spécification d'approvisionnement

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 4, *Aerospace fastener systems*.

This second edition cancels and replaces the first edition (ISO 9154:1999), which has been technically revised.

Annex A forms a normative part of this International Standard. Annexes B and C are for information only.

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INTERNATIONAL STANDARD ISO 9154:2016(E)

Aerospace — Bolts, with MJ threads, made of heat-resistant nickel-based alloy, strength class 1 550 MPa — Procurement specification

1 Scope

This International Standard specifies the characteristics and quality assurance requirements for MJ threads bolts made of heat-resisting nickel-base alloy, of strength class 1 550 MPa, for aerospace construction.

It is applicable whenever it is referenced in a definition document.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 5855-2, *Aerospace — MJ threads — Part 2: Limit dimensions for bolts and nuts*

3 Terms and definitions

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

3.1
batch
quantity of finished products, manufactured using the same processes, from a single material cast (single heat of alloy) having the same definition document number, diameter, and length code, heat treated together to the same specified condition and produced as one continuous run

3.2
inspection lot
quantity of bolts products from a single production *batch* (3.1) having the same definition document number

3.3
definition document
document specifying directly or indirectly all the requirements for products

Note 1 to entry: The definition document may be an International Standard, an in-house standard, or a drawing.

3.4
crack
rupture in the material which may extend in any direction and which may be intercrystalline or transcrystalline in character

3.5
seam
longitudinal open surface defect

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3.6
lap
surface defect caused by folding over metal fins or sharp corners and then forming them into the surface

3.7
crevice
hollow area at thread crest

3.8
inclusions
non-metallic particles originating from the material manufacturing process

Note 1 to entry: These particles may be isolated or arranged in strings.

3.9
microstructural shearing
shear banding
V- or U-shaped rippled grain structure immediately below the thread root or chevron-shaped rippled grain structure within the thread crest

3.10
sampling plan
plan according to which one or more samples are taken in order to obtain information and possibly to reach a decision, if possible

Note 1 to entry: In this International Standard, each sampling plan defines the number of bolts to be inspected as a function of the size of the batch and the acceptance number [number of defective items acceptable (Ac)][1)]

3.11
simple random sampling
sampling 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

3.12
critical defect
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

3.13
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

3.14
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 specifications having little bearing on the effective use or operation of this product

3.15
limiting quality
LQ
<sampling plan> a quality level which corresponds to a specified and relatively low probability of acceptance

Note 1 to entry: It is the limiting lot quality characteristic that the consumer is willing to accept with a low probability that a lot of this quality would occur.

1) Supplementary information taken from ISO 2859-1.

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Note 2 to entry: For the purposes of this International Standard, the limiting quality quoted in Table 4 corresponds to a probability of acceptance of 10 %.

3.16
acceptable quality limit
AQL
maximum percent defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average

Note 1 to entry: Variant: Quality level, which in a sampling plan, corresponds to a specified but relatively high probability of acceptance.

4 Quality assurance

4.1 General

4.1.1 Approval of manufacturers

All parts which are going to be assembled to a flying aircraft, need to be qualified per airworthiness regulations. The manufacturer of these parts shall have a quality system that complies with EASA / FAA or an equivalent regulation such as SAE AS 9100 / EN 9100.

Quality documentation for parts produced in accordance with this International Standard, shall be maintained for a minimum period of 10 years.

The approval of the manufacturer shall be granted by the Certification Authorities, or their appointed representative, who may be the prime contractor.

4.1.2 Qualification of bolts

The purpose of inspections[2)] is to verify that the design and manufacturing conditions of a bolt enable it to satisfy the requirements of this International Standard.

The qualification shall be granted by the Certification Authorities in the purchaser's country, or their appointed representative, who may be the prime contractor.

4.1.3 Acceptance of bolts

The purpose of inspections is to verify, as simply as possible, using a method which is inexpensive, with the uncertainty inherent in statistical sampling, that the bolts satisfy the requirements of this International Standard.

They shall be carried out by the manufacturer or under his responsibility.

The manufacturer is responsible for the quality of the bolts manufactured.

4.2 Qualification inspection conditions

Unless otherwise specified, the inspection shall be carried out on the following:

— each type and diameter of bolt;

— 28 bolts selected from a single inspection lot by simple random sampling.

2) In order to simplify the text, the term "inspections" used in this International Standard also refers to "inspections and tests".

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The test programme may possibly be reduced, or the qualification granted, without inspection: Any such decision shall be based on the results obtained on similar types and diameters of bolts, provided that the design and manufacturing conditions are identical.

The inspections shall be repeated on any bolt if the manufacturing conditions have modified.

Table 2 indicates the allocation of bolt sample for the inspections.

4.3 Acceptance inspection conditions

Inspections shall be carried out on each production batch or inspection lot. Bolts from the batch or lot to be inspected shall be selected by simple random sampling.

Each bolt may be submitted to several inspections, provided that none of characteristics to be verified has been previously altered during any of these inspections.

The bolts to be subjected to destructive inspections may be those on which non-destructive inspections have been carried out.

If a more stringent inspection is deemed necessary, all or part of the qualification inspections may be performed during the acceptance inspections. In this case, the number of bolts submitted is the same as that submitted for qualification inspection.

Production batches or inspection lots declared unacceptable after the production acceptance inspections shall be submitted for re-inspection only after all the defective units have been removed and/or defects have been corrected. In this case, the attribute(s) which caused the rejection shall be verified using a sample of twice the normal size with the same number of defective items acceptable.

4.4 Use of “statistical process control (SPC)”

When a characteristic is obtained by a controlled statistical process, the manufacturer has the possibility, in order to declare conformity of the characteristic, of refraining from the final systematic sampling provided for in this International Standard, if he is capable of **formally justifying** this choice by using ISO/TR 13425 and the standards quoted in it as a basis.

This justification will include the following phases:

— analysis of the key characteristics of the product;

— analysis of the risks for each implemented process;

— determination of the parameters and/or characteristics to be respected under SPC;

— determination of the capabilities of each process;

— drawing up an inspection plan and integration in the manufacturing process;

— drawing up of routes and control charts (ISO 7870-1, ISO 7870-2, ISO 7870-3);

— use of control charts for data consolidation;

— determination of the audits to be run and the control to be carried out to ensure reliability of the device.

To be usable in production, this process shall or should be validated beforehand by the qualifying body, either during the qualification phase, or a posteriori according to the case, by analysing the justificatory file and the results of the qualification inspections such as provided for in Clause 5. **Such SPC process not applicable to destructive tests** apart from the measurement of the hydrogen content.

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5 Requirements

The requirements of this International Standard are given in Table 1 and, unless otherwise specified, they apply to bolts ready for use. The test temperature, unless otherwise specified, shall be the ambient temperature. These requirements complement the requirements of all other standards or specifications referenced in the definition document.

Table 1 — Requirements and test methods

Clause	Characteristic	Requirement	Inspection and test method	Designation[a]	Sample size
5.1	Material	In accordance with the definition document	See material standard		As required by semi-finished product
5.2	Dimensions	In accordance with the definition document	Standard gauging	Q	20
				A	Tables 3 and 4
5.3	Manufacturing				
5.3.1	Forging	The heads of the bolts shall be formed by a forging process before heat treatment. The equipment shall ensure an adequate and uniform temperature throughout the production batch.	According to the route of manufacture The equipment used shall be approved.	Q	
5.3.2	Heat treatment	The forged blanks shall be heat-treated to produce the properties required by the definition document. Blanks shall not be heat-treated more than twice.	According to the process route The equipment used shall be approved.	Q	
5.3.3	Removal of surface contamination (bearing face and shank)	If machining is required, it is necessary to respect the requirements of 5.5.1.			
5.3.4	Fillet between head and shank	The fillet radius shall be cold rolled after heat treatment and machining so as to remove all visual signs of machining and to create superficial cold-working. The deformation shall not exceed the values in Figure 1. The requirements apply on bolts except on the following: a) threaded to head bolts; b) bolts with a nominal diameter <5 mm.	Visual examination at a suitable magnification of ×10 to ×20 and dimensional check	Q	5
				A	Tables 3 and 4
5.3.5	Threads	Formed by a single rolling process after full heat treatment	According to the manufacturing route	Q	

[a] Q = Qualification, A = Acceptance.

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