INTERNATIONAL STANDARD

ISO 5858

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Aerospace — Self-locking nuts with maximum operating temperature less than or equal to 425 °C — Procurement specification

Aéronautique et espace — Écrous à freinage interne dont la température maximale d'utilisation est inférieure ou égale à 425 °C — Spécification d'approvisionnement

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Contents

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 5858 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Sub-Committee SC 4, *Aerospace fastener systems*.

Annex A forms an integral part of this International Standard. Annex B is for information only.

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Aerospace — Self-locking nuts with maximum operating temperature less than or equal to 425 °C — Procurement specification

1 Scope

This International Standard specifies the requirements for metric self-locking nuts, with MJ thread, for use in aerospace construction at a maximum temperature less than or equal to 425 °C.

It applies to self-locking nuts as defined above, provided that reference is made to this International Standard in the relevant definition document.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 691:1983, *Wrench and socket openings — Metric series — Tolerances for general use.*

ISO 1463:1982, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method.*

ISO 2859-1:1989, *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

ISO 3452:1984, *Non-destructive testing — Penetrant inspection — General principles.*

ISO 3887:1976, *Steel, non-alloy and low-alloy — Determination of depth of decarburization.*

ISO 5855-2:1988, *Aerospace — MJ threads — Part 2: Limit dimensions for bolts and nuts.*

ISO 7403:1983, *Fasteners for aerospace construction — Spline drive wrenching configuration — Metric series.*

ISO 7481:1984, *Aerospace — Fasteners — Self-locking nuts with maximum operating temperature less than or equal to 425 °C — Test methods.*

ISO 8788:1987, *Aerospace — Fasteners — Tolerances of form and position for nuts.*

ISO 9002:1987, *Quality systems — Model for quality assurance in production and installation.*

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 definition document: Document specifying all the requirements for nuts, i.e.

— metallurgical;

— geometrical and dimensional;

— functional (strength and temperature classes).

The definition document may be an International Standard, a national standard, an in-house standard or a drawing.

3.2 finished nut: Nut ready for use, inclusive of any possible treatments and/or surface coatings, as specified in the definition document.

3.3 batch: Definite quantity of some commodity manufactured or produced under conditions which are presumed to be uniform.[1)]

For the purposes of this International Standard, a batch is a quantity of finished nuts, of the same type and same diameter, produced from a material obtained from the same melt, manufactured in the course of the same production cycle, following the same manufacturing route and having undergone all the relevant heat treatments and surface treatments.

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: Open surface defect resulting from extension of the metal.

3.6 lap: The folding over of unwelded metal that can arise when the material is formed (drawing) or in the finished product (pressing or forging).

3.7 inclusions: Non-metallic particles originating from the material manufacturing process. These particles may be isolated or arranged in strings.

3.8 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.[1)]

3.9 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.[1)]

3.10 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 specifications having little bearing on the effective use or operation of this product.[1)]

3.11 sampling plan: A plan according to which one or more samples are taken in order to obtain information and possibly to reach a decision.[1)]

For the purposes of this International Standard, each sampling plan specifies the number of nuts to be inspected as a function of the size of the batch and the acceptance number (number of defective items acceptable — Ac).[2)]

3.12 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.[1)]

3.13 acceptable quality level (AQL): A quality level which in a sampling plan corresponds to a specified but relatively high probability of acceptance.

It is the 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.[1)]

3.14 limiting quality (LQ): In a sampling plan, a quality level which corresponds to a specified and relatively low probability of acceptance. 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)]

In this International Standard, the limiting quality quoted in table 12 corresponds to a consumer's risk of 10 %.

3.15 self-locking torque: The torque to be applied to the nut or bolt to maintain its movement of rotation in relation to the associated part, the assembly being under no axial load and the nut-locking system being completely engaged with the bolt (two pitches minimum protrusion including the end chamfer).

3.16 seating torque: The tightening torque to be applied to the nut or bolt to introduce or to increase the axial load in the assembly.

3.17 unseating torque: The untightening torque to be applied to the nut or bolt to reduce or remove the axial load in the assembly.

3.18 breakaway torque: The torque required to start unscrewing the nut or bolt with respect to the associated part, with the nut-locking device still fully engaged on the bolt, but after the axial load in the assembly has been removed by unscrewing half a turn followed by a halt in rotational movement.

3.19 wrench torque: The tightening and untightening torques which the driving feature of the nut shall withstand, repeatedly, without any permanent deformation which would prevent the appropriate wrench from being used and preclude re-use of the nut.

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1) Definition taken from ISO 3534:1977. (ISO 3534 is currently being revised by ISO/TC 69, *Applications of statistical methods*.)

2) Supplementary information taken from ISO 2859-1.

4 Quality assurance

4.1 General

4.1.1 Approval of manufacturers

The manufacturer shall conform to the quality assurance and approval procedures defined by ISO 9002. The purpose of these procedures is to ensure that a manufacturer has a quality system and the capability for continuous production of nuts complying with the specified quality requirements.

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 nuts

The purpose of qualification inspections and tests of nuts is to check that the design and manufacturing conditions of a nut allow it to satisfy the requirements of this International Standard.

Qualification of the nuts 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 Production acceptance of nuts

The purpose of production acceptance inspections and tests of a nut is to check, as simply as possible, using a method which is inexpensive but the most representative of the actual conditions of use, with the uncertainty inherent in statistical sampling, that the nuts satisfy the requirements of this International Standard.

Production acceptance inspections and tests shall be carried out by the manufacturer, or under his responsibility. The manufacturer is responsible for the quality of the nuts manufactured.

4.2 Qualification inspection and test conditions

Qualification inspections and tests (requirements, methods, numbers of nuts) are specified in table 1. They shall be carried out on

— each type and diameter of nut,

— 100 nuts selected from a single batch by simple random sampling.

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

The inspections and tests shall be repeated on any nut if the supplier or the manufacturing conditions have changed.

Qualification inspections and tests are summarized in table 2.

4.3 Production acceptance inspection and test conditions

Production acceptance inspections and tests (requirements, methods, numbers of nuts) are specified in table 1. They shall be carried out on each batch. Nuts from the batch to be tested shall be selected by simple random sampling.

Each nut may be submitted to several inspections and tests.

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

If a more stringent inspection is deemed necessary, all or part of the qualification inspections and tests may be performed during the production acceptance inspections and testing. In this case, the number of nuts submitted to these inspections and tests is the same as that submitted for qualification inspections and tests.

Batches declared unacceptable after the production acceptance inspections and tests shall be resubmitted for inspection or testing only after all the defective units have been removed and/or defects have been corrected.

Twice the normal sample size shall be used for re-inspecting or re-testing the attributes causing the initial rejection; the same acceptance level (Ac) shall be used.

Production acceptance inspections and tests are summarized in table 2.

5 Requirements

The requirements of this International Standard are given in table 1. They complement the requirements of all other standards or specifications referenced in the definition document of the nut.

NOTE 1 The attention of the users of this International Standard is drawn to the fact that if there is no International Standard specifying the method to be used, a prior agreement is necessary between the user and the manufacturer with respect to the following inspections and tests:

— spectrographic analysis or spectroscopic analysis of the material (see 5.1.1);

— micrographic inspection of the structure of the material (see 5.1.2);

— inspection of carburization or decarburization (see 5.1.3);

— magnetoscopic inspection of surface discontinuities (see 5.1.4);

— magnetic permeability inspection (see 5.1.6);

— inspection by chemical reagent of the type of surface coating (see 5.2.2);

— tactile inspection or inspection using a profilometer of the surface roughness (see 5.3.2).

Table 1 — Technical requirements and test methods

Clause	Characteristic	Technical requirement	Inspection and test method	Test category	Sample size
5.1	**Materials**				
5.1.1	**Type**	The material shall be as specified in the definition document.	Spectrographic analysis or spectroscopic analysis (method to be agreed upon between the user and manufacturer).	Qualification	3
5.1.2	**Microstructure**	Nuts shall be free from cracks. The inclusions shall not exceed the values specified in the material standard.	Micrographic inspection of a transverse section (method to be agreed upon between the user and manufacturer).	Qualification	5
5.1.3	**Carburization or decarburization** [1]	No area of carburization and no area of total decarburization is permissible. An area of partial decarburization is permissible provided that the thickness over the area is less than or equal to 0,1 mm	Microscopic examination (method to be agreed upon between the user and manufacturer) or Vickers microhardness measurement (using a 300 g load) in accordance with ISO 3887, or an equivalent method.	Qualification	5
5.1.4	**Surface discontinuities** [2]	The types of permissible surface discontinuities are given in annex A. The maximum depth allowed for these discontinuities is given in table 14. Cracks are not permitted.	Magnetoscopic[1] (method to be agreed upon between the user and manufacturer), or penetrant inspection in accordance with ISO 3542. In the event of any doubt arising as to the nature of the defects detected, inspect defective nuts under low magnification after sectioning.	Qualification	5
5.1.5	**Hardness**	The hardness of the finished nuts shall be within the limits specified in the definition document of the nut or the material standard.	See ISO 7481.	Qualification Production acceptance	5 Table 13, column B
5.1.6	**Non-magnetism** [3]	The magnetic permeability of the finished nuts shall be less than 2 (air = 1) in a magnetic field of 15 916 A/m.	Method to be agreed upon between the user and manufacturer.	Qualification	5
5.2	**Surface coating**				
5.2.1	**Presence**	Surface coating shall be applied at the locations specified in the definition document.	Visual inspection.	Qualification Production acceptance	100 Tables 11 and 12
5.2.2	**Type** [4]	Surface coating shall be as specified in the definition document.	Visual inspection or inspection by chemical reagent in case of doubt (method to be agreed upon between the user and manufacturer).	Qualification Production acceptance	3 Table 13, column A

Clause	Characteristic	Technical requirement	Inspection and test method	Test category	Sample size
5.2.3	**Thickness** [4]	The thickness of the surface coating shall be within the limits specified in the definition document.	Device for measuring the thickness of surface coatings. In case of doubt, micrographic inspection in accordance with ISO 1463.[5]	Qualification Production acceptance	5 Table 13, column A
5.2.4	**Adhesion** **a) of molybdenum disulfide** (MoS_2)	There shall be no sign of flaking, cracking or softening in use.	Maintain the nuts at the maximum operating temperature specified in the definition document for 3 h, then cool the nuts slowly to ambient temperature.	Qualification	5
	b) of silver	There shall be no sign of blisters or exfoliation in use.	Maintain the nuts at the maximum operating temperature specified in the definition document for 4 h, then rapidly cool the nuts with compressed air (at a pressure of 0,3 MPa to 0,4 MPa) by means of a nozzle, having a 1,5 mm diameter, held close to the surface of the nuts.		
5.2.5	**Corrosion resistance** [1]	The surface coating specified in the definition document (protective treatment and, possibly, lubrication) shall ensure effective protection against corrosion.	Neutral salt spray (NSS) test in accordance with ISO 9227. Exposure for 336 h without signs of iron rust.	Qualification	8
5.3	**Surface condition**				
5.3.1	**Appearance**	Finished nuts shall be free from burrs and bumps.	Visual inspection. In the event of any doubt arising as to the nature of the defects detected, inspect defective nuts under low magnification after sectioning.	Qualification Production acceptance	100 Tables 11 and 12
5.3.2	**Surface roughness** [2]	The surface roughness of the nuts shall be as specified in the definition document.	Tactile inspection or inspection using a profilometer (method to be agreed upon between the user and manufacturer).	Qualification	5
5.4	**Marking**	The nuts shall be marked as specified in the definition document.	Visual inspection.	Qualification Production acceptance	100 Tables 11 and 12
5.5	**Dimensions**				
5.5.1	**General dimensions**	The dimensions and any deviations in form and position, measured at ambient temperature, shall be within the limits specified in the definition document.	Suitable limit gauges or measuring instruments.	Qualification Production acceptance	20 Tables 11 and 12

Clause	Characteristic	Technical requirement	Inspection and test method	Test category	Sample size
5.5.2	**Thread**	The thread shall be in conformity with the definition document. — **Nuts with locking by plastic insert** The threaded GO gauge shall be capable of being freely screwed up to the locking device. — **All-metal self-locking nuts** The threaded GO gauge shall be capable of being freely screwed for at least one and a half turns. As regards nuts with a molybdenum disulfide dry-film lubrication, a bolt with standard threads shall be capable of being freely screwed for at least one and a half turns.	Threaded GO/NO-GO gauges. Threaded GO/NO-GO gauges. Bolt with standard threads in accordance with ISO 5855-2.	Qualification Production acceptance	20 Tables 11 and 12
5.5.3	**Wrench engagement** [6]	The deformation necessary to achieve internal locking shall not prevent a wrench from being used. A female gauge, of identical form to the driving feature of the nut to be inspected, shall be capable of being freely installed over a length equal to the wrenching height specified in the definition document.	Female gauge satisfying the following dimensions: a) **Hexagonal and bi-hexagonal drive** Minimum tolerance specified in ISO 691. b) **Spline drive** Maximum material condition of female wrenching device in accordance with ISO 7403.	Qualification Production acceptance	20 Tables 11 and 12
5.5.4	**Squareness of the bearing surface**	Any out-of-squareness of the bearing surface, relative to the thread, shall be within the limits specified in ISO 8788.	See ISO 7481.	Qualification Production acceptance	20 Tables 11 and 12

Clause	Characteristic	Technical requirement	Inspection and test method	Test category	Sample size
5.6	**Performance**				
5.6.1	**Axial load**	The finished nuts shall withstand the axial load specified for their tensile strength class, as laid down in the definition document.	See ISO 7481.	Qualification Production acceptance	8 Table 13, column B
	a) 80 % test	The nuts shall not display — any cracks, — any permanent set, — any significant reduction in their locking torque.	The load to be applied is specified in table 3 of this International Standard.		
	b) 100 % test	The nuts shall not display — any crack, — any fracture. Permanent set and resultant effects (reduction or disappearance of the locking torque) are permissible.	The load to be applied is specified in table 4 of this International Standard.[7]		
5.6.2	**Wrenching feature** [8]	Finished nuts shall withstand the torque specified for the tensile strength class, as laid down in the definition document, and shall not display any crack or deformation preventing a standard socket or spanner from being used.	See ISO 7481. The torque to be applied 15 times by alternately tightening and untightening shall be as specified in table 5 in this International Standard.	Qualification	3
5.6.3	**Stress embrittlement** [9]	Heat treatment and surface treatment shall not cause any embrittlement that may prevent the nuts from withstanding continuously, without cracking or rupturing, the axial load specified for their tensile strength class, as laid down in the definition document.	See ISO 7481. The tightening torque to be applied shall be as specified in table 6 in this International Standard. The axial load shall be applied for 168 h.	Qualification	3
5.6.4	**Torque-out** [10]	The retention device in the body of the nut shall be capable of withstanding the torque arising during screwing, tightening, unscrewing and untightening, and the body of the nut shall not become detached from the plate, the cage or gang channel. No crack or deformation shall be present which is likely to prevent the nut from being re-used.	See ISO 7481. The torque specified in table 7 in this International Standard shall be applied in both directions.	Qualification	3
5.6.5	**Push-out** [11]	Finished nuts shall be capable of withstanding the axial load which may arise during screwing without any cracks appearing. Any deformation at the thread axis shall be less than 0,8 mm and shall not prevent a standard bolt being installed over at least one and a half turns.	See ISO 7481. The load specified in table 8 in this International Standard shall be applied.	Qualification	3