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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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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 re-submitted 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 reused.	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

Clause	Characteristic	Technical requirement	Inspection and test method	Test category	Sample size
5.6.6	**Locking**	The locking device shall enable — the nuts to be re-used after several removal operations; — correct tensioning of the bolts when a normal tightening torque is applied and there shall be no risk of causing the bolts to fail under tension. After the test has been completed, the thread of the bolts and nuts shall not display any signs of stripping, permanent deformation or seams likely to reduce the effectiveness of the threads. Furthermore, the bolt thread shall enable a new nut to be screwed up to the point where the locking device is engaged.			
5.6.6.1	Presence of locking element		Visual inspection.	Qualification Production acceptance	100 Tables 11 and 12
5.6.6.2	Inspection of locking torque at ambient temperature				
5.6.6.2.1	Over 15 cycles[12)]	The locking torques shall lie within the maximum and minimum values specified in table 9, columns 1 and 4.	See ISO 7481. The tightening torque to be applied is specified in table 6 in this International Standard.	Qualification	8
5.6.6.2.2	Over 1 cycle	The locking torques shall be within the maximum and minimum values specified in table 9, columns 1 and 5.	See ISO 7481. The tightening torque to be applied is specified in table 6 in this International Standard.	Production acceptance	Table 13, column A
5.6.6.3	Inspection of locking torques at ambient temperature, after exposure to the maximum operating temperature	After the nut has been exposed to the maximum operating temperature specified in the definition document of the nut, the locking torques, measured over three cycles, shall be within the maximum and minimum values specified in table 9 — columns 2 and 4, for all-metal self-locking nuts; — columns 3 and 4, for nuts with locking by plastic insert.	See ISO 7481. The tightening torque to be applied is specified in table 6 in this International Standard.	Qualification	8
5.6.6.4	Permanent set	The locking torques of finished nuts, measured at ambient temperature on a maximum threaded mandrel followed by a minimum threaded mandrel, shall lie within the maximum and minimum values specified in table 9, columns 1 and 4.	See ISO 7481.	Qualification	5

Clause	Characteristic	Technical requirement	Inspection and test method	Test category	Sample size
5.6.7	**Vibration** [13]	The finished nuts shall be capable of absorbing, without failure, the energy imparted by vibrations, tremors, shocks, etc., that are likely to be experienced in operation without suffering any structural damage (cracks, fracture of the insert, expulsion of the locking elements, fracture of threads, etc.) or any loss of their locking characteristics.	See ISO 7481. The tightening torque specified in table 10 in this International Standard shall be applied five times. Half of the all-metal self-locking nuts to be tested (5) shall be exposed to the maximum operating temperature specified in the definition document before the tightening torque is applied for the first time. The test shall be performed for a period of time equivalent to 30 000 cycles of vibration at 30 Hz. Rotation of the nut, relative to the bolt, less than or equal to 360° is permissible. Failure of the bolt shall not be considered as grounds for rejecting the nut.	Qualification	10
5.6.8	**Sealing** [14]	Sealing nuts, ready for use, shall withstand an air pressure of 0,35 MPa for 30 s without leakage.	Visual inspection.	Qualification Production acceptance	5 Tables 11 and 12
5.6.9	**Swaging** [15]	The skirt of the finished clinch nuts shall be capable of being flared using a 60° conical tool to 1,2 times its original diameter without cracking or fracturing.	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	5 Table 13, column B
5.7	**Delivery**				
5.7.1	**Packaging**	The nuts shall be packed so as to prevent damage and corrosion during handling, transportation and storage. Each primary package shall only contain nuts with the same part number and the same production lot number.	Visual inspection.	Qualification Production acceptance	100 % of deliveries

Clause	Characteristic	Technical requirement	Inspection and test method	Test category	Sample size
5.7.2	**Labelling**	Each individual package shall have the manufacturer's name or trade-mark, the complete part number, the quantity, the production lot number and the date of manufac-ture clearly shown on a label.	Visual inspection.	Qualification Production acceptance	100 % of deliveries

1) Inspections applicable only to nuts made of steel or steel alloy.

2) Inspection to be carried out before coating of the surface or after removal of the surface coating.

3) Inspection applicable only to nuts made of stainless steel.

4) Inspection applicable only to electrolytic coatings (cadmium, silver, etc.).

5) This inspection may be performed on nuts that have been subjected to the inspection of microstructure (see 5.1.2).

6) Test applicable only to all-metal self-locking wrench nuts.

7) For the qualification testing of all-metal self-locking nuts, the nuts shall be exposed for 6 h to the maximum operating temperature specified in the definition document before the load is applied.

8) Test applicable only to wrench nuts.

9) Test applicable only to nuts heat-treated to a hardness equal to or greater than 44 HRC.

10) Test applicable only to floating anchor nuts, gang channel nuts and fixed anchor nuts, produced in several parts and assembled by brazing or clinching.

11) Test applicable only to gang channel and anchor nuts, with the exception of corner nuts (see ISO 7481) and of reduced series single-lug nuts.

12) For all-metal self-locking nuts made of stainless steel with MoS_2-type dry-film lubrication, this test shall be carried out over five cycles in order to avoid any risk of seizing.

13) Test applicable only to nuts of diameters of 5 mm, 6 mm, 7 mm, 8 mm, 10 mm and 12 mm. (See ISO 7481.)

14) Test applicable only to nuts guaranteed against non-sealing.

15) Test applicable only to clinch nuts.

Table 2 — Summary of qualification and production acceptance inspections and tests

Characteristics	Qualification	Production acceptance
	Sub-clause	
Materials		
Type	5.1.1	
Microstructure	5.1.2	
Carburization or decarburization	5.1.3	
Surface discontinuities	5.1.4	
Hardness	5.1.5	5.1.5
Non-magnetism	5.1.6	
Surface coating		
Presence	5.2.1	5.2.1
Type	5.2.2	5.2.2
Thickness	5.2.3	5.2.3
Adhesion	5.2.4	
Corrosion resistance	5.2.5	
Surface condition		
Appearance	5.3.1	5.3.1
Roughness	5.3.2	
Marking	5.4	5.4
Dimensions		
General dimensions	5.5.1	5.5.1
Thread	5.5.2	5.5.2
Wrench engagement	5.5.3	5.5.3
Squareness of the bearing surface	5.5.4	5.5.4
Performance		
Axial load	5.6.1	5.6.1
Wrenching feature	5.6.2	
Stress embrittlement	5.6.3	
Torque-out	5.6.4	
Push-out	5.6.5	
Presence of the locking element	5.6.6.1	5.6.6.1
Inspection of locking torque at ambient temperature		
— over 15 cycles	5.6.6.2.1	
— over 1 cycle		5.6.6.2.2
— after exposure to the maximum operating temperature	5.6.6.3	
Permanent set	5.6.6.4	
Vibration	5.6.7	
Sealing	5.6.8	5.6.8
Swaging	5.6.9	5.6.9
Delivery		
Packaging	5.7.1	5.7.1
Labelling	5.7.2	5.7.2

Table 3 — Loads to be applied in the 80 % axial load test [see 5.6.1 a)]

Thread	Cross-sectional area to be tested mm²	Load N			
		Tensile strength classification of the nut			
		900 MPa	1 100 MPa	1 250 MPa	1 550 MPa
MJ3×0,5	5,439	3 900	4 800	5 400	6 700
MJ3,5×0,6	7,335	5 300	6 500	7 300	9 100
MJ4×0,7	9,517	6 900	8 400	9 500	11 800
MJ5×0,8	15,296	11 000	13 500	15 300	19 000
MJ6×1	21,753	15 700	19 100	21 800	27 000
MJ7×1	30,93	22 300	27 200	30 900	38 400
MJ8×1	41,682	30 000	36 700	41 700	51 700
MJ10×1,25	65,136	46 900	57 300	65 100	80 800
MJ12×1,25	97,128	69 900	85 500	97 100	120 400
MJ14×1,5	131,562	94 700	115 800	131 600	163 100
MJ16×1,5	175,613	126 400	154 500	175 600	217 800
MJ18×1,5	225,949	162 700	198 800	225 900	280 200
MJ20×1,5	282,571	203 500	248 700	282 600	350 400
MJ22×1,5	345,478	248 700	304 000	345 500	428 400
MJ24×2	401,68	289 200	353 500	401 700	498 100
MJ27×2	515,708	371 300	453 800	515 700	639 500
MJ30×2	643,877	463 600	566 600	643 900	798 400
MJ33×2	786,185	566 100	691 800	786 200	974 900
MJ36×2	942,632	678 700	829 500	942 600	1 168 900
MJ39×2	1 113,218	801 500	979 600	1 113 200	1 380 400

Table 4 — Loads to be applied in the 100 % axial load test [see 5.6.1 b)]

Thread	Cross-sectional area to be tested mm²	Load N			
		Tensile strength classification of the nut			
		900 MPa	1 100 MPa	1 250 MPa	1 550 MPa
MJ3×0,5	5,439	4 900	6 000	6 800	8 400
MJ3,5×0,6	7,335	6 600	8 100	9 200	11 400
MJ4×0,7	9,517	8 600	10 500	11 900	14 800
MJ5×0,8	15,296	13 800	16 800	19 100	23 700
MJ6×1	21,753	19 600	23 900	27 200	33 700
MJ7×1	30,93	27 800	34 000	38 700	47 900
MJ8×1	41,682	37 500	45 800	52 100	64 600
MJ10×1,25	65,136	58 600	71 600	81 400	101 000
MJ12×1,25	97,128	87 400	106 800	121 400	150 500
MJ14×1,5	131,562	118 400	144 700	164 500	203 900
MJ16×1,5	175,613	158 100	193 200	219 500	272 200
MJ18×1,5	225,949	203 400	248 500	282 400	350 200
MJ20×1,5	282,571	254 300	310 800	353 200	438 000
MJ22×1,5	345,478	310 900	380 000	431 800	535 500
MJ24×2	401,68	361 500	441 800	502 100	622 600
MJ27×2	515,708	464 100	567 300	644 600	799 300
MJ30×2	643,877	579 500	708 300	804 800	998 000
MJ33×2	786,185	707 600	864 800	982 700	1 218 600
MJ36×2	942,632	848 400	1 036 900	1 178 300	1 461 100
MJ39×2	1 113,218	1 001 900	1 224 500	1 391 500	1 725 500

Table 5 — Torques to be applied for testing the wrenching feature (see 5.6.2)

Nominal thread diameter mm	Torque N·m			
	Tensile strength classification of the nut			
	900 MPa	1 100 MPa	1 250 MPa	1 550 MPa
3	1,3	1,7	1,9	2,2
3,5	2	2,4	2,8	3,3
4	2,6	3,2	3,6	4,5
5	5,5	6,7	7,6	9,5
6	11,3	13,8	15,7	19,5
7	22	27	30,6	38
8	32,8	40	45,5	56,5
10	52	63,5	72	89,5
12	86	105	120	148
14	130	159	180	225
16	177	214	243	300
18	243	297	337	420
20	345	422	480	595
22	480	587	666	825
24	595	725	825	1 025
27	768	940	1 067	1 325
30	960	1 175	1 335	1 650
33	1 150	1 400	1 600	1 980
36	1 335	1 630	1 850	2 290
39	1 520	1 860	2 110	2 615

Table 6 — Tightening torques to be applied for the stress embrittlement test (see 5.6.3) **and for measuring locking torques** (see 5.6.6.2.1, 5.6.6.2.2 and 5.6.6.3)

Nominal thread diameter mm	Torque N·m			
	Tensile strength classification of the nut			
	900 MPa	1 100 MPa	1 250 MPa	1 550 MPa
3	1	1,2	1,4	1,7
3,5	1,5	1,8	2,1	2,5
4	2	2,4	2,8	3,4
5	3,9	4,7	5,4	6,7
6	9	11	12,5	15,5
7	16,4	20	22	28
8	23,7	29	33	41
10	43	53	60	74
12	72	88	100	125
14	97	118	135	167
16	126	154	175	217
18	170	208	236	293
20	260	318	360	448
22	355	434	493	611
24	440	538	610	758
27	575	703	800	990
30	710	868	986	1 225
33	860	1 050	1 200	1 490
36	1 000	1 225	1 390	1 725
39	1 140	1 400	1 585	1 970

Table 7 — Torques to be applied in the torque-out test (see 5.6.4)

Nominal thread diameter mm	Torque to be applied according to the material of the nut N·m	
	Nut made of steel, alloy steel or stainless steel	Nut comprising an aluminium alloy element
3	3	2,4
3,5	4	3,2
4	6	4,8
5	9	7,2
6	13	10,4
7	18	14,4
8	23	18,4
10	38	30,4

Table 8 — Loads to be applied in the push-out test (see 5.6.5)

Nominal thread diameter mm	Load N
3	200
3,5	270
4	360
5	460
6	570
7	570
8	570
10	570

Table 9 — Locking torques (see 5.6.6)

Nominal thread diameter mm	Locking torque N·m max.[1]	max.[2]	max.[3]	min.[4]	min.[5]
3	0,75	1,5	1,12	0,1	0,2
3,5	0,9	1,8	1,35	0,11	0,22
4	1,2	2,4	1,8	0,15	0,3
5	2	4	3	0,25	0,5
6	3,2	6,4	4,8	0,35	0,7
7	4,6	9,2	6,9	0,5	1
8	6	12	9	0,7	1,4
10	9,5	19	14,25	1,2	2,4
12	15	30	22,5	1,8	3,6
14	22	44	33	2,6	5,2
16	33	66	49,5	3,7	7,4
18	44	88	66	4,9	9,8
20	50	100	75	6,3	12,6
22	65	130	97,5	7,5	15
24	75	150	112,5	9,3	18,6
27	95	190	142,5	11,4	22,8
30	110	220	165	14	28
33	120	240	180	16	32
36	136	272	204	19	38
39	157	314	235,5	21	42

1) Maximum values for test at ambient temperature

— over 15 cycles (see 5.6.6.2.1);
— over 1 cycle (see 5.6.6.2.2);
— for permanent set (see 5.6.6.4).

2) Maximum values for the test at ambient temperature after exposure to the maximum operating temperature for all-metal self-locking nuts (see 5.6.6.3).

3) Maximum values for the test at ambient temperature after exposure to the maximum operating temperature for nuts with locking by plastic insert (see 5.6.6.3).

4) Minimum values for the test at ambient temperature

— over 15 cycles (see 5.6.6.2.1);
— after exposure to the maximum operating temperature (see 5.6.6.3);
— for permanent set (see 5.6.6.4).

5) Minimum values for the test at ambient temperature over 1 cycle (see 5.6.6.2.2).

Table 10 — Tightening torques to be applied in the vibration test (see 5.6.7)

Nominal thread diameter mm	Torque N·m
5	4
6	6,4
7	9,2
8	12
10	19
12	30