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Aerospace — Self-locking nuts with maximum operating temperature greater than 425 °C — Test methods

Aéronautique et espace — Écrous à freinage interne dont la température maximale d'utilisation est supérieure à 425 °C — Méthodes d'essai

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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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 4, *Aerospace fastener systems*.

This third edition cancels and replaces the second edition (ISO 8642:2008), which has been technically revised.

The main changes are as follows:

— several references to figures and tables have been corrected;

— designation of figures and tables has been complemented.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Aerospace — Self-locking nuts with maximum operating temperature greater than 425 °C — Test methods

1 Scope

This document specifies test methods for metric self-locking nuts with MJ threads intended for use in aerospace applications at maximum operating temperature greater than 425 °C. It describes the test device and the method for each test.

It applies to self-locking nuts as defined above, provided that the relevant documents (dimensional standard, product standard, drawing, procurement specification, etc.) refer to this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 691, *Assembly tools for screws and nuts — Wrench and socket openings — Tolerances for general use*

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

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

ISO 7403, *Aerospace — Spline drives — Wrenching configuration — Metric series*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Inspections and tests

4.1 Hardness test

4.1.1 Procedure

The following procedures shall be followed:

— Rockwell hardness in accordance with ISO 6508-1;

— Vickers hardness HV 5 to HV 100 in accordance with ISO 6507-1;

— Rockwell superficial hardness in accordance with ISO 6508-1;

— microhardness.

The method corresponding to the hardness unit indicated should be used. Conversion charts may be used if other test methods have been used to obtain the results; given their inaccuracy, the results obtained can be inaccurate. In the event of a dispute, the results obtained using the method corresponding to the hardness unit indicated shall take precedence.

4.1.2 Method

This test shall be carried out at ambient temperature.

The measurement zone (bearing surface, across flats, underside of anchor nut lugs, etc.) shall satisfy the following conditions:

a) thickness at least equal to 10 × the penetration depth;

b) parallelism with respect to bearing surface no greater than 3°.

If the above requirements cannot be met, carry out this test on a cut section after moulding the nut into a resin capable of maintaining it in the correct orientation.

Remove all possible coating (protection, lubrication, paint, etc.) in the measurement zone. Align the bearing surface to obtain the required relationship. These two operations shall not generate any heat liable to modify the characteristics of the material constituting the nut being tested.

Carry out the test and check the conformity with the requirements of the dimensional standard, product standard or drawing.

Nuts subjected to this test shall not be reused.

4.2 Bearing surface squareness test

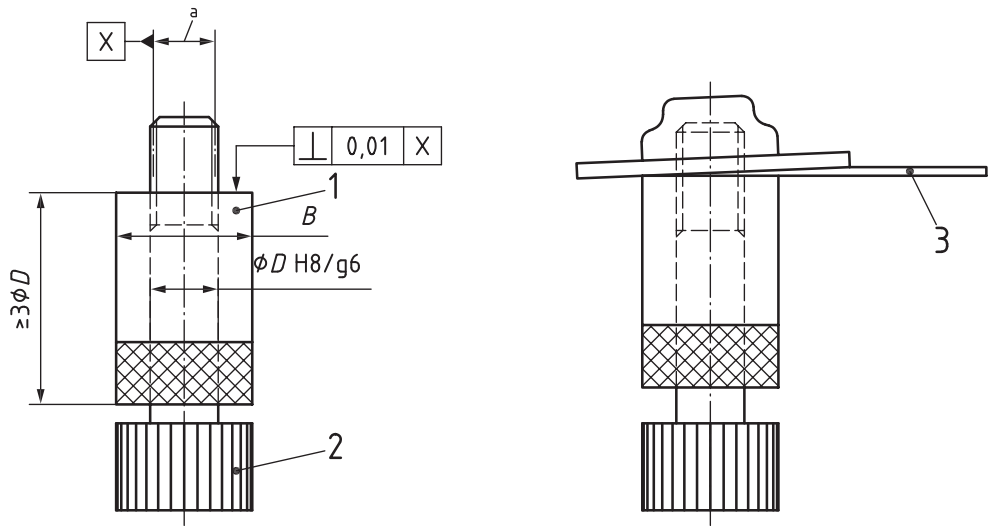
4.2.1 Test device

The test device is illustrated in Figure 1 and shall include the following elements:

a) a threaded mandrel with end in accordance with ISO 5855-2, with the exception of the pitch diameter which shall be in accordance with the values specified in Table 4 for the maximum mandrel;

b) a collar sliding on the plain portion of the threaded mandrel whose external diameter *B* is at least equal to reference dimension *A* for type I, III and VI nuts in Figure 2 and equal to reference dimension *A* for type II, IV and V nuts in Figure 2;

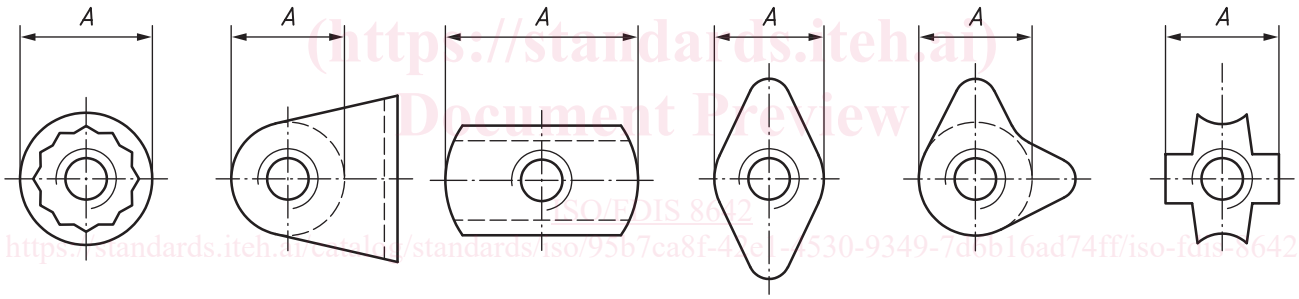
c) an appropriate feeler gauge.



Key

1 sliding collar
2 threaded mandrel
3 feeler gauge
[a] Pitch diameter.

Figure 1 — Bearing surface squareness test



a) Type I **b) Type II** **c) Type III** **d) Type IV** **e) Type V** **f) Type VI**

NOTE Type I are wrench nuts; type II and type III are clinch nuts; type IV and type V are fixed anchor nus; and type VI are floating anchor nuts and gang channel nuts.

Figure 2 — Nut configurations

4.2.2 Method

The test shall be carried out at ambient temperature.

For floating nuts, extract the nut from the cage or channel.

Lubricate the mandrel and nut threads (or threaded part) as stated in Table 1 (if necessary). Install, with or without using a spanner, the threaded mandrel into the nut or threaded part until it engages with the self-locking zone.

Move the collar into contact with the bearing surface.

Evaluate the out-of-squareness by means of a feeler gauge whose thickness corresponds to the permissible squareness error permitted by the dimensional standard, the drawing or the procurement specification.

For clinch nuts, the sliding collar shall have a counterbore to accommodate the shank.

Table 1 — Test bolt and lubrication

Nut to be tested		Test bolt		Additional lubrication
Material	Coating	Material	Coating	
Steel or alloy steel	Any	Alloy steel	None	Synthetic oil
Stainless steel	Silver or MoS_2	Stainless steel	None	
	None		Silver	

4.3 Axial load test

4.3.1 Test device

The test device is illustrated in Figure 3 and shall include the following elements:

a) a steel bearing plate, heat-treated to a hardness HRC ≥ 40;

b) a bolt with a rolled thread and the following characteristics:

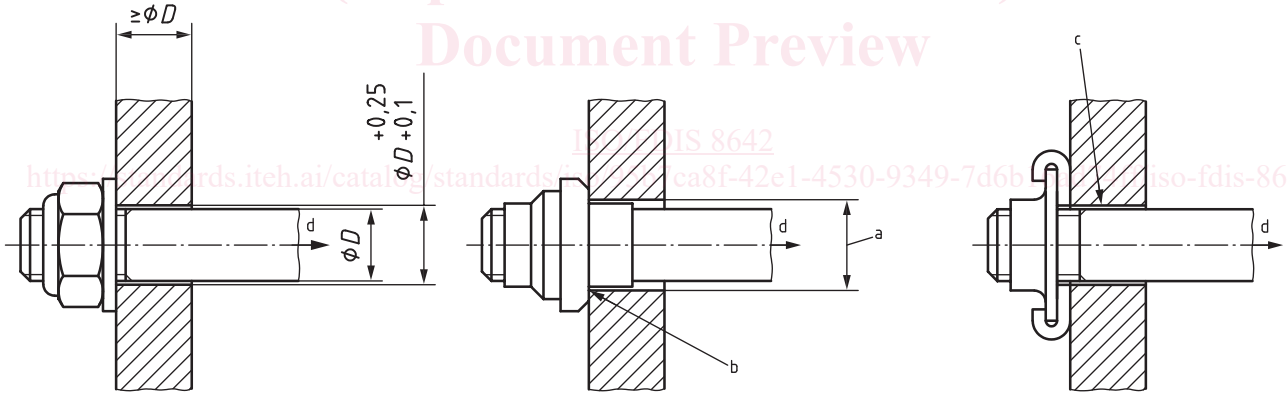
1) threads in accordance with ISO 5855-2;

2) tensile strength class greater than that of the nut under test;

3) material and coating: no specific requirement;

c) a torque wrench.

Dimensions in millimetres



a) Wrench nuts and non-floating anchor nuts

b) Clinch nuts

c) Floating anchor nuts and gang channel nuts

a Maximum shank diameter.

b Chamfer to suit the nut radius.

c Hole to allow the specified float.

d Loading direction.

Figure 3 — Axial load test fixture

4.3.2 Method

4.3.2.1 Principle

The axial load is transmitted to the nut by the bolt, the nut resting on the bearing plate.

4.3.2.2 80 % test

This test shall be carried out at ambient temperature.

Lubricate the bolt and nut threads as stated in Table 1 (if necessary). Assemble the bearing plate on the bolt. Assemble the nut and measure the locking torque, using a torque wrench, when the protrusion is two pitches minimum (including chamfer).

Position the assembly on the tensile machine. Apply the load slowly and progressively. Reduce the load slowly and progressively when the value quoted in the procurement specification has been reached.

Remove the assembly from the tensile machine. Unscrew the nut a half-turn and cease movement, then again unscrew and measure the breakaway torque, using the torque wrench.

Remove the nut, then submit it to a visual examination and, if necessary, an examination at a magnification of × 10 after sectioning, to check conformity with the requirements of the procurement specification.

4.3.2.3 100 % test

This test shall be carried out at ambient temperature.

If the test includes a heat soak, then heat the nut and maintain it at the temperature quoted in the procurement specification. Take the nut from the oven and allow it to cool slowly to ambient temperature, then, in all cases, proceed as follows.

Lubricate the bolt and nut threads as specified in Table 1 (if necessary), assemble the bearing plate on the bolt. Assemble the nut with a protrusion of two bolt pitches minimum (including chamfer).

Position the assembly on the tensile machine and apply the load slowly and progressively. Reduce the load slowly and progressively when the value quoted in the procurement specification has been reached.

Remove the assembly from the tensile machine. Remove the nut, then submit it to a visual examination, and if necessary, an examination at a magnification of × 10 after sectioning to check conformity with the requirements of the procurement specification.

Nuts subjected to this test shall not be reused.

4.4 Wrenching feature test

4.4.1 General

This test applies only to wrenchable nuts.

4.4.2 Test device

The test device is illustrated in Figure 4 and shall include the following elements:

a) a steel block, heat-treated to a hardness of HRC ≥ 40;

b) a bolt with a rolled thread and the following characteristics:

   1) threads in accordance with ISO 5855-2;

   2) tensile strength class: no specific requirement;

3) material and coating: no specific requirement;

c) a torque wrench.

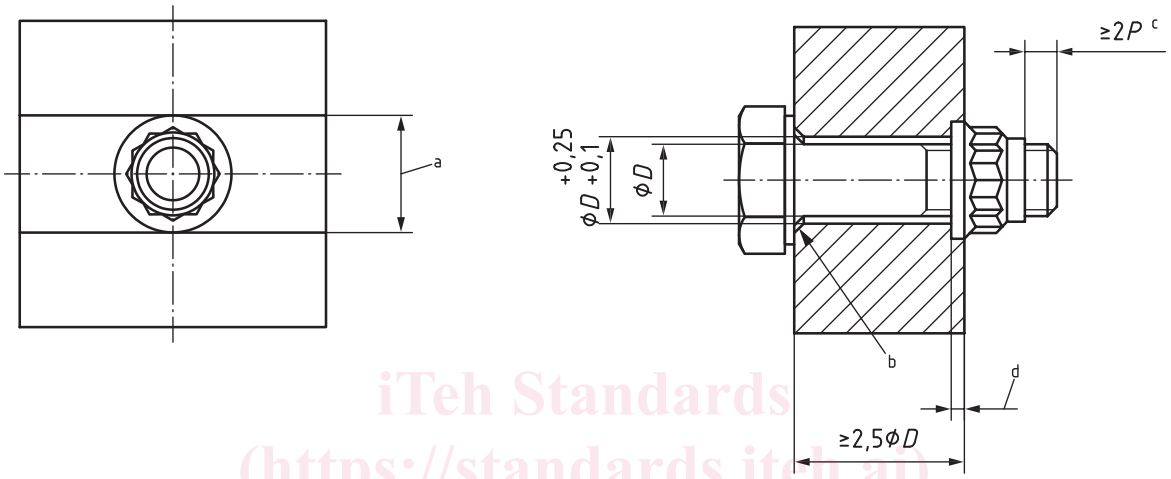
NOTE Any other device that prevents the rotation of the nut and allows the specified torque to be applied is acceptable; for example:

— a nut welded on a block of the same material, the assembly being heat-treated to the correct level;

— nuts mounted in counter-rotation on a threaded rod of strength class appropriate to hold the required torques without deformation;

— a nut mounted on a bolt of strength class appropriate to hold the required torques without deformation as a spacer is placed between the nut and the bolt head.

Dimensions in millimetres



a Width of slot equal to diameter of circle circumscribing the wrenching feature.

b Chamfer to suit underhead radius.

c Including chamfer, where *P* is the pitch.

d Depth of slot equal to flange height of nut under test.

Figure 4 — Wrenching feature test

4.4.3 Method

This test shall be carried out at ambient temperature.

Make two flats on the flange of the nut so that it has a clearance of 0,05 mm to 0,1 mm inside the slot, lubricate the bolt and nut threads as specified in Table 1 (if necessary). Insert the modified nut into the slot. Assemble the bolt and moderately tighten it, then assemble the block into a vice.

Repeat the following operations the number of times specified in the procurement specification:

Apply the torque to the nut, in a tightening movement, as quoted in the procurement specification, with the aid of a torque wrench having a socket with an opening tolerance in accordance with ISO 691 or ISO 7403. Remove, then replace the socket wrench. Apply the same torque to the nut in an untightening direction.

Finally, dismantle the assembly, then submit the nut to a visual examination and, if necessary, an examination at a magnification of × 10 after sectioning to check conformity with the requirements of the procurement specification.

Nuts subjected to this test shall not be reused.