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Aerospace — Nuts, self-locking, with maximum operating temperature less than or equal to 425 °C — Test methods

Aéronautique et espace — Écrous à freinage interne dont la température maximale d'utilisation est inférieure ou égale à 425 °C — Méthodes de contrôle et d'essai

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Foreword

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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 document 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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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 7481:2000), which has been technically revised.

The main changes are as follows:

— normative references have been updated and changed to undated;

— Table 4 title error corrected;

— Table 5 has been corrected;

— the footnote in Table 5 has been added;

— the document has been editorially updated.

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 — Nuts, self-locking, with maximum operating temperature less than or equal to 425 °C — Test methods

1 Scope

This document specifies test methods for metric self-locking nuts with MJ threads intended for use in aerospace construction at maximum operating temperatures less than or equal to 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, 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 (scales A, B, C, D, E, F, G, H, K, N, T)*

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 choice depends on the configuration of the nut and available equipment. The authorized procedures shall meet the following requirements:

— 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.

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 correspond to the following conditions:

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

b) parallelism with respect to bearing surface not greater than 3°.

Should this not be possible, carry out this test on a cut section after moulding the nut into thermosetting resin.

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 then check conformity with the requirements of the dimensional standard or drawing.

Nuts subjected to this test shall not be used again.

4.2 Bearing surface squareness test

4.2.1 Test device

The test device is illustrated in Figure 1.

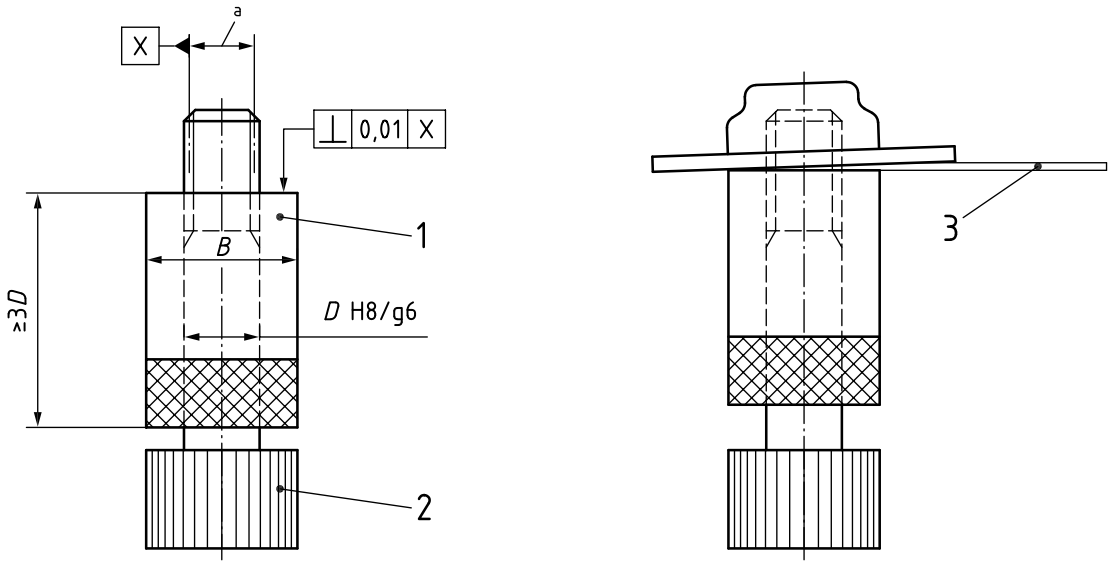
The test device shall include the following elements:

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 5 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, II and V nuts in Figure 2 and equal to reference dimension A for type III and IV nuts in Figure 2;

c) an appropriate feeler gauge.

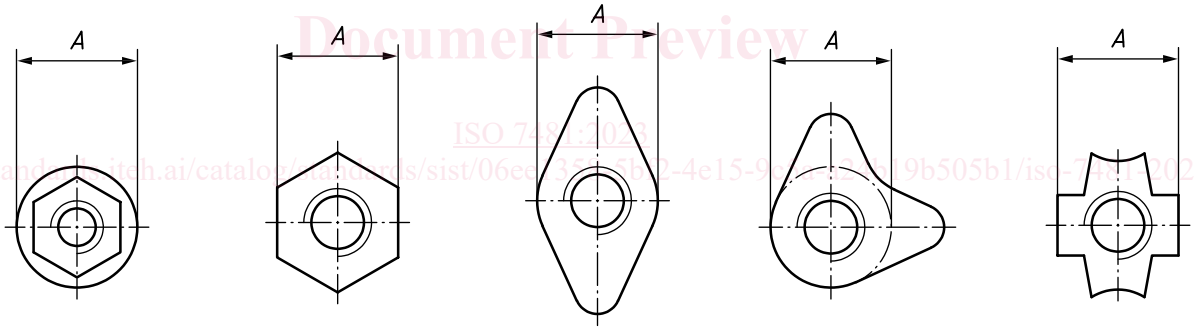
For clinch nuts, the sliding collar shall have a counterbore to accommodate the shank.



Key

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

Figure 1 — Test device bearing surface squareness



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

NOTE Types I and II are wrench nuts and clinch nuts. Types III and IV are fixed anchor nuts. Type V are floating anchor nuts and gang channel nuts.

Figure 2 — Types of internally threaded fasteners

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 (or threaded part) threads as stated in Table 1 (if necessary). Screw, with or without a wrench, the threaded mandrel into the nut or threaded part up to a minimum engagement of three turns.

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.

4.3 Axial load test

4.3.1 Test device

The test device is illustrated in Figure 3.

The test device includes the following elements:

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

b) a conical washer (for testing countersunk nuts);

c) a bolt with characteristics as follows:

   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.

4.3.2 Method

4.3.2.1 General

The axial load is transmitted to the nut by the bolt, the nut resting on the bearing plate. For countersunk nuts, a conical washer is interposed.

4.3.2.2 80 % test

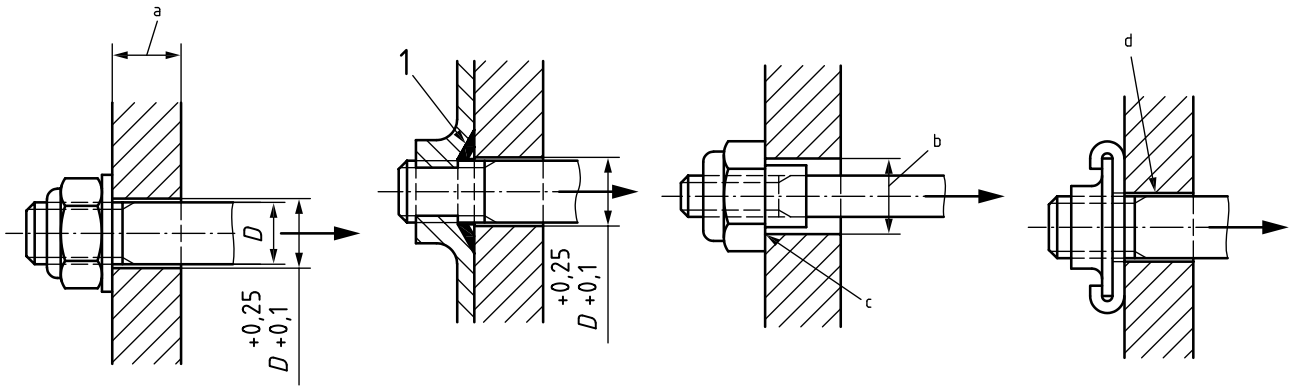
This test shall be carried out at ambient temperature.

Lubricate the bolt and nut threads as stated in Table 1 (if necessary). Assemble the bearing plate and, if used in conjunction with the nut, the conical washer onto the bolt. Assemble the nut and measure the locking torque 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.

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.



a) Wrench nuts and non-countersunk anchor nuts **b) Countersunk anchor nuts** **c) Clinch nuts** **d) Floating anchor nuts and gang channel nuts**

Key

1 washer to fit countersink

a Thickness ≥ *D*.

b Maximum shank diameter $^{+0,25}_{+0,10}$.

c Chamfer to suit the nut radius.

d The hole shall allow the specified float.

Figure 3 — Test set-up axial load test

Table 1 — Test bolt and lubrication, example

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

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 proceed as follows.

Lubricate the bolt and nut threads as specified in Table 1 (if necessary), assemble the bearing plate and, if required, the conical washer, onto 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 used again.

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.

The test device includes the following elements:

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

b) a bolt with characteristics as follows:

   1) threads: in accordance with ISO 5855-2;

   2) tensile strength class: no specific requirement;

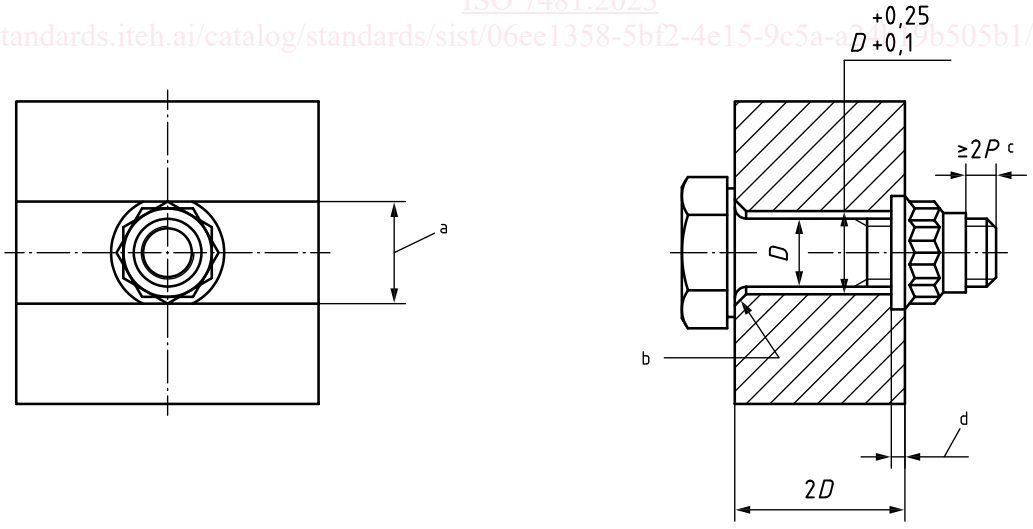
   3) material and coating: no specific requirement.

NOTE Any other device which prevents the rotation of the nut and allows the specified torque to be applied is acceptable. For instance:

— 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;

— 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.



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 — Test set-up for wrenching feature test