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ISO 8642

Second edition
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8642 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 4, *Aerospace fastener systems*.

This second edition cancels and replaces the first edition (ISO 8642:1986) which has been technically revised.

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

1 Scope

This International Standard specifies test methods for metric self-locking nuts with MJ threads intended for use in aerospace construction 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, drawing, procurement specification, etc.) refer to this International Standard.

Other test devices or test methods than those specified in this International Standard may be used, but, in the event of a dispute, the requirements laid down in this International Standard shall take precedence.

This International Standard shall be used in conjunction with ISO 8641.

2 Normative references

The following referenced documents are indispensable for the application 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*

ISO 8641, *Aerospace — Self-locking nuts with maximum operating temperature greater than 425 °C — Procurement specification*

3 Inspections and tests

3.1 Hardness test

3.1.1 Procedure

The authorized procedures are:

— 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.

It is strongly recommended to use the method corresponding to the hardness unit indicated. Should this not be possible, the use of conversion charts is allowed, but, given their inaccuracy, the results obtained shall be used warily. In the event of a dispute, the results obtained using the method corresponding to the hardness unit indicated shall take precedence.

3.1.2 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°.

Should this not be possible, carry out this test on a cut section after moulding the nut into a resin capable of maintaining it in the correct position.

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.

3.2 Bearing surface squareness test

3.2.1 Test device

The test device is illustrated in Figure 1 and includes 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, 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.

3.2.2 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). Screw, with or without using a spanner, the threaded mandrel into the nut or threaded part until it engages with the self-locking zone.

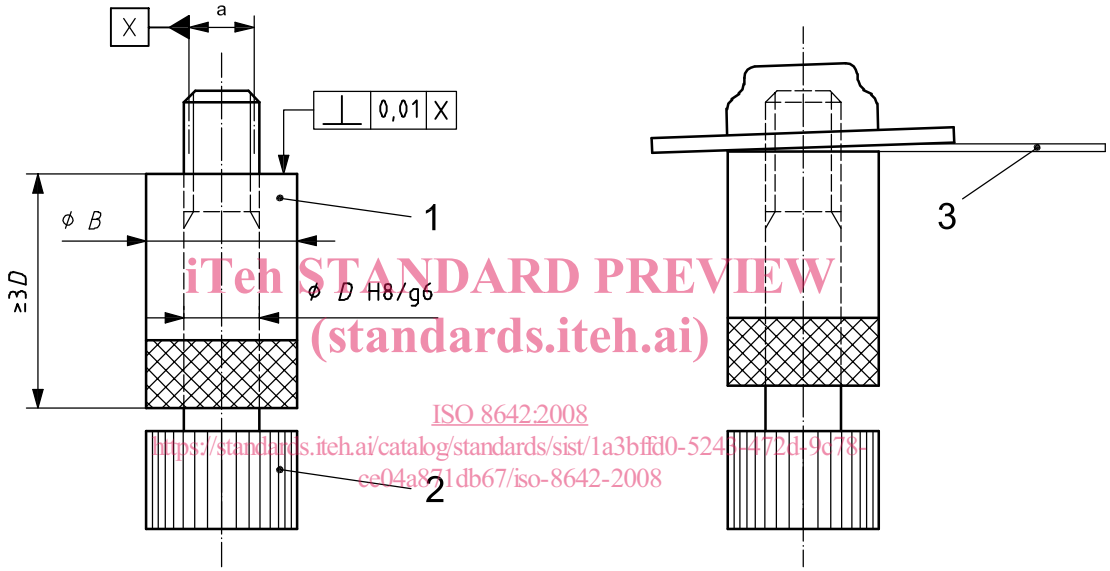
Move the collar into contact with the bearing surface.

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	

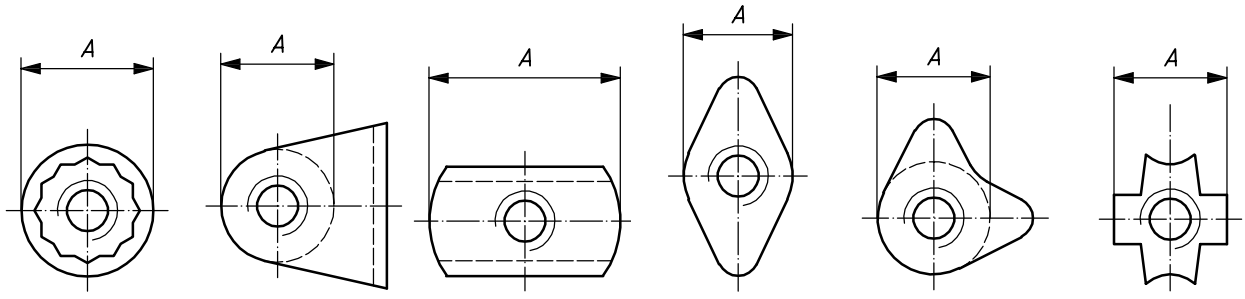


Key

1 sliding collar
2 threaded mandrel
3 feeler gauge

a Pitch diameter.

Figure 1



Type I **Type II** **Type III** **Type IV** **Type V** **Type VI**

Wrench nuts **Clinch nuts** **Fixed anchor nuts** **Floating anchor nuts and gang channel nuts**

Figure 2

3.3 Axial load test

3.3.1 Test device

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

a) a steel bearing plate, heat-treated to a hardness $\geqslant$ 40 HRC;

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.

3.3.2 Method

3.3.2.1 Principle

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

3.3.2.2 80 % test

This test shall be carried out at ambient temperature.

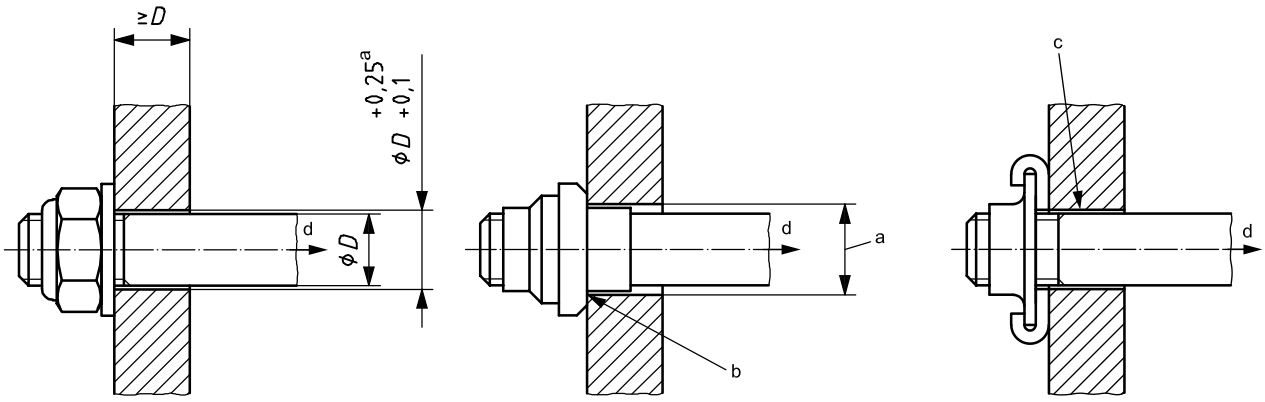
Lubricate the bolt and nut threads as stated in Table 1 (if necessary). Assemble the bearing plate on the bolt. Assemble the nut and measure the locking torque, using the torque wrench, when the protrusion is two pitches minimum (including chamfer).

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 $\times$ 10 after sectioning, to check conformity with the requirements of the procurement specification.

Dimensions in millimetres



Wrench nuts and non-floating anchor nuts | **Clinch nuts** | **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

3.3.2.3 Test at ambient temperature and test at ambient temperature after maximum operating temperature baking (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 used again.

3.4 Wrenching feature test

3.4.1 General

This test applies only to wrenchable nuts.

3.4.2 Test device

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

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

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.

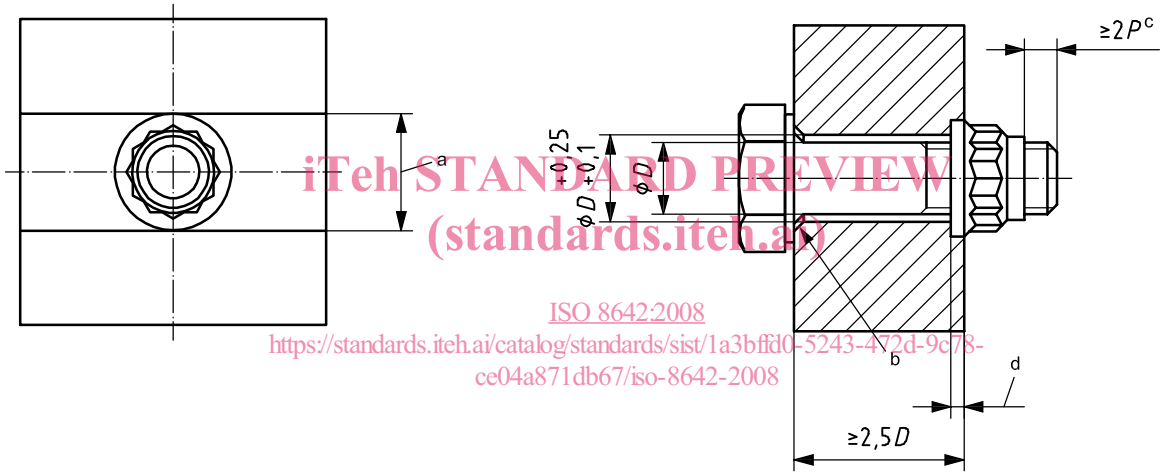
NOTE Any other device that prevents the rotation of the nut and allows the specified torque to be applied is acceptable; for example:

— 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

3.4.3 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 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 conformance 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 used again.

3.5 Torque-out test

3.5.1 General

This test applies only to nuts made from more than one part, either by design (floating anchor nuts or gang channel nuts), or by the needs of manufacture (fixed anchor nuts whose body is assembled to the base-plate by brazing or clinching).

It aims to check that the retention device is able to resist rotation of the threaded portion during tightening and untightening.

3.5.2 Test device

The test device is illustrated in Figure 5, dimensions are given in Table 2 and it includes the following elements:

a) a fixing plate;

b) a shouldered mandrel, threaded in accordance with ISO 5855-2. (A shouldered sleeve mounted on a bolt may also be used.)

c) a locknut threaded in accordance with ISO 5855-2;

d) rivets with universal head or bolts with cylindrical head and hexagonal nuts to fix the nut or the portion of the gang channel under test (standardized aerospace fasteners);

e) a torque wrench.

3.5.3 Method

This test shall be carried out at ambient temperature.

Attach the nut, or portion of channel to be tested, on the plate by means of rivets or bolts and nuts, the preformed head of rivets or the head of bolts being located on the same side as the element under test. Lubricate the mandrel and nut threads as specified in Table 1 (if necessary). Screw in the mandrel so that the shoulder contacts the threaded element of the nut (on bearing surface or bottom of counterbore). Apply the torque to the nut, in a tightening movement, as quoted in the procurement specification, using the torque wrench.

Assemble the locknut and apply to it the same torque in the reverse direction.

Dismantle the assembly, then submit the threaded element as well as the base-plate, the cage or the channel 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.