BRITISH STANDARD AEROSPACE SERIES

BS A 343:1999
ISO 9140:1998

Nuts, plain or slotted (castellated) — Test methods

ICS 49.030.30

National foreword

This British Standard reproduces verbatim ISO 9140:1998 and implements it as the UK national standard.

The UK participation in its preparation was entrusted by Technical Committee ACE/12, Aerospace fasteners and fastening systems, to Subcommittee ACE/12/1, Aerospace fasteners and fastening systems (international), which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, the ISO title page, page ii, pages 1 to 6, an inside back cover and a back cover.

This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 April 1999

ISBN 0 580 32261 0

Amendments issued since publication

Amd. No.	Date	Text affected

INTERNATIONAL STANDARD

ISO 9140

First edition
1998-12-15

Aerospace — Nuts, plain or slotted (castellated) — Test methods

Aéronautique et espace — Écrous ordinaires ou à créneaux — Méthodes de contrôle et d'essai

Reference number
ISO 9140:1998(E)

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 3.

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 9140 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 4, *Aerospace fastener systems*.

Descriptors: aircraft industry, fasteners, MJ threads, nuts (fasteners), tests, hardness tests, mechanical tests, metric system.

Aerospace — Nuts, plain or slotted (castellated) — Test methods

1 Scope

This International Standard specifies test methods for metric plain or slotted (castellated) nuts, with MJ threads in accordance with ISO 5855-2, for use in aerospace construction. It describes the test device and the method for each test.

It is applicable to nuts as defined above, provided that the relevant documents (product standard, definition document, procurement specification, etc.) refer to this International Standard.

This International Standard is to be used in conjunction with ISO 9139 or any other similar document.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 691:1997, *Assembly tools for screws and nuts — Wrench and socket openings —Tolerances for general use.*

ISO 1024:1989, *Metallic materials — Hardness test — Rockwell superficial test (scales 15N, 30N, 45N, 15T, 30T and 45T).*

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

ISO 6507-1:1997, *Metallic materials — Vickers test hardness — Part 1: Test method.*

ISO 6508:1986, *Metallic materials — Hardness test — Rockwell test (scales A - B - C - D - E - F - G - H - K).*

ISO 9139:1998, *Aerospace —Nuts, plain or slotted (castellated) — Procurement specification.*

3 Inspections and tests

3.1 Hardness test

3.1.1 Procedure

The procedure is a function of the nut configuration and of the available apparatus. The authorized procedures are as follows:

— Rockwell hardness, in accordance with ISO 6508;

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

— Rockwell superficial hardness, in accordance with ISO 1024;

— microhardness.

3.1.2 Method

This test shall be carried out at ambient temperature.

The measurement shall be taken on the bearing surface or on one of the flats.

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

Remove all possible coating (protection, lubrication, paint, etc.) in the measurement zone. True up 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 to be tested.

Carry out the test and then check conformity with the requirements of the dimensional standard or of the definition document.

Nuts subjected to this test shall not be reused.

3.2 Bearing surface squareness test

3.2.1 Test device

The test device is illustrated in Figure 1.

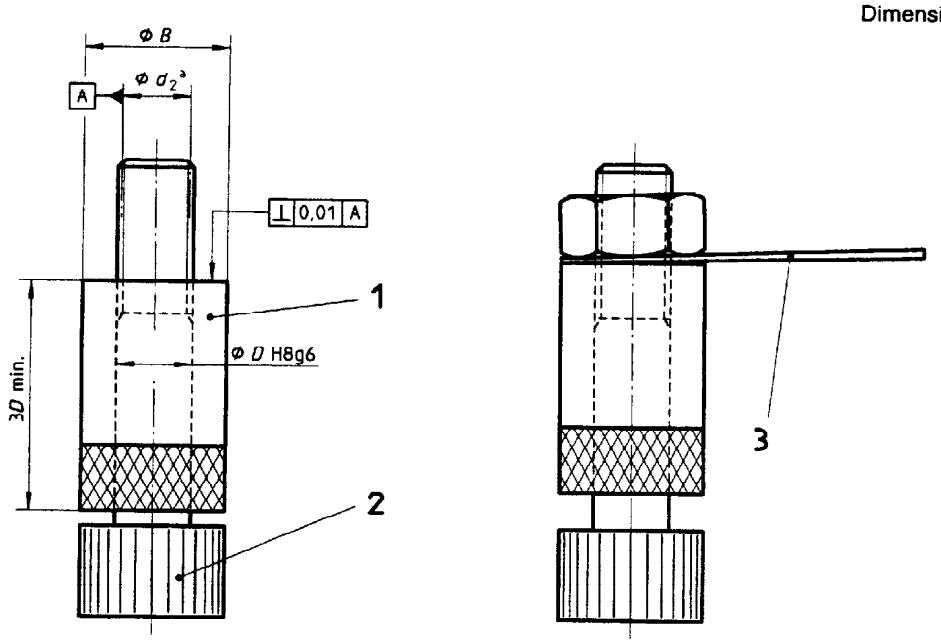
The test device includes the following elements:

a) a threaded mandrel with an end in accordance with ISO 5855-2, except for the pitch diameter which shall be in accordance with the values specified in Table 1;

b) a collar sliding on the plain portion of the threaded mandrel the external diameter B of which shall be at least equal to the across flat dimension of the nut to be tested;

c) a feeler gauge the thickness of which shall be equal to the permissible out-of-squareness specified in the product standard, in the definition document or the procurement specification.

Dimensions in millimetres



Key

1 Sliding collar

2 Threaded mandrel

3 Feeler gauge

[a] Pitch diameter

Figure 1

Table 1 — Pitch diameter of the mandrel of the bearing surface squareness test

Dimensions in millimetres

Thread	d_2 $^{0}_{-0,01}$
3 × 0,5	2,662
3,5 × 0,6	3,096
4 × 0,7	3,53
5 × 0,8	4,464
6 × 1	5,333
7 × 1	6,333
8 × 1	7,332
10 × 1,25	9,169
12 × 1,25	11,167
14 × 1,5	13,003
16 × 1,5	15,002
18 × 1,5	17,001
20 × 1,5	19
22 × 1,5	20,999
24 × 2	22,673
27 × 2	25,672
30 × 2	28,67
33 × 2	31,67
36 × 2	34,67
39 × 2	37,67

3.2.2 Method

The test shall be carried out at ambient temperature.

Manually screw the nut to be tested onto the mandrel until the thread is fully engaged.

Move the collar into contact with the nut.

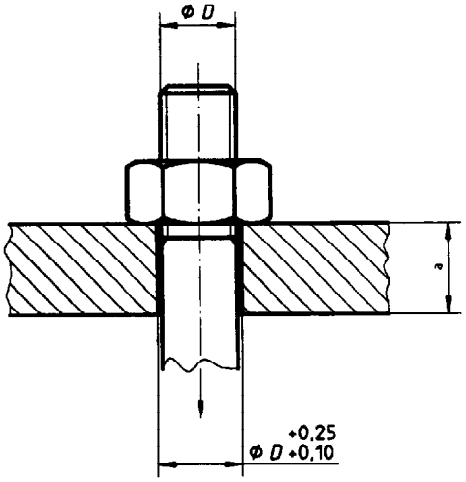
Evaluate the out-of-squareness by means of the feeler gauge then check conformity with the requirements of the product standard, or the definition document or the procurement specification.

3.3 Axial load test

3.3.1 Test device

The test device is illustrated in Figure 2.

Dimensions in millimetres



[a] Thickness ≥ D

Figure 2

The test device includes the following elements:

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

b) a bolt with the following characteristics:

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

   2) tensile strength class: greater than that of the nut to be tested,

   3) material and coating: no specific requirement.

3.3.2 Method

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

3.3.2.1 80 % test

This test shall be carried out at ambient temperature.

Fit the bolt into the bearing plate then assemble the nut to be tested with a protrusion of two pitches minimum (including chamfer).

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

Remove the assembly from the tensile test machine.

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

3.3.2.2 100 % test

Proceed in the same way as for the 80 % test, with only the load to be applied being different.

Nuts subjected to this test shall not be reused.

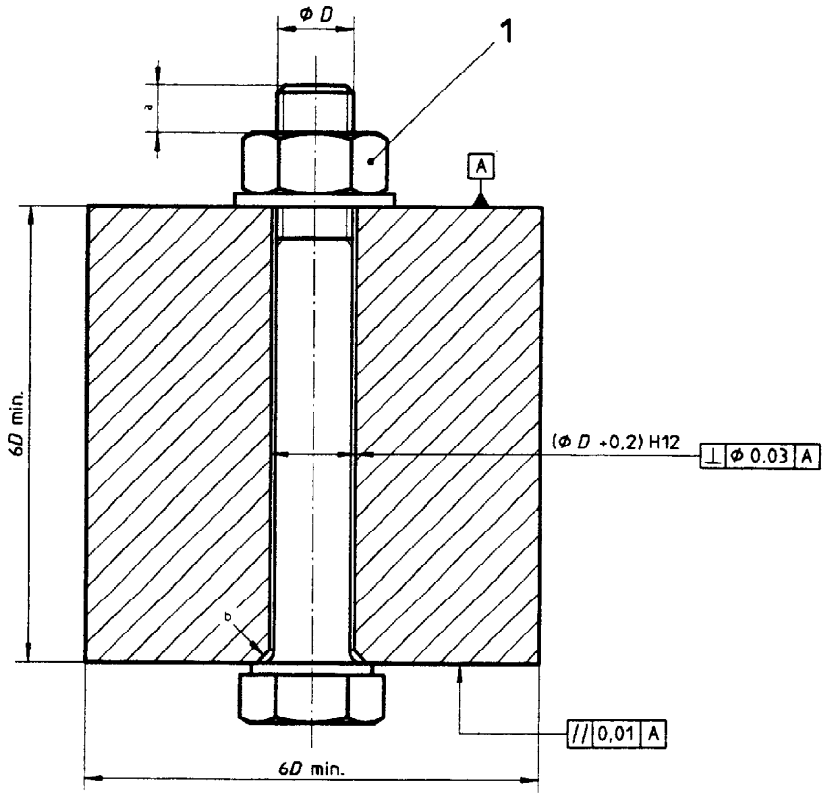
3.4 Stress embrittlement test

This test is only applicable to nuts heat-treated to HRC ≥ 39 except when stated otherwise in the procurement specification or definition document.

3.4.1 Test device

The test device is illustrated in Figure 3.

Dimensions in millimetres



Key

1 Nut to be tested

[a] 2 pitches min., including chamfer

[b] Chamfer to suit underhead radius

Figure 3

The test device includes the following elements:

a) a block with parallel faces made of steel, heat treated to HRC ≥ 40;

b) a bolt with the following characteristics:

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

   2) tensile strength class: greater than that of the nut to be tested,

   3) material: cadmium-plated steel or steel with any other suitable coating with an equivalent coefficient of friction;

c) a washer.

3.4.2 Method

This test shall be carried out at ambient temperature without additional lubrication.

Fit the bolt into the test block and hold it by the head. Fit the washer, then the nut to be tested.

Apply to the nut the seating torque specified in the procurement specification with a socket or closed wrench, the opening tolerance of which is in accordance with ISO 691. Maintain the nut under axial tension during the length of time specified in the procurement specification.

After this time, dismantle the assembly, then submit the nut to a visual examination and, if necessary, to 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.

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