

Self-locking nuts with maximum operating temperature less than or equal to 425 °C — Procurement specification

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Aerospace Standards Policy Committee (ACE/-) to Technical Committee ACE/12, upon which the following bodies were represented:

- The Association of Electronics, Telecommunications and Business Equipment Industries
- British Industrial Fasteners Federation
- Ministry of Defence
- Society of British Aerospace Companies Ltd.

This British Standard, having been prepared under the direction of the Aerospace Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 September 1992

© BSI 01-2000

The following BSI references relate to the work on this standard:
Committee reference ACE/12
Draft for comment 86/77250 DC

ISBN 0 580 21140 1

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
1 Scope	1
2 Normative references	1
3 Definitions	1
4 Quality assurance	3
5 Requirements	3
Annex A (normative) Type of permissible surface discontinuities	20
Annex B (informative) Bibliography	20
Figure A.1	20
Table 1 — Technique requirements and test methods	4
Table 2 — Summary of qualification and production acceptance inspections and tests	13
Table 3 — Loads to be applied in the 80 % axial load test	14
Table 4 — Loads to be applied in the 100 % axial load test	14
Table 5 — Torques to be applied for testing the wrenching feature	15
Table 6 — Tightening torques to be applied for the stress embrittlement test and for measuring locking torques	15
Table 7 — Torques to be applied in the torque-out test	16
Table 8 — Loads to be applied in the push-out test	16
Table 9 — Locking torques	17
Table 10 — Tightening torques to be applied in the vibration test	17
Table 11 — Classification of visual and dimensional inspections	18
Table 12 — Sampling plans for visual and dimensional inspections and sealing test	18
Table 13 — Sampling plans for the inspection of mechanical and metallurgical characteristics	19
Table 14 — Maximum depth of permissible surface discontinuities	19
List of references	Inside back cover

National foreword

This British Standard has been prepared under the direction of the Aerospace Standards Policy Committee. It is identical with ISO 5858:1991 *Aerospace — Self-locking nuts with maximum operating temperature less than or equal to 425 °C — Procurement specification* published by the International Organization for Standardization (ISO).

Cross-references

International Standard	Corresponding British Standard
ISO 1463:1982	BS 5411 <i>Methods of test for metallic and related coatings</i> Part 5:1984 <i>Measurement of local thickness of metal and oxide coatings by the microscopical examination of cross-sections</i> (Identical)
ISO 2859-1:1989	BS 6001 <i>Sampling procedures for inspection by attributes</i> Part 1:1991 <i>Specification for sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection</i> (Identical)
ISO 5855-2:1988	BS 6293 <i>MJ threads for aerospace construction</i> Part 2:1982 <i>Specification for dimensions for bolts and nuts</i> (Identical)
ISO 7403:1983	BS A 294:1984 <i>Specification for spline drive wrenching configuration. Metric series</i> (Identical)
ISO 7481:1984	BS A 295:1985 <i>Methods of test for self-locking nuts with maximum operating temperature less than or equal to 425 °C</i> (Identical)
ISO 9002:1987	BS 5750 <i>Quality systems</i> Part 2:1987 <i>Specification for production and installation</i> (Identical)
ISO 9227:1990	BS 7479:1991 <i>Method for salt spray corrosion tests in artificial atmospheres</i> (Identical)

The Technical Committee has reviewed the provisions of ISO 691:1983, ISO 3452:1984, ISO 3887:1976 and ISO 8788:1987, to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. Related British Standards to ISO 691:1983 are BS 192:1982 and BS 3555:1988. Related British Standards to ISO 3887:1976 are BS 6617-1:1985 and BS 6617-2:1987.

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 20, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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 uniform¹⁾

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)

¹⁾ Definition taken from ISO 3534:1977. (ISO 3534 is currently being revised by ISO/TC 69, *Applications of statistical methods*.)

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 item²⁾

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 purpose²⁾

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 product²⁾

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 decision²⁾

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)³⁾

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 chosen²⁾

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 average²⁾

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 occur²⁾

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

²⁾ Definition taken from ISO 3534:1977. (ISO 3534 is currently being revised by ISO/TC 69, *Applications of statistical methods*.)

³⁾ 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 (A_c) 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^a	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^b	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 ^a (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^c	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