INTERNATIONAL STANDARD

ISO 6157-2

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Fasteners — Surface discontinuities —

Part 2:
Nuts

Éléments de fixation — Défauts de surface —

Partie 2: Écrous

Reference number
ISO 6157-2:1995(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.

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 6157-2 was prepared by Technical Committee ISO/TC 2, *Fasteners*, Subcommittee SC 1, *Mechanical properties of fasteners*.

ISO 6157 consists of the following parts, under the general title *Fasteners — Surface discontinuities*:

— *Part 1: Bolts, screws and studs for general requirements*

— *Part 2: Nuts*

— *Part 3: Bolts, screws and studs for special requirements*

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Fasteners — Surface discontinuities —

Part 2:
Nuts

1 Scope

This part of ISO 6157 establishes limits for various types of surface discontinuities on nuts.

It applies to nuts with

— nominal thread diameters from 5 mm up to and including 39 mm;

— product grades A and B;

— all property classes according to ISO 898-2 and ISO 898-6, unless otherwise specified in product standards or agreed between supplier and purchaser.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 6157. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 6157 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 468:1982, *Surface roughness — Parameters, their values and general rules for specifying requirements.*

ISO 898-2:1992, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread.*

ISO 898-6:1994, *Mechanical properties of fasteners — Part 6: Nuts with specified proof load values — Fine pitch thread.*

ISO 2320:1983, *Prevailing torque type steel hexagon nuts — Mechanical and performance properties.*

ISO 3269:1988, *Fasteners — Acceptance inspection.*

ISO 10484:—[1], *Widening test on nuts.*

ISO 10485:1991, *Cone proof load test on nuts.*

1) To be published.

3 Types, causes, appearance and limits of surface discontinuities

Even if the permissible limits for surface discontinuities indicated in this clause occur, the minimum values for the mechanical and functional properties specified in ISO 898-2, ISO 898-6 and ISO 2320, as appropriate, shall still be met. In addition, the dimensional requirements of the appropriate product standard shall be satisfied.

NOTES

1 The figures in this clause are examples only; they also apply correspondingly to other types of nuts.

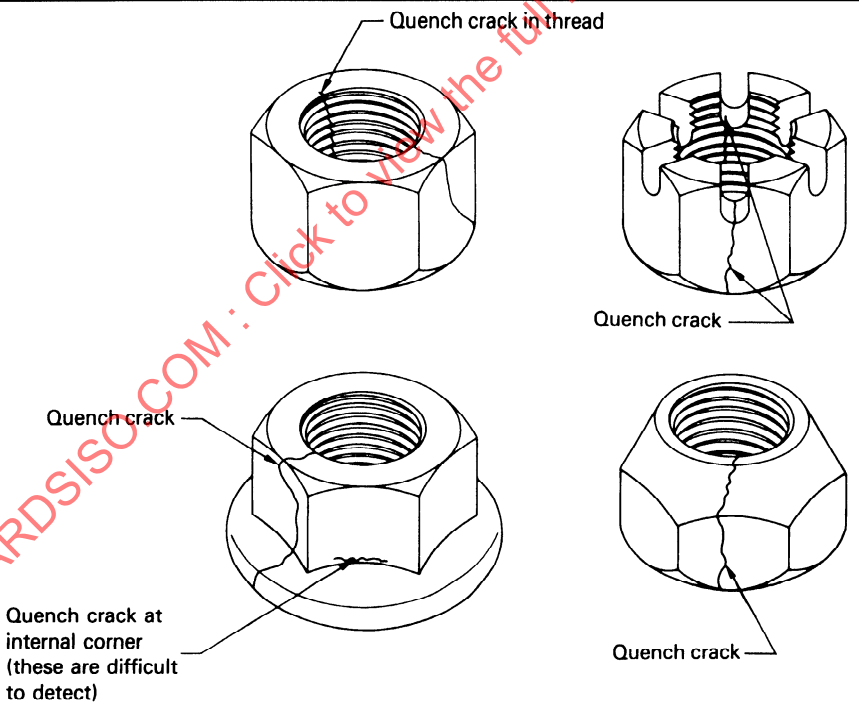
2 The individual figures show the surface discontinuities exaggerated in some cases for clarity.

3.1 Cracks

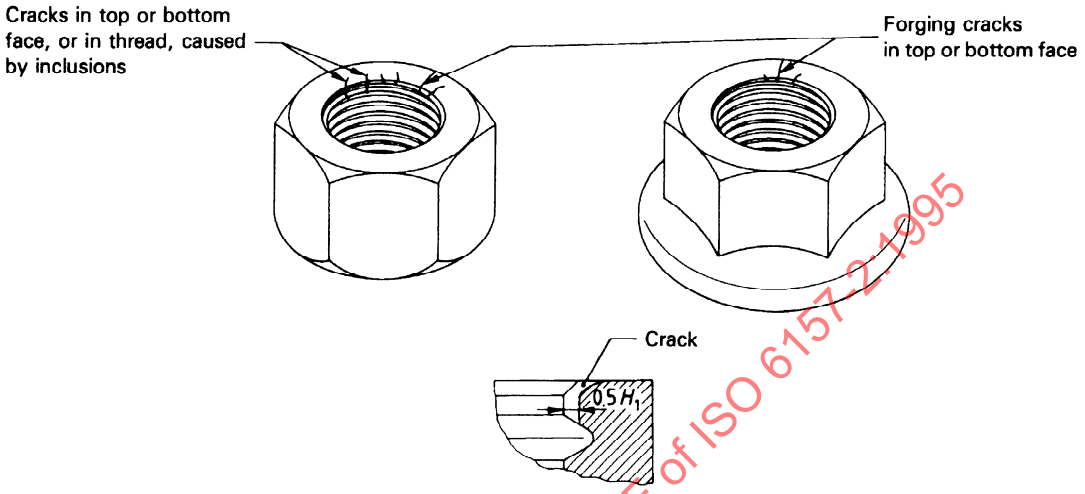
A crack is a clean (crystalline) fracture passing through or across the grain boundaries and may possibly follow inclusions of foreign elements. Cracks are normally caused by overstressing the metal during forging or other forming operations, or during heat treatment, or may have been present in the raw material.

Where parts are subjected to significant reheating, cracks are usually discoloured by scale.

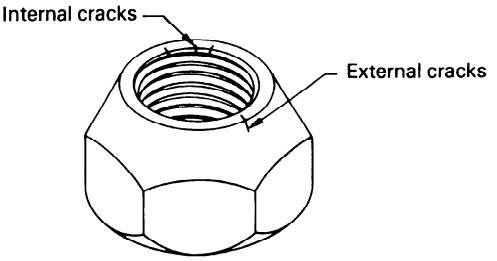
3.1.1 Quench cracks

Cause	Quench cracks may occur during hardening due to excessively high thermal and transformation stresses. Quench cracks usually follow an irregular and erratic course on the surface of the nut.
Appearance	
Limits	Quench cracks of any depth, any length, or in any location shall not be permitted.

3.1.2 Forging cracks and inclusion cracks

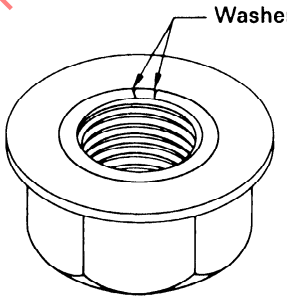
Cause	Forging cracks may occur during the cut-off or forging operations and are located only in the top and bottom face of the nuts or in the intersection of the face and flat. Inclusion cracks are caused by non-metallic inclusions inherent in the raw material.
Appearance	
Limits	Cracks located in the top and bottom faces shall be permitted, provided that: — there are not more than two forging cracks which extend across the full width of the bearing face, neither of which shall exceed a depth of 0,05d; — no crack extends into the tapped hole beyond the first full thread; — no crack in the first full thread exceeds a depth of 0,5H_1; where d is the nominal thread diameter; d_w is the diameter of the bearing face; H_1 is the effective thread height $H_1 = 0{,}541P$ where P is the pitch of the thread; s is the width across flats. In the case of nuts with a flange, cracks in the area between s and d_w shall not be permitted.

3.1.3 Cracks in the locking element of all-metal prevailing torque type nuts

Cause	Cracks in the locking element of all-metal prevailing torque type nuts may occur during the cut-off, forging or deflecting process, and are either on the external or internal face.
Appearance	
Limits	Cracks in the locking element resulting from the forging process shall be permitted, provided that all mechanical and functional requirements are met and that — there are not more than two cracks which extend the full width of the crown circle, neither of which shall exceed a depth of $0{,}05d$; — no crack extends into the tapped hole beyond the first full thread; — no crack in the first full thread exceeds a depth of $0{,}5H_1$; where d is the nominal thread diameter; H_1 is as defined in 3.1.2. Cracks in the locking element resulting from the deflecting process shall not be permitted.

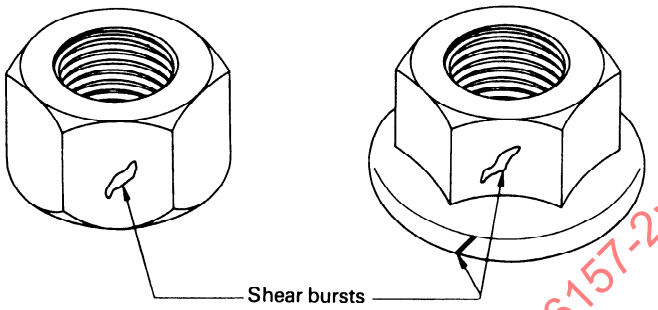
3.1.4 Cracks in the washer retainer of nuts with captive washers

A crack in the washer retainer is an opening in a lip or hub of metal used for securing a washer on a nut.

Cause	Washer-retainer cracks may occur when pressure is applied to the lip or hub during assembly of the washer.
Appearance	
Limits	Washer-retainer cracks are permissible if limited to the contour of the lip or hub used for retaining purposes, provided that the washer is securely held and able to rotate freely.

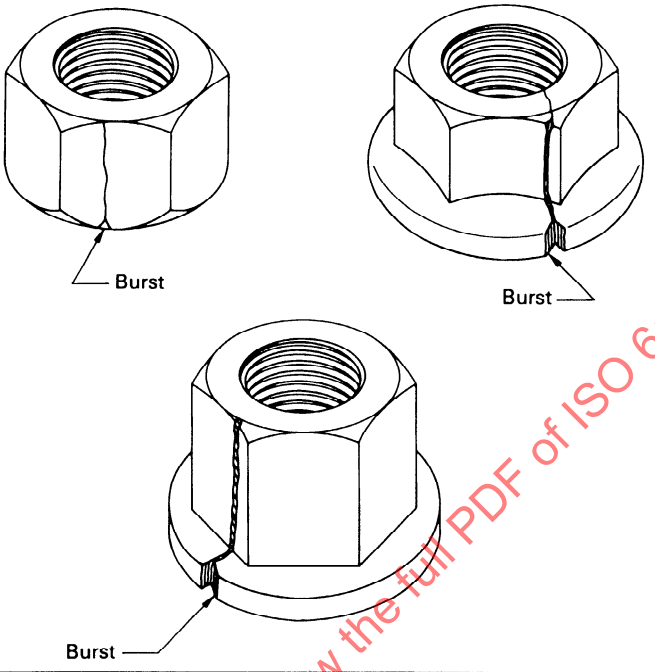
3.2 Shear bursts

Shear bursts are open breaks in the surface of the metal.

Cause	Shear bursts occur, for example, during forging operations on the external surfaces of nuts and at the periphery of nuts with a flange. Shear bursts are located in a plane with an orientation of approximately 45° to the axis of the nut.
Appearance	
Limits	No shear burst in the flats of hexagon nuts shall extend into the bearing faces of a nut or the crown circle of a nut with a flange. Shear bursts occurring at the intersection of two wrenching flats shall not reduce the width across corners below the specified minimum value. Shear bursts at the periphery of the flange of nuts with a flange are allowed, providing they do not extend into the minimum diameter of the bearing face, d_w.

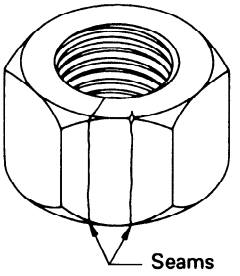
3.3 Bursts

Bursts are open breaks in the surface of the metal.

Cause	Bursts may occur, for example, during forging operations on the external surfaces of nuts and at the periphery of nuts with a flange because of surface discontinuities in the raw material.
Appearance	
Limits	If a burst occurs in connection with a seam resulting from the raw material, the seam may extend into the crown circle (see 3.4) but not the burst. Bursts occurring at the intersection of two wrenching flats shall not reduce the width across corners below the specified minimum value. No burst or shear burst located at the intersection of the top or bottom face with a wrenching flat shall have a width greater than $(0{,}25 + 0{,}02s)$ mm, where s is the width across flats. Bursts and shear bursts at the periphery of the flange of nuts with a flange are allowed, provided that they do not extend into the minimum diameter of the bearing face, d_w, and that the width of the burst does not exceed $0{,}08d_c$, where d_c is the flange diameter.

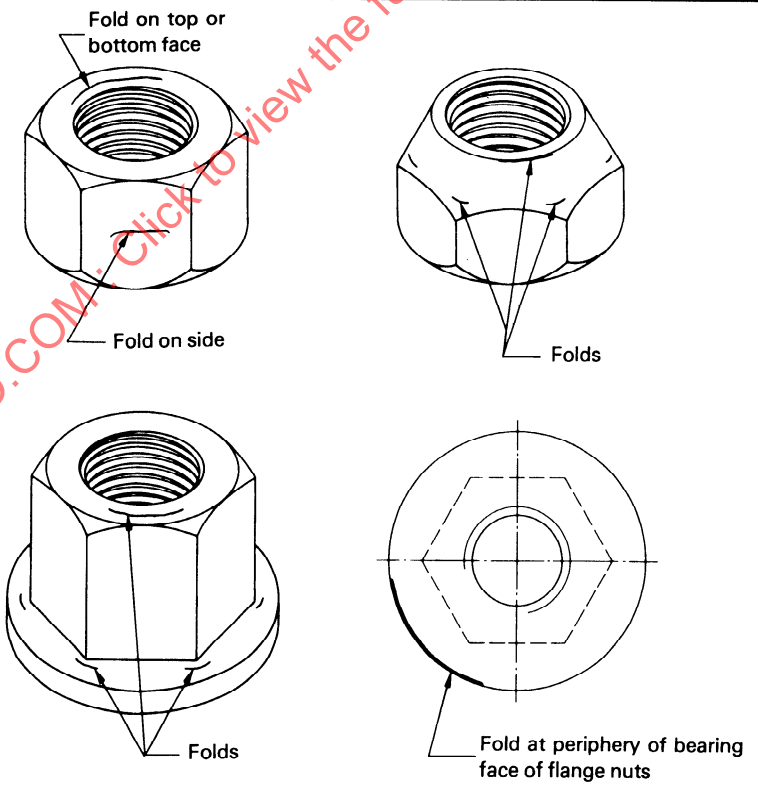
3.4 Seams

A seam is a longitudinal surface discontinuity in the form of an unwelded open fold in the material.

Cause	Seams are usually inherent in the raw material from which fasteners are made.
Appearance	
Limits	Seams shall be permitted, provided that a depth from the surface of 0,05d for all thread sizes is not exceeded, where d is the nominal thread diameter.

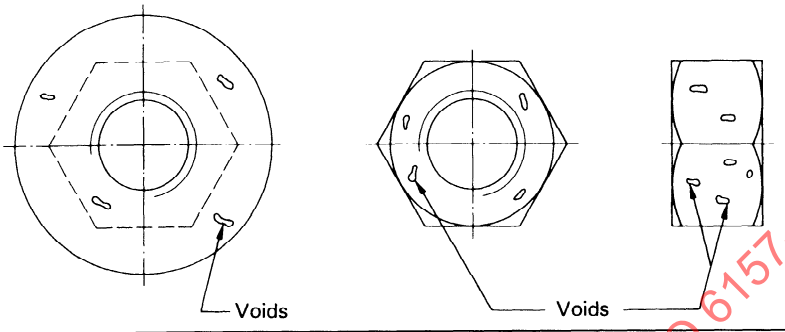
3.5 Folds

A fold is a doubling over of metal which occurs at the surface of the nut during forging.

Cause	Folds may be produced by material displacements during forging operations on nuts at or near the intersection of diameter changes, or on the top or bottom face of the nut.
Appearance	
Limits	Folds are permitted, but those located at the intersection of the flange periphery and bearing face of nuts with a flange shall not intrude into the bearing surface.

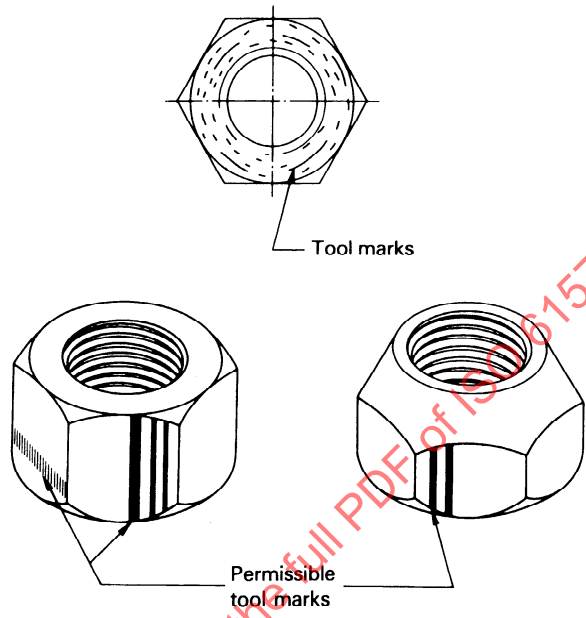
3.6 Voids

A void is a shallow pocket or hollow on the surface of a nut caused by non-filling of metal during forging or upsetting.

Cause	Voids are produced by marks or impressions of chips (shear burrs) or by rust formation on the raw material. They are not planished during forging or upsetting operations.
Appearance	
Limits	Depth, h, of voids: $h \leqslant 0{,}02d$ but with 0,25 mm max. where d is the nominal thread diameter. Area of all voids: The combined surface area of all voids on the bearing face shall not exceed 5 % of the bearing surface, for nuts with nominal thread diameter $d \leqslant 24$ mm 10 % of the bearing surface, for nuts with nominal thread diameter $d > 24$ mm.

3.7 Tool marks

Tool marks are longitudinal or circumferential grooves of shallow depth.

Cause	Tool marks are produced by relative motions between the work piece and the manufacturing tool.
Appearance	Tool marks are most frequently elongated or circumferential. 
Limits	Tool marks on the bearing surface shall not exceed a surface roughness of R_a = 3,2 µm when tested in accordance with ISO 468. Tool marks on other surfaces are allowed.

3.8 Damages

Damages are indentations of any surface of a nut.

Cause	Damages, for example dents, scrapes, nicks and gouges, are produced by external actions during handling and transport.
Appearance	Damages have no precise geometrical shape, location or direction; they are identifiable as external action.
Limits	Damages as described above shall not cause rejection unless it can be shown that they impair usability. (See also the requirements given at the beginning of clause 3.) If necessary, special packing and handling procedures may be used in order to avoid unacceptable damage during transport.

4 Inspection and evaluation procedure

Sampling shall be carried out in accordance with ISO 3269, using the following procedures.

4.1 Routine acceptance inspection

For routine acceptance purposes, visual inspection procedures may be used to ensure that products conform to this part of ISO 6157.

4.2 Non-destructive testing

A representative sample shall be taken from the lot in accordance with ISO 3269 and subject to either × 10 magnification visual examination tests or other suitable tests, for example magnetic techniques or eddy current. If no unacceptable surface discontinuity is found, the lot shall be accepted. If a user requires 100 % examination, this shall be stated at the time of ordering.

4.3 Destructive testing

If, after removing the surface coating, surface discontinuities are found which are likely to exceed the allowable limits, parts with the most severe surface discontinuities shall be selected for destructive testing (see ISO 10484 and ISO 10485).

4.4 Referee test

For referee purposes, nuts shall satisfy the widening test in accordance with ISO 10484. The cone proof load test in accordance with ISO 10485 may be applied in addition to the widening test, on agreement between the manufacturer and user.

4.5 Evaluation

If on visual inspection any product is found with quench cracks or deflection cracks in the locking element, or discontinuities which exceed the dimensional limits, the lot shall be subject to rejection.

If any part fails the appropriate destructive tests specified in 4.3 and 4.4, the lot shall be subject to rejection.