INTERNATIONAL STANDARD ISO 3353

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Aerospace construction — Rolled threads — Runout and lead threads

Constructions aérospatiales — Filetages roulés — Filets incomplets côté tige (ou tête) et côté extrémité

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FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

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No Member Body expressed disapproval of the document.

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Aerospace construction — Rolled threads — Runout and lead threads

1 SCOPE AND FIELD OF APPLICATION

This International Standard defines the requirements for the thread runout at the junction of the thread and shank (or thread and head) and, at the extreme end of fasteners, the lead thread, for rolled threads used in aerospace construction. It specifies a referee method, by optical projection, for establishing conformity with these requirements.

Although this International Standard specifically refers to bolts, it may be applied to externally threaded products where the threads are produced by rolling, except where special runout or lead thread requirements are specified.

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2 DEFINITION OF A COMPLETELY FORMED THREAD

A completely formed thread follows the basic profile, within the tolerance, over an axial distance of 1 pitch (P) (points A, B, C). See figure 1.

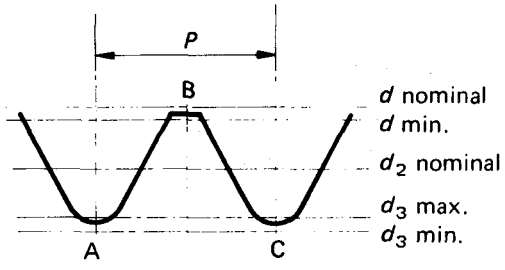

FIGURE 1 — **Completely formed thread**

The incomplete threads are situated between the end of the plain portion of the shank and the first thread root which is completely formed, where the minor diameter d_3 is not greater than the maximum permissible minor diameter.

For pitch diameter shank fasteners, the runout X comprises only incomplete threads, and will not extend into the underhead radius (see figure 2B).

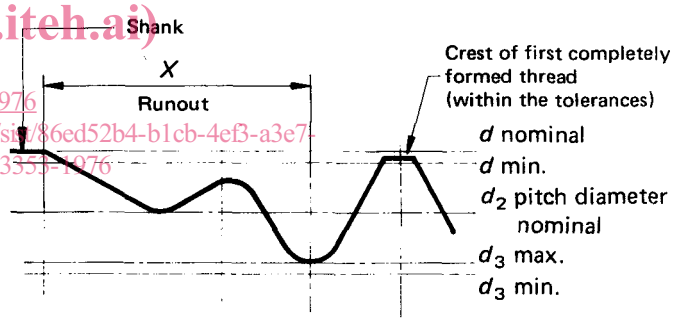

FIGURE 2A — **Full shank fasteners**

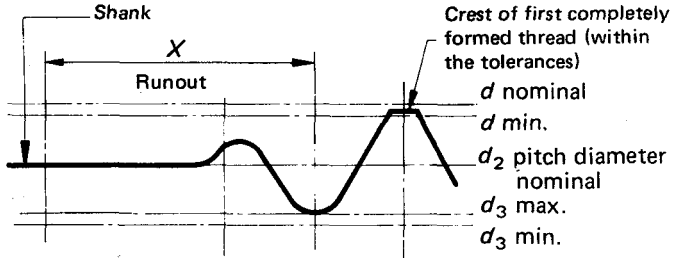

FIGURE 2B — **Pitch diameter shank fasteners**

3 DEFINITION OF RUNOUT AND LEAD THREADS

3.1 Shank end or head end (runout)

For full shank fasteners, including oversize shank fasteners, the runout X (see figure 2A) shall comprise the incomplete threads imparted by the die plus an unrolled portion of the blank diameter from which the thread is rolled.

3.2 Extreme end (lead threads) (figure 3)

3.2.1 *Lead threads*

The lead threads are situated between the end of the bolt and the first complete thread, where the diameter at the crest is not less than the minimum permissible crest diameter.

3.2.2 *Ineffective threads*

The ineffective threads are situated between the end of the bolt and the first effective thread, where the pitch diameter of the pressure flank of the thread corresponds with the minimum permissible diameter at that point, i.e. d_2 min.

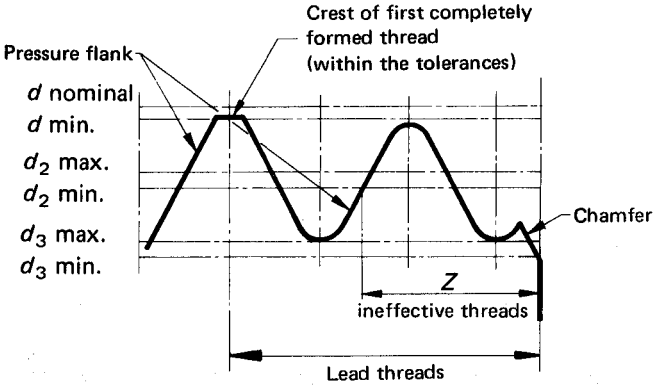

FIGURE 3 – **External end**

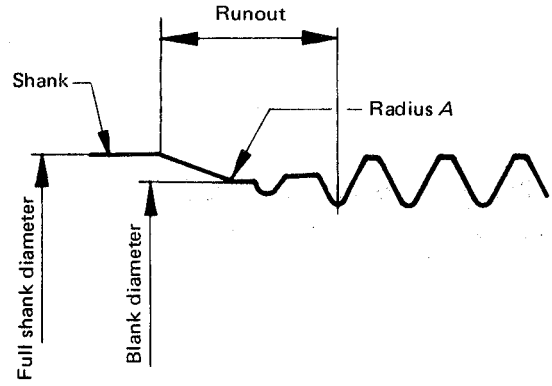

FIGURE 4A – **Taper transition**

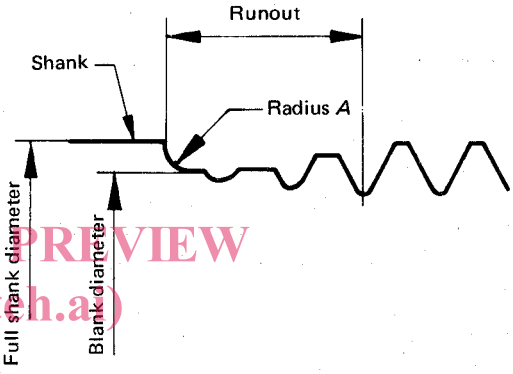

FIGURE 4B – **Shoulder transition**

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4 MANUFACTURING AND INSPECTION REQUIREMENTS

4.1 Runout radius

The flanks at the root of the incomplete thread shall be joined by a radius or by two radii and a flat that are smooth and devoid of abrupt tool stop marks. This radius or these radii shall be not smaller than the minimum root radius specified for the complete threads.

4.2 Shank end or head end (runout)

4.2.1 *Full shank fasteners* (i.e. those having a nominal shank diameter equivalent to the nominal thread size)

4.2.1.1 The runout X (figure 2A) shall be between 2 P and 1 P minimum. The incomplete thread part of the runout shall be not less than 0,6 P.

4.2.1.2 The transition between the blank diameter and the full shank diameter shall consist of a radius A and either a taper, as shown in figure 4A, or a shoulder, as shown in figure 4B. The radius A shall be not smaller than the minimum root radius specified for the thread. For parts as in figure 4B, the incomplete thread must not encroach upon radius A.

4.2.2 *Pitch diameter shank fasteners* (i.e. those having a nominal shank diameter equivalent to that of the blank diameter from which the thread is rolled)

The runout X (figure 2B) shall be between 2 P maximum and 0,6 P minimum.

4.2.3 *Oversize shank fasteners*

The transition between the blank diameter and the oversize shank diameter shall consist of a radius and a taper, as shown in figure 5, with increased length of runout Z, where

$$Z = X + \frac{\text{increase in diameter}}{2 \tan \theta_{min}}$$

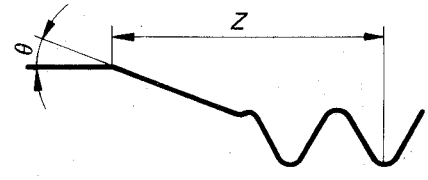

FIGURE 5 – **Taper transition for oversize shank fasteners**

4.2.4 *Threaded to head fasteners*

4.2.4.1 The dimension W (see figure 6A) between the end of the complete thread and the face of the fastener head shall be as follows :

$$W_{min} = 1{,}5\,P + \text{maximum underhead radius}$$

$$W_{max} = W_{min} + 0{,}5\,P$$

The incomplete threads shall be as specified in 4.2.1 or 4.2.2, as appropriate, but shall not encroach on the underhead radius.

4.2.4.2 In the case of flush head fasteners, the thread runout shall not encroach on the underhead radius (see figure 6B).

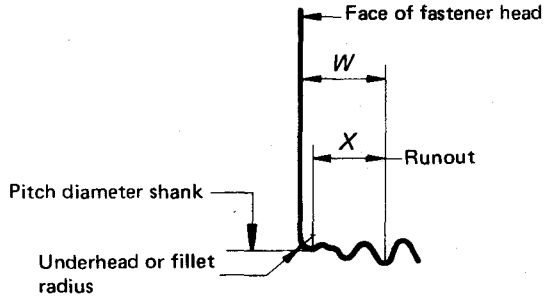

FIGURE 6A – **Threaded to head fasteners**

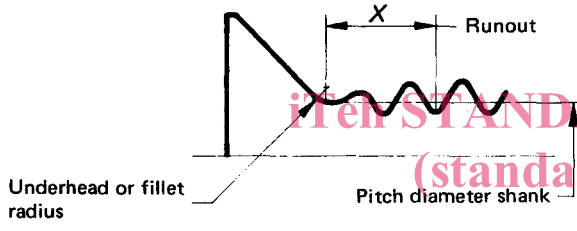

FIGURE 6B – **Flush head fasteners threaded to head**

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4.2.5 *Incomplete thread portion*

The incomplete thread portion of the runout shall gradually decrease in depth within an axial length of not less than 0,6 P and shall blend smoothly with the blank diameter from which the thread is rolled.

4.3 Extreme end (lead threads)

4.3.1 The lead threads Y shall not be greater than 2 P from the end of the fastener including chamfers. See figure 3.

4.3.2 The ineffective threads Z shall not be greater than 1,5 P from the end of the fastener including chamfer. See figure 3.

5 INSPECTION OF RUNOUT AND LEAD THREADS

The inspection methods used during manufacture shall be at the discretion of the manufacturer, provided that they ensure conformity with the requirements previously stated.

A referee method for establishing conformity with requirements for runout and lead threads shall be by optical projection as given below.

5.1 Comparator chart requirements

A chart for measuring the runout and lead threads shall be as defined in figure 8 and the following sub-clauses. The chart shall be magnified 20 times minimum to match the comparator capability.

5.1.1 *Shank or head end (runout)*

a) Horizontal parallel lines to define the minimum thread height defined as one-half the difference between minimum major diameter and maximum minor diameter.

b) Representing the maximum length of thread runout, vertical line A, located a distance to the left of vertical line B, in accordance with the following requirements :

2 P for fasteners with standard shank diameters, for pitch diameter shank fasteners and for threaded to head fasteners;

$2P + \dfrac{\text{oversize shank diameter increment}}{2 \tan \theta_{min}}$ for fasteners with oversize shank diameters (normally $\theta = 15°$ to $35°$).

c) Vertical index line B intersecting 30° flank angle line at point C.

d) Representing the minimum length of thread runout, line B_1 is located a distance to the left of line B, in accordance with the following requirements :

1 P for full shank diameter fasteners;

$1P + \dfrac{\text{oversize shank diameter increment}}{2 \tan \theta_{max}}$ for fasteners with oversize shank diameter;

0,6 P for pitch diameter shank fasteners and for threaded to head fasteners.

5.1.2 *Extreme end (lead threads)*

a) Horizontal parallel lines as described in 5.1.1 a) above.

b) Vertical line G intersecting 30° flank angle line E at point F.

c) Vertical line H located a distance of 2 P to the right of G.

d) Vertical line K located a distance of 1,5 P to the left of H.

5.2 Procedure

5.2.1 *For runout threads*

Rotate the part to find the first complete thread nearest to the end of the shank which has the thread crest and root coinciding with the chart horizontal lines representing the minimum thread height. Then move the part shadow horizontally until the left flank of the above thread coincides with line D.

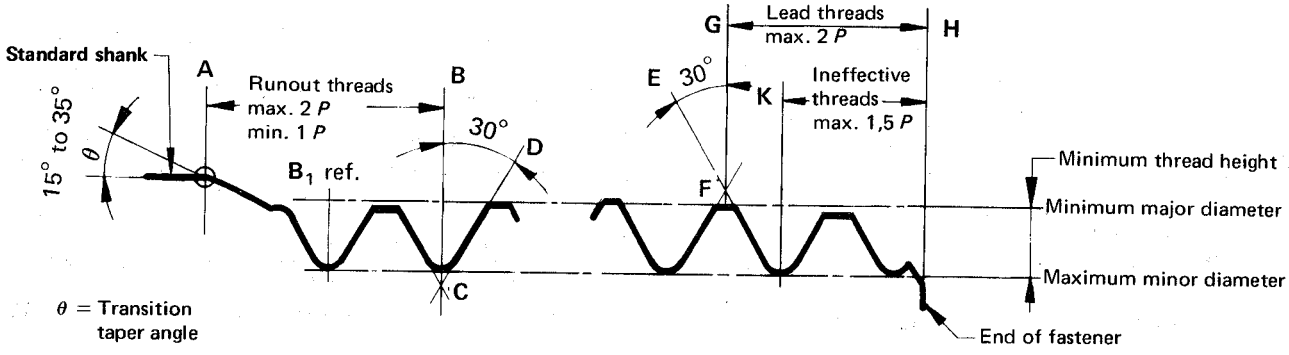
The end of the thread runout next to the shank or head shall then fall between lines A and B_1 to be acceptable.

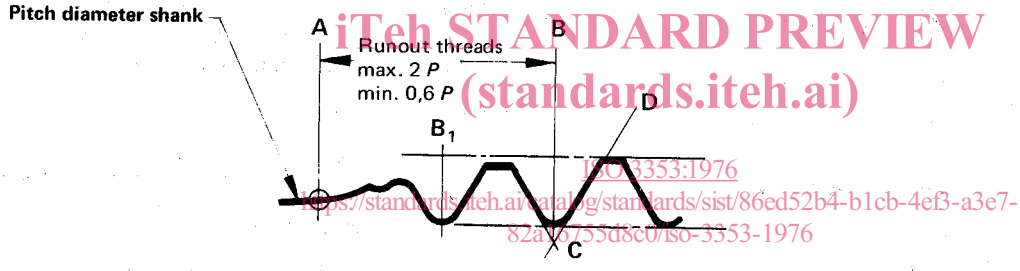
5.2.2 *For lead threads*

Rotate the part to find the first complete thread nearest to the end of the part which has the thread crest and root coinciding with the chart horizontal lines representing the minimum thread height. Then move the part shadow horizontally until the right flank of the above thread coincides with line E.

The end of the lead thread shall then fall between lines G and H to be acceptable.

Rotate the part through 90° to check that ineffective threads fall between lines K and H.





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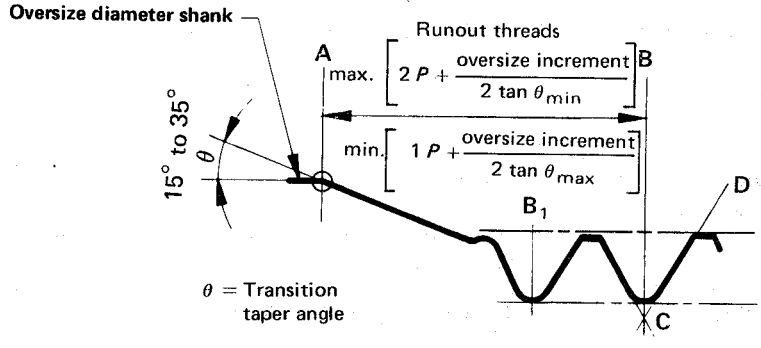

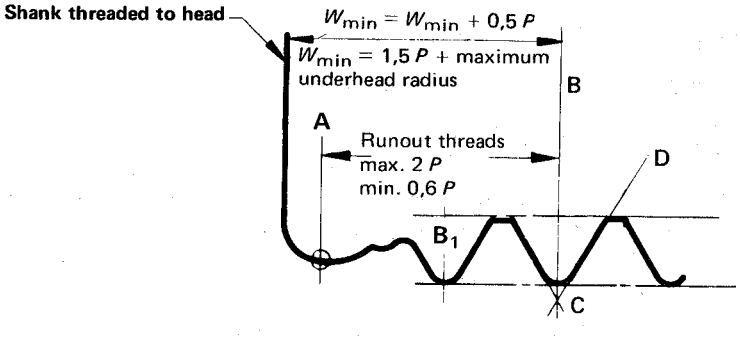

FIGURE 7 — **Comparator chart requirements for determining length of lead and runout threads**