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Aerospace — UNJ threads — Gauging

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National foreword

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Contents

Page

Foreword ..... **iv**

1 Scope **1**

2 Normative references **1**

3 Terms, definitions, symbols and abbreviated terms **1**
3.1 Terms and definitions 1
3.2 Symbols and abbreviated terms 2

4 Types of gauges **3**
4.1 Gauges and setting plugs for external threaded products 3
4.2 Gauges for internal threaded products 3

5 Reference temperature **3**

6 Function, design and use of gauges **4**
6.1 Gauges for external threads 4
6.1.1 Virtual pitch diameter indicating thread gauges 4
6.1.2 Solid or adjustable GO screw ring gauges 4
6.1.3 Simple pitch diameter indicating thread gauges 4
6.1.4 Major diameter gauges 5
6.1.5 Minor diameter gauges 5
6.1.6 Optical comparator checks 5
6.2 Gauging for internal threads 5
6.2.1 GO screw plug gauges 5
6.2.2 NOT GO screw plug gauges 5
6.2.3 Minor diameter gauges 5
6.2.4 Virtual pitch diameter indicating thread gauges 5
6.2.5 Simple pitch diameter indicating thread gauges 6

7 Setting of gauges **6**
7.1 Setting gauges for external threads 6
7.2 Setting ring gauge for indication thread gauges 6

8 Gauging of threads **6**
8.1 General 6
8.2 Internal threads evaluation 7

Bibliography **22**

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 15872:2002), which has been technically revised and includes the following changes:

— unused symbols have beenremoved from Table 1: WGO, WNG, Z1, ZPL, and ZR.

— Figures have been changed to align with 8.1.

— Normative references have been updated.

— Terminology has been updated.

— The document has been editorially revised.

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INTERNATIONAL STANDARD ISO 15872:2017(E)

Aerospace — UNJ threads — Gauging

1 Scope

This document provides methods for the gauging of ISO UNJ threads complying with ISO 3161.

Other methods of ensuring that the product is within the specified limits can be used, provided that correlation with the specified gauges is established.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1, *Geometrical product specifications (GPS) — Standard reference temperature for the specification of geometrical and dimensional properties*

ISO 3161, *Aerospace — UNJ threads — General requirements and limit dimensions*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5408 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
best wire size
cylinder or sphere which has a radius so that it will contact the thread flanks at the pitch cylinder intersection

Note 1 to entry: The radius of the best wire or sphere is theoretically equal to 0,288 68*P*.

3.1.2
indicating gauge
device having contacts which will precisely compare the size of a work piece thread to a setting standard of known dimensions

Note 1 to entry: The value for the indicated characteristic thus established is the dimensional value attributed to the work piece. An indicating gauge can have contacts designed to measure any thread characteristic. This document specifies the characteristics and designs for ISO UNJ threads.

3.1.3
simple pitch diameter
diameter of an imaginary cylinder intersecting an actual thread over the width of one groove where that width is equal to one half of the basic pitch

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3.1.4
virtual pitch diameter
pitch diameter of the smallest (for external threads) or largest (for internal threads) perfect thread form with GO gauge profile which can engage the product threads for a distance equal to the GO gauge thread engagement

3.2 Symbols and abbreviated terms

See Table 1.

Table 1 — Symbols, abbreviated terms and definitions

Symbol or abbreviated term	Definition
D_1	Basic minor diameter of the internal thread of a workpiece
d_2	Basic pitch diameter of the external thread of a workpiece
es	Fundamental deviation of the external thread of a workpiece
EI	Fundamental deviation of the internal thread of a workpiece
H	Height of the triangle of a thread profile
H_1	Tolerance for the diameter of plain plug gauges
H_P	Tolerance on the size of check plug gauges for plain calliper gauges
(LSL)	Lower specification limit
m	Distance between the middle of the tolerance zones TR of a screw ring gauge and TCP of a GO check plug
(USL)	Upper specification limit
P	Pitch

Symbol or abbreviated term	Definition
$T_{\alpha 1}/2$	Tolerance for each flank angle of a profile with complete flanks
$T_{\alpha 2}/2$	Tolerance for each flank angle of a profile with truncated flanks
T_{CP}	Tolerance on the pitch diameter of GO and NOT GO screw check plugs, wear check plugs and setting plugs
T_d	Tolerance for the major diameter of the external thread of a workpiece
T_{d2}	Tolerance for the pitch diameter of the external thread of a workpiece
T_{d3}	Tolerance for the minor diameter of the external thread of a workpiece
T_{D1}	Tolerance for the minor diameter of the internal thread of a workpiece
T_P	Pitch tolerance
T_{D2}	Tolerance for the pitch diameter of the internal thread of a workpiece
T_{PL}	Tolerance for the pitch diameter of GO and NOT GO screw plug gauges
T_R	Tolerance for the pitch diameter of GO and NOT GO screw ring gauges

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4 Types of gauges

4.1 Gauges and setting plugs for external threaded products

The function, design and use of gauges and setting plugs for external threads are explained in the following subclauses.

Gauge type	Subclause
a) GO screw ring gauges	6.1.2
b) Setting plug for adjustable GO screw ring and indicating thread gauges	7.1.1
c) Virtual pitch diameter indicating thread gauges	6.1.1
d) Simple pitch diameter indicating thread gauges	6.1.3
e) Flat contact gauges for major diameter	6.1.4
f) Point contact indicating thread gauges for minor diameter	6.1.5
g) Optical comparator for root radius and minor diameter	6.1.6

4.2 Gauges for internal threaded products

The function, design and use of gauges for internal threads are explained in the following subclauses.

Gauge type	Subclause
a) GO screw plug gauges	6.2.1
b) NOT GO screw plug gauges	6.2.2
c) Plain gauges for minor diameter (plug gauge)	6.2.3.1
d) GO full form screw plug gauges	6.2.3.2
e) Virtual pitch diameter indicating thread gauges	6.2.4
f) Simple pitch diameter indicating thread gauges	6.2.5
g) Setting ring gauge for indicating thread gauges (solid type)	7.2

5 Reference temperature

In accordance with ISO 1, the dimensions of the gauge and the product shall be checked at the temperature of 20 °C.

If the product and the gauge have the same coefficients of linear expansion, the temperature may deviate from 20 °C, provided the temperature of the product and the gauge are the same.

If the product and the gauge have different coefficients of linear expansion, the temperature of both, at the time of gauging, shall be:

a) 20 °C ± 2 °C for sizes 1,000 UNJ and smaller;

b) 20 °C ± 1 °C for larger threads.

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6 Function, design and use of gauges

6.1 Gauges for external threads

6.1.1 Virtual pitch diameter indicating thread gauges

6.1.1.1 It measures, on two or three segments or rolls, the maximum material virtual pitch diameter taking into account variations of form such as pitch variation, helix and flank variations, roundness and taper which produces an enlargement of the virtual pitch diameter. In addition, virtual pitch diameter control ensures the flank angle contact is sufficient to ensure that the root radius does not exceed the maximum limit. Measurement of virtual pitch diameter with indicating gauges shall be obtained to calculate virtual minus simple pitch diameter differential unless the simple pitch diameter limits, gauged in accordance with 6.1.3, are within the limits defined by the maximum pitch diameter and the form variation limits in ISO 3161.

6.1.1.2 Indicating gauges have two or three contacts at 180° or 120°, respectively. Gauges with segments or rolls are designed with the length of the GO virtual maximum material gauging elements equal to the GO ring gauge length equal to nine pitches (P) or the basic major diameter of the thread, whichever is the smallest. For configuration and profile requirements, see Figure 1.

6.1.1.3 The minor diameter of the GO virtual maximum material thread segments and the diameter of the circle surrounded by the roll cluster of GO virtual maximum material rolls shall be equal to the pitch diameter of the product minus 0,375H, less the T_{PL} value in Table 2 minus tolerance when assembled in the gauge frame. This corresponds to a flat width of 0,312 5P on the minor crest for the thread. The crest shall be flat in an axial plane and parallel to the axis of the segments or rolls.

6.1.1.4 The major diameter of the GO virtual maximum material segments and the root of the GO virtual maximum material rolls shall be cleared beyond a 0,125P flat either by an extension of the flanks of the thread toward a sharp vee or by an undercut no greater than 0,125P maximum width and approximately central. The root clearance shall be such that the major diameter of the full form section of the thread setting plug gauge is cleared after the assembled gauge has been properly set to size.

6.1.1.5 The pitch diameter cylinder axis of threaded segments and rolls shall be straight within the diameter tolerance zone equal to T_{PL} specified in Table 2. The half-angle variations in the segment or roll thread shall be within the limits specified in Table 3. For the pitch variations, see Table 4.

6.1.2 Solid or adjustable GO screw ring gauges

To ensure the ease of assembly of product threads and conformance to the maximum material virtual pitch diameter limits, solid or adjustable, GO screw ring gauges with thread form in accordance with Figure 1 and setting gauges in accordance with 7.1.1 may be used. Solid GO screw ring gauges shall not be permitted to exceed the product thread dimensional limits. The gauge thickness/length shall be standardized (see 6.1.1.2). Details on adjustable GO thread ring gauges and truncated setting plugs may be obtained from ASME B1.2.

6.1.3 Simple pitch diameter indicating thread gauges

The simple pitch diameter indicating gauge with cone and vee rolls or segments or rolls with best wire size radius is applied to ensure that the pitch diameter is greater than the minimum limit. The indicators are set to the GO threaded setting plug gauge. Readings indicate the position of the pitch diameter and the minimum measurement shall be no less than the minimum pitch diameter limit. The minimum measured pitch diameter shall be within the ISO 3161 form variation limit compared to the virtual pitch diameter measurement in accordance with 6.1.1, i.e. the differential value.

The simple pitch diameter contacts have cone and vee rolls or segments which contact the product pitch cylinder. Other designs have two or three rolls with radii on annular ribs on rolls made to best

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