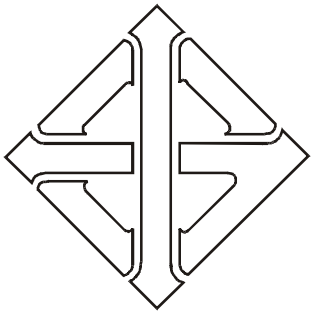

มาตรฐานผลิตภัณฑ์อุตสาหกรรม

THAI INDUSTRIAL STANDARD

มอก. 2358 – 2550

ISO 1502 : 1996

เกลียวเมตริกไอเอสโอสำหรับใช้งานทั่วไป – เครื่องมือวัดและการวัด

ISO GENERAL - PURPOSE METRIC SCREW THREADS – GAUGES AND GAUGING

สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม

กระทรวงอุตสาหกรรม

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สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม
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มาตรฐานผลิตภัณฑ์อุตสาหกรรมกำหนดขึ้นโดยรับ ISO 1502:1996(E) ISO general-purpose metric screw threads – Gauges and gauging มาใช้ในระดับเหมือนกันทุกประการ (identical) โดยใช้ ISO ฉบับภาษาอังกฤษเป็นหลัก

คณะกรรมการมาตรฐานผลิตภัณฑ์อุตสาหกรรมได้พิจารณามาตรฐานนี้แล้ว เห็นสมควรเสนอรัฐมนตรีประกาศตามมาตรา 15 แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. 2511

ประกาศกระทรวงอุตสาหกรรม

ฉบับที่ 3796 (พ.ศ. 2550)

ออกตามความในพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม

พ.ศ. 2511

เรื่อง กำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม

เกลียวเมตริกไอเอสโอสำหรับใช้งานทั่วไป-เครื่องมือวัดและการวัด

อาศัยอำนาจตามความในมาตรา 15 แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. 2511 รัฐมนตรีว่าการกระทรวงอุตสาหกรรมออกประกาศกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม เกลียวเมตริกไอเอสโอสำหรับใช้งานทั่วไป-เครื่องมือวัดและการวัด มาตรฐานเลขที่ มอก. 2358-2550 ไว้ ดังมีรายละเอียดต่อท้ายประกาศนี้

ประกาศ ณ วันที่ 2 ตุลาคม พ.ศ. 2550

โฆสิต ปั้นเปี่ยมรัษฎ์

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม

มาตรฐานผลิตภัณฑ์อุตสาหกรรม
เกลียวเมตริกไอเอสโอสำหรับใช้งานทั่วไป – เครื่องมือวัดและการวัด

บทนำ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนดขึ้นโดยรับ ISO 1502 : 1996(E) ISO general-purpose metric screw threads - Gauges and gauging มาใช้ในระดับเหมือนกันทุกประการ (identical) โดยใช้ ISO ฉบับภาษาอังกฤษเป็นหลัก

ขอบข่าย

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนดรายละเอียดสำหรับการผลิต และการใช้เครื่องมือวัดสำหรับการตรวจสอบเกลียวเมตริกไอเอสโอสำหรับใช้งานทั่วไปกับรูปร่างพื้นฐาน ตาม ISO 68.

โดยกำหนดชนิดของเครื่องมือวัด (ตาม ISO 1502 ข้อ 4.1 และ 4.2) ซึ่งแนะนำสำหรับการวัดเกลียวนอกและเกลียวในของชิ้นงาน และกำหนดการปรับแต่งและตรวจสอบความเที่ยงตรงของเครื่องมือวัด

วิธีการตรวจสอบอื่นอาจนำมาใช้ได้ ตัวอย่างเช่น การวัดด้วยเครื่องมือวัดที่อ่านค่าได้ แต่การตัดสินให้ใช้การวัดด้วยเครื่องมือวัดตามมาตรฐานนี้

จุดมุ่งหมายของมาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ คือการกำหนดวิธีในการแยกแยะระหว่างเกลียวซึ่งมีขนาดเป็นไปตามเกณฑ์ และเกลียวซึ่งไม่เป็นไปตามเกณฑ์

เพื่อความสามารถในการเปลี่ยนทดแทนกันได้และหลีกเลี่ยงการขัดแย้งระหว่างผู้ทำและผู้ซื้อใช้ใช้กฎเกณฑ์ ดังต่อไปนี้

ก) ผู้ทำต้องไม่ส่งมอบชิ้นงานเกลียวใด ๆ ซึ่งมีขนาดเกลียวจริง (เช่น เส้นผ่านศูนย์กลางพิตช์และเส้นผ่านศูนย์กลางพิตช์เสมือน) อยู่นอกเกณฑ์กำหนด

ข) ผู้ซื้อต้องไม่ปฏิเสธชิ้นงานเกลียวใด ๆ ซึ่งมีขนาดเกลียวจริง (เช่น เส้นผ่านศูนย์กลางพิตช์และเส้นผ่านศูนย์กลางพิตช์เสมือน) อยู่ในเกณฑ์กำหนด

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด ความต้องการสำหรับชนิดและขนาดของเครื่องมือวัดสำหรับวัดเกลียวสภาวะที่จะนำเครื่องมือวัดไปใช้ และกฎในการตรวจสอบชิ้นงานเกลียว

เอกสารอ้างอิง

เอกสารอ้างอิงที่ระบุต่อไปนี้ใช้ประกอบกับมาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ เอกสารอ้างอิงฉบับที่ระบุปีที่พิพม์ให้ใช้ฉบับที่ระบุ ส่วนเอกสารที่ไม่ระบุปีที่พิมพ์นั้นให้ใช้ฉบับล่าสุด (รวมถึงฉบับแก้ไขเพิ่มเติม)

ISO 1 : 1975, Standard reference temperature for industrial length measurements.

ISO 68 :-[1], ISO general-purpose screw threads - Basic profile.

ISO 1938-1 :-[2], Inspection of plain workpieces - Part 1 : Plain limit gauges.

ข้อกำหนด

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด ข้อกำหนดสำหรับ สัญลักษณ์และคำย่อ ชนิดของเครื่องมือวัด การวัดชิ้นงาน อุณหภูมิอ้างอิง การใช้งานการตรวจสอบและการใช้เครื่องมือวัด ขอบเขตของเกณฑ์ความคลาดเคลื่อนสำหรับเส้นผ่านศูนย์กลางของเครื่องมือวัด ขอบเขตของเกณฑ์ความคลาดเคลื่อนสำหรับเครื่องมือวัดแบบแผ่นราบ รูปร่างเกลียวสำหรับเครื่องมือวัด ลักษณะทั่วไปสำหรับเครื่องมือวัดเกลียว เกณฑ์ความคลาดเคลื่อนและความสึกหรอที่ยอมรับได้สำหรับเครื่องมือวัดเส้นผ่านศูนย์กลางพิตช์ สมการเพื่อการคำนวณขีดจำกัดของเครื่องมือวัด และภาคผนวก รายละเอียดตาม ISO 1502 : 1996 ข้อ 3 ถึงข้อ 13

1) ระหว่างจัดพิมพ์ (Revision of ISO 68 : 1973)

2) ระหว่างจัดพิมพ์

ISO general-purpose metric screw threads — Gauges and gauging

1 Scope

This International Standard gives details for the manufacture and use of gauges for checking ISO general-purpose metric screw threads with a basic profile in accordance with ISO 68.

It specifies the features of the types of gauges (listed in 4.1 and 4.2) which are recommended for checking external and internal screw threads of workpieces and for the setting and checking of certain of the screw gauges.

It is recognized that other methods of checking may be used, for example measurements with indicating instruments. Checking with gauges in accordance with this International Standard is always decisive.

The aim of this International Standard is to provide means of distinguishing between workpiece threads that comply with the limits of size and those that do not.

In order to ensure the interchangeability of workpiece threads and to avoid disputes between the manufacturer and purchaser, the following principles should be applied:

a) the manufacturer should not deliver any workpiece thread whose actual thread size (e.g. pitch diameter and virtual pitch diameter) lies outside the specified limits;

b) the purchaser should not reject any workpiece thread whose actual thread size (e.g. pitch diameter and virtual pitch diameter) lies inside the specified limits.

In order to satisfy these two principles, this International Standard establishes requisite types and sizes of gauges for checking screw threads, the conditions under which these gauges are to be used, and rules for the inspection of the workpiece threads.

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 1:1975, *Standard reference temperature for industrial length measurements.*

ISO 68:—[1], *ISO general-purpose screw threads — Basic profile.*

ISO 1938-1:—[2], *Inspection of plain workpieces — Part 1: Plain limit gauges.*

3 Symbols and abbreviations

The symbols and abbreviations used in the text and figures in this International Standard are listed in table 1.

1) To be published. (Revision of ISO 68:1973)

2) To be published.

Table 1 — Symbols and abbreviations

Symbol or abbreviation	Definition
b_1	Width of the clearance groove at the major diameter of a gauge thread profile with complete flanks
b_2	Width of the clearance groove at the minor diameter of a gauge thread profile with complete flanks
b_3	Width of the clearance groove at the major and minor diameter, respectively, of a gauge thread profile with truncated flanks
d, D	Basic major diameter of a workpiece thread
D_1	Basic minor diameter of the internal thread of a workpiece
d_2, D_2	Basic pitch diameter of a workpiece thread
es	Fundamental deviation of the external thread of a workpiece (it is zero for tolerance position h)
EI	Fundamental deviation of the internal thread of a workpiece (it is zero for tolerance position H)
F_1	For thread profiles with truncated flanks, the radial distance between the pitch diameter line and the end of the straight part of the flank in the direction of the crest
F_2	For thread profiles with truncated flanks, the radial distance between the pitch diameter line and the end of the straight part of the flank in the direction of the root
H	Height of the triangle of a thread profile
H_1	Tolerance on the diameter of plain plug gauges
H_2	Tolerance on plain ring gauges and the separation of the plain faces of calliper gauges
H_P	Tolerance on the size of check plug gauges for plain calliper gauges
LML	Least material limit
m	Distance between the middle of the tolerance zones T_R of a screw ring gauge and T_{CP} of a GO check plug
MML	Maximum material limit
P	Pitch
r_1	Radius of the clearance groove of the root profile of GO and NOT GO screw ring gauges or of GO and NOT GO screw calliper gauges

Symbol or abbreviation	Definition
r_2	Radius of the clearance groove of the root profile of GO and NOT GO screw plug gauges
S	Displacement of the clearance groove from the centre of a thread profile with truncated flanks
$T_{\alpha 1}/2$	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_{D1}	Tolerance for the minor diameter of the internal thread of a workpiece
T_{D2}	Tolerance for the pitch diameter of the internal thread of a workpiece
T_P	Tolerance for the pitch of a gauge thread
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
W_{GO}	Amount available for permissible wear of GO screw plug gauges and GO screw ring gauges
W_{NG}	Amount available for permissible wear of NOT GO screw plug gauges and NOT GO screw ring gauges
Z_1	Distance between the middle of the tolerance zone H_1 of a GO plug gauge and the lower limit of the minor diameter of a workpiece
Z_2	Distance between the middle of the tolerance zone H_2 of a GO calliper gauge or a GO ring gauge and the upper limit of the major diameter of a workpiece
Z_{PL}	Distance between the middle of the tolerance zone T_{PL} of a GO screw plug gauge and the lower limit of a workpiece thread
Z_R	Distance between the middle of the tolerance zone T_R of a GO screw ring gauge and the upper limit of a workpiece thread

4 Types of gauges

4.1 Gauges for external threads of workpieces and their check plugs and setting plugs

The following types are recommended:

— solid GO screw ring gauges;

— adjustable GO screw ring gauges;

— check plugs (GO and NOT GO) for new solid GO screw ring gauges;

— setting plugs for adjustable GO screw ring gauges;

— wear check plugs for solid or adjustable GO screw ring gauges;

— GO screw calliper gauges;

— setting plugs for GO screw calliper gauges;

— NOT GO screw calliper gauges;

— setting plugs for NOT GO screw calliper gauges;

— solid NOT GO screw ring gauges;

— adjustable NOT GO screw ring gauges;

— check plugs (GO and NOT GO) for new solid NOT GO screw ring gauges;

— setting plugs for adjustable NOT GO screw ring gauges;

— wear check plugs for solid or adjustable NOT GO screw ring gauges;

— plain GO ring gauges;

— plain GO calliper gauges;

— plain NOT GO calliper gauges;

— plain NOT GO ring gauges;

— check plugs for new plain GO calliper gauges;

— check plugs for new plain NOT GO calliper gauges;

— wear check plugs for plain GO calliper gauges.

4.2 Gauges for internal threads of workpieces

The following types are recommended:

— GO screw plug gauges;

— NOT GO screw plug gauges;

— plain GO plug gauges;

— plain NOT GO plug gauges.

5 Gauging of workpieces

It is not necessary to use all the gauges mentioned in clause 4. However, in gauging the limits (checking that the tolerances have been respected), it is essential that a GO and NOT GO gauging always be carried out with one of the GO screw gauges and one of the NOT GO screw gauges referred to in 4.1 and 4.2.

5.1 Gauging of external threads

Preferably a solid or adjustable GO screw ring gauge should be used for gauging an external thread.

To save time, for convenience in checking, or in cases where a GO screw ring gauge is not applicable, a GO screw calliper gauge may be used.

It is, however, recommended that gauging with GO screw calliper gauges should be supplemented by random sampling with a GO screw ring gauge, so that when a large number of parts are checked with a GO screw calliper gauge, a certain percentage receives an additional check with a GO screw ring gauge, thus giving greater assurance of interchangeability between the workpiece threads.

A GO screw calliper gauge should not be used if the manufacturing process is likely to cause deviations in the workpiece thread, which this gauge is not certain to detect, for example local pitch errors in milled threads or burrs at the start of the thread. Furthermore, a GO screw calliper gauge is not suitable for checking non-rigid parts, for example thin-walled parts which would be deformed by this gauge. In these cases, checking should be carried out with a GO screw ring gauge.

Similarly, only solid or adjustable NOT GO screw ring gauges should be used for non-rigid workpieces, for example thin-walled parts which would be deformed by checking with a NOT GO screw calliper gauge.

A NOT GO screw calliper gauge is used for checking the simple pitch diameter of an external thread.

GO and NOT GO gauges are used for gauging the major diameter of an external thread of a workpiece. Whether a calliper or ring gauge is used is determined by the form and rigidity of the workpiece. Plain ring gauges should be used on non-rigid parts (see ISO 1938-1).

5.2 Gauging of internal threads

GO and NOT GO screw plug gauges are used for gauging internal threads of a workpiece; GO and NOT GO plain plug gauges are used for gauging the minor diameter of a workpiece thread (see ISO 1938-1).

5.3 Inspection gauging

5.3.1 By the manufacturer

In general, the inspection department that checks the threads made in a workshop may use the same kind of gauges as are used in the workshop.

Disagreement between manufacturing and inspection can occur when products close to the limits of sizes are gauged.

When disputes do arise, it is recommended that the product be accepted if it is shown to be satisfactory by any gauge of the type concerned known to be within the requirements of this International Standard (taking into consideration the admissible wear).

In cases of dispute, checking of the ring gauges by check plugs is decisive if there is no other agreement between the manufacturer and purchaser.

NOTE 1 The possibility of disputes can be reduced to a minimum by grading the gauges so that those used by manufacturers provide a more stringent check than those used on inspection. Generally, this can be achieved by issuing to the workshops new or only slightly worn GO gauges and slightly worn NOT GO gauges. Inspection should be made with GO gauges which are approaching the condition of maximum permissible wear and with new NOT GO gauges.

5.3.2 By the purchaser

There are three possible procedures, as listed below, for inspection of workpiece threads on behalf of the purchaser by an inspector who does not belong to the manufacturing plant concerned.

a) The inspector gauges the workpiece threads with the manufacturer's gauges.

   In this case, the accuracy of the gauges used may be checked by means of check plugs and setting plugs which belong either to the manufacturing plant (manufacturer) or to the inspector (purchaser) or, as far as screw plugs are concerned, by direct measurement.

b) The inspector uses his own gauges for gauging the workpiece threads.

   In cases of dispute it is recommended that the product be accepted if it is shown to be satisfactory by any gauge of the type concerned known to be within the requirements of this International Standard (taking into consideration the admissible wear).

c) The inspector uses his own inspection gauges for gauging the workpiece threads.

   The position of the tolerance zone for these gauges shall be such as to ensure that the purchaser does not reject threads whose actual size lies within the limits specified for the workpiece.

This International Standard does not specify which gauges are to be used by the inspector; it only recommends that the purchaser inform the manufacturer when ordering what procedure will be employed for the inspection of the workpiece threads. Worn gauges shall not be used for sample inspection.

6 Reference temperature

In accordance with ISO 1, the dimensions of both the gauge and the workpiece are related to a temperature of 20 °C.

If the workpieces and gauges have the same coefficient of linear expansion (e.g. steel workpieces and steel gauges), the checking temperature may deviate from 20 °C without detriment to the results, provided that the temperatures of both gauges and workpieces are the same.

If the workpieces and gauges have different coefficients of linear expansion [e.g. steel workpieces and carbide gauges or brass workpieces and gauges of steel (or carbide)], the temperature of both shall be (20 ± 2) °C at the time of gauging. Otherwise the difference between the thermal expansions of the workpiece and the gauge shall be taken into consideration.

7 Function, checking and use of gauges

Throughout this clause, the designations of paragraphs are as follows:

a) function;

b) control;

c) use.

NOTE 2 In the absence of b), there is no specification for control.

7.1 Gauges for external threads of workpieces and their check plugs and setting plugs

7.1.1 Solid or adjustable GO screw ring gauges

a) A GO screw ring gauge checks the virtual size of the external thread (gauging the virtual pitch diameter); i.e. it checks the maximum material limit of the pitch diameter, taking into account deviations of form and pitch errors and errors in flank angles, which produce an apparent enlargement of the pitch diameter (virtual pitch diameter) of the workpiece. In addition, this gauge checks whether the length of the straight flank is adequate; i.e. that the rounding at the root of the profile of the workpiece thread does not encroach too far upon the flank of the thread. The major diameter of the external thread is not checked by this gauge.

Checking with the GO screw ring gauge is essentially in accordance with the Taylor principle (see clause 11).

b) A solid GO screw ring gauge manufactured according to the specified sizes shall be checked by GO and NOT GO screw check plugs and shall be monitored regularly with a wear check plug.

If a NOT GO screw check plug is not used, other provisions (e.g. direct measurement) shall be made so as to ensure that the maximum permitted size of the pitch diameter of a new GO screw ring gauge is not exceeded. Checking of ring gauges with check plugs is preferable to all other forms of control.

An adjustable GO screw ring gauge shall be set to its setting plug and shall be monitored regularly with a wear check plug.

c) The GO screw ring gauge, when screwed by hand without using excessive force, shall pass over the whole length of the workpiece thread. If assembly is not possible, the workpiece thread does not comply with the specification.

7.1.2 Screw check plugs for new solid GO screw ring gauges

a) GO and NOT GO screw check plugs are used to check the limits of the pitch diameter of a new solid GO screw ring gauge. A GO screw check plug checks the GO limit of the total profile of a new solid GO screw ring gauge.

c) The GO screw check plug, when screwed by hand without using excessive force, shall pass through the new solid GO screw ring gauge.

The NOT GO screw check plug, when screwed by hand without using excessive force, may enter into both ends of the new solid GO screw ring gauge, but by not more than one turn of thread[3].

7.1.3 Setting plugs for adjustable GO screw ring gauges

a) A setting plug which comprises two successive portions, one with complete flanks and the other with truncated flanks, is used to set an adjustable GO screw ring gauge.

It is not essential to use a double-length setting plug if the GO screw ring gauge is checked with a NOT GO screw check plug (see 7.1.2) after it has been adjusted.

b) The GO screw ring gauge shall be set on the portion of the setting plug with complete flanks.

c) The portion of the setting plug with truncated flanks, when screwed by hand without using excessive force, shall pass through the GO screw ring gauge.

When the portion with truncated flanks of the setting plug is screwed through the screw ring gauge, there shall be no perceptible clearance between the plug and the ring. If there is a clearance, the ring gauge shall be lapped and adjusted in accordance with the manufacturer's instructions to the correct form and size.

7.1.4 Wear check plug for solid or adjustable GO screw ring gauges

a) A wear check plug is used to ascertain that the wear limit of the pitch diameter of a GO screw ring gauge has not exceeded the wear limit. It embodies the pitch diameter of a GO screw ring gauge at the specified limit of wear.

3) The one turn of thread is determined when withdrawing the check plug.

c) The wear check plug, when screwed by hand without using excessive force, may enter into both ends of the GO screw ring gauge, but by not more than one turn of thread[3].

If the plug can be screwed in by more than one turn of thread, the GO screw ring gauge no longer meets the specification.

7.1.5 GO screw calliper gauges

a) A GO screw calliper gauge checks the maximum limit of the pitch diameter in an axial plane, as apparently increased by errors of pitch and flank angle in the workpiece. Furthermore, it checks whether the length of the straight flank is adequate, for example that the rounding of the root of the profile does not encroach too far upon the flank of the thread. The major diameter of the external thread, however, is not checked.

With regard to the embodiment of the virtual pitch diameter, a GO screw calliper gauge seriously violates the Taylor principle (e.g. periodic errors of pitch and deviations of form).

b) The GO screw calliper gauge shall be set with the setting plug specified.

c) Workpiece threads are generally checked by the GO screw calliper gauge under its own weight or in accordance with a fixed working load to correspond with the method of adjustment of the gauge.

The GO screw calliper gauge shall accept the workpiece thread at three positions at least, evenly distributed over the whole circumference of the thread. If the GO screw calliper gauge cannot pass over the workpiece thread, than the workpiece thread does not comply with the specification.

When put on the workpiece, the GO screw calliper gauge may be moved slightly to and fro in a circumferential direction in order to minimize the effects of friction.

In cases of dispute, gauging with a GO screw ring gauge, preferably of the solid type, is decisive.

7.1.6 Setting plugs for GO screw calliper gauges

a) The GO anvils of a screw calliper gauge shall be set with a setting screw plug.

c) The GO screw calliper gauge shall pass over the setting plug under its own weight or under a fixed working load. If this is not possible or if there is a clearance, the anvils of the GO screw calliper gauge shall be adjusted.

When put on the setting plug, the GO screw calliper gauge may be moved slightly to and fro in a circumferential direction.

7.1.7 NOT GO screw calliper gauges

a) A NOT GO screw calliper gauge checks the minimum limit of the pitch diameter. It operates very largely in accordance with the Taylor principle [see figure 10 a)].

b) The NOT GO screw calliper gauge shall be set with the setting plug specified.

c) The NOT GO screw calliper gauge shall not pass over the workpiece except for the first two threads of the workpiece thread. The checking shall be carried out under the same conditions of presentation as the adjustment by means of the setting plug; it shall take place in at least three positions, evenly distributed over the circumference.

If the gauge thread profile corresponds to figure 10 b), each gauging shall be repeated by displacing the gauge axially by one thread pitch.

7.1.8 Setting plugs for NOT GO screw calliper gauges

a) The NOT GO anvils of a screw calliper gauge shall be set with a setting screw plug.

c) The NOT GO screw calliper gauge shall pass over the setting plug under its own weight or under a fixed load. If the calliper will not pass over or if there is a clearance, the NOT GO screw calliper gauge anvils shall be adjusted.

When put on the setting plug, the NOT GO screw calliper gauge may be moved slightly to and fro in a circumferential direction.

7.1.9 Solid or adjustable NOT GO screw ring gauges

a) A NOT GO screw ring gauge is intended to check whether the actual pitch diameter of a workpiece exceeds the specified minimum size. Checking with a NOT GO screw ring gauge does not correspond to the Taylor principle when checking rigid workpieces. In cases of non-rigid workpieces, departure from the Taylor principle is of less importance because of the flexibility of the workpieces.

b) A solid NOT GO screw ring gauge manufactured according to the specified sizes shall be checked by GO and NOT GO screw check plugs and shall be monitored regularly with the wear check plug.

If a NOT GO check plug is not used, other provisions shall be made to ensure that the maximum limit of the pitch diameter of a new NOT GO screw ring gauge is not exceeded.

An adjustable NOT GO screw ring gauge shall be set with the setting plug specified and monitored regularly with a wear check plug.

c) A NOT GO screw ring gauge, when screwed by hand without using excessive force on the workpiece thread, may enter on both sides but by not more than two turns of thread[4]. If the gauge can be screwed onto the workpiece by more than two turns of thread, the thread does not comply with the specification. The NOT GO screw ring gauge shall not pass completely over a workpiece having a length of thread of three threads or less.

7.1.10 Screw check plugs for new solid NOT GO screw ring gauges

a) GO and NOT GO screw check plugs are used to check the pitch diameter limits of a new solid NOT GO screw ring gauge. The GO screw check plug makes sure that the clearing diameter of the new NOT GO solid screw ring gauge is not too small.

If a wear check plug for the NOT GO screw ring gauge is provided, the NOT GO check plug may be dispensed with.

c) The GO screw check plug, when screwed by hand without using excessive force, shall pass through the corresponding new solid NOT GO screw ring gauge.

The NOT GO screw check plug gauge, when screwed by hand without using excessive force, may enter the new solid NOT GO screw ring gauge at both ends but by not more than one turn of thread[5].

7.1.11 Setting plugs for adjustable NOT GO screw ring gauges

a) A setting plug which contains two successive portions, one with complete flanks and the other with truncated flanks, is used to set an adjustable NOT GO screw ring gauge to the specified pitch diameter.

It is not essential to use a double-length setting plug if the NOT GO screw ring gauge is checked with a NOT GO screw check plug as described in 7.1.10 after the ring has been adjusted.

b) The NOT GO screw ring gauge shall be set on the portion of the setting plug with complete flanks.

c) The portion of the setting plug with complete flanks, when screwed by hand without using excessive force, shall pass through a screw ring gauge.

When the portion with truncated flanks of the setting plug is screwed through the ring gauge, there shall be no perceptible clearance between the plug and the ring. If there is a clearance, the ring gauge shall be lapped and adjusted to the correct form and size in accordance with the manufacturer's instructions.

7.1.12 Wear screw check plugs for solid or adjustable NOT GO screw ring gauges

a) A wear screw check plug checks whether the pitch diameter of a NOT GO screw ring gauge has exceeded the wear limit. It embodies the pitch diameter of a NOT GO screw ring gauge at the specified limit of wear.

If a NOT GO screw check plug for the NOT GO screw ring gauge is provided, the wear check plug may be dispensed with.

c) The wear screw check plug, when screwed by hand without using excessive force, may enter into both ends of the NOT GO screw ring gauge but by not more than one turn of thread[5].

If the plug can be screwed in by more than one turn of thread, the NOT GO screw ring gauge no longer meets the specification.

7.1.13 Gauges for the major diameter of workpieces

a) The major diameter of a workpiece thread is gauged by means of plain GO and NOT GO calliper gauges or ring gauges. For checking the GO limit of non-rigid workpieces, preference should be given to the use of a plain GO and NOT GO ring gauge; calliper gauges are recommended

4) The two turns of thread are determined when withdrawing the gauge.

5) The one turn of thread is determined when withdrawing the check plug.

only if the workpieces have been manufactured by methods which do not involve the risk of errors in circularity.

c) The GO plain calliper gauge shall pass over the workpiece thread under its own weight or under an agreed load; the NOT GO plain calliper gauge may pass over the workpiece thread but only in a zone which has a distance of not more than two pitch lengths (2*P*) from the start of the thread. Otherwise the workpiece thread does not comply with the specification.

7.2 Gauges for internal threads of workpieces

7.2.1 GO screw plug gauges

a) A GO screw plug gauge checks the virtual size of the internal thread (gauging the virtual pitch diameter). This is effected by checking the minimum limit of the pitch diameter, taking into account pitch errors, errors in flank angles and deviations of form, which produce an apparent reduction of the pitch diameter of the workpiece (virtual pitch diameter). In addition, it checks the minimum limit of the major diameter and also whether the length of straight flank is sufficient; i.e. that the rounding at the root of the profile does not encroach too far upon the flank of the thread. This gauge does not check the minor diameter of the workpiece thread.

Checking with a GO screw plug gauge is essentially in accordance with the Taylor principle.

b) Wear of the GO screw plug shall be monitored by re-measurement of the gauge at intervals of time according to the intensity of use.

The admissible wear of the GO screw plug gauge is found by taking measurements.

Instead of measuring, a wear check gauge (calliper gauge) with its setting plug may be used. However, in cases of dispute, sizes obtained by means of correctly performed measurements are decisive.

c) The GO screw plug gauge, when screwed by hand without using excessive force, shall enter the whole length of the workpiece thread. If entry is not possible, the workpiece thread does not comply with the specification.

7.2.2 NOT GO screw plug gauges

a) A NOT GO screw plug gauge checks whether the actual pitch diameter exceeds the specified maximum size.

The NOT GO screw plug gauge checks approximately on the Taylor principle.

b) It is recommended that the NOT GO screw plug gauge be checked regularly for wear.

c) The NOT GO screw plug gauge, when screwed by hand without using excessive force, may enter into both ends of the threaded part, but by not more than two turns of thread[6]. If it can be screwed in by more than two turns of thread, the workpiece thread does not comply with the specification. The NOT GO screw plug gauge shall not pass completely through a workpiece with a length of thread of three threads or less.

7.2.3 Gauges for the minor diameter

a) The minor diameter of a thread is checked by means of plain cylindrical GO and NOT GO plug gauges. The use of spherical-ended gauges and rod gauges is not permissible.

c) The GO plain plug gauge, when introduced by hand without using excessive force, shall pass through the workpiece thread. The NOT GO plain plug gauge may enter into both ends of the workpiece thread but only in a zone which has a distance of not more than one pitch length (1*P*) from the start of the thread.

8 Tolerance zones for the diameters of gauges (see figures 1 and 2)

A GO or NOT GO screw ring gauge that has errors of pitch and/or flank angle (the permissible amounts of which are given in clause 12) has a virtual pitch diameter which is smaller than the simple pitch diameter. It can only be screwed onto a perfect GO screw check plug if the simple pitch diameter of the latter is also smaller by a certain amount (the sum of the diametral equivalents of the pitch errors and flank angle errors of the screw thread concerned) than the simple pitch diameter of the screw ring gauge. If the GO screw check plug also has errors of pitch and/or flank angle opposite in sign to those of the gauge, its simple pitch diameter must be smaller by yet another amount to enable the screw ring gauge to be screwed onto the check plug. (The purchaser and manufacturer

6) The two turns of thread are determined when withdrawing the gauge.

shall agree whether the screw ring gauge should be measured or inspected by screw check plugs.)

The simple pitch diameter of screw ring gauges may be measured directly, rather than inspected by screw check plugs. In order to ensure, as far as is practicable, that a screw ring gauge accepted as satisfactory by direct measurement is also acceptable as satisfactory by the GO screw check plug, it is necessary for the simple pitch diameter tolerance zone of the GO check plug to be displaced downwards by an amount m in relation to the simple pitch diameter tolerance zone of the screw ring gauge (see figure 1). The values of m given in table 4 correspond to the sum of the diametral equivalents of the average errors to be expected in the pitch and flank angles of the check plug and the screw ring gauge in relation to the specified tolerances on these elements.

In the same way, the simple pitch diameter of the external thread of a workpiece (the thread of which has errors of pitch and/or flank angle) must be smaller than the simple pitch diameter of the ring gauge, in order that the external thread can be screwed into this gauge.

When screwing a GO screw plug gauge into the internal thread of a workpiece, the same considerations are valid as are mentioned for screwing a GO screw ring gauge to the external thread of a workpiece. Deviations of pitch and flank angle cause virtual pitch diameters which require in each case that a difference (equivalent) exists between the simple pitch diameters of the screwed parts.

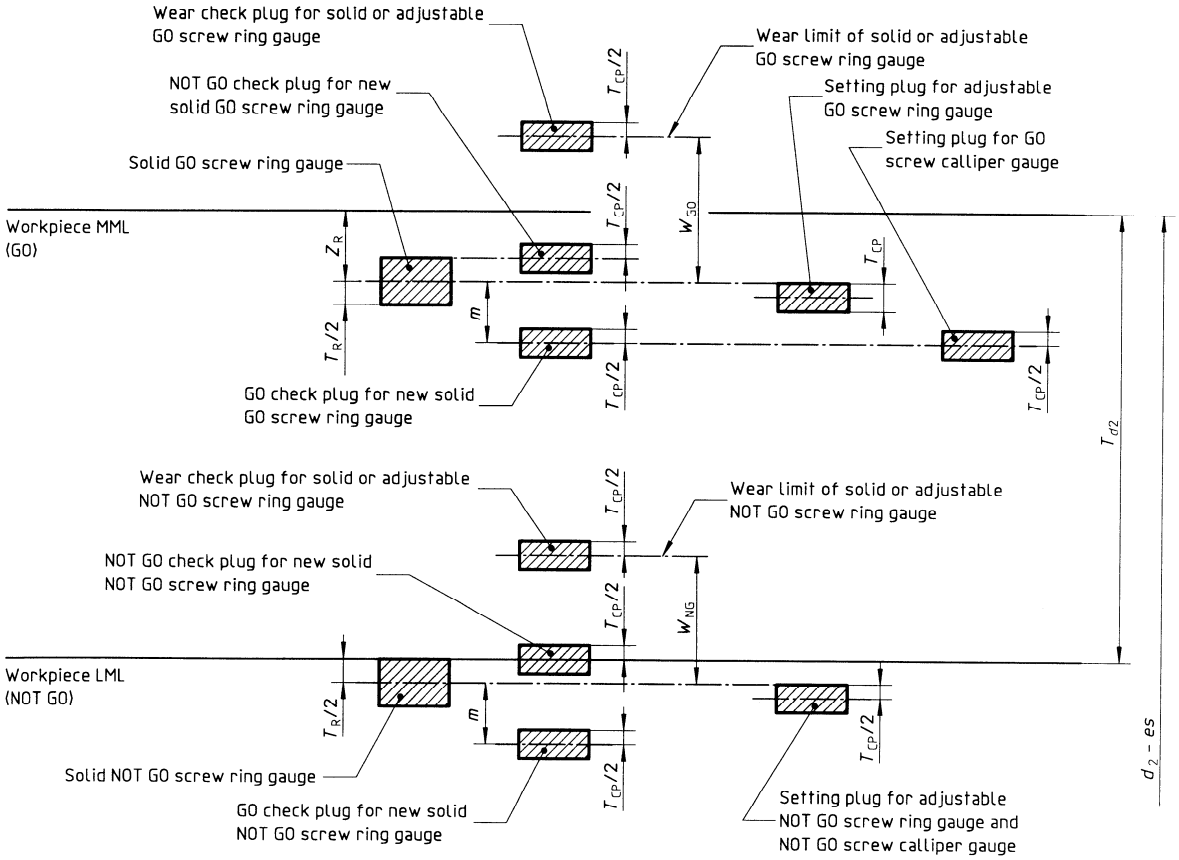


Figure 1 — Tolerance zones for the pitch diameter of gauges for external threads (diagram)

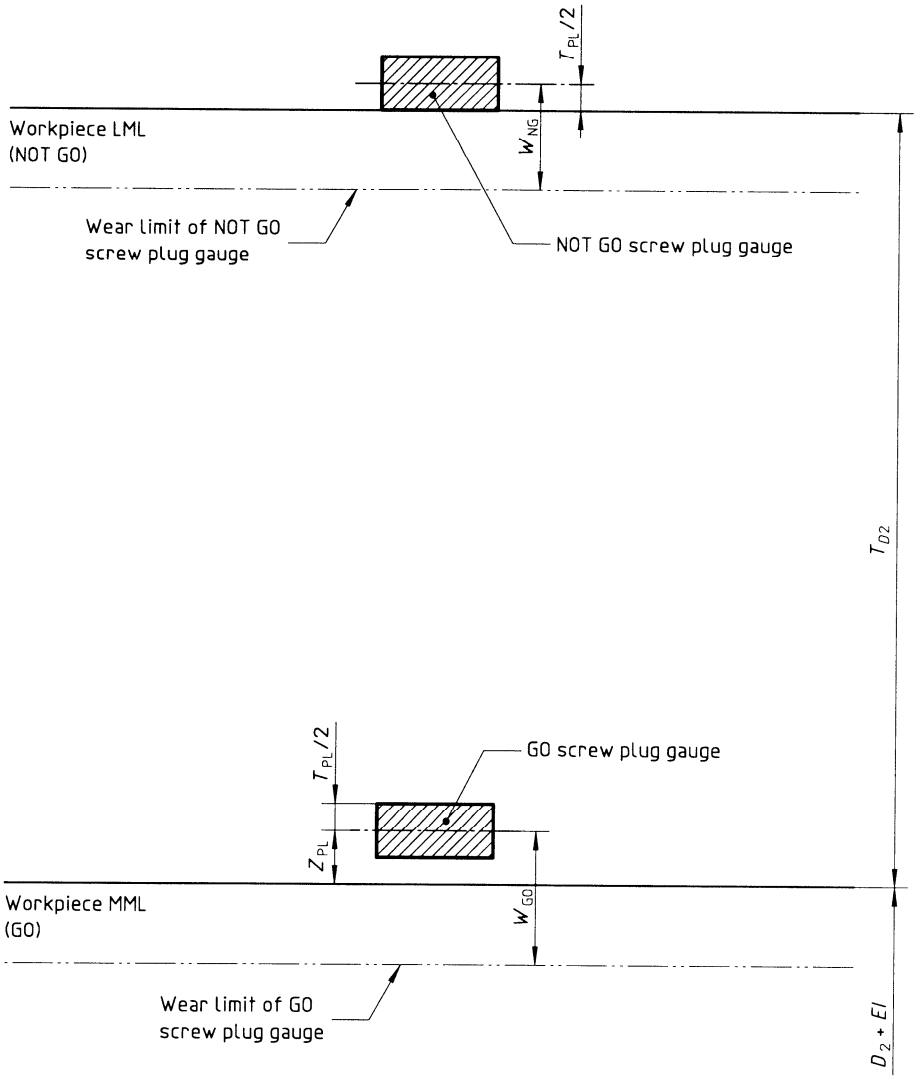


Figure 2 — Tolerance zones for the pitch diameter of gauges for internal threads (diagram)

9 Tolerance zones for plain gauges
(see figures 3 and 4)

Tolerance zones for check gauges for calliper gauges are to be chosen according to the requirements of ISO 1938-1.

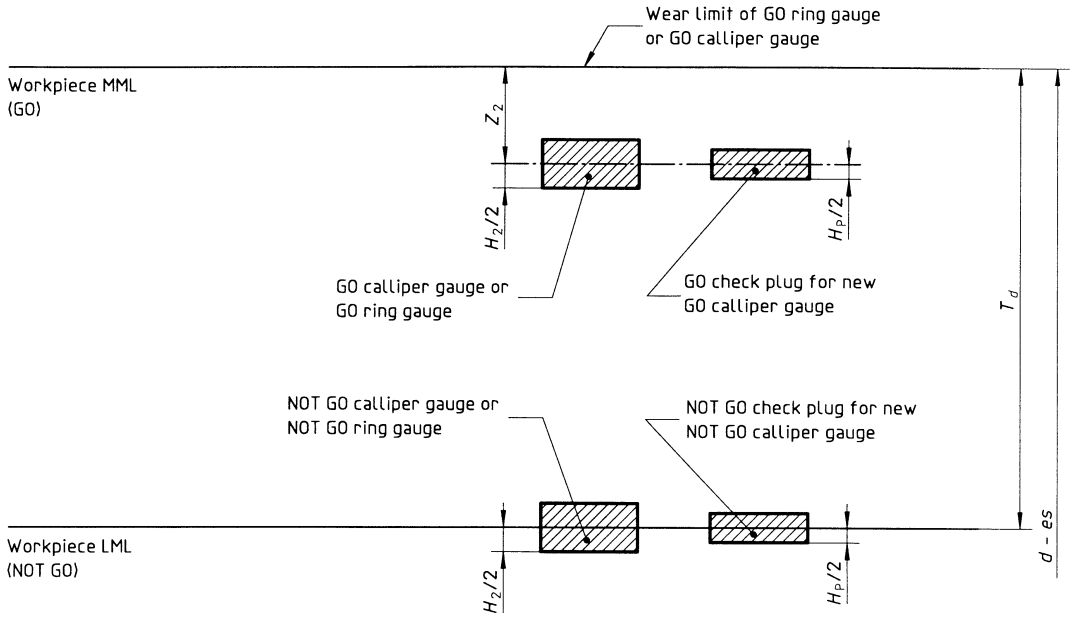


Figure 3 — Tolerance zones for plain gauges for major diameter of external threads (diagram)

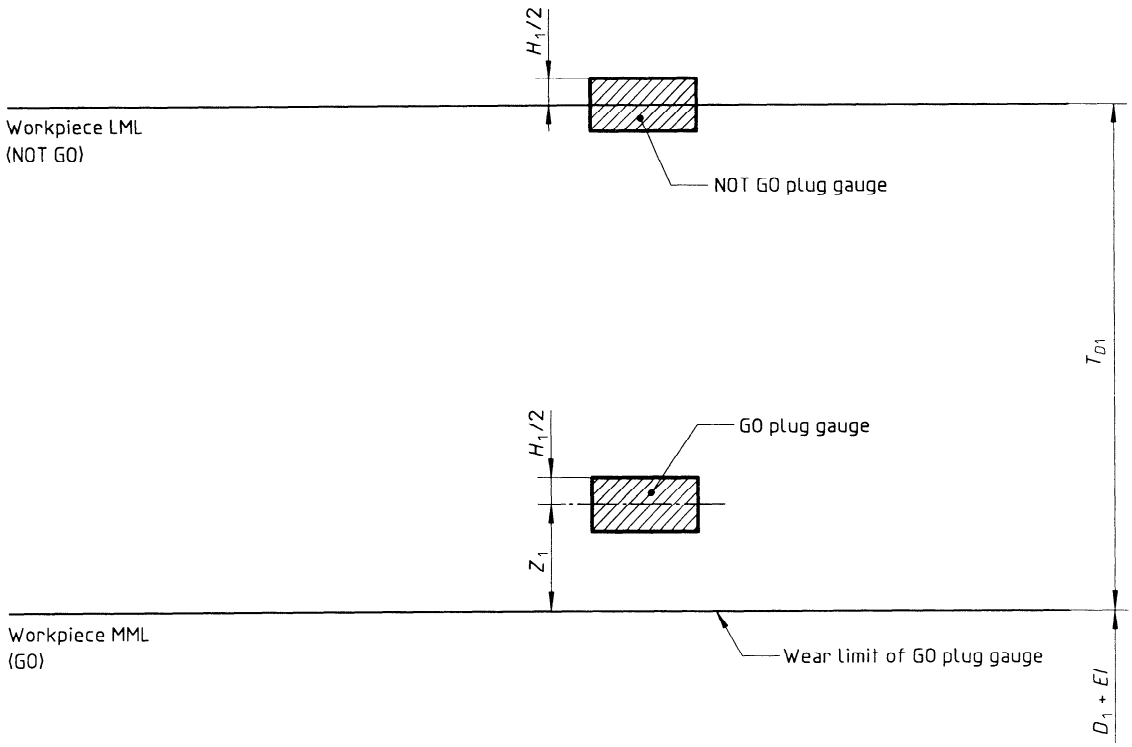


Figure 4 — Tolerance zones for plain gauges for minor diameter of internal threads (diagram)

10 Thread profiles for gauges

10.1 Profiles with complete flanks
(see figures 5 and 6)

The following gauges shall have profiles in accordance with figure 5:

— GO check plugs for new solid GO screw ring gauges;

— GO check plugs for new solid NOT GO screw ring gauges;

— GO screw plug gauges;

— setting plugs for adjustable GO screw ring gauges (one portion);

— setting plugs for adjustable NOT GO screw ring gauges (one portion);

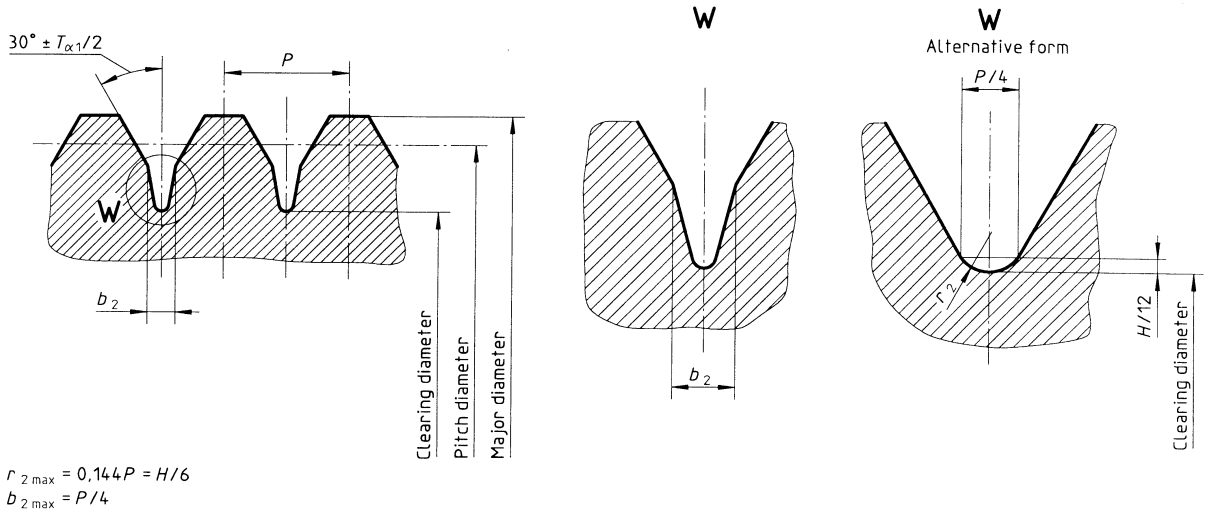
— setting plugs for adjustable GO screw calliper gauges;

— NOT GO screw check plugs for new solid NOT GO screw ring gauges;

— setting plugs for NOT GO screw calliper gauges;

— wear check plugs for solid or adjustable NOT GO screw ring gauges.

A profile with complete flanks according to figure 5 can be made with a clearance groove of maximum b_2 (see table 2) or with a radius of maximum r_2 (see table 2) which contacts tangentially the straight part of the flank. The form of the clearance groove is left to the discretion of the manufacturer.



$r_{2\,max} = 0{,}144P = H/6$
$b_{2\,max} = P/4$

Figure 5 — Profile with complete flanks (external thread)

The following gauges should have profiles in accordance with figure 6:

— GO screw ring gauges;

— anvils of GO screw calliper gauges.

A profile with complete flanks according to figure 6 can be made with a clearance groove of maximum b_1 (see table 2) or with a radius of maximum r_1 (see table 2) which contacts tangentially the straight part of the flank. The form of the clearance groove is left to the discretion of the manufacturer.

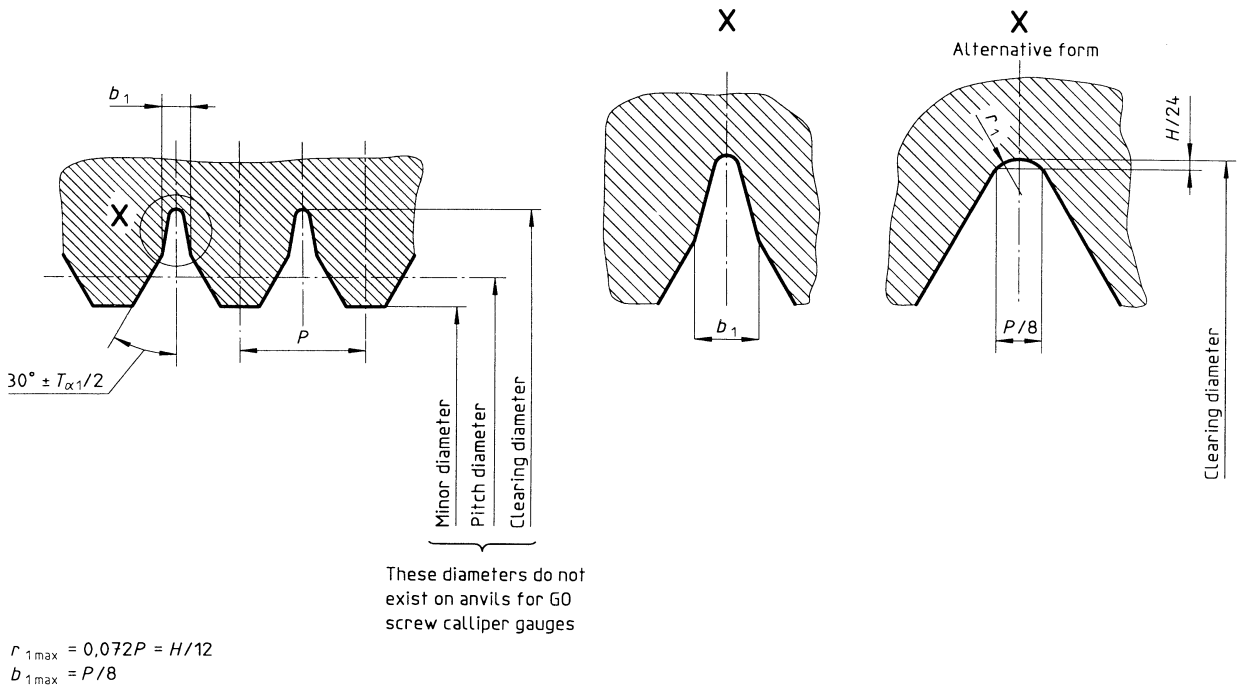


Figure 6 — Profile with complete flanks (internal thread)

Table 2 — Values for profiles with complete flanks (see figures 5 and 6)

Values in millimetres

Pitch, P	$b_{1max} = P/8$	$r_{1max} = 0{,}072P = H/12$	$b_{2max} = P/4$	$r_{2max} = 0{,}144P$	$H/24$
0,2	With radius of maximum r_1	0,014	With radius of maximum r_2	0,029	0,007
0,25		0,018		0,036	0,009
0,3		0,022		0,043	0,011
0,35		0,025		0,050	0,012
0,4		0,029		0,058	0,014
0,45		0,032		0,065	0,016
0,5		0,036		0,072	0,018
0,6		0,043	0,15	0,086	0,022
0,7		0,050	0,17	0,1	0,025
0,75		0,054	0,19	0,11	0,027
0,8		0,058	0,2	0,11	0,029
1		0,072	0,25	0,14	0,036
1,25	0,15	0,090	0,31	0,18	0,045
1,5	0,19	0,108	0,37	0,21	0,054
1,75	0,22	0,126	0,44	0,25	0,063
2	0,25	0,144	0,5	0,29	0,072
2,5	0,32	0,180	0,61	0,36	0,090
3	0,4	0,217	0,75	0,43	0,108
3,5	0,48	0,253	0,88	0,5	0,126
4	0,5	0,288	1	0,58	0,144
4,5	0,55	0,325	1,1	0,65	0,162
5	0,6	0,361	1,25	0,72	0,180
5,5	0,7	0,397	1,4	0,79	0,198
6	0,8	0,433	1,5	0,86	0,217
8	1	0,576	2	1,152	0,289

10.2 Profiles with truncated flanks
(see figures 7 and 8)

The following gauges have profiles in accordance with figure 7:

— NOT GO screw check plugs for new solid GO screw ring gauges;

— setting plugs for adjustable GO screw ring gauges (one portion);

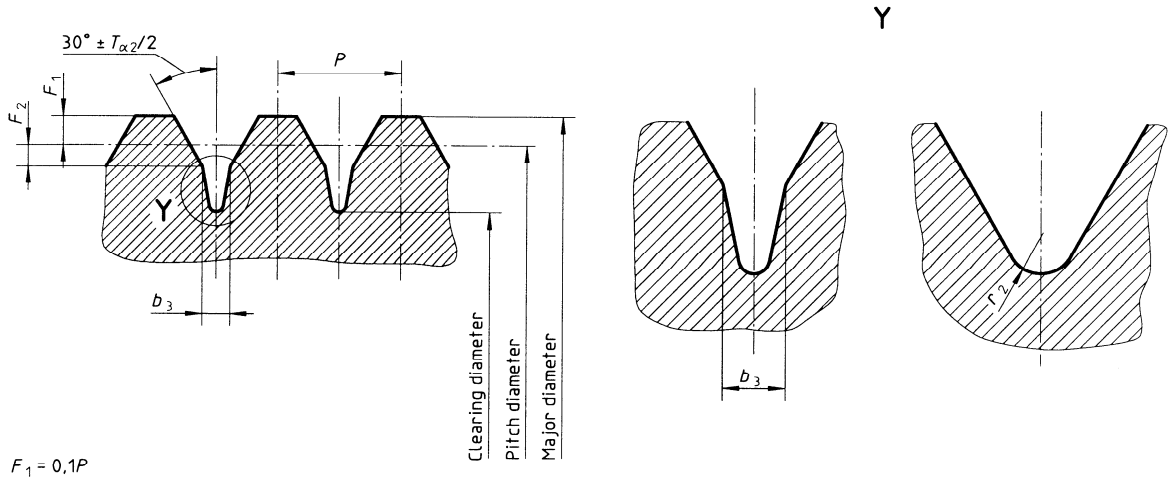
— setting plugs for adjustable NOT GO screw ring gauges (one portion);

— wear check plugs for solid or adjustable GO screw ring gauges;

— NOT GO screw plug gauges.

A profile with truncated flanks according to figure 7 shall be made for screw threads up to $P = 1$ mm with a radius of maximum r_2 (see table 2) which contacts tangentially the straight part of the flank, and for screw threads with $P = 1{,}25$ mm and larger with a clearance groove of b_3 (see table 3). The form of the clearance groove is left to the discretion of the manufacturer (see figure 7).

For reasons of manufacturing facilities, the form and the sizes of the clearance groove for the portion with truncated flanks of the setting plugs can be the same as for that portion having complete flanks.



NOTE — For F_2, see table 3.

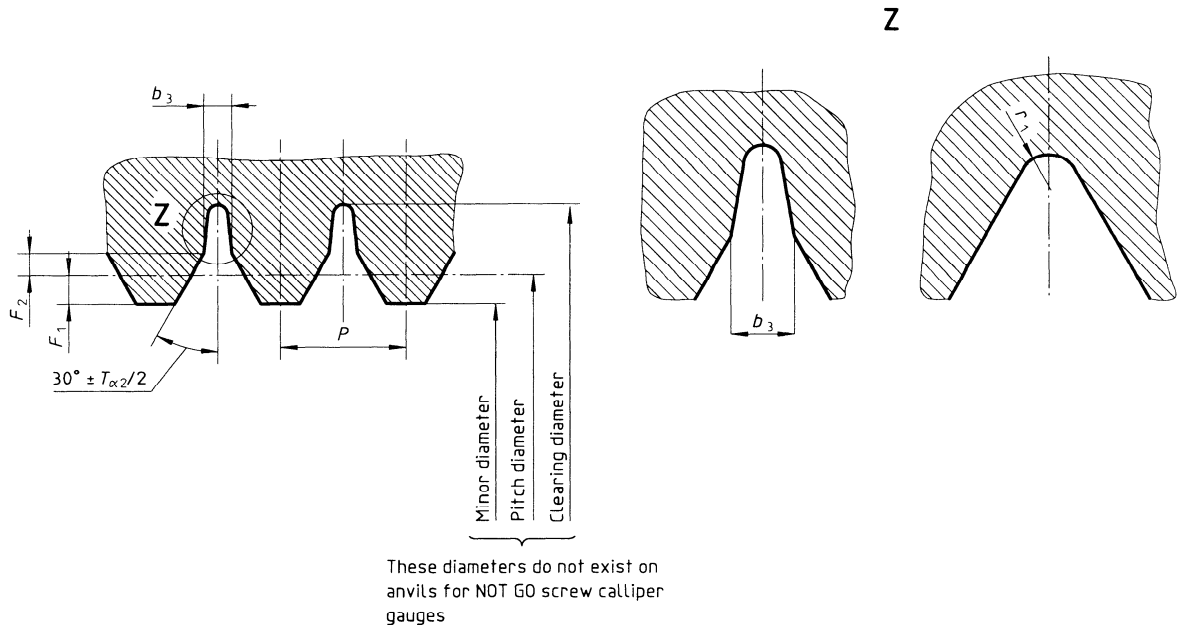
Figure 7 — Profile with truncated flanks (external thread)

The following gauges have profiles in accordance with figure 8:

— NOT GO screw ring gauges;

— anvils of NOT GO screw calliper gauges.

A profile with truncated flanks according to figure 8 shall be made for screw threads up to $P = 1$ mm with a radius of maximum r_1 (see table 2) which contacts tangentially the straight part of the flank, and for screw threads with $P = 1{,}25$ mm and larger with a clearance groove of b_3 (see table 3). The form of the clearance groove is left to the discretion of the manufacturer (see figure 8).



$F_1 = 0{,}1P$
$b_3 = (P/2) - 2\,F_2 \tan 30°$
$r_{1\,max} = 0{,}072P = H/12$

NOTE — For F_2, see table 3.

Figure 8 — Profile with truncated flanks (internal thread)

10.3 Displacement of the clearance groove for a profile with truncated flanks

The clearance groove may be displaced in relation to the centre of the profile of the thread by an amount S (see figure 9) which is equal to the limit deviations of b_3 (see table 3).

The tolerance on b_3 can be increased as follows: when the measured displacement X is smaller than the tolerance on displacements S, the tolerance on b_3 can be increased by $2(S - X)$.

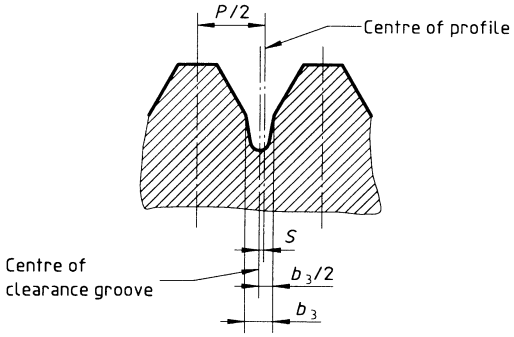


Figure 9 — Displacement of the clearance groove for a profile with truncated flanks

Table 3 — Values for profiles with truncated flanks (see figures 7, 8 and 9)

Values in millimetres

Pitch P	$F_1 = 0,1P$	F_2			b_3	
		0,2P	0,15P	0,1P	Nominal size	Limit deviations
0,2 0,25 0,3	0,02 0,025 0,03				With radius of maximum r_1 and r_2, respectively, or clearance groove[1)]	
0,35 0,4 0,45	0,035 0,04 0,045					
0,5 0,6 0,7	0,05 0,06 0,07					
0,75 0,8 1	0,075 0,08 0,1					
1,25 1,5 1,75	0,125 0,15 0,175	0,25 0,3 0,35			0,3 0,4 0,45	± 0,04 ± 0,04 ± 0,05
2 2,5 3	0,2 0,25 0,3	0,4	0,375 0,45		0,5 0,8 1,0	± 0,05 ± 0,05 ± 0,08
3,5 4 4,5	0,35 0,4 0,45		0,525 0,6	0,45	1,1 1,3 1,7	± 0,08 ± 0,1 ± 0,1
5 5,5 6	0,5 0,55 0,6			0,5 0,55 0,6	1,9 2,1 2,3	± 0,1 ± 0,1 ± 0,1
8	0,8			0,8	3,1	± 0,1

1) Clearance grooves are optional.

11 General features of screw gauges

All gauges shall be designed to conform to the Taylor principle as far as possible. This applies not only to gauges for checking workpiece threads but also to gauges intended for checking or setting those gauges. Exceptions are only permissible where there is justification for them.

NOTE 3 The Taylor principle is a statement to the effect that the maximum material limits of as many related elements or dimensions as practical should be incorporated in a GO gauge, whereas the minimum material limit of each such related element or dimension may be gauged only by individual minimum material limit gauges or gauging methods.

11.1 Gauges for external threads of workpieces

11.1.1 Solid or adjustable GO screw ring gauges

The length of thread on a GO screw ring gauge shall be at least 80 % of the length of engagement of the workpiece thread (thread length of the nut).

11.1.2 Setting plugs for adjustable GO screw ring gauges

A double-length setting plug with a thread length twice the GO screw ring gauge length is required for adjustable GO screw ring gauges. One half of this setting plug has a thread profile with complete flanks and the other half has a profile with truncated flanks.

11.1.3 GO screw calliper gauges

On the anvils of a GO screw calliper gauge for fine pitches (up to 0,5 mm approximately), alternate thread profiles may be omitted.

11.1.4 Setting plugs for GO screw calliper gauges

The length of thread on a setting plug for GO screw calliper gauges corresponds to that of the anvil of the GO screw calliper gauge.

11.1.5 NOT GO screw calliper gauges

Each anvil of a NOT GO screw calliper gauge shall be so designed that it contacts the workpiece thread on no more than two flanks (see figure 10). On fine-pitch gauges, these flanks shall be situated not more than three pitches apart.

If the gauge corresponds to figure 10 b), each gauging shall be repeated by displacing the gauge from one pitch to the other.

11.1.6 Setting plugs for NOT GO screw calliper gauges

This type of setting plug shall have at least three turns of thread[7].

11.1.7 Solid or adjustable NOT GO screw ring gauges

This type of gauge shall have a length of thread of at least three turns of thread.

11.1.8 Setting plugs for adjustable NOT GO screw ring gauges

This type of setting plug shall have at least six turns of thread[8].

11.2 Gauges for internal threads of workpieces

11.2.1 GO screw plug gauges

The length of thread on a GO screw plug gauge shall be at least 80 % of the length of engagement of the workpiece thread (thread length of the nut).

11.2.2 NOT GO screw plug gauges

A NOT GO screw plug gauge shall have a length of thread of at least three turns of thread.

11.3 Blunt start of thread

Incomplete threads, even when they are chamfered, are still sharp enough to break. It is therefore recommended that, so as not to prejudice checking, any part of the thread that is incompletely formed should be removed (see figure 11) or, if this is not possible, a 30° chamfer should be provided (see figure 12).

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7) The complete threads are to be counted. Three threads are necessary in order to use the measuring method with three wires.

8) The complete threads are to be counted.

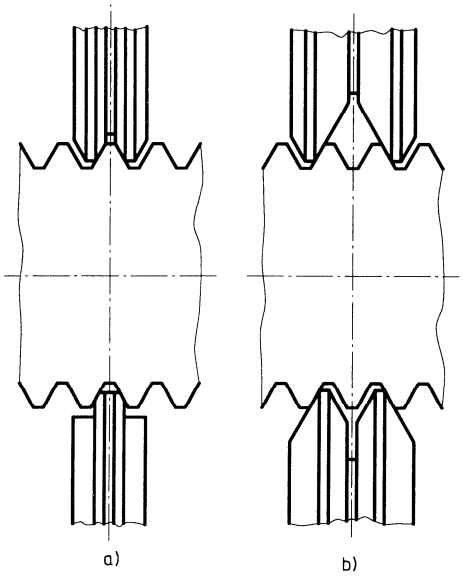

Figure 10 — NOT GO screw calliper gauges

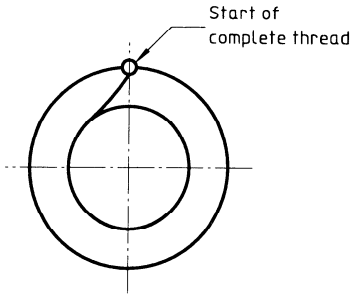

Figure 11 — Start of complete thread

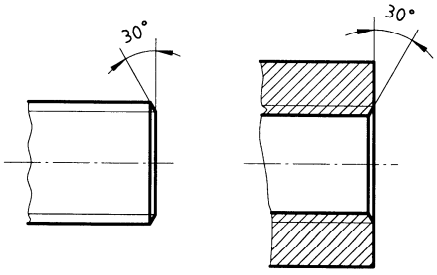

Figure 12 — Chamfer of thread

12 Tolerances and permissible wear for pitch diameters of gauges (see tables 4 to 9)

In order to limit the number of GO gauges for the same size of screw thread, for economical reasons the following rule of preference is recommended.

For screw threads with workpiece tolerances of grade 6 and coarser, the values in table 4 should be chosen according to grade 6.

For screw threads with workpiece tolerances finer than grade 6, the values in table 4 should be chosen according to the lowest grade recommended in ISO 965-1, for each tolerance position.

Table 4 — Tolerances and values m, Z_R and Z_{PL} for pitch diameters (see figures 1 and 2)

Values in micrometres

T_{d2} or T_{D2}		T_R	T_{PL}	T_{CP}	m	Z_R [1]	Z_{PL}
over	up to and incl.						
—	50	8	6	6	10	− 4	0
50	80	10	7	7	12	− 2	2
80	125	14	9	8	15	2	6
125	200	18	11	9	18	8	12
200	315	23	14	12	22	12	16
315	500	30	18	15	27	20	24
500	670	38	22	18	33	28	32

1) The values for Z_R are to be inserted into table 10 taking into consideration the sign; i.e. the use of the minus values in the formula given in table 10 results in plus values. Minus values for Z_R mean that Z_R is situated outside of the tolerance T_{d2} (see figure 1).

Table 5 — Permissible wear on pitch diameters of GO and NOT GO screw plugs and ring gauges (see figures 1 and 2)

Values in micrometres

T_{d2} or T_{D2}		W_{GO}		W_{NG}	
over	up to and incl.	GO screw ring gauge	GO screw plug gauge	NOT GO screw ring gauge	NOT GO screw plug gauge
—	50	10	8	7	6
50	80	12	9,5	9	7,5
80	125	16	12,5	12	9,5
125	200	21	17,5	15	11,5
200	315	25,5	21	19,5	15
315	500	33	27	25	19
500	670	41	33	31	23

Table 6 — Tolerances for each flank angle

Values in minutes

Pitch P mm	$T_{\alpha 1}/2$ *)	$T_{\alpha 2}/2$ **)
0,2	± 60	± 60
0,25	± 48	± 48
0,3	± 40	± 40
0,35	± 35	± 35
0,4	± 31	± 31
0,45	± 26	± 26
0,5	± 25	± 25
0,6	± 21	± 21
0,7	± 18	± 18
0,75	± 17	± 17
0,8	± 16	± 16
1	± 15	± 16
1,25	± 13	± 16
1,5	± 12	± 16
1,75	± 11	± 16
2	± 10	± 14
2,5	± 10	± 14
3	± 9	± 13
3,5	± 9	± 12
4	± 8	± 11
4,5	± 8	± 11
5	± 8	± 11
5,5	± 8	± 10
6	± 8	± 10
8	± 8	± 10

*) See figures 5 and 6.
**) See figures 7 and 8.

Table 7 — Pitch tolerances

Tolerances in micrometres

Gauge thread lengths		
⩽ 32 mm	> 32 mm ⩽ 50 mm	> 50 mm ⩽ 80 mm
T_P		
5	6	7

NOTE — The pitch tolerance T_P applies to the maximum measured error whether it occurs as a cumulative progressive error over the total length of thread or as a periodic error or as a local error of pitch. For a double-length setting plug, the thread length used when determining the pitch deviation is one-half the overall thread length of the setting plug, and the pitch tolerance is the maximum permissible deviation between any two threads spaced apart by not more than one-half the overall thread length of the setting plug.

Table 8 — Tolerances for plain gauges for the major diameter of external threads (see figure 3)

Values in micrometres

Workpiece tolerance T_d for major diameter		$H_2/2$	$H_P/2$	Z_2
over	up to and incl.			
—	85	4	1	8
85	140	5	1,5	20
140	335	8	2	38
335	850	15	3	54
850	950	21	4	60

Table 9 — Tolerances for plain gauges for the minor diameter of internal threads (see figure 4)

Values in micrometres

Workpiece tolerance T_{D1} for minor diameter		$H_1/2$	Z_1
over	up to and incl.		
—	100	4	9
100	180	5	22
180	375	8	38
375	710	13	52
710	1 250	23	65

13 Formulae for calculation of gauge limits

The moduli of $|EI|$ and $|es|$ shall be inserted in the formulae given in tables 10 to 13.

13.1 Screw gauges for external threads of workpieces

See table 10.

13.2 Plain gauges for the major diameters of external threads of workpieces

See table 11.

13.3 Screw gauges for internal threads of workpieces

See table 12.

13.4 Plain gauges for the minor diameters of internal threads of workpieces

See table 13.

Table 10 — Formulae for screw gauges for external threads of workpieces and their associated setting and check gauges

Type of gauge		Thread profile according to figure	Limits for gauge thread					
			Major diameter or clearing diameter		Pitch diameter		Minor diameter or clearing diameter	
			Theoretical size	Tolerance	Theoretical size	Tolerance	Theoretical size	Tolerance
1	Solid GO screw ring gauge	6	min. size = $d - es + \frac{H}{12} + T_{PL}$ with clearance groove b_1 or radius		[1] $d_2 - es - Z_R$	[1] $\pm T_R/2$	$D_1 - es$	$\pm T_R/2$
2	GO screw check plug for new solid GO screw ring gauge	5	$d - es$	$\pm T_{PL}$ [2]	$d_2 - es - Z_R - m$	$\pm T_{CP}/2$	max. size = $D_1 - es - Z_R - m - \frac{H}{6}$ with clearance groove b_2 or radius	
3	NOT GO screw check plug for new solid GO screw ring gauge	7	$d_2 - es - Z_R + \frac{T_R}{2} + 2F_1$	$\pm T_{PL}/2$	$d_2 - es - Z_R + \frac{T_R}{2}$	$\pm T_{CP}/2$	max. size = $D_1 - es - \frac{T_R}{2} - \frac{H}{6}$ with clearance groove b_3 or radius	
4	Adjustable GO screw ring gauge	6	min. size = $d - es + \frac{H}{12} + T_{PL}$ with clearance groove b_1 or radius		[3]	[3]	$D_1 - es$	$\pm T_R/2$
5a	Setting plug for adjustable GO screw ring gauge	5	$d - es$	$\pm T_{PL}$ [2]	$d_2 - es - Z_R - \frac{T_{CP}}{2}$	$\pm T_{CP}/2$	max. size = $D_1 - es - \frac{T_R}{2} - \frac{H}{6}$ with clearance groove b_2 or radius	
5b		7	$d_2 - es - Z_R - \frac{T_{CP}}{2} + 2F_1$	$\pm T_{PL}/2$				
6	Wear check plug for solid or adjustable GO screw ring gauge	7	$d_2 - es - Z_R + W_{GO} + 2F_1$	$\pm T_{PL}/2$	$d_2 - es - Z_R + W_{GO}$	$\pm T_{CP}/2$	max. size = $D_1 - es - \frac{T_R}{2} - \frac{H}{6}$ with clearance groove b_3 or radius	
7	GO screw calliper gauge	6	[4]	[4]	[4]	[4]	[4]	[4]
8	Setting plug for GO screw calliper gauge	5	$d - es$	$\pm T_{PL}$ [2]	$d_2 - es - Z_R - m$	$\pm T_{CP}/2$	max. size = $D_1 - es - Z_R - m - \frac{H}{6}$ with clearance groove b_2 or radius	
9	NOT GO screw calliper gauge	8	[5]	[5]	[5]	[5]	[5]	[5]
10	Setting plug for NOT GO screw calliper gauge	5	$d - es - T_{d2}$	$\pm T_{PL}$ [2]	$d_2 - es - T_{d2} - \frac{T_R}{2} - \frac{T_{CP}}{2}$	$\pm T_{CP}/2$	max. size = $D_1 - es - T_{d2} - \frac{T_R}{2} - \frac{T_{CP}}{2} - m - \frac{H}{6}$ with clearance groove b_2 or radius	

Type of gauge		Thread profile according to figure	Limits for gauge thread					
			Major diameter or clearing diameter		Pitch diameter		Minor diameter or clearing diameter	
			Theoretical size	Tolerance	Theoretical size	Tolerance	Theoretical size	Tolerance
11	Solid NOT GO screw ring gauge	8	min. size = $d - es + T_{PL}$ with clearance groove b_3 or radius		1) $d_2 - es - T_{d2} - \frac{T_R}{2}$	1) $\pm T_R/2$	$d_2 - es - T_{d2} - \frac{T_R}{2} - 2F_1$	$\pm T_R$
12	GO screw check plug for new solid NOT GO screw ring gauge	5	$d - es$	$\pm T_{PL}$ 2)	$d_2 - es - T_{d2} - \frac{T_R}{2} - m$	$\pm T_{CP}/2$	max. size = $D_1 - es - T_{d2} - \frac{T_R}{2} - m - \frac{H}{6}$ with clearance groove b_2 or radius	
13	NOT GO screw check plug for new solid NOT GO screw ring gauge	5	$d - es - T_{d2}$	$\pm T_{PL}$	$d_2 - es - T_{d2}$	$\pm T_{CP}/2$	max. size = $D_1 - es - T_{d2} - \frac{H}{6}$ with clearance groove b_2 or radius	
14	Adjustable NOT GO screw ring gauge	8	min. size = $d - es + T_{PL}$ with clearance groove b_3 or radius		3)		$d_2 - es - T_{d2} - \frac{T_R}{2} - 2F_1$	$\pm T_R$
15a	Setting plug for adjustable NOT GO screw ring gauge	5	$d - es - T_{d2} - \frac{T_R}{2}$	$\pm T_{PL}$	$d_2 - es - T_{d2} - \frac{T_R}{2} - \frac{T_{CP}}{2}$	$\pm T_{CP}/2$	max. size = $D_1 - es - T_{d2} - \frac{H}{6}$ with clearance groove b_2 or radius	
15b		7	$d_2 - es - T_{d2} - \frac{T_R}{2} - \frac{T_{CP}}{2} + 2F_1$	$\pm T_{PL}$				
16	Wear check plug for solid or adjustable NOT GO screw ring gauge	5	$d - es - T_{d2} - \frac{T_R}{2} + W_{NG}$	$\pm T_{PL}$	$d_2 - es - T_{d2} - \frac{T_R}{2} + W_{NG}$	$\pm T_{CP}/2$	max. size = $D_1 - es - T_{d2} - \frac{H}{6}$ with clearance groove b_2 or radius	

1) These sizes are valid if the solid screw ring gauges are not produced according to the GO and NOT GO check plugs but are measured; this shall be agreed upon between the manufacturer and purchaser.

2) If the profile on the major diameter is to be sharp, this sharp profile shall be slightly broken even if the tolerances are violated (width of flat 0,03 mm max. and 0,02 mm min.).

3) Size and deviation are not specified as the gauge is set on its setting plug.

4) On gauging members of the GO screw calliper gauges, the distance between the pitch diameter line and the crest line is $(D_2 - D_1)/2$. The root of this profile is equal to that of the GO screw ring gauge. Circular runout radial tolerance for circular shaped anvils is 5 µm.

5) The profile sizes of the gauging members of NOT GO screw calliper gauges are equal to NOT GO screw ring gauges. Circular runout radial tolerance for circular shaped anvils is 5 µm.

Table 11 — Formulae for plain gauges for major diameters

Type of gauge	Theoretical size	Tolerance
Plain GO ring gauge or plain GO calliper gauge	$d - es - Z_2$	$\pm H_2/2$
Plain NOT GO calliper gauge or plain NOT GO ring gauge	$d - es - T_d$	$\pm H_2/2$
NOTE — Wear limit for GO gauges is the upper limit of the workpiece diameter.		

Table 12 — Formulae for screw gauges for internal threads

Type of gauge	Thread profile according to figure	Limits of gauge thread				
		Major diameter		Pitch diameter		Minor diameter or clearing diameter
		Theoretical size	Tolerance	Theoretical size	Tolerance	
GO screw plug gauge	5	$D + EI + Z_{PL}$	$\pm T_{PL}$	$D_2 + EI + Z_{PL}$	$\pm T_{PL}/2$	max. size = $D_1 + EI - \frac{H}{6}$ with clearance groove b_2 or radius
NOT GO screw plug gauge	7	$D_2 + EI + T_{D2} + \frac{T_{PL}}{2} + 2F_1$	$\pm T_{PL}$	$D_2 + EI + T_{D2} + \frac{T_{PL}}{2}$	$\pm T_{PL}/2$	max. size = $D_1 + EI - \frac{H}{6}$ with clearance groove b_3 or radius

NOTES

1 Wear limit for the pitch diameter of a GO screw plug gauge:

$D_2 + EI + Z_{PL} - W_{GO}$

2 Wear limit for the pitch diameter of a NOT GO screw plug gauge:

$D_2 + EI + T_{D2} + \frac{T_{PL}}{2} - W_{NG}$

Table 13 — Formulae for plain gauges for minor diameters

Type of gauge	Theoretical size	Tolerance
Plain GO plug gauge	$D_1 + EI + Z_1$	$\pm H_1/2$
Plain NOT GO plug gauge	$D_1 + EI + T_{D1}$	$\pm H_1/2$
NOTE — Wear limit for GO gauges is the lower limit of the workpiece diameter.		

Annex A
(informative)

Bibliography

[1] ISO 965-1:—[9], *ISO general-purpose metric screw threads — Tolerances — Part 1: Principles and basic data.*

9) To be published. (Revision of ISO 965-1:1980)