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Metrski navoj ISO za splošno uporabo - Mere in merjenje

ISO general-purpose metric screw threads -- Gauges and gauging

Filetages métriques ISO pour usages généraux -- Calibres à limites et vérification

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INTERNATIONAL STANDARD

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ISO general-purpose metric screw threads — Gauges and gauging

Filetages métriques ISO pour usages généraux — Calibres à limites et vérification

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Contents

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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.

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 1502 was prepared by Technical Committee ISO/TC 1, *Screw threads*, Subcommittee SC 4, *Verification*.

This second edition cancels and replaces the first edition (ISO 1502:1978), which has been technically revised.

Annex A of this International Standard is for information only.

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
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.