

ISO metric screw threads

Gauges for external and internal threads

Gauging system and terminology

DIN
13
Part 16

Metrisches ISO-Gewinde; Lehren für Bolzen- und Muttergewinde;
Lehrensystern und Benennungen

Supersedes June 1976 edition.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

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1 Scope and field of application

Standards DIN 13 Parts 16 to 18 give instructions relevant to the manufacture and use of gauges for checking ISO metric screw threads with diameters of 1 mm and larger complying with DIN 13 Parts 1 to 10. Other methods of checking, for example measurement with indicating instruments, may be used, care being taken to ensure that the results achieved are the same as those obtained by using the gauges. The results of inspection using gauges complying with DIN 13 Parts 16 to 18 shall always be definitive.

The purpose of these standards 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 manufacturer and purchaser, the following principles should be applied.

a) The manufacturer shall not deliver any workpiece thread which lies outside the specific limits.

This requirement shall be deemed to have been fulfilled if none of the workpieces delivered lie outside the limits embodied in the gauges, which have been calculated in accordance with DIN 13 Part 17.

b) The purchaser shall not reject any workpiece thread which lies inside the specified limits.

This requirement shall be deemed to have been fulfilled if none of the workpiece threads rejected lie inside the limits embodied in the gauges, which have been calculated in accordance with DIN 13 Part 17.

To achieve widespread application of the two principles given above, these standards establish the requisite types and sizes of gauges for the checking of screw threads, the conditions under which these gauges are to be used, and rules for checking workpiece threads.

2 Reference temperature

In accordance with DIN 102 (equivalent to ISO 1-1975), the dimensions of both the gauge and the workpiece are related to a temperature of 20 °C.

If workpieces and gauges have the same coefficient of linear thermal expansion (when checking steel workpieces by means of steel gauges), for example, the checking temperature may deviate from 20 °C without detriment to the result, provided that the temperatures of both gauge and workpiece are the same.

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If the workpieces and gauges have different coefficients of linear thermal expansion (when checking steel workpieces by means of carbide gauges or copper zinc alloy workpieces by means of steel or carbide gauges), the temperature of both shall be $(20 \pm 2)^\circ\text{C}$ at the time of gauging. Otherwise, the difference in thermal expansion of the workpiece and of the gauge shall be taken into consideration.

3 Types of gauge

This standard specifies the essential features of the types of gauge listed below which are recommended for checking workpiece external and internal threads with thread diameters of 1 mm and larger and for setting and verifying workshop screw thread gauges 1).

3.1 Gauges for workpiece external threads and their associated check plugs and setting plugs

Gauges, check plugs and setting plugs are classified as follows:

- solid GO screw ring gauges;
- adjustable GO screw ring gauges;
- GO and NOT GO screw check plugs 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;
- solid NOT GO screw ring gauges;
- adjustable NOT GO screw ring gauges;
- GO and NOT GO screw check plugs 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 gauges for major diameter (ring or calliper gauges).

3.2 Gauges for workpiece internal threads

Gauges for workpiece internal threads are classified as follows:

- GO screw plug gauges;
- NOT GO screw plug gauges;
- plain gauges for minor diameter (plug gauges).

4 Function and verification of gauges

4.1 Gauges for workpiece external threads and their associated check plugs and setting plugs

4.1.1 Solid or adjustable GO screw ring gauges

GO screw ring gauges are used to check the virtual size of external threads (virtual pitch gauging), i.e. it checks the maximum limit of the pitch diameter taking into account deviations of form (pitch errors, flank angle errors, deviations from roundness, deviations from straightness of the thread axis over the gauge length) which produce an apparent enlargement of the workpiece pitch diameter (virtual pitch diameter). These

1) GO and NOT GO gauges may be combined into one gauge.

gauges are also used to check whether the length of the straight flank is adequate, i.e. that the rounding at the root of the profile does not encroach too far upon the thread flank. The major diameter of the external thread, however, is not checked by these gauges.

GO screw ring gauges operate largely in accordance with the Taylor principle (see DIN 7150 Part 2).

GO screw ring gauges with errors in pitch and flank angle, the limit sizes of which are given in table 9 of DIN 13 Part 17, January 1987 edition, can only be screwed onto a GO screw check plug of prescribed dimensions if the pitch diameter of the check plug is smaller than the pitch diameter of the GO screw ring gauge by a specific amount (equal to the sum of the amounts allowing for the pitch and flank angle errors of the screw thread concerned). If the pitch and flank angle errors of a GO screw check plug also have a sign opposite to those relating to the associated GO screw ring gauge, the pitch diameter of the GO screw check plug shall be smaller by a further amount, or that of the GO screw ring gauge larger, in order to allow the GO screw ring gauge to be screwed onto the GO screw check plug. (Measurement of GO screw ring plugs instead of gauging may be made subject to prior agreement between user and manufacturer.)

For the same reasons, the pitch diameter of a workpiece external thread with pitch and flank angle errors shall be smaller than the pitch diameter of the GO screw ring gauge in order that it can be screwed into this.

Solid GO screw ring gauges manufactured according to the prescribed sizes shall be verified by GO and NOT GO screw check plugs, and it should be checked regularly for wear using a wear check plug.

If a NOT GO screw check plug is not used, provision shall be made to ensure that the maximum size of the pitch diameter of the GO screw ring gauge is not exceeded. Adjustable GO screw ring gauges shall be set using the associated setting plugs and should regularly be checked for wear using a wear check plug, or GO and NOT GO check plugs.

4.1.2 GO and NOT GO screw check plugs for new solid GO screw ring gauges

Screw check plugs are used to check the limits of the pitch diameter of new solid GO screw ring gauges. GO screw check plugs are also used to check the GO limit of the total profile of new solid GO screw ring gauges.

4.1.3 Setting plugs for adjustable GO screw ring gauges

Setting plugs containing two successive portions (one with complete flanks and the other with truncated flanks) are used to set adjustable GO screw ring gauges to the specified pitch diameter.

If adjusted GO screw ring gauges are checked with a NOT GO check plug as described in subclause 4.1.2, the setting plug need only have the portion with complete flanks.

4.1.4 Wear check plugs for solid or adjustable GO screw ring gauges

Wear check plugs are used to check whether the pitch diameter of GO screw ring gauges has exceeded the wear limit. It embodies the pitch diameter of GO screw ring gauges at the prescribed limit of wear.

4.1.5 GO screw calliper gauges

GO screw calliper gauges are used to check the maximum limit or the pitch diameter in one 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, i.e. that the rounding of the root of the profile does not encroach too far upon the thread flank. The major diameter of the external thread, however, is not checked by these gauges.

GO screw calliper gauges seriously violate the Taylor principle in respect of the embodiment of the virtual pitch diameter, since deviations of form such as deviations from roundness and periodic errors of pitch are not detected.

GO screw calliper gauges shall be set using the associated setting plugs.

4.1.6 Setting plugs for GO screw calliper gauges

These setting plugs are used to set the anvils, e.g. measuring rollers, on GO screw calliper gauges.

4.1.7 NOT GO screw calliper gauges

NOT GO screw calliper gauges are used to check the minimum limit of the pitch diameter. They operate largely in accordance with the Taylor principle.

4.1.8 Setting plugs for NOT GO screw calliper gauges

These setting plugs are used to set the anvils, e.g. measuring rollers, on NOT GO screw calliper gauges.

4.1.9 Solid or adjustable NOT GO screw ring gauges

NOT GO screw ring gauges are used to check whether the actual pitch diameter is less than the prescribed minimum size. They do not operate in accordance with the Taylor principle when used to check rigid workpieces. Here, however, the departure from the Taylor principle is of less importance because of the flexibility of the workpieces.

Solid NOT GO screw ring gauges manufactured according to the prescribed sizes shall be verified by GO and NOT GO screw check plugs. It should be checked regularly for wear using a wear check plug.

Adjustable NOT GO screw ring gauges shall be set using the associated setting plug and should regularly be checked for wear using a wear check plug.

NOT GO screw ring gauges with errors in pitch and flank angle, the limit deviations of which are given in table 9 of DIN 13 Part 17, January 1987 edition, can only be screwed onto a GO screw check plugs of prescribed dimensions if the pitch diameter of the check plug is smaller than the pitch diameter of the NOT GO screw ring gauge by a specific amount (equal to the sum of the amounts allowing for the pitch and flank angle errors of the screw thread concerned). If the pitch and flank angle errors of GO screw check plugs also have a sign opposite to those relating to the associated NOT GO screw ring gauge, the pitch diameter of the GO screw check plug shall be smaller by a further amount, or that of the NOT GO screw ring gauge larger, in order to allow the NOT GO screw ring gauge to be screwed onto the GO screw check plug. (Measurement of NOT GO screw ring plugs instead of gauging may be carried out subject to prior agreement between user and manufacturer).

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

4.1.10 GO and NOT GO screw check plugs for new solid NOT GO screw ring gauges

GO and NOT GO screw check plugs are used to check the limits of the pitch diameter of new solid NOT GO screw ring gauges. GO screw check plugs are also used to check that the clearing diameter of the new NOT GO screw ring gauge is not too small.

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

4.1.11 Setting plugs for adjustable NOT GO screw ring gauges

Setting plugs containing two successive portions (one with complete flanks and the other with truncated flanks) are used to set adjustable NOT GO screw ring gauges to the specified pitch diameter.

If adjusted NOT GO screw ring gauges are checked with a NOT GO check plug as described in subclause 4.1.10, the setting plug need only have the portion with complete flanks.

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

Wear check plugs are used to check whether the pitch diameter of NOT GO screw ring gauges has exceeded the wear limit. It embodies the pitch diameter of NOT GO screw ring gauges at the prescribed limit of wear.

4.1.13 Gauges for major diameter

The major diameter of workpiece screw threads shall be checked by means of plain GO and NOT GO calliper gauges or plain GO and NOT GO ring gauges (see DIN 7150 Part 1).

Ring gauges should be used for checking the GO limit of non-rigid workpieces.

4.2 Gauges for workpiece internal threads**4.2.1 GO screw plug gauges**

GO screw plug gauges are used to check the virtual size of internal threads (virtual pitch gauging), i.e. it checks the minimum limit of the pitch diameter taking into account deviations of form (pitch errors, flank angle errors, deviations from roundness, deviations from straightness of the thread axis over the gauge length) which produce an apparent reduction of the workpiece pitch diameter (virtual pitch diameter).

These gauges are also used to check the minimum limit of the major diameter and whether the length of the straight flank is adequate, i.e. that the rounding at the root of the profile does not encroach too far upon the thread flank. It does not, however, check the minor diameter of the internal thread.

GO screw plug gauges operate largely in accordance with the Taylor principle.

The same considerations as for screwing the GO screw ring gauge onto the workpiece external thread shall apply for screwing the GO screw plug gauge into the workpiece internal thread; see subclause 4.1.1.

Pitch errors and flank angle errors are liable to cause a difference between the pitch diameters of the threaded components, which is equal to an amount that is dependent on the magnitude of the errors.

The permissible wear of GO screw plug gauges is found by measurement; instead of measuring, a wear check gauge (calliper gauge) with the associated setting plug may be used. In cases of dispute, however, the dimensions determined by measurement are decisive.

It is recommended that the GO screw plug gauge be regularly checked for wear.

If GO screw plug gauges are used for checking the useful thread length of screw threaded pocket holes, the start of the thread shall be formed in accordance with DIN 13 Part 17, January 1987 edition, figure 15.

4.2.2 NOT GO screw plug gauges

NOT GO screw plug gauges are used to check whether the actual pitch diameter of a workpiece internal thread exceeds the prescribed maximum size. NOT GO screw plug gauges operate largely in accordance with the Taylor principle. It is recommended that NOT GO screw plug gauges be checked regularly for wear.

4.2.3 Gauges for minor diameter

The minor diameter of workpiece screw threads shall be checked by means of plain cylindrical GO and NOT GO plug gauges (see DIN 7150 Part 2). Spherically-faced gauges and rod gauges shall not be used for this purpose.

Standards referred to

DIN 13 Part 1	ISO metric screw threads; 1 mm to 68 mm diameter coarse pitch threads; nominal sizes
DIN 13 Part 2	ISO metric screw threads; 0,2 mm, 0,25 mm and 0,35 mm fine pitch threads with diameter from 1 mm to 50 mm; nominal sizes
DIN 13 Part 3	ISO metric screw threads; 0,5 mm fine pitch threads with diameter from 3,5 mm to 90 mm; nominal sizes
DIN 13 Part 4	ISO metric screw threads; 0,75 mm fine pitch threads with diameters from 5 mm to 110 mm; nominal sizes
DIN 13 Part 5	ISO metric screw threads; 1 mm and 1,25 mm fine pitch threads with diameters from 7,5 mm to 200 mm; nominal sizes
DIN 13 Part 6	ISO metric screw threads; 1,5 mm fine pitch threads with diameters from 12 mm to 300 mm; nominal sizes
DIN 13 Part 7	ISO metric screw threads; 2 mm fine pitch threads with diameters from 17 mm to 300 mm; nominal sizes
DIN 13 Part 8	ISO metric screw threads; 3 mm fine pitch threads with diameters from 28 mm to 300 mm; nominal sizes
DIN 13 Part 9	ISO metric screw threads; 4 mm fine pitch threads with diameters from 40 mm to 300 mm; nominal sizes
DIN 13 Part 10	ISO metric screw threads; 6 mm fine pitch threads with diameters from 70 mm to 500 mm; nominal sizes
DIN 13 Part 17	ISO metric screw threads; gauges for external and internal threads; gauge sizes and design features
DIN 13 Part 18	ISO metric screw threads; gauges for external and internal threads; gauging of workpieces and use of gauges
DIN 102	Reference temperature of measuring tools and workpieces
DIN 7150 Part 2	ISO system of limits and fits; testing of workpiece elements with cylindrical and parallel mating surfaces
ISO 1 – 1975	Standard reference temperature for industrial length measurements

Other relevant standards

DIN 2244	Screw threads; concepts
ISO 1502 – 1978	ISO general purpose metric screw threads; gauging

Previous editions

DIN 244: 12.23; DIN 2244: 01.27; DIN 13 and DIN 14 Supplement 5: 06.30; DIN 13 Part 2: 01.45; HgN 21 549, 21 552: 09.43; DIN 13 Part 16: 01.52, 03.71, 06.76.

Amendments

The following amendments have been made to the June 1976 edition.

- The specifications of clause 1, items a) and b), have been simplified and amended.
- The standard has been editorially revised and the references to other standards have been updated.

Explanatory notes to DIN 13 Parts 16 to 18

These standards are equivalent in substance with International Standard ISO 1502 – 1978, ISO general purpose metric screw threads; gauging. The former ISO Recommendation ISO/R 1502, which was prepared by ISO/TC 1, Screw threads, on the basis of national standards from a number of countries, and, first published in 1970, having proved its value in all countries using the metric system, was converted without major technical changes into International Standard ISO 1502 – 1978, which was confirmed without amendments at the plenary meeting of ISO/TC 1 held in Berlin in September 1983. Although a working group was set up (Secretariat: USA), its scope being to assess the possibility of simplifying the gauging system so as to allow the countries which still work with the inch system also to adopt this ISO Standard at a later date, the first meeting of this working group has not as yet been held. Furthermore, the overwhelming majority of the ISO/TC 1 members has declared its disapproval of any technical amendments being made to the content of the ISO Standard.

The modifications made in these editions of DIN 13 Parts 16 to 18 represent only minor corrections to the June 1976 editions, and do not conflict with the technical content of the ISO Standard.

The history and technical development of ISO 1502 was described in the Explanatory notes to the previous, June 1976, edition of DIN 13 Part 16. Reference is also made to the following publications by the chairman of the responsible ISO committee at the time:

Prof. Dr. Ing. H. Schmidt. *Lehren für metrisches ISO-Gewinde – Ausführung und Handhabung* (Gauges for ISO metric screw threads; manufacture and use). *Werkstatt und Betrieb*, 1965: 98 (11), 797 – 800.

Prof. Dr. Ing. H. Schmidt. *Lehren für metrisches ISO-Gewinde – Lehrenmaße und Lehrentoleranzen* (Gauges for ISO metric screw threads; dimensions and tolerances). *Werkstatt und Betrieb*, 1968: 101 (11), 653 – 656.

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