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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Pipe threads where pressure-tight joints are not made on the threads —

Part 2 :
Verification by means of limit gauges

Filetages de tuyauterie pour raccordement sans étanchéité dans le filet —

Partie 2 : Vérification par calibres à limites

Reference number
ISO 228-2 : 1987 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 228-2 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings.*

This second edition cancels and replaces the first edition (ISO 228-2 : 1980), of which it constitutes a minor revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Printed in Switzerland

Pipe threads where pressure-tight joints are not made on the threads —

Part 2 :
Verification by means of limit gauges

1 Scope and field of application

This part of ISO 228 specifies the verification, by means of limit gauges, of cylindrical threads, the dimensions and tolerances of which are given in ISO 228-1.

For industrial applications (see for example ISO 1179), it may be necessary to carry out additional checks.

Since this 55° profile has different elements to be verified, it is necessary to provide for several GO and several NOT GO gauges :

a) the threaded GO gauges (see clauses 6 and 7) shall ensure that the profile of the machined piece does not exceed the maximum of material provided for by the tolerances applied to the dimensions of the profile defined by ISO 228-1;

b) the threaded NOT GO gauges for the threads of the pieces (see clauses 6 and 7) fix the minimum material limit on the flanks of the thread.

NOTE — Reference checks may be carried out in specialized laboratories.

2 References

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1 : Designation, dimensions and tolerances.*

ISO 1179, *Pipe connections, threaded to ISO 228-1, for plain end steel and other metal tubes in industrial applications.*

ISO 1502, *ISO general purpose metric screw threads — Gauging.*

3 Symbols and explanations

The symbols used in this part of ISO 228 are the same as those used in ISO 1502 for the ISO thread gauges, plus some additional symbols (n, S, u), as shown in table 1.

Table 1

Symbol	Explanation
b_3	Width of clearance groove at the major and minor diameter respectively of the thread profile with truncated flanks
$d=D$	Basic major diameter of the thread
$d_1 = D_1$	$= d - 1{,}280\,654\,P$: Basic minor diameter of the thread
$d_2 = D_2$	$= d - 0{,}640\,327\,P$: Basic pitch diameter of the thread
m	Distance between the middle of the tolerance zones T_R of the threaded ring gauge and T_{CP} of the GO check plug
n	Nominal value of b_3
P	Pitch
s	Displacement of the clearance groove with truncated flanks
S	Tolerance on b_3
T_{CP}	Tolerance on the pitch diameter of GO and NOT GO threaded check plugs and wear check plugs
T_{d2}	Tolerance on the pitch diameter of the external thread
T_{D2}	Tolerance on the pitch diameter of the internal thread
T_{PL}	Tolerance on the pitch diameter of GO and NOT GO threaded plug gauges
T_R	Tolerance on the pitch diameter of GO and NOT GO threaded ring gauges
u	$= 0{,}147\,84\,P$: Twice the radial height of rounding at crest and root of thread
W_{GO}	Average amount available for the permissible wear of GO threaded plug gauge and GO threaded ring gauge
W_{NG}	Average amount available for the permissible wear of NOT GO threaded plug gauge and NOT GO threaded ring gauge
Z_{PL}	Distance between the middle of the tolerance zone T_{PL} of the GO threaded plug gauge and the lower limit of the thread
Z_R	Distance between the middle of the tolerance zone T_R of the GO threaded ring gauge and the upper limit of the thread

4 Function, control and use of gauges

4.1 Gauges for external threads and their check plugs

4.1.1 Solid GO threaded ring gauge

4.1.1.1 Function

The threaded GO ring gauge checks the virtual size of the external thread on the GO side (gauging the virtual pitch diameter), i.e. it checks the maximum material limit of the pitch diameter, taking into account deviations of form (departures from roundness and lack of straightness of the thread axis over the gauge length) and pitch errors, helix variations and errors in the flank angles, which produce an apparent enlargement of the pitch diameter (virtual pitch diameter). 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 does not encroach too far upon the flank of the thread.

This gauge shows the maximum material limit.

Checking with the threaded GO ring gauge is essentially in accordance with the Taylor principle (see ISO 1502 : 1978, subclause 7.1.1).

4.1.1.2 Control

The solid threaded GO ring gauge manufactured according to the prescribed sizes shall be checked using the threaded GO and NOT GO check plugs and should be controlled regularly with the wear check plug.

If the NOT GO check plug is not used, other provisions shall be made so as to ensure that the maximum size of the pitch diameter of the threaded GO ring gauge is not exceeded.

4.1.1.3 Use

The threaded GO ring gauge screwed by hand, without excessive force, shall pass over the whole length of the thread. If this is not possible, the thread does not comply with the specifications.

4.1.2 Threaded check plugs for new solid threaded GO ring gauge

4.1.2.1 Function

These threaded check plugs (GO and NOT GO) are used to check the limits of the pitch diameter of the new solid threaded GO ring gauge.

4.1.2.2 Use

The threaded GO check plug screwed by hand, without excessive force, shall pass through the new solid threaded GO ring gauge.

The threaded NOT GO check plug screwed by hand, without excessive force, may enter into both ends of the new solid threaded GO ring gauge, but not more than one turn of thread.[1)]

4.1.3 Wear check plug for solid threaded GO ring gauge

4.1.3.1 Function

The wear check plug is used to ascertain that the pitch diameter of the threaded GO ring gauge has not exceeded the wear limit. It embodies the pitch diameter of the threaded GO ring gauge at the prescribed limit of wear.

4.1.3.2 Use

The wear check plug screwed by hand, without excessive force, may enter into both ends of the threaded GO ring gauge, but not more than one turn of thread.[1)]

If it can be screwed in more than one turn of thread, the threaded GO ring gauge no longer meets the specifications.

4.1.4 Solid threaded NOT GO ring gauge

4.1.4.1 Function

The threaded NOT GO ring gauge is intended to check whether the actual pitch diameter exceeds the specified minimum size. The checking with the threaded NOT GO ring gauge does not correspond to the Taylor principle when checking rigid machined pieces. In cases of non-rigid machined pieces, the departure from the Taylor principle is of less importance because of the flexibility of the pieces.

4.1.4.2 Control

The solid threaded NOT GO ring gauge manufactured according to the prescribed sizes shall be checked using the threaded GO and NOT GO check plugs and should be controlled regularly with the wear check plug.

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

4.1.4.3 Use

The threaded NOT GO ring gauge, screwed by hand without excessive force onto the thread, may be screwed on both sides but not more than two turns of thread.[1)]

1) The number of turns of thread is determined when unscrewing the plug or ring gauge.

If the gauge can be screwed more than two turns of thread, the thread does not comply with the specifications.

The threaded NOT GO ring gauge shall not pass completely over a threaded part having a length of three threads or less.

4.1.5 Threaded check plugs for new solid threaded NOT GO ring gauge

4.1.5.1 Function

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

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

4.1.5.2 Use

The threaded GO check plug screwed by hand, without excessive force, shall pass through the corresponding new solid threaded NOT GO ring gauge.

The NOT GO check plug gauge screwed by hand, without excessive force, may enter the new solid threaded NOT GO ring gauge at both ends, but not more than one turn of thread.[1)]

4.1.6 Wear check plug for solid threaded NOT GO ring gauge

4.1.6.1 Function

The wear check plug checks whether the pitch diameter of the threaded NOT GO ring gauge has exceeded the wear limit. It embodies the pitch diameter of the threaded NOT GO ring gauge at the prescribed limit of wear.

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

4.1.6.2 Use

The wear check plug screwed by hand, without excessive force, may enter into both ends of the threaded NOT GO ring gauge, but not more than one turn of thread.[1)]

If it can be screwed in more than one turn of thread, the threaded NOT GO ring gauge no longer meets the specifications.[1)]

4.2 Gauges for internal threads

4.2.1 Threaded GO plug gauge

4.2.1.1 Function

The threaded GO plug gauge checks the virtual size of the internal thread on the GO side (gauging the virtual pitch diameter). This is effected by checking the minimum limit of the pitch diameter, taking into account pitch errors, errors in the flank angles, helix variations and deviations of form (departures from roundness and lack of straightness of the thread axis over the gauge length) which produce an apparent reduction of the pitch diameter (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 shows the maximum material limit.

Checking with the threaded GO plug gauges is essentially in accordance with the Taylor principle (see ISO 1502 : 1978, subclause 7.2.1).

4.2.1.2 Control

The threaded GO plug gauge should be checked regularly for wear.

The wear of the threaded GO plug gauge is found by measuring.

4.2.1.3 Use

The threaded GO plug gauge screwed by hand, without excessive force, shall pass through the whole length of the thread. If this is not possible, the thread does not comply with the specifications.

4.2.2 Threaded NOT GO plug gauge

4.2.2.1 Function

The threaded NOT GO plug gauge checks whether the actual pitch diameter exceeds the specified maximum size.

The threaded NOT GO plug gauge checks approximately according to the Taylor principle (see ISO 1502 : 1978, subclause 7.2.2).

4.2.2.2 Control

The threaded NOT GO plug gauge shall be checked regularly for wear.

1) The number of turns of thread is determined when unscrewing the plug or ring gauge.

4.2.2.3 Use

The threaded NOT GO plug gauge screwed by hand, without excessive force, may enter into both ends of the threaded part, but not more than two turns of thread.[1)]

If it can be screwed in more than two turns of thread, the thread does not comply with the specifications. The threaded NOT GO plug gauge shall not pass completely through a machined piece with a length of three threads or less.

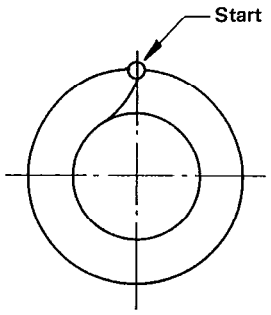


Figure 1 — Start of complete thread

5 Entry of the thread

Incomplete threads, even if they are chamfered, are still sharp enough to break. In order that checking is not affected, it is therefore recommended that the incompletely formed part of the thread be removed (see figure 1) or, if this is not possible, that a chamfer to the thread root of 27° 30′ be specified (see figure 2).

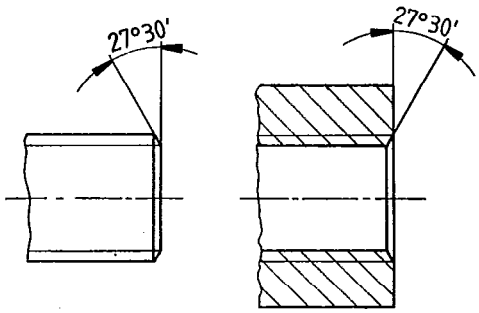


Figure 2 — Chamfer of start of thread

1) The number of turns of thread is determined when unscrewing the plug.

6 Threaded gauges for the external thread

6.1 GO side

6.1.1 Relative positions of pitch diameter tolerance zones

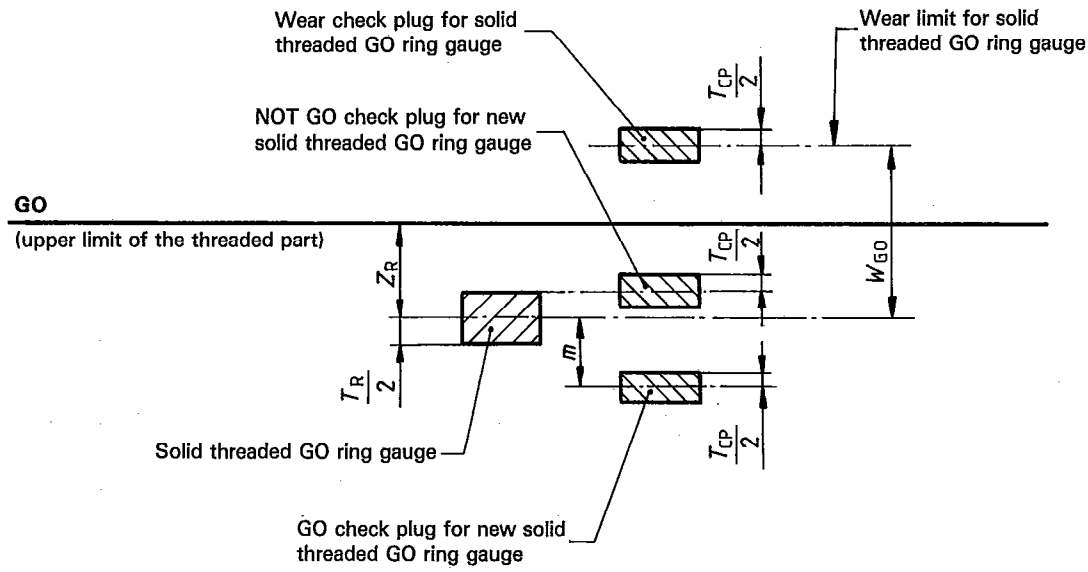
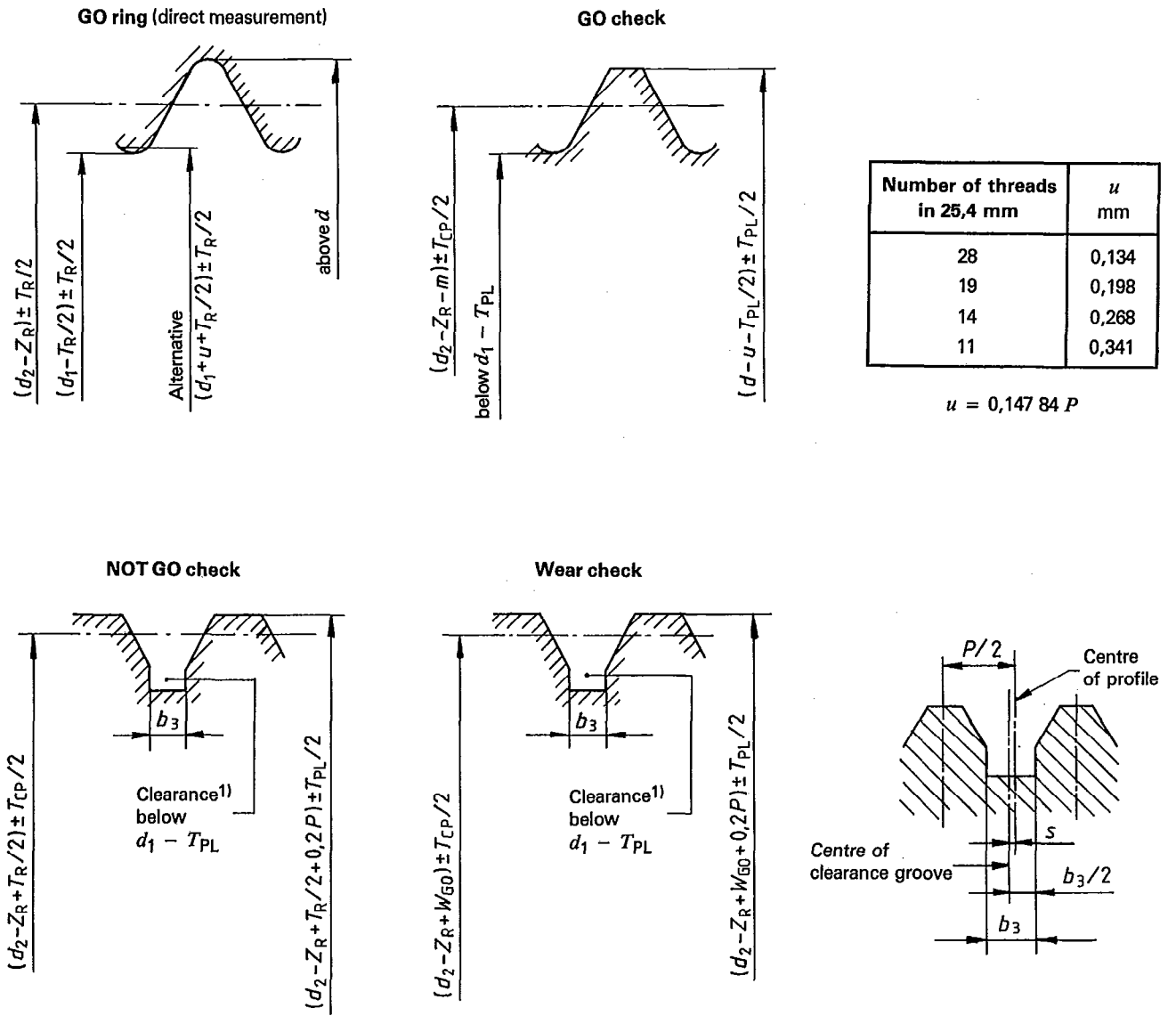


Figure 3 — Relative positions of pitch diameter tolerance zones

6.1.2 Thread profiles



Number of threads in 25,4 mm	u mm
28	0,134
19	0,198
14	0,268
11	0,341

$u = 0,147\,84\,P$

Figure 4 — Thread profiles

1) The form of the relief is left to the discretion of the manufacturer.

6.2 NOT GO side

6.2.1 Relative positions of pitch diameter tolerance zones

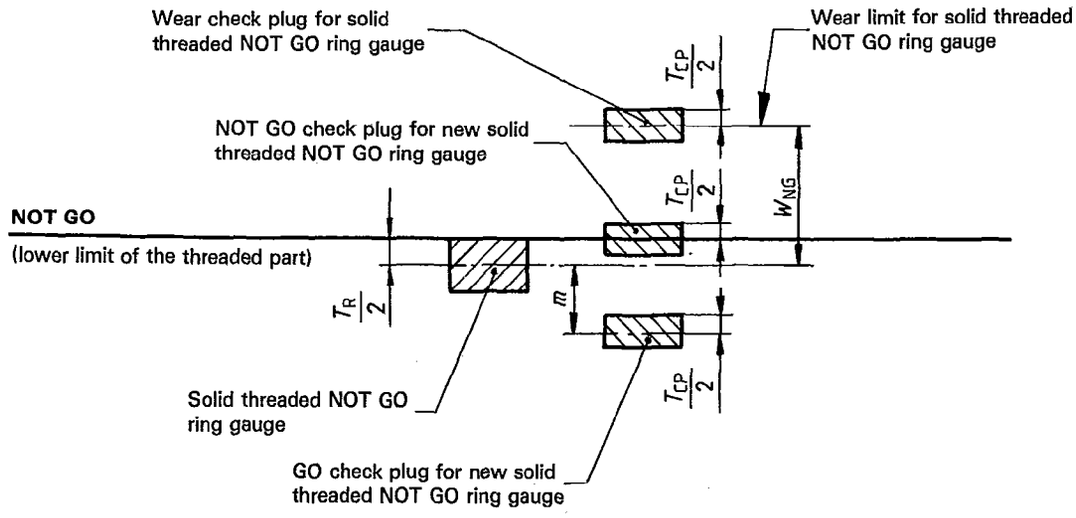


Figure 5 — Relative positions of pitch diameter tolerance zones

6.2.2 Thread profiles

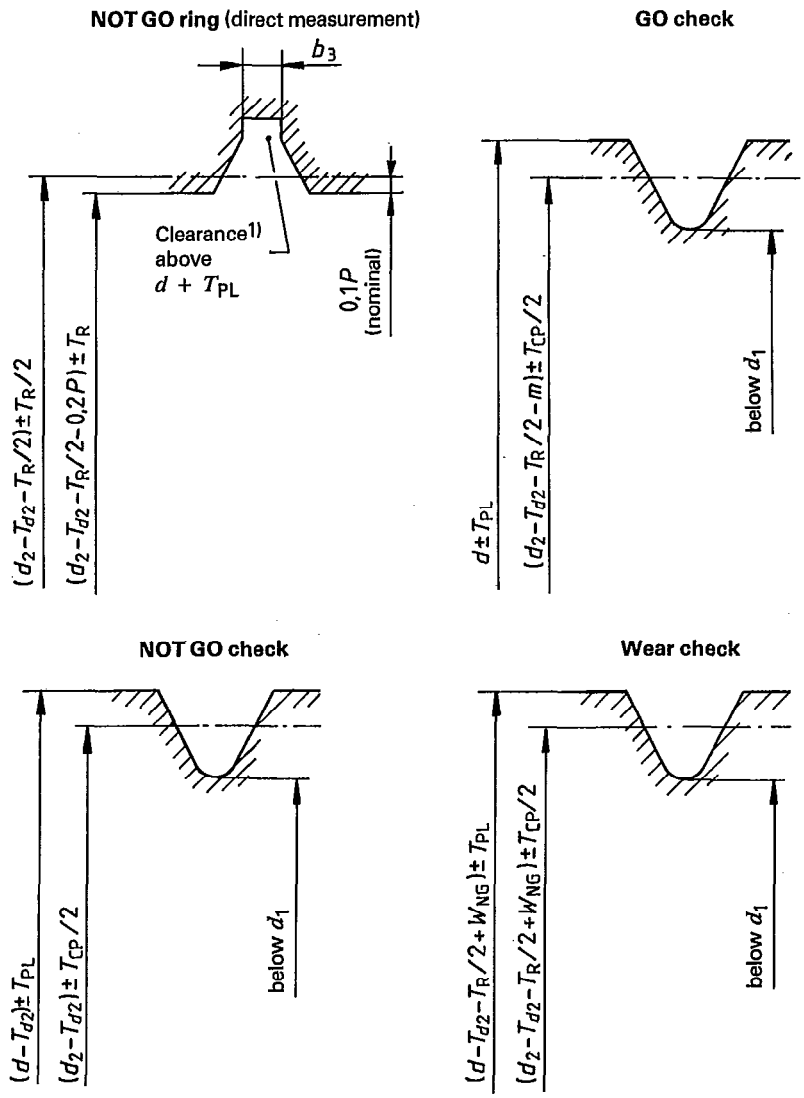


Figure 6 — Thread profiles

1) The form of the relief is left to the discretion of the manufacturer.

6.3 Numerical values

Given in ISO 228-1 :

P, d, d_1, d_2

Tolerance T_{d2}, class A or B

6.3.1 Threaded rings and checks for class A external thread[1)]

Table 2*

Dimensions in micrometres

Designation	T_{d2}	T_R	T_{PL}	T_{CP}	m	Z_R	W_{NG}	W_{GO}
1/16 and 1/8	107	16	10	10	17	2	13	18
1/4 and 3/8	125	16	10	10	17	2	13	18
1/2 to 7/8	142	20	12	10	20	9	17	23
1 to 2	180	20	12	10	20	9	17	23
2 1/4 to 4	217	26	16	14	24	13	21	28
4 1/2 to 6	217	26	16	14	24	13	21	28

* For GO rings, a profile is permitted without a radius with an internal diameter, in millimetres, truncated to

$(d_1 + u + T_R/2) \pm T_R/2$

where $u = 0{,}147\,84\,P$

For example, for the GO ring sizes 1/16 and 1/8 (for $P = 0{,}907$ mm) it is permitted to have

$(d_1 + 0{,}134 + 0{,}008) \pm 0{,}008 = d_1 + 0{,}142 \pm 0{,}008$

6.3.2 Threaded rings and checks for class B external thread

NOT GO side[2)]

Table 3

Dimensions in micrometres

Designation	T_{d2}	T_R	T_{PL}	T_{CP}	m	W_{NG}
1/16 and 1/8	214	26	16	14	24	21
1/4 and 3/8	250	26	16	14	24	21
1/2 to 7/8	284	26	16	14	24	21
1 to 2	360	34	20	18	30	28
2 1/4 to 4	434	34	20	18	30	28
4 1/2 to 6	434	34	20	18	30	28

1) The GO ring and its checks are also valid for class B threads.

2) For the GO side, the same ring and checks as for class A (see table 2).

6.3.3 Other values as a function of the pitch P

Table 4

Designation	P mm	Number of threads in 25,4 mm	b_3[1] nominal n mm	b_3[1] tolerance S mm	Tolerances on the half-angle [2] minutes	Tolerances on the half-angle [3] minutes
1/16 and 1/8	0,907	28	0		± 15	± 16
1/4 and 3/8	1,337	19	0,4	± 0,04	± 13	± 16
1/2 to 7/8	1,814	14	0,5	± 0,05	± 11	± 14
1 to 6	2,309	11	0,8	± 0,05	± 10	± 14

1) The maximum displacement permitted between the middle of the groove b_3 and that of the profile is equal to S. If the effective displacement s is less than S, the upper limit $n + S$ of b_3 may be exceeded by twice the difference $S - s$ (which amounts to accepting for the distance between each lateral face of b_3 and the middle of the profile the value $[(n + S)/2] \pm S$).

2) For profiles with complete flanks.

3) For profiles with shortened flanks.

6.3.4 Tolerance on the pitch P

The tolerance on the pitch P measured between any two threads over the length of the gauge is ± 5 µm.

7 Threaded gauges for the internal thread

7.1 Threaded GO and NOT GO plugs for internal threads

7.1.1 Relative positions of pitch diameter tolerance zones

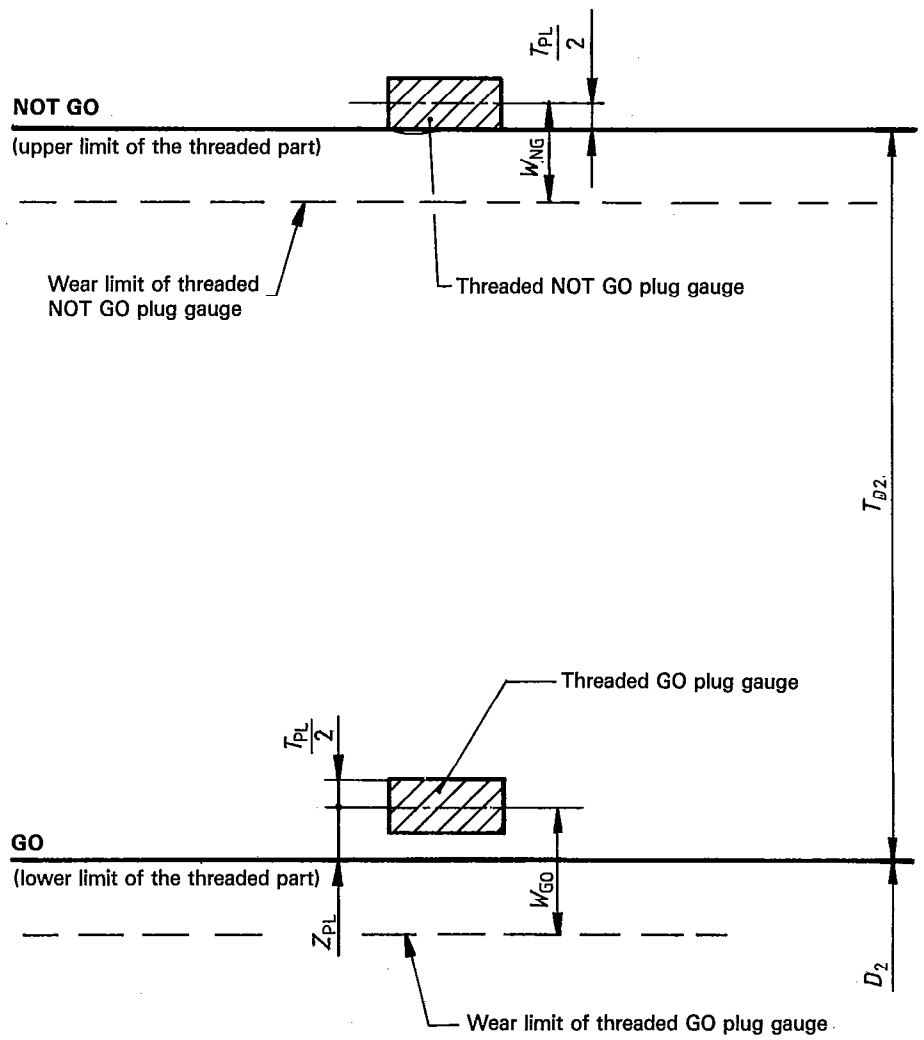


Figure 7 — Relative positions of pitch diameter tolerance zones

7.1.2 Thread profiles

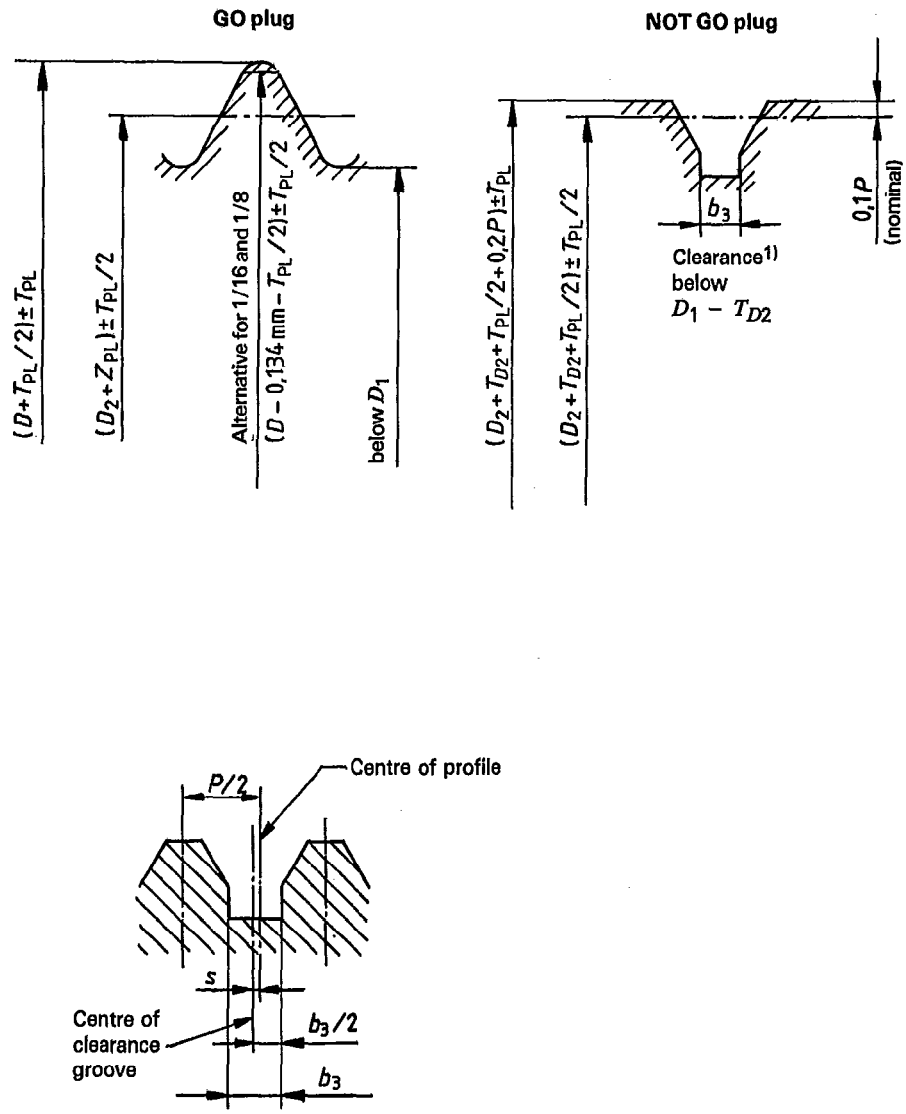


Figure 8 — Thread profiles

1) The form of the relief is left to the discretion of the manufacturer.

7.2 Numerical values

Given in ISO 228-1 :

P, D, D_1, D_2

Tolerance T_{D2}

7.2.1 Internal thread

Table 5

Dimensions in micrometres

Designation	T_{D2}	Z_{PL}	T_{PL}	W_{NG}	W_{GO}
1/16 and **1/8***	107	8	10	10	14
1/4 and **3/8**	125	8	10	10	14
1/2 to **7/8**	142	13	12	13	19
1 to **2**	180	13	12	13	19
2 1/4 to **4**	217	18	16	17	23
4 1/2 to **6**	217	18	16	17	23

* For 1/16 and 1/8 GO plugs, a profile is permitted without a radius with an external diameter, in millimetres, truncated to

$$(D - 0{,}134 - T_{PL}/2) \pm T_{PL}/2 = D - 0{,}139 \pm 0{,}005$$

7.2.2 Other values as a function of the pitch P

Table 6

Designation	P mm	Number of threads in 25,4 mm	b_3 [1] nominal n mm	b_3 [1] tolerance S mm	Tolerances on the half-angle [2] minutes	Tolerances on the half-angle [3] minutes
1/16 and **1/8**	0,907	28	0		± 15	± 16
1/4 and **3/8**	1,337	19	0,4	± 0,04	± 13	± 16
1/2 to **7/8**	1,814	14	0,5	± 0,05	± 11	± 14
1 to **6**	2,309	11	0,8	± 0,05	± 10	± 14

1) The maximum displacement permitted between the middle of the groove b_3 and that of the profile is equal to S. If the effective displacement s is less than S, the upper limit $n + S$ of b_3 may be exceeded by twice the difference $S - s$ (which amounts to accepting for the distance between each lateral face of b_3 and the middle of the profile the value $[(n + S)/2] \pm S$).

2) For profiles with complete flanks.

3) For profiles with shortened flanks.

7.2.3 Tolerance on the pitch P

The tolerance on the pitch P measured between any two threads over the length of the gauge is ± 5 µm.

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Descriptors : piping, screw threads, pipe threads, thread gauges, verification, dimensions, dimensional tolerances.

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