International Standard 7/2

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Pipe threads where pressure-tight joints are made on the threads —
Part 2 : Verification by means of limit gauges

Filetages de tuyauterie pour raccordement avec étanchéité dans le filet — Partie 2 : Vérification par calibres à limites

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Foreword

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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.

International Standard ISO 7/2 was developed by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, and was circulated to the member bodies in May 1980.

It has been approved by the member bodies of the following countries :

Australia	India	South Africa, Rep. of
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France
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Pipe threads where pressure-tight joints are made on the threads — Part 2 : Verification by means of limit gauges

1 Scope and field of application

This Part of ISO 7 specifies the verification by means of limit gauges of taper internal and external and of parallel internal threads, the dimensions and tolerances of which form the subject of International Standard ISO 7/1.

This International Standard does not profess to cover completely all the requirements necessary for full control of thread quality and dimensions. Additional control of tools and equipment and visual inspection during production are required to ensure compliance with part 1 of this International Standard.

In the event of a dispute over thread dimensions, the gauges in this International Standard shall be considered as decisive for the dimensions which they control.

2 References

ISO 7/1, *Pipe threads where pressure-tight joints are made on the threads — Part 1 : Designation, dimensions, tolerances.*

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

3 Symbols and explanations

The symbols used are the same as in ISO 1502 for the ISO thread gauges plus a few additional ones :

Symbol	Explanation
b_3	Width of clearance groove at the minor diameter of the thread profile with truncated flanks
c_1	Height of the small diameter end face of the tolerance step on the taper full-form threaded plug gauge
c_2	Height of the large diameter end face of the tolerance step on the taper full-form threaded plug gauge
$d = D$	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
g	Diameter of the counterbore in the small diameter end of the full-form threaded ring gauge
l	Length on which the tolerance on taper can be measured
l_0	Basic length of the full-form threaded plug gauge
l_1	Length beyond the gauge plane of the full-form threaded plug gauge
l_2	Minimum length of the full-form threaded plug gauge from the gauge plane
l_3	Total length of the full-form threaded ring gauge
l_4	Length of the threaded part in the full-form threaded ring gauge
l_5	Basic gauge length of the thread to ISO 7/1
P	Pitch
T_1	Tolerance for the position of the gauge plane on external thread
T_2	Tolerance for the position of the gauge on internal thread
T_{CP}	Tolerance for the pitch diameter of the modified threadform check plug
T_{PL}	Tolerance for the pitch diameter of the full-form threaded plug gauge
T_R	Tolerance for the pitch diameter of the full-form threaded ring gauge
u	$= 0{,}147\,84\,P$, twice the radial height of rounding at crest and root of thread
w	Permissible wear of the gauges

4 Design of gauges

4.1 General

The taper full-form threaded limit type plug and ring gauges have been chosen as representing the requirements for the mating components within the tolerances of ISO 7/1.

The taper check plugs for controlling the manufacturing tolerances and wear allowance for the taper full-form thread ring gauges are made to a modified thread form recommended in ISO 1502. The dimensions have been adapted to the requirements of ISO 7/1.

Because of the 1 : 16 taper of the gauges chosen, it is possible to represent the maximum and minimum limits of diameter by means of tolerance steps within the axial length of the gauges.

Incompletely formed threads are removed in accordance with ISO 1502, sub-clause 11.3 to a maximum of one quarter of a turn of the thread.

4.2 Taper full-form threaded plug gauge

These gauges are 1 : 16 taper full-form threaded plug gauges (see figure 1). They are of basic gauge length plus an amount $\frac{T_2}{2}$ equal in length to the positive half tolerance for the internal thread (ISO 7/1, table 1, columns 8 and 14).

However, because of the necessity to remove incomplete threads, it is recommended that the gauges be extended at the large diameter end by an amount l_1 equal to three pitches beyond the gauge plane. The gauges may be shortened at the small diameter end to the minimum length l_2 from the gauge plane.

NOTE — l_2 was arbitrarily chosen equal to ISO 7/1, table 1, column 19.

The gauges incorporate a step equal to the total tolerance T_2 on the position of the gauge plane of the internal thread. For threads 1/2 to 6, the large diameter end face of the step is marked positive (+) and the small diameter end face of the step is marked negative (−).

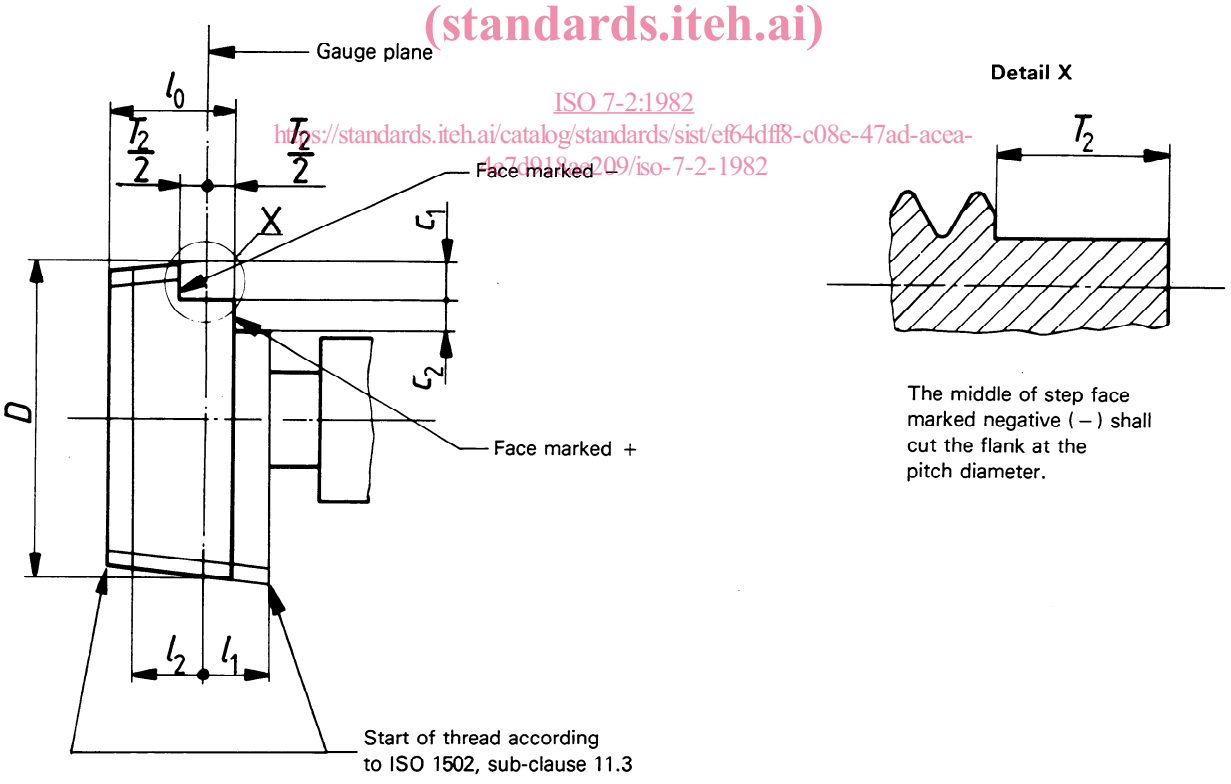


Figure 1 — Taper full-form threaded plug gauge

4.3 Taper full-form threaded ring gauge

These gauges are 1 : 16 taper full-form threaded ring gauges (see figure 2). They have a basic length equal to the maximum gauge length (ISO 7/1, table 1, column 11). The gauge plane is situated at the face of the larger diameter end of the ring gauge. The gauges incorporate a step at the small diameter end equal to the total tolerance T_1 for the position of the gauge plane of the external thread.

The small diameter end face of the gauge is marked positive (+) and the face of the step is marked negative (−).

The gauges are counterbored from the small diameter end for the diameter g until a threaded portion of the length l_4 is left (see table 1).

NOTE — l_4 was arbitrarily chosen equal to ISO 7/1, table 1, column 19 plus 1/2 pitch to compensate for the relief on the incomplete parts of the first threads.

4.4 Taper modified thread-form check plugs

These check plugs are 1 : 16 taper with a modified thread form which contacts on the flanks only. They are used to check the

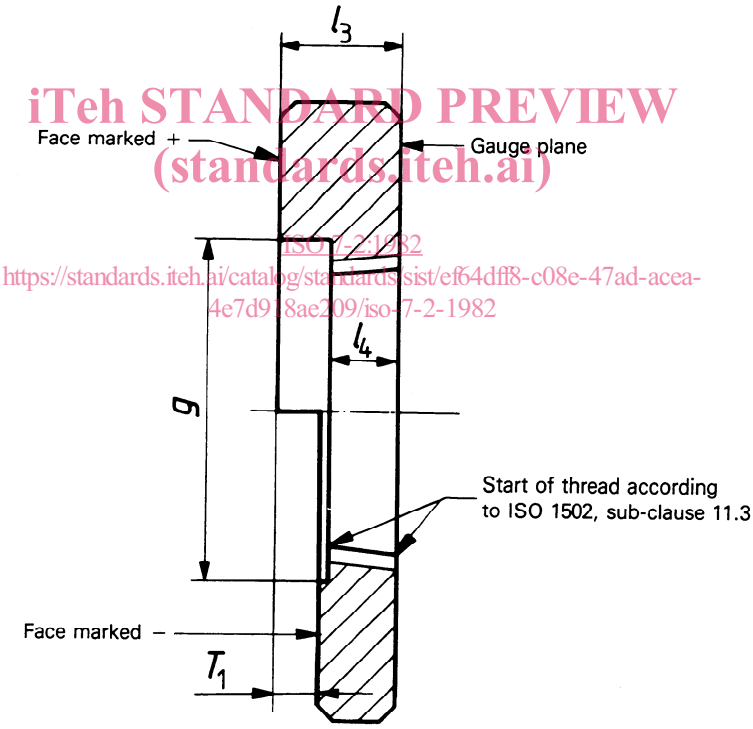


Figure 2 — Taper full-form threaded ring gauge

dimensions of the taper full-form threaded ring gauges when manufacturing the ring gauges (see figures 3, 4 and 5).

They can also be used to check wear, but additional controls are then required.

These check plugs have a basic length equal to the basic gauge length (ISO 7/1, table 1, column 8) plus three pitches. A step is positioned at the gauge plane. The check plugs may be shortened at the small diameter end to l_4 from the gauge plane.

NOTE — Same note for l_4 as in 4.3.

5 Dimensions and tolerances of gauges

Given in ISO 7/1 :

P, $d = D$, $d_1 = D_1$, $d_2 = D_2$

Tolerances T_1 and T_2

Dimensions of gauges are specified in table 1.

Formulae for gauge manufacturing dimensions and tolerances in the gauge plane are given in tables 2 and 3. The diameters of new plug and ring gauges are enlarged by T_{PL} and reduced by T_R respectively from the basic diameters to provide a sufficient wearing allowance.

Values as a function of the pitch P are given in table 4.

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

The tolerance on the taper on diameter over the length of the taper is

— on the taper full-form threaded plug gauge :
+ 5 µm + l µm,

— on the taper full-form threaded ring gauge :
− 10 µm − l µm,

where l is the length in millimetres on which the tolerance on taper can be measured; for example, for l = 15 mm the tolerance on the taper on a full-form threaded plug is + 5 µm + 15 µm = 20 µm.

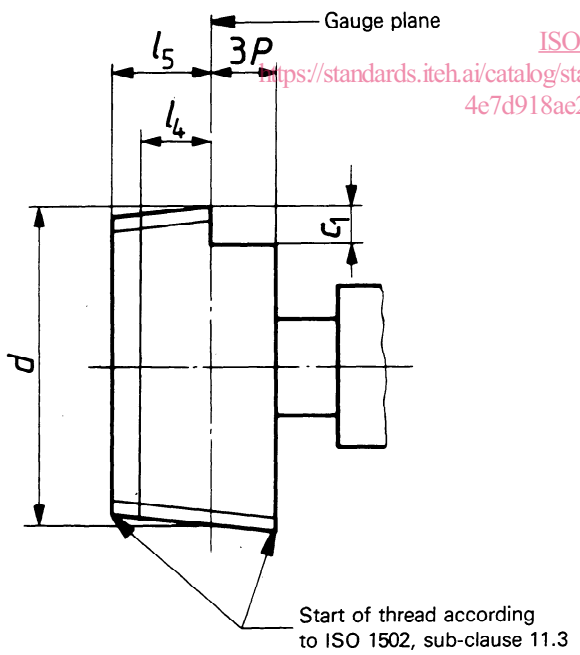
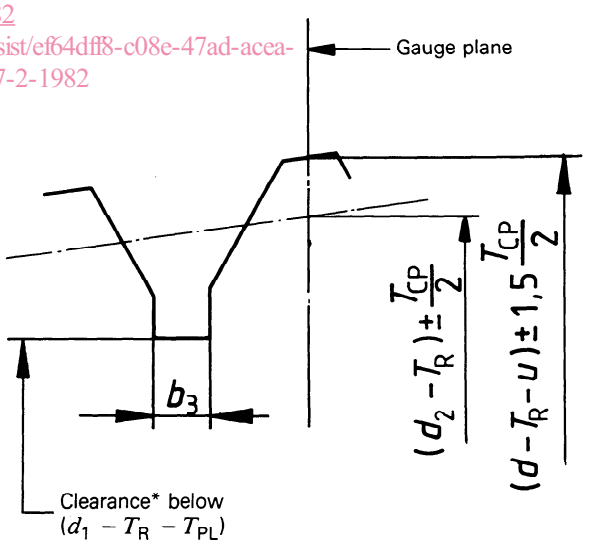


Figure 3 — Taper modified thread-form check plug



* The form of the relief is left to the discretion of the manufacturer.

Figure 4 — Profile of the taper modified thread-form check plug

Table 1 — Dimensions of gauges

Dimensions in millimetres

Designation of thread	Pitch	Basic diameters at gauge plane			Taper threaded plug gauges							Taper threaded ring gauges						Taper check plugs	
		Major	Pitch	Minor	Basic length of gauge	Recommended extension	Minimum length from gauge plane	Tolerance step		Height of shoulders		Basic length		Tolerance step		Length of threaded portion	Diameter of counterbore	Basic gauge length	Height of step
	P	$d = D$	$d_2 = D_2$	$d_1 = D_1$	l_0	l_1	l_2	T_2		c_1	c_2	l_3		T_1		l_4	g	l_5	c_1
1	2	3	4	5	6	7	8	9		10	11	12		13		14	15	16	17
1/16	0,907	7,723	7,142	6,561	5,103	2,721	2,494	2,268	±0,013	1,2	0,8	4,876	0 −0,013	1,814	±0,013	2,948	9,5	3,969	1,2
1/8	0,907	9,728	9,147	8,566	5,103	2,721	2,494	2,268		1,2	0,8	4,876		1,814		2,948	11,5	3,969	1,2
1/4	1,337	13,157	12,301	11,445	7,687	4,011	3,677	3,342		2,0	1,6	7,353		2,674		4,345	15,5	6,016	2,0
3/8	1,337	16,662	15,806	14,950	8,021	4,011	3,677	3,342		2,0	1,6	7,687		2,674		4,345	19,0	6,350	2,0
1/2	1,814	20,955	19,793	18,631	10,432	5,442	4,988	4,536		3,2	2,4	9,979		3,628		5,896	23,5	8,164	3,2
3/4	1,814	26,441	25,279	24,117	11,793	5,442	4,988	4,536		3,2	2,4	11,339		3,628		5,896	29,0	9,525	3,2
1	2,309	33,249	31,770	30,291	13,277	6,927	6,350	5,773	±0,025	4,0	3,2	12,700	0 −0,025	4,618	±0,025	7,504	36,0	10,391	4,0
1 1/4	2,309	41,910	40,431	38,952	15,586	6,927	6,350	5,773		5,0	3,6	15,009		4,618		7,504	44,5	12,700	5,0
1 1/2	2,309	47,803	46,324	44,845	15,586	6,927	6,350	5,773		5,5	4,0	15,009		4,618		7,504	50,5	12,790	5,5
2	2,309	59,614	58,135	56,656	18,761	6,927	7,504	5,773		6,0	4,0	18,184		4,618		8,659	62,0	15,875	6,0
2 1/2	2,309	75,184	73,705	72,226	20,926	6,927	9,236	6,927		7,0	4,5	20,926		6,927		10,390	77,5	17,462	7,0
3	2,309	87,884	86,405	84,926	24,101	6,927	9,236	6,927		7,0	4,5	24,101		6,927		10,390	90,5	20,638	7,0
4	2,309	113,030	111,551	110,072	28,864	6,927	10,390	6,927		8,0	5,0	28,864		6,927		11,545	115,5	25,400	8,0
5	2,309	138,430	136,951	135,472	32,039	6,927	11,545	6,927		8,0	5,0	32,039		6,927		12,700	141,0	28,575	8,0
6	2,309	163,830	162,351	160,872	32,039	6,927	11,545	6,927		8,0	5,0	32,039		6,927		12,700	166,5	28,575	8,0

Table 2 — Formulae for gauge manufacturing and tolerances in the gauge plane

Dimensions	Full-form taper plug gauge	Full-form taper ring gauge	Taper check plug
Major diameter	$(D + T_{PL}) \pm 1{,}5\frac{T_{PL}}{2}$	For dimensions and tolerances, see 6.5	$(d - T_R - u) \pm 1{,}5\frac{T_{CP}}{2}$
Pitch diameter	$(D_2 + T_{PL}) \pm \frac{T_{PL}}{2}$		$(d_2 - T_R) \pm \frac{T_{CP}}{2}$
Minor diameter	$(D_1 + T_{PL}) \pm 1{,}5\frac{T_{PL}}{2}$		Clearance groove of width b_3 or below $d_1 - T_R - T_{PL}$

Table 3 — Manufacturing tolerances of gauges

Dimensions in micrometres

Designation of thread	T_{PL}	T_R	T_{CP}
1/16 and 1/8	12	14	8
1/4 and 3/8	14	18	10
1/2 and 3/4	14	24	12
1 to 2	18	24	12
2 1/2 to 6	18	30	16

Table 4 — Other values as a function of the pitch P

Designation of thread	Pitch P mm	Number of threads in 25,4 mm	Width of clearance groove b_3 mm	Two times height of crest rounding u mm	Tolerance of the flank-angle minutes	Permissible wear from basic diameters (− for plugs, + for rings) $w^{1)}$ µm
1/16 and 1/8	0,907	28	0	0,134	± 15	14
1/4 and 3/8	1,337	19	0,4 ± 0,04	0,198	± 13	21
1/2 and 3/4	1,814	14	0,5 ± 0,05	0,268	± 11	28
1 to 6	2,309	11	0,6 ± 0,05	0,341	± 10	36

1) These values correspond to the difference in diameter on 0,25 P of a taper thread.

6 Use and verification of gauges

6.1 General

The taper full-form threaded plug and ring gauges indicate the virtual size of taper threads at the maximum material position, taking into account deviations of form (departures from roundness, lack of straightness of the thread axis over the gauge thread length) and pitch and taper errors, helix variations, errors in flank angles which produce an apparent enlargement (in the case of external threads) or reduction (in the case of internal threads) of the pitch diameter (virtual pitch diameter) of the threads.

In addition, the gauges indicate 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.

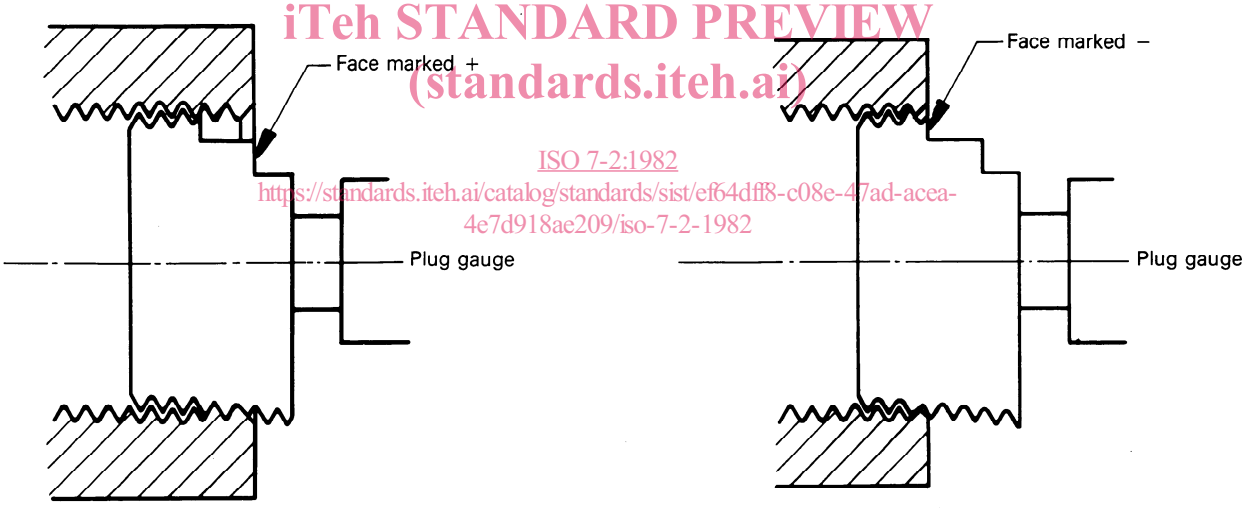
For parallel internal threads, the taper full-form threaded plug gauges indicate the virtual diameter and thread form at the entrance of the thread. In practice, the actual diameter gauged is affected by the chamfer of the thread. Nevetheless, the gauge reading shall be taken at the end face of the product.

6.2 Verification of internal threads

The taper full-form threaded plug gauge (see figure 1) is screwed hand-tight into the internal thread. The internal thread is within the permissible tolerances if the end-face of the product lies between the step faces, or flush with either face of the step on the gauge (see figure 5).

6.3 Verification of external taper threads

The taper full-form threaded ring gauge (see figure 2) is screwed hand-tight onto the external thread. The external



Internal thread (parallel or taper) of maximum size

Internal thread (parallel or taper) of minimum size

NOTES

1 Parallel threads are illustrated.

2 Taper of gauges is shown exaggerated.

Figure 5 — Verification of internal threads