INTERNATIONAL STANDARD 1502

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

ISO general purpose metric screw threads — Gauging

Filetages métriques ISO pour usages généraux — Vérification par calibres à limites

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

International Standard ISO 1502 was developed by Technical Committee ISO/TC 1, *Screw threads*. It was submitted directly to the ISO Council, in accordance with clause 6.13.1 of the Directives for the technical work of ISO. It cancels and replaces ISO Recommendation R 1502-1970, which had been approved by the member bodies of the following countries :

Austria	India	Portugal
Belgium	Israel	Romania
Chile	Italy	South Africa, Rep. of
Czechoslovakia	Japan	Spain
Denmark	Korea, Rep. of	Sweden
Egypt, Arab Rep. of	Netherlands	Thailand
France	Norway	Turkey
Germany	Peru	United Kingdom
Hungary	Poland	

The member bodies of the following countries had expressed disapproval of the document on technical grounds :

Australia*	Switzerland*
Canada	U.S.A.
New Zealand*	U.S.S.R.*

* Subsequently these member bodies indicated their approval of International Standard ISO 1502.

CONTENTS

ISO general purpose metric screw threads — Gauging

1 SCOPE AND FIELD OF APPLICATION

This International Standard gives the necessary instructions for the manufacture and use of gauges for checking ISO general purpose metric screw threads complying with ISO 68 and ISO 261.

It is recognized that other methods of checking may be used, for example measurement 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 manufacturer and purchaser, the following principles should be applied :

a) the manufacturer shall not deliver any workpiece thread the actual thread size (for example the pitch diameter and the virtual pitch diameter) of which lies outside the specified limits;

b) the purchaser shall not reject any workpiece thread the actual thread size (for example the pitch diameter and the virtual pitch diameter) of which lies inside the specified limits.

In order to satisfy these two principles, this International Standard establishes 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 the inspection of the workpiece threads.

2 REFERENCES

ISO 1, *Standard reference temperature for industrial length measurements.*

ISO 68, *ISO general purpose screw threads — Basic profile.*

ISO 261, *ISO general purpose screw threads — General plan.*

ISO 965/I, *ISO general purpose metric screw threads — Tolerances — Principles and basic data.*

ISO/R 1938, *ISO system of limits and fits — Part II : Inspection of plain workpieces.*

3 TYPES OF GAUGES

This International Standard specifies the essential features of the types of gauges[1] listed in 3.1 and 3.2 which are recommended for the checking of workpiece external and internal screw threads and for the setting and checking of certain of the screw gauges.

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

- Solid GO screw ring gauge
- Adjustable GO screw ring gauge
- Check plugs (GO and NOT GO) for new solid GO screw ring gauge
- Setting plug for adjustable GO screw ring gauge
- Wear check plug for solid or adjustable GO screw ring gauge
- GO screw calliper gauge
- Setting plug for GO screw calliper gauge
- NOT GO screw calliper gauge
- Setting plug for NOT GO screw calliper gauge
- Solid NOT GO screw ring gauge
- Adjustable NOT GO screw ring gauge
- Check plugs (GO and NOT GO) for new solid NOT GO screw ring gauge
- Setting plug for adjustable NOT GO screw ring gauge
- Wear check plug for solid or adjustable NOT GO screw ring gauge
- Plain gauges for major diameter (ring or calliper gauges)

3.2 Gauges for workpiece internal threads

- GO screw plug gauge
- NOT GO screw plug gauge
- Plain gauges for minor diameter (plug gauges)

1) The GO and NOT GO gauges may be combined.

4 GAUGING OF WORKPIECES

It is not necessary to use all the gauges mentioned in clause 3 in the workshop or inspection department. 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 above.

4.1 Gauging of external threads

A solid or adjustable GO **screw ring gauge** should preferably be used for gauging an external thread.

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

It is, however, recommended that a gauging with GO screw calliper gauges should be supplemented by random sampling with the GO screw ring gauge, so that when a large number of parts is 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.

The 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. Further, the 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.

The NOT GO **screw calliper gauge** is used for checking the simple pitch diameter of the external thread on the NOT GO side.

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

For gauging the major diameter of the workpiece external thread the plain GO and NOT GO gauges are used. Whether a calliper or ring gauge will be used is determined by the form and rigidity of the workpiece. Ring gauges should be used for non-rigid parts.

4.2 Gauging of internal threads

For the gauging of workpiece internal thread the GO **screw plug gauge** and NOT GO **screw plug gauge** are used.

For gauging the minor diameter of the workpiece internal thread the GO **plain plug gauge** and NOT GO **plain plug gauge** are used.

4.3 Inspection gauging

4.3.1 *By the manufacturer*

Generally speaking, the inspection department that checks the threads made in the 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 shall 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 manufacturer and purchaser.

NOTE – 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 by 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 use GO gauges which are approaching the condition of maximum permissible wear and new NOT GO gauges.

4.3.2 *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, he may check the accuracy of the gauges employed 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 workpiece threads.

In cases of dispute it is recommended that the product shall 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 the actual size of which 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 informs 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.

5 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 the gauges have the same coefficient of linear expansion (for example steel workpieces and steel gauges), the checking temperature may deviate from 20 °C without detriment to the result, provided that the temperatures of both gauges and workpieces are about the same.

If the workpieces and gauges have different coefficients of linear expansion (for example 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 of the thermal expansion of the workpiece and of the gauge shall be taken into consideration.

6 SYMBOLS AND EXPLANATIONS

In the list given below, the symbols mentioned in this International Standard are summarized and explained.

Symbols and explanations

Symbol	Explanation
b_1	Width of the clearance groove at the major diameter of the thread profile with complete flanks
b_2	Width of the clearance groove at the minor diameter of the thread profile with complete flanks
b_3	Width of the clearance groove at the major and minor diameter respectively of the thread profile with truncated flanks
d, D	Basic major diameter of the workpiece thread
D_1	Basic minor diameter of the internal workpiece thread
d_2, D_2	Basic pitch diameter of the workpiece thread
es	Fundamental deviation of the external thread (for tolerance position h the fundamental deviation es is equal to zero)
EI	Fundamental deviation of the internal thread (for tolerance position H the fundamental deviation EI is equal to zero)
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 the thread profile
H_1	Tolerance for plain plug gauges
H_2	Tolerance for plain calliper gauges and plain ring gauges
H_P	Tolerance for reference gauges for plain calliper gauges
m	Distance between the middle of the tolerance zones T_R of the screw ring gauge and T_{CP} of the GO check plug
P	Pitch
s	Displacement of the clearance groove with truncated flanks

Symbol	Explanation
$T_{\alpha_1}/2$	Tolerance for the flank angle of profiles with complete flanks
$T_{\alpha_2}/2$	Tolerance for the flank angle of profiles with truncated flanks
T_{CP}	Tolerance for the pitch diameter of GO and NOT GO screw check plugs and wear check plugs and setting plugs
T_d	Tolerance for the major diameter of the workpiece external thread
T_{d2}	Tolerance for the pitch diameter of the workpiece external thread
T_{D1}	Tolerance for the minor diameter of the workpiece internal thread
T_{D2}	Tolerance for the pitch diameter of the workpiece internal thread
T_P	Tolerance for the pitch of the 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}	Average amount available for the permissible wear of GO screw plug gauge and GO screw ring gauge
W_{NG}	Average amount available for the permissible wear of the NOT GO screw plug gauge and NOT GO screw ring gauge
Z_1	Distance between the middle of the tolerance zone H_1 of the GO plug gauge and the lower limit of the workpiece minor diameter
Z_2	Distance between the middle of the tolerance zone H_2 of the GO calliper gauge or the GO ring gauge and the upper limit of the workpiece major diameter
Z_{PL}	Distance between the middle of the tolerance zone T_{PL} of the GO screw plug gauge and the lower limit of the workpiece thread
Z_R	Distance between the middle of the tolerance zone T_R of the GO screw ring gauge and the upper limit of the workpiece thread

7 FUNCTION, CHECKING AND USE OF GAUGES

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

a) = function; b) = control; c) = use.

7.1 Gauges for workpiece external threads and their check plugs and setting plugs

7.1.1 *Solid or adjustable GO screw ring gauge*

a) The GO screw 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, lack of straightness of the thread axis over the gauge length) and pitch errors, helix variations, errors in the 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 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.

b) The solid GO screw ring gauge manufactured according to the prescribed sizes is checked by the GO and NOT GO screw check plugs and should regularly be controlled with the wear check plug.

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

The adjustable GO screw ring gauge is set to its setting plug and shall regularly be controlled with the wear check plug.

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

7.1.2 *Screw check plugs for new solid GO screw ring gauge*

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

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

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

7.1.3 *Setting plug for adjustable GO screw ring gauge*

a) The setting plug which contains two successive portions, one with complete flanks and the other with truncated flanks, is used to set the adjustable GO screw ring gauge to the specified pitch diameter.

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 is set on the portion of the setting plug with complete flanks.

c) The portion with complete flanks 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, no perceptible clearance is permissible between the plug and the ring. If there is a clearance, the ring gauge shall be lapped and adjusted to correct form and size.

7.1.4 *Wear check plug for solid adjustable GO screw ring gauge*

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

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

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

7.1.5 *GO screw calliper gauge*

a) This 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.

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

With regard to the embodiment of the virtual pitch diameter, the GO screw calliper gauge seriously violates the Taylor principle (periodic errors of pitch and deviations of form, such as departures from roundness are not detected).

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 least at three positions, evenly distributed over the whole circumference of the thread. If this is not possible, 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 minimise the effects of friction.

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

7.1.6 *Setting plug for GO screw calliper gauge*

a) With this setting plug the anvils of the GO calliper gauge are set.

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 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 gauge*

a) The NOT GO screw calliper gauge checks the minimum limit of the pitch diameter. It operates very largely in accordance with the Taylor principle.

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

7.1.8 *Setting plug for NOT GO screw calliper gauge*

a) With this setting plug the anvils of the NOT GO calliper gauge are set.

c) The NOT GO screw calliper gauge shall pass over the setting plug under its own weight or under a fixed load. If it is not possible 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 gauge*

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

b) The solid NOT GO screw ring gauge manufactured according to the prescribed sizes shall be checked by the GO and NOT GO screw check plugs and shall regularly be controlled 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 NOT GO screw ring gauge is not exceeded.

The adjustable NOT GO screw ring gauge shall be set with the setting plug specified and regularly controlled with the wear check plug.

c) The NOT GO screw ring gauge, screwed by hand without using excessive force on the workpiece thread, may enter on both sides but not more than two turns of thread[1]. If the gauge can be screwed on the workpiece more than two turns of thread, the thread does not comply with the specifications. 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 gauge*

a) The check plugs (GO and NOT GO) are used to check the pitch diameter limits of the 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.

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

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

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

7.1.11 *Setting plug for adjustable NOT GO screw ring gauge*

a) The setting plug which contains two successive portions, one with complete flanks and the other with truncated flanks, is used to set the 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 described in 7.1.10 after it has been adjusted.

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

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

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

7.1.12 *Wear check plug for solid or adjustable NOT GO screw ring gauge*

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

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

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

If it can be screwed in 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*

a) The major diameter of the 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 ring gauge (Taylor principle); the calliper gauges are recommended only if the workpieces have been manufactured by methods which do not involve the risk of errors of 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 shall not pass over the thread. Otherwise the workpiece thread does not comply with the specifications.

7.2 Gauges for workpiece internal threads

7.2.1 *GO screw plug gauge*

a) The GO screw 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 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. It does not check the minor diameter of the internal thread.

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

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

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

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 screwed by hand, without using excessive force, shall pass over the whole length of the workpiece thread. If this is not possible, the workpiece thread does not comply with the specifications.

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

7.2.2 *NOT GO screw plug gauge*

a) The 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 screwed by hand, without using 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 workpiece thread does not comply with the specifications. 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 the 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 introduced by hand, without using excessive force, shall pass through the workpiece thread. The NOT GO plain plug gauge shall enter not more than one turn of thread at either end of the workpiece thread.

8 TOLERANCE ZONES FOR PITCH DIAMETER OF SCREW 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 on to 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 screw on to the check plug. (The purchaser and the manufacturer 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 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 3 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 a workpiece external thread, 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.

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

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

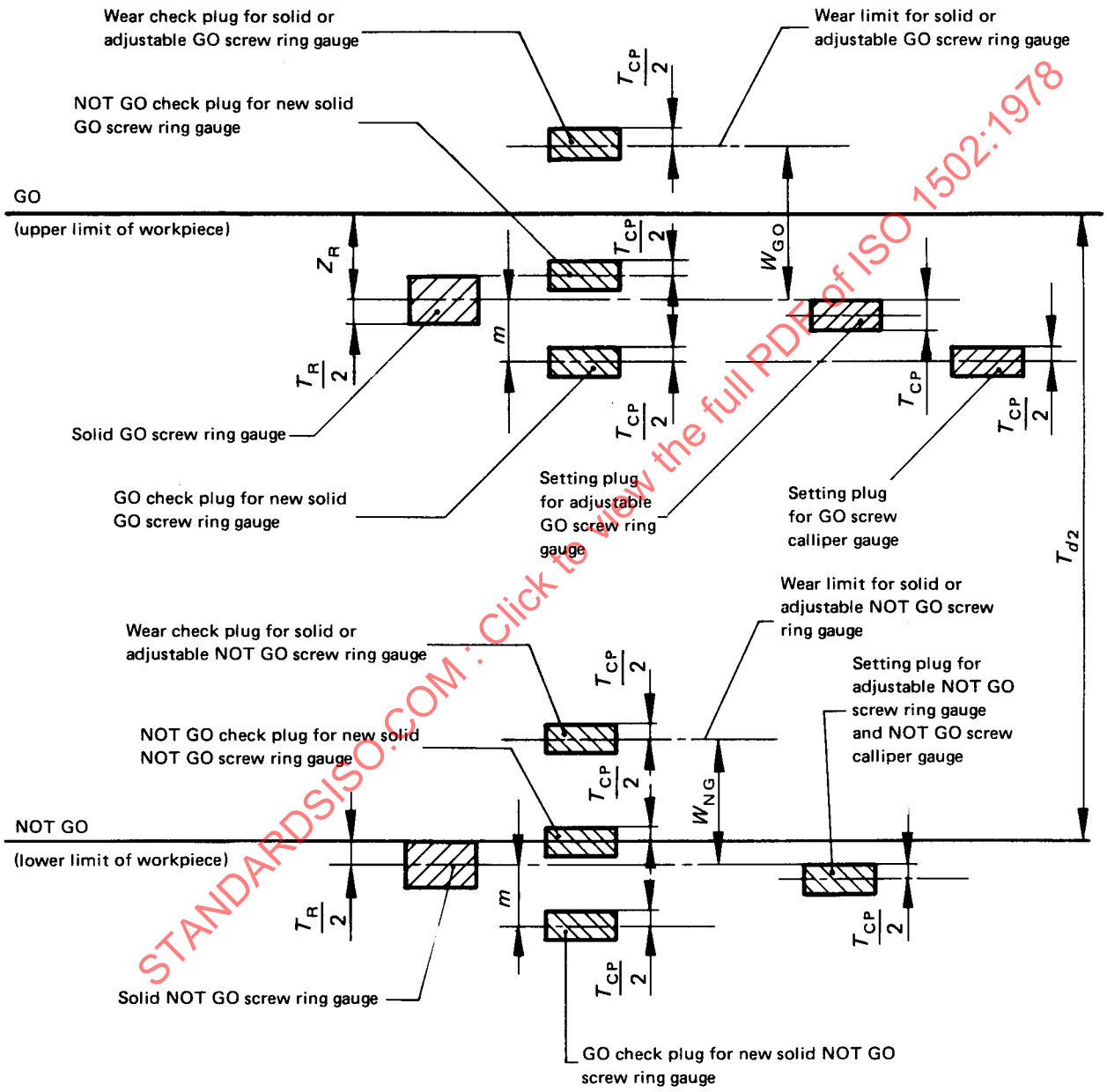

FIGURE 1 – **Tolerance zones for the pitch diameter of gauges for external threads (diagram)**

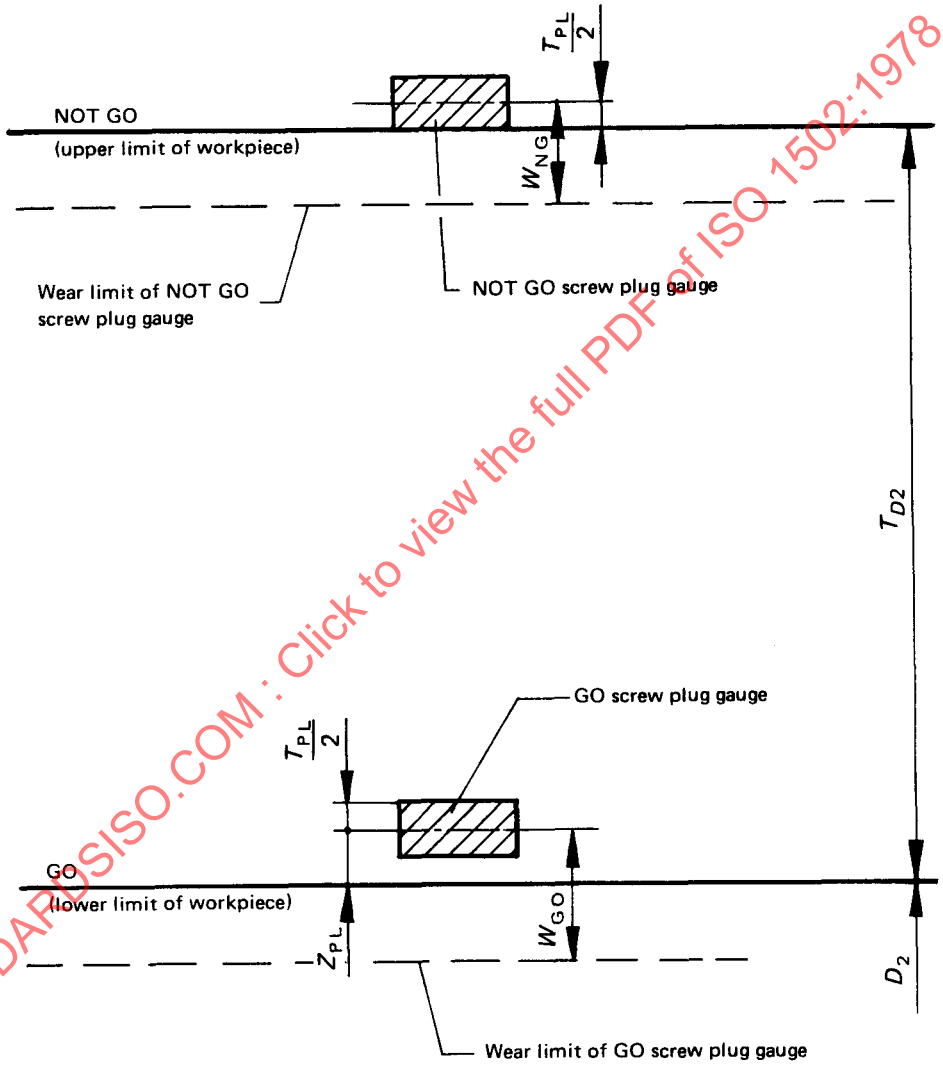

FIGURE 2 – **Tolerance zones for the pitch diameter of gauges for internal threads (diagram)**

9 TOLERANCE ZONES FOR PLAIN GAUGES (See figures 3 and 4)

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

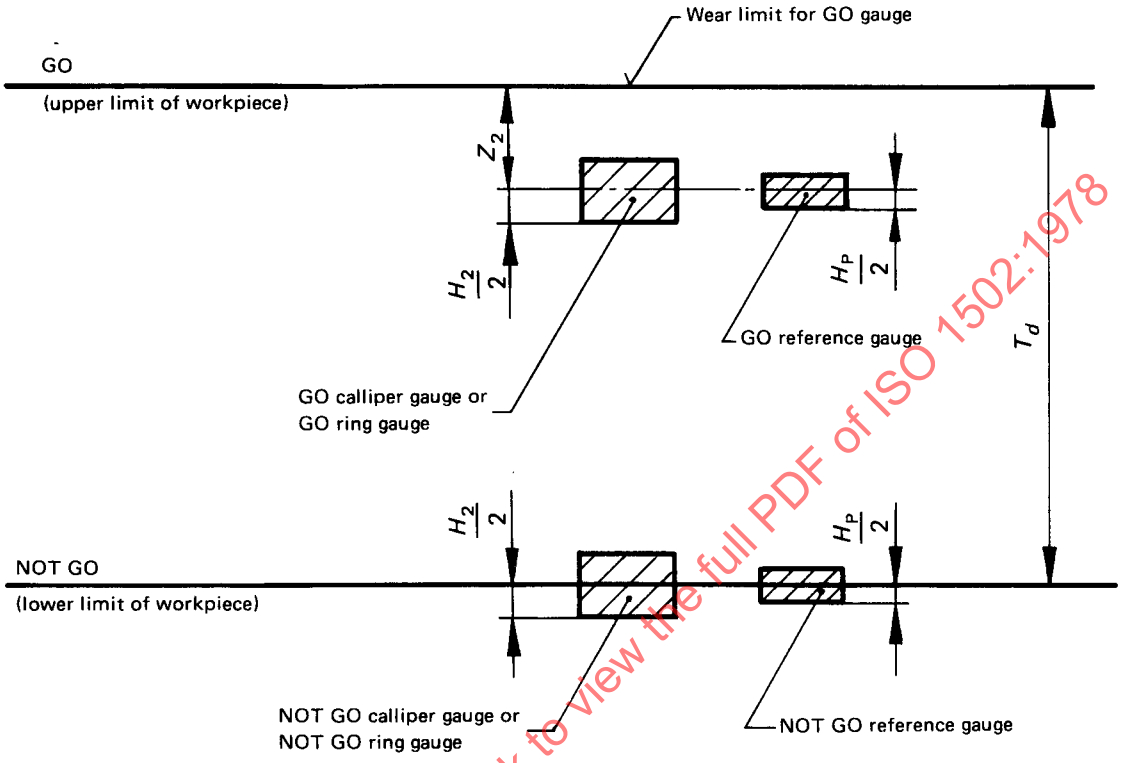

FIGURE 3 – **Tolerance zones for plain gauges for major diameter of external threads (diagram)**

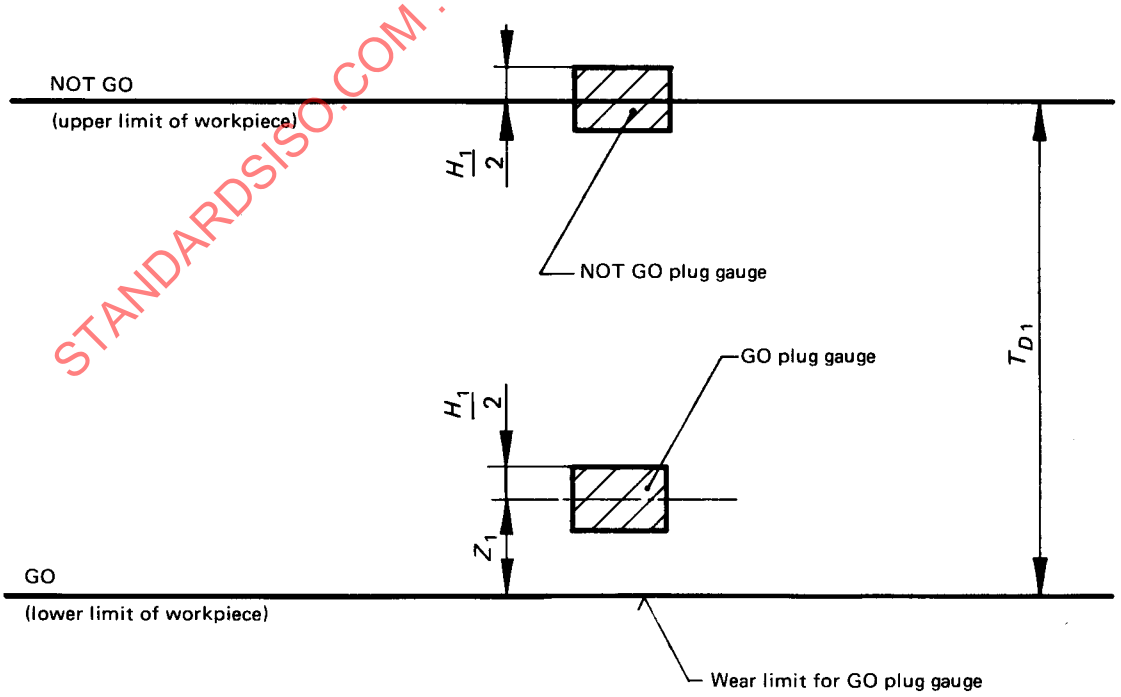

FIGURE 4 – **Tolerance zones for plain gauges for minor diameter of internal threads (diagram)**

10 THREAD PROFILES FOR GAUGES

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

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

– GO check plug for solid GO screw ring gauge

– GO check plug for solid NOT GO screw ring gauge

– GO screw plug gauge

– Setting plug for adjustable GO screw ring gauge (one portion)

– Setting plug for adjustable NOT GO screw ring gauge (one portion)

– Setting plug for adjustable GO screw calliper gauge

– NOT GO screw check plug for solid NOT GO screw ring gauge

– Setting plug for NOT GO screw calliper gauge

– Wear check plug for solid or adjustable NOT GO screw ring gauge

The profile with complete flanks according to figure 5 can be made with a radius of maximum r_2 (see table 1) which contacts tangentially the straight part of the flank, or with a clearance groove of maximum b_2 (see table 1). The form of the clearance groove is left to the discretion of the manufacturer.

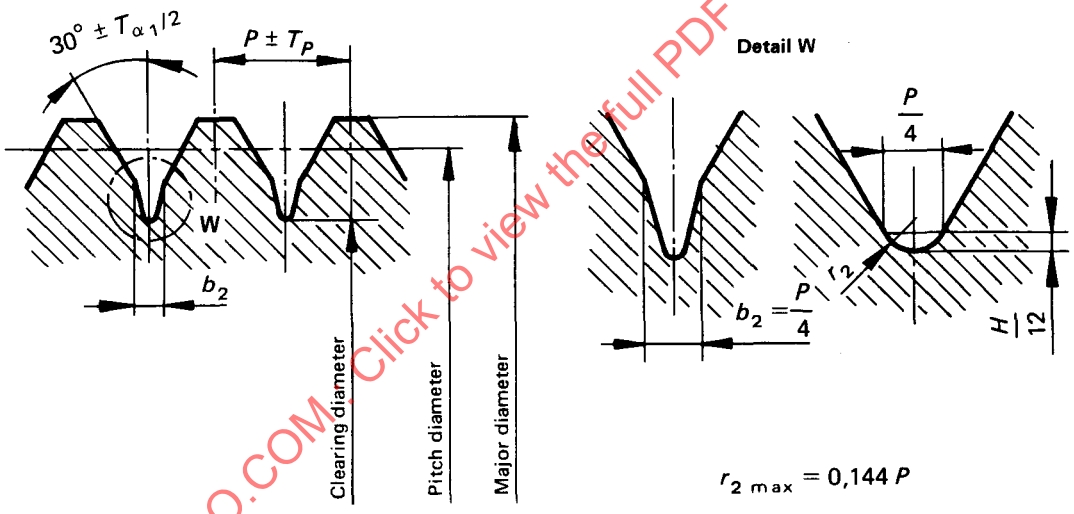

FIGURE 5 – **Profile with complete flanks**

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

— GO screw ring gauge

— Anvils of GO screw calliper gauge

The profile with complete flanks according to figure 6 can be made with a radius of maximum r_1 (see table 1), which contacts tangentially the straight part of the flank, or with a clearance groove of maximum b_1 (see table 1). The form of the clearance groove is left to the discretion of the manufacturer.

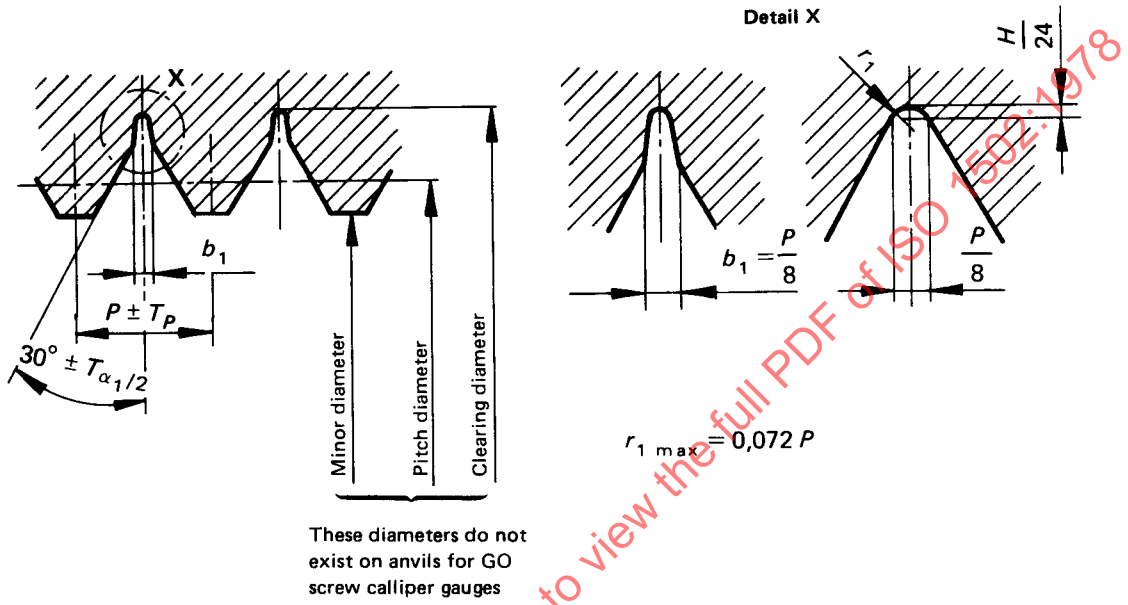

FIGURE 6 — **Profile with complete flanks**

TABLE 1 – **Values for profiles with complete flanks** (See figures 5 and 6)

Values in millimetres

Pitch P	$b_{1\ max} = \frac{P}{8}$	$r_{1\ max} = 0{,}072\,P = \frac{H}{12}$	$b_{2\ max} = \frac{P}{4}$	$r_{2\ max} = 0{,}144\,P$	$\frac{H}{24}$
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

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 plug for solid GO screw ring gauge

– Setting plug for adjustable GO screw ring gauge (one portion)

– Setting plug for adjustable NOT GO screw ring gauge (one portion)

– Wear check plug for solid or adjustable GO screw ring gauge

– NOT GO screw plug gauge

The 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 1) 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 2). The form of the clearance groove is left to the discretion of the manufacturer.

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.

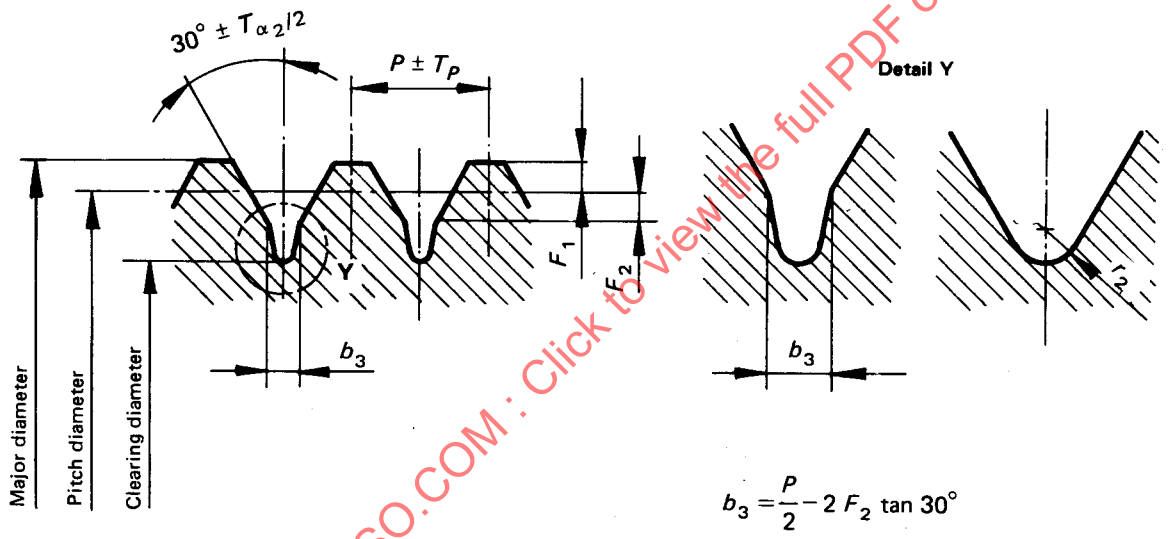

FIGURE 7 – **Profile with truncated flanks**

The following gauges have profiles in accordance with figure 8 :

– NOT GO screw ring gauge

– Anvils of NOT GO screw calliper gauge

The 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 1) 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 2). The form of the clearance groove is left to the discretion of the manufacturer.

Displacement of the clearance groove for the 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 permissible deviation of b_3 (see table 2).

The deviation for b_3 can be increased, if the real displacement is smaller than the permitted displacement S, by an amount which is double the difference between permitted and real displacement.

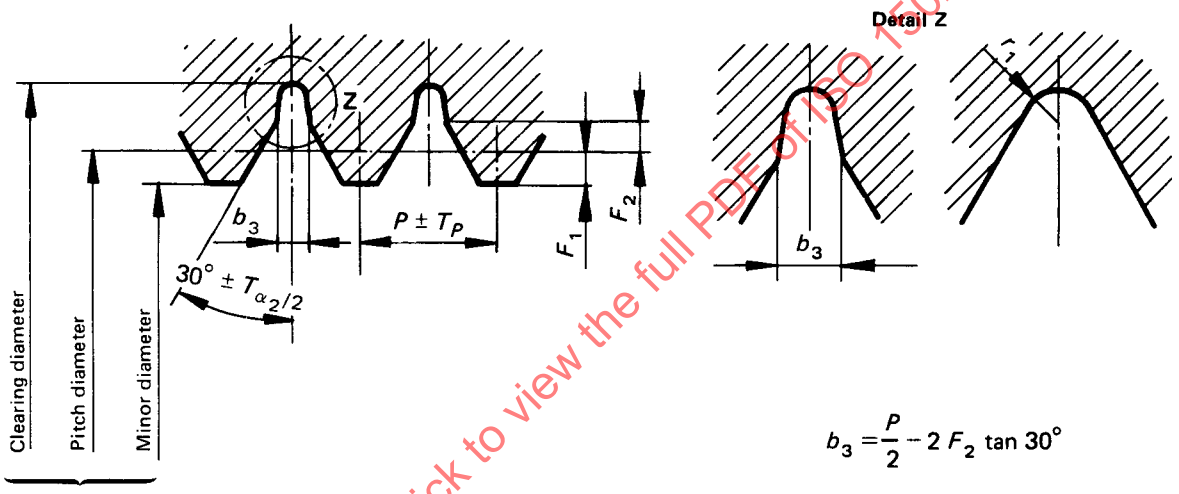

FIGURE 8 – **Profile with truncated flanks**

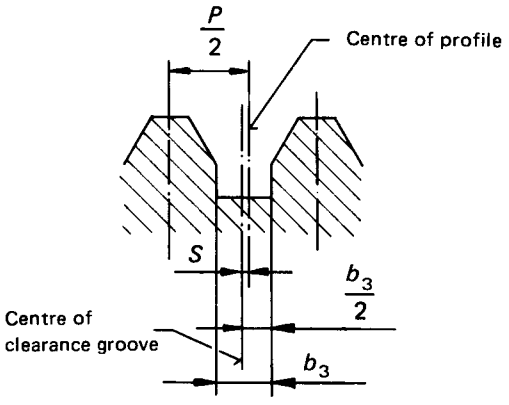

FIGURE 9 – **Displacement of the clearance groove for the profile with truncated flanks**

TABLE 2 – **Values for profiles with truncated flanks** (See figures 7 and 8)

Values in millimetres

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

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 the gauges for checking workpiece threads but also to the gauges intended for checking or setting those gauges. Exceptions are only permissible where there is justification for them.

NOTE – 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 the 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 workpiece external threads

11.1.1 *Solid or adjustable GO screw ring gauge*

The length of thread on the 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 plug for adjustable GO screw ring gauge*

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 truncated flanks and the other half has a profile with complete flanks.

11.1.3 *GO screw calliper gauge*

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

11.1.4 *Setting plug for GO screw calliper gauge*

The length of thread on the 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 gauge*

Each anvil of the 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 10b) each gauging shall be repeated by displacing the gauge from one pitch to the other.

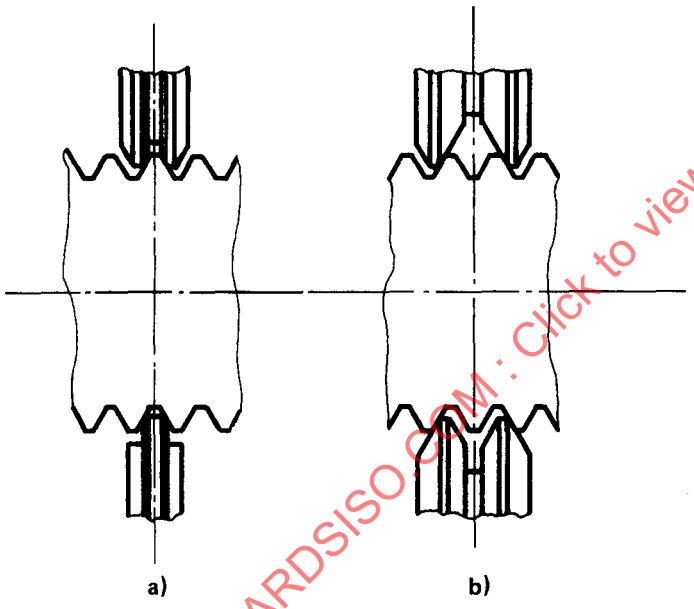

FIGURE 10 – **NOT GO screw calliper gauge**

11.1.6 *Setting plug NOT GO screw calliper gauge*

This setting plug shall have at least three turns of thread[1].

11.1.7 *Solid or adjustable NOT GO screw ring gauge*

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

11.1.8 *Setting plug for adjustable NOT GO screw ring gauge*

This setting plug shall have at least six turns of thread[2].

11.2 Gauges for workpiece internal threads

11.2.1 *GO screw plug gauge*

The length of thread on the 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 gauge*

The NOT GO screw plug gauge shall have a length of thread of at least three turns of thread[2].

11.3 Blunt start of thread

Incomplete threads, even when they are chamfered, are still shap enough to break. It is therefore recommended that, so as not to prejudice checking, the 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).

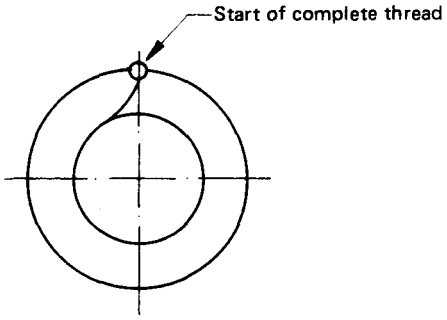

FIGURE 11 – **Start of complete thread**

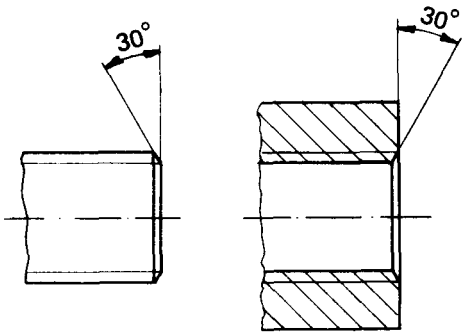

FIGURE 12 – **Chamfer of start of thread**

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

2) The complete threads are to be counted.

12 TOLERANCES AND PERMISSIBLE WEAR FOR GAUGES

In order to limit the number of GO gauges for one and 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 3 should be chosen according to grade 6.

For screw threads with workpiece tolerances finer than grade 6, the values in table 3 should be chosen according to the lowest grade recommended in ISO 965/I, for each tolerance position.

TABLE 3 – **Tolerance and value *m* for the pitch diameter** (See figures 1 and 2)

Values in micrometres

T_{d2} and T_{D2} respectively		T_R	T_{PL}	T_{CP} [1]	m	Z_R [2]	Z_{PL}
over	up to						
24	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) These are maximum values.

2) The values for Z_R are to be inserted into table 9 taking into consideration the sign, i.e. the use of the minus values in the formula given in table 9 results in plus values. The minus value for Z_R means that Z_R is situated outside of the tolerance T_{d2} (see figure 1).

TABLE 4 – **Calculated values for average permissible wear**

Values in micrometres

T_{d2} and T_{D2} respectively		W_{GO}		W_{NG}	
over	up to	GO screw ring gauge	GO screw plug gauge	NOT GO screw ring gauge	NOT GO screw plug gauge
24	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