INTERNATIONAL STANDARD

ISO 5609-1

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Tool holders for internal turning with cylindrical shank for indexable inserts —

Part 1: Designation, styles, dimensions and calculation for corrections

Porte-plaquette de tournage intérieur à queue cylindrique pour plaquettes amovibles —

Partie 1: Désignation, formes, dimensions et calcul de corrections

Reference number
ISO 5609-1:2012(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5609-1 was prepared by Technical Committee ISO/TC 29, *Small tools*, Subcommittee SC 9, *Tools with cutting edges made of hard cutting materials*.

This first edition of ISO 5609-1 cancels and replaces ISO 5609:1998 and ISO 6261:2011, which have been technically revised.

ISO 5609 consists of the following parts, under the general title *Tool holders for internal turning with cylindrical shank for indexable inserts*:

Part 1: Designation, styles, dimensions and calculation for corrections

Part 2: Style F

Part 3: Style K

Part 4: Style L

Part 5: Style U

Part 6: Style Q

Introduction

This part of ISO 5609 also determines tool holder styles adopted from ISO 6261[1)] which are only standardized by the following designations:

Style P of a 117,5° cutting edge angle, offset shank, for end cutting;

Style S of a 45° cutting edge angle, offset shank, for side and end cutting;

Style W of a 60° cutting edge angle, offset shank, for end cutting;

Style Y of an 85° cutting edge angle, offset shank, for end cutting.

1) Withdrawn.

Tool holders for internal turning with cylindrical shank for indexable inserts —

Part 1: Designation, styles, dimensions and calculation for corrections

1 Scope

This part of ISO 5609 specifies the code for the designation, styles, general dimensions and calculation for corrections for tool holders for internal turning with cylindrical shank. It is intended to be used in conjunction with, and is completed by, ISO 5609-2, ISO 5609-3, ISO 5609-4, ISO 5609-5 and ISO 5609-6.

These tool holders are primarily intended for indexable inserts made of hardmetal, ceramic or other cutting materials to be mounted by clamping and to be used for internal turning operations.

This part of ISO 5609 also incorporates the contents of ISO 6261:2011[12)] [designation for tool holders with cylindrical shank (boring bars) for indexable inserts].

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2768-1, *General tolerances — Part 1: tolerances for linear and angular dimensions without individual tolerance indications*

ISO 3002-1, *Basic quantities in cutting and grinding — Part 1: Geometry of the active part of cutting tools — General terms, reference systems, tool and working angles, chip breakers*

ISO 5608:1995, *Turning and copying tool holders and cartridges for indexable inserts — Designation*

3 Configuration of the designation

The designation code includes 10 symbols for the designation of dimensions and other characteristics of the tool holder and the indexable insert.

In addition to the standardized designation (symbols 1 to 10) a supplementary symbol consisting of a maximum of three letters and/or numbers may be added by the manufacturer for a better description of his/her products on condition that this symbol is separated from the standardized designation by a hyphen.

No addition to or extension of the code given in this part of ISO 5609 shall be made without consultation with ISO/TC 29 and without its agreement. Rather than adding symbols not provided for in this system, all necessary explanations should be added in detailed sketches or specifications to the designation conforming to this International Standard.

The meaning of the 10 compulsory symbols constituting the code is as follows:

2) Withdrawn.

Position	Definition of designation symbols
1	letter symbol identifying the type of tool (see 4.1) [The term “tool” in this part of ISO 5609 refers to boring bars (tool holders with cylindrical shank).];
2	number symbol identifying the diameter of the shank (see 4.2);
3	letter symbol identifying the length of the tool (see 4.3);
—	hyphen not counted as a symbol;
4	letter symbol identifying the method of holding the indexable insert (see 4.4);
5	letter symbol identifying the indexable insert shape (see 4.5) [in accordance with ISO 1832];
6	letter symbol identifying the style of the tool (see 4.6);
7	letter symbol identifying the insert normal clearance (see 4.7);
8	letter symbol identifying the hand of the tool (see 4.8);
9	number symbol identifying the size of the indexable insert (see 4.9) [in accordance with ISO 1832];
10	number symbol identifying the numbers of flats and their location (see 4.10).

The term “tool” in this part of ISO 5609 refers to boring bars (tool holders with cylindrical shank).

EXAMPLE

1	2	3	—	4	5	6	7	8	9	—	10
S	25	S	—	P	S	K	N	R	12	—	41

4 Designation symbols

4.1 Symbol for the type of tool — Symbol 1

See Table 1.

Table 1 — Symbol 1

Letter symbol	Type of tool
S	Solid steel tool
A	Solid steel tool with coolant/lubrication hole
B	Solid steel tool with anti-vibration device
D	Solid steel tool with anti-vibration device and coolant/lubrication hole
C	Hardmetal (carbide) tool with fixed steel head
E	Hardmetal (carbide) tool with fixed steel head and coolant/lubrication hole
F	Hardmetal (carbide) tool with fixed steel head and anti-vibration device
G	Hardmetal (carbide) tool with fixed steel head, anti-vibration device and coolant/lubrication hole
H	Solid heavy metal tool
J	Solid heavy metal tool with coolant/lubrication hole
K	Heavy metal tool with fixed steel head
L	Heavy metal tool with fixed steel head and coolant/lubrication hole

4.2 Symbol for the diameter of the shank — Symbol 2

The number symbol for the shank diameter is the value of the diameter, d or d_1, in millimetres. If the resulting symbol has only one digit, it shall be preceded by 0 (zero).

EXAMPLE 1

shank diameter 25 mm

symbol 25

EXAMPLE 2

shank diameter 8 mm

symbol 08

4.3 Symbol for the tool length — Symbol 3

See Table 2.

Table 2 — Symbol 3

Dimensions in millimetres

Letter symbol	Tool length
A	32
B	40
C	50
D	60
E	70
F	80
G	90

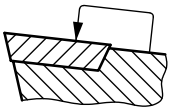
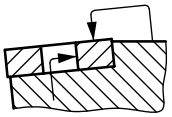
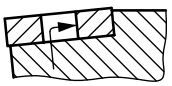
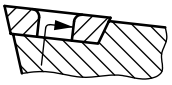
Table 2 *(continued)*

Letter symbol	Tool length
H	100
J	110
K	125
M	150
N	160
P	170
Q	180
R	200
S	250
T	300
U	350
V	400
W	450
X	Special length, to be specified
Y	500

4.4 Symbol for the method of holding the horizontally mounted indexable insert — Symbol 4

See Table 3.

Table 3 — Symbol 4

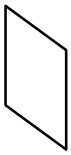
Letter symbol	Method of holding	Indexable insert	Illustration
C	Top clamping	without hole	
M	Top and hole clamping	with hole or with counterbore for hol-ding	
P	Hole clamping		
S	Screw clamping through hole	with counterbore for hol-ding	

4.5 Symbol for the indexable insert shape — Symbol 5

See Table 4.

Table 4 — Symbol 5

Dimensions in millimetres

Letter symbol	Included angle ε_r	Indexable insert shape		Remark
H	120°	Hexagonal		Equilateral and equiangular
O	135°	Octagonal		
P	108°	Pentagonal		
S	90°	Square		
T	60°	Triangular		
C	80°	Rhombic		Equilateral but non-equiangular
D	55°			
E	75°			
M	86°			
V	35°			
W	80°	Hexagonal with 80° included angle		
L	90°	Rectangular		Non-equilateral but equiangular
A	85°	Parallelogram-shaped		Non-equilateral and non-equiangular
B	82°			
K	55°			
R	—	Round		Round
NOTE The included angle is always the smaller angle.				

4.6 Symbol for the tool style — Symbol 6

See Clause 5, Table 9, for symbol 6.

4.7 Symbol for the indexable insert normal clearance — Symbol 7

The letter symbols according to Table 5 apply to the indexable inserts normal clearance, α_n, on the cutting edge (see Figure 1).

For non-equilateral indexable inserts, the symbol applies to the normal clearance of the longer side.

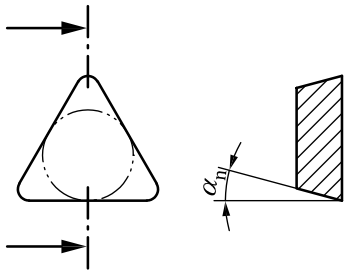


Figure 1 — Normal clearance α_n

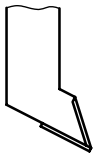
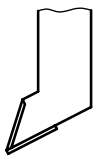
Table 5 — Symbol 7

Letter symbol	α_n
A	3°
B	5°
C	7°
D	15°
E	20°
F	25°
G	30°
N	0°
P	11°

4.8 Symbol for the hand of tool — Symbol 8

See Table 6.

Table 6 — Symbol 8

Letter symbol	Hand of tool	Illustration/Figure
R	Right hand	
L	Left hand	

4.9 Symbol for the indexable insert size — Symbol 9

See Table 7.

Table 7 — Symbol 9

Dimensions in millimetres

Indexable insert type	Number symbol
Equilateral and equiangular (H, O, P, S, T) and equilateral and non-equiangular (C, D, E, M, V, W)	The symbol of designation for the indexable insert size is the side length, disregarding any decimals
	EXAMPLE Edge length: 16,5 mm Symbol: 16
Non-equilateral but equiangular (L), and non-equilateral and non-equiangular (A, B, K)	The symbol of designation for the indexable insert size is always given for the major cutting edge or the longer cutting edge. The symbol of designation is the length, disregarding any decimals.
	EXAMPLE Length of the major cutting edge: 19,5 mm Symbol: 19
Round insert (R)	The symbol of designation for the indexable insert size is always given for the diameter value, disregarding any decimals.
	EXAMPLE Diameter: 15,875 mm Symbol: 15
NOTE When the symbol resulting from the retained value has only one digit, it shall be preceded by 0 (zero). EXAMPLE Cutting edge length: 9,525 mm; Symbol of designation: 09	

4.10 Symbol for the round shank shape — Symbol 10 — Number of flats

See Table 8.

Table 8 — Symbol 10

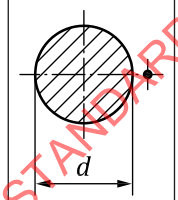
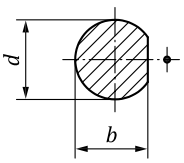
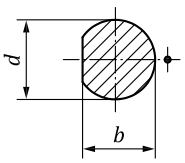
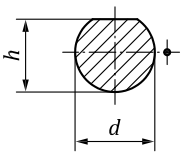
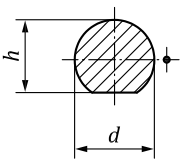
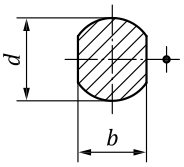
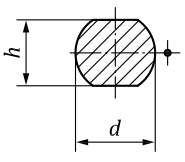
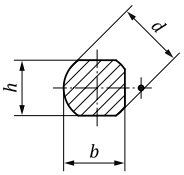
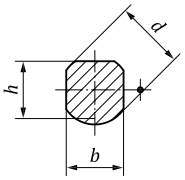
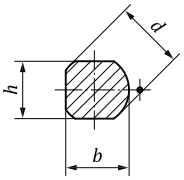
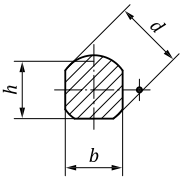
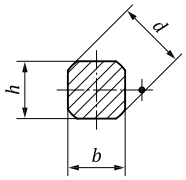
Shank shape		Shank shape		Shank shape		Shank shape		Shank shape	
Code	Illustration	Code	Illustration	Code	Illustration	Code	Illustration	Code	Illustration
10		11		12		13		14	
—	—	21		22		—	—	—	—
—	—	31		32		33		34	

Table 8 *(continued)*

Shank shape		Shank shape		Shank shape		Shank shape		Shank shape	
Code	**Illustration**	**Code**	**Illustration**	**Code**	**Illustration**	**Code**	**Illustration**	**Code**	**Illustration**
—	—	41		—	—	—	—	—	—

b width of flat
d shank diameter
h height of flat

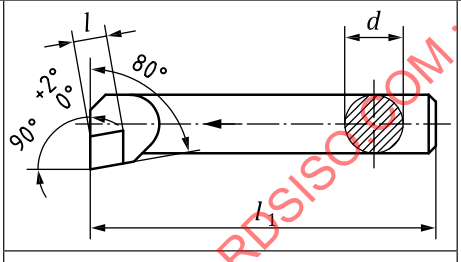
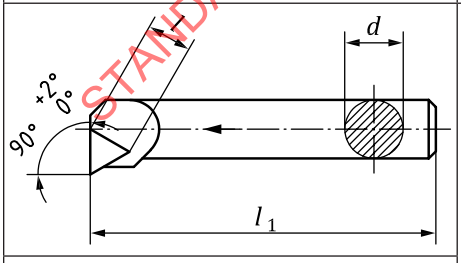
5 Summary of characteristics

Table 9 contains a summary of the characteristics of tool holders for internal turning with cylindrical shank for indexable inserts standardized in ISO 5609-2, ISO 5609-3, ISO 5609-4, ISO 5609-5 and ISO 5609-6 with their corresponding letter symbols and shank sizes.

The arrows shown on the illustrations (figures) indicate the primary direction of feed.

Table 9 —

Dimensions in millimetres

Style	**Illustration (sketch)** Tool cutting edge angle κ_r Insert included angle ε_r		**Symbols for the shank diameter** d_1										**Reference for dimensions** ISO 5609 **series**
			8	**10**	**12**	**16**	**20**	**25**	**32**	**40**	**50**	**60**	
F	 $\kappa_r = 90°$	Designation of cutting edge length l	06	06									ISO 5609-2
	 $\kappa_r = 90°$	Designation of cutting edge length l		11	11	11	11 16	16	16	16 22	22	22 27	

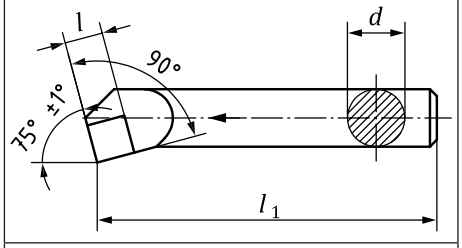
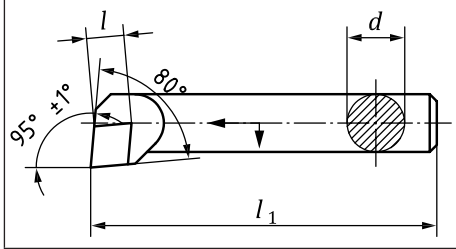
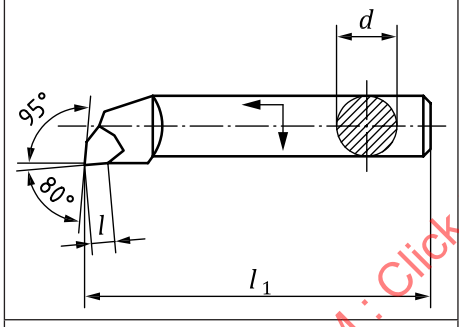
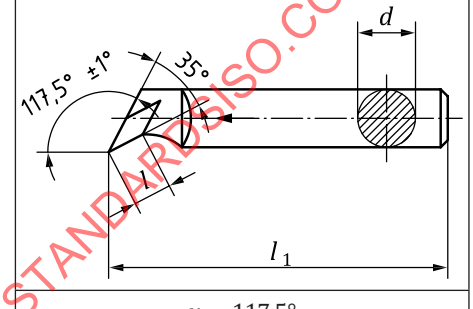
Style	Illustration (sketch) Tool cutting edge angle κ_r Insert included angle ε_r		Symbols for the shank diameter d_1										Reference for dimensions ISO 5609 series
			8	10	12	16	20	25	32	40	50	60	
K	 κ_r = 75°	Designation of cutting edge length l				09	09	09 12	12	12 15	15 19	15 19	ISO 5609-3
L	 κ_r = 95°	Designation of cutting edge length l	06	06	06	09	09	12	12	12	16 19	16 19	ISO 5609-4
L	 κ_r = 95°	Designation of cutting edge length l	03	04	04	04 06	06	06 08	06 08	06 08			ISO 5609-4
P	 κ_r = 117,5°	Designation of cutting edge length l				11	11 13	13 16	16	16			—

Table 9 *(continued)*

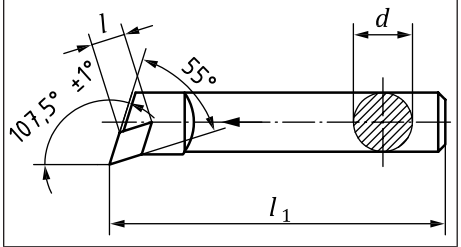
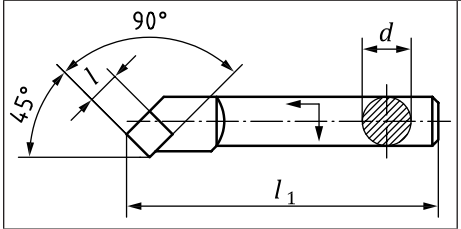
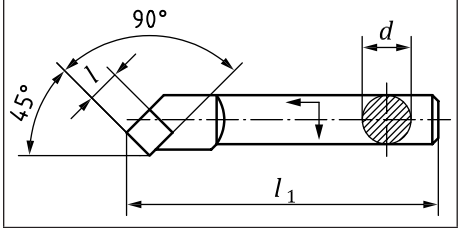
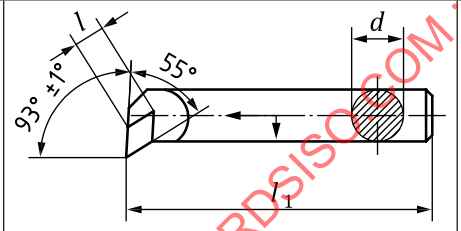
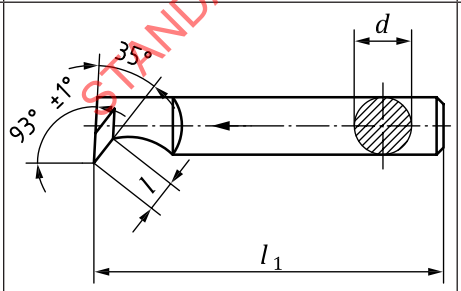
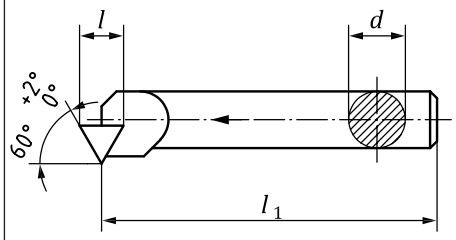
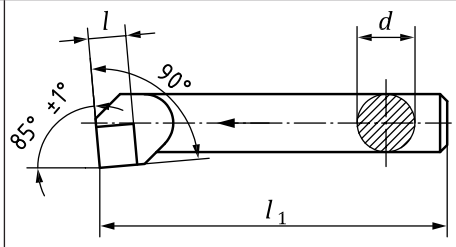
Style	Illustration (sketch) Tool cutting edge angle κ_r Insert included angle ε_r		Symbols for the shank diameter d_1										Reference for dimensions ISO 5609 series
			8	10	12	16	20	25	32	40	50	60	
Q	 κ_r = 107,5°	Designation of cutting edge length l			07	07	11	11 15	11 15	15	15		ISO 5609-6
	 κ_r = 107,5°	Designation of cutting edge length l				11	11 13	13 16	16	16			
S[a]	 κr = 45°	45° cutting edge angle, offset shank, for side and end cutting				09	09	09 12	12	12 15	15 19	15 19	—
U	 κ_r = 93°	Designation of cutting edge length l			07	07	11 15	11 15	15	15	15 19	15 19	ISO 5609-5
U	 κ_r = 93°	Designation of cutting edge length l				11	11 13	11 13	16				ISO 5609-5

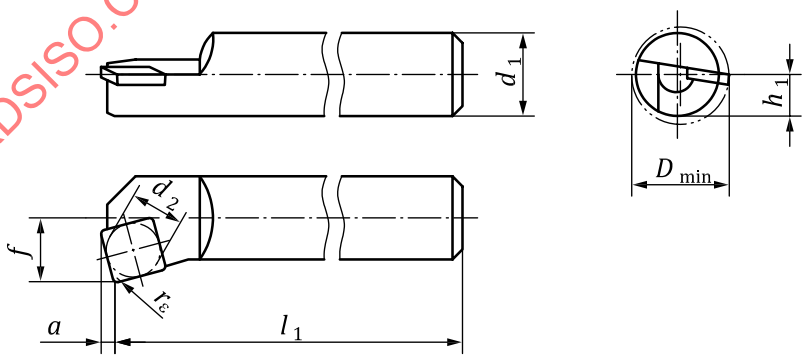
Table 9 *(continued)*

Style	Illustration (sketch) Tool cutting edge angle κ_r Insert included angle ε_r		Symbols for the shank diameter d_1										Reference for dimensions ISO 5609 series
			8	10	12	16	20	25	32	40	50	60	
W	 $\kappa_r = 60°$	Designation of cutting edge length l		11	11	11	11 16	16	16	16 22	22	22 27	—
Y	 $\kappa_r = 85°$	Designation of cutting edge length l				09	09	09 12	12	12 15	15 19	15 19	—
NOTE	The arrows in the illustrations/figures show the primary direction of feed.												
a	Tools of style S may also be equipped with round inserts (shape R).												

6 Dimensions

6.1 Diameter of shank, d_1, dimension, f, and length, l_1

Table 10 contains the dimensions, f, length, l_1, and the smallest possible internal diameter, D_{min}, for operating in relation to the relevant shank diameter, d_1; see Figure 2.



$h_1 = \frac{d_1}{2}$, if the boring bar has a standard design (see 4.2), or

$h_1 = \frac{h}{2}$, if the boring bar is equipped with flats in the direction of h (see Table 3)

Figure 2 — Tool holder, style K

Table 10 —

Dimensions in millimetres

d_1	f [a]	l_1 [b]	D_{min}
g7	$^{0}_{-0,25}$	k16	
8	6	80	11
10	7	100	13
12	9	125	16
16	11	150	20
20	13	180	25
25	17	200	32
32	22	250	40
40	27	300	50
50	35	350	63
60	43	400	80

[a] For the identification of dimensions *f*, see 7.4.

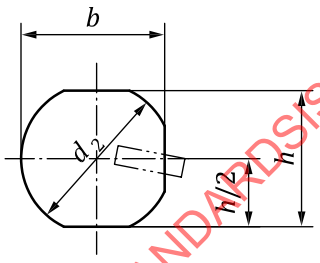
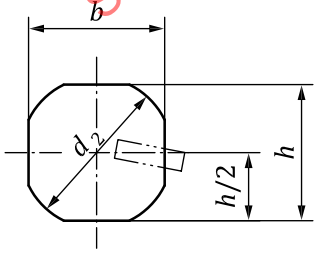
[b] For the identification of length l_1, see 7.3.

6.2 Profile of the shank

The standard design of the shanks is with circular profile without flats. Shanks with one to four flats on the shank may be provided at the discretion of the manufacturer or by agreement. Flats shall be in accordance with the dimensions given in Table 11.

Table 11 —

Dimensions in millimetres

Shape of the boring bar flats	d_1	8	10	12	16	20	25	32	40	50	60
	b[a]	7,6	9,5	11,5	15	19	24	31	39	48,5	58,5
one flat in direction of shank width *b*	h[a]	7,2	9	11	14	18	23	30	38	47	57
	b[a]	7,2	9	11	14	18	23	30	38	47	57
two flats in direction of shank width *b*	h[a]	7,2	9	11	14	18	23	30	38	47	57

[a] General tolerances in accordance with ISO 2768 — m.

7 Identification of dimensions

7.1 Cutting edge corners

7.1.1 Cutting edge corner *K*

The specified point, *K*, is defined as follows.

Consider plane P_f (assumed working plane) and P_s (tool cutting edge plane) in accordance with ISO 3002-1 for a selected point on the major cutting edge (for example point of tangency of major cutting edge with inscribed circle).

a) For $\kappa_r \leq 90°$, point *K* is defined as the intersection of plane, P_s, a plane parallel to plane, P_f , tangent to the corner radius and a plane containing the tool face A_γ (see Figures 3 and 4).

b) For $\kappa_r > 90°$, point *K* is defined as the intersection of a plane parallel to plane P_f, tangent to the corner radius, a plane perpendicular to plane P_f tangent to the corner radius and a plane containing the tool face A_γ (see Figures 5 and 6).

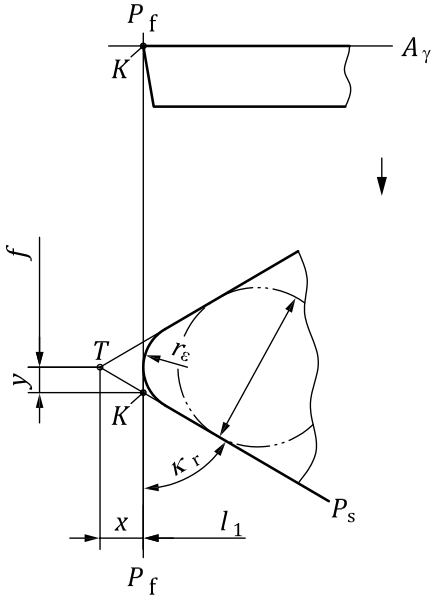


Figure 3 — Cutting edge angle $\kappa_r \leq 90°$, with transverse feed for side cutting

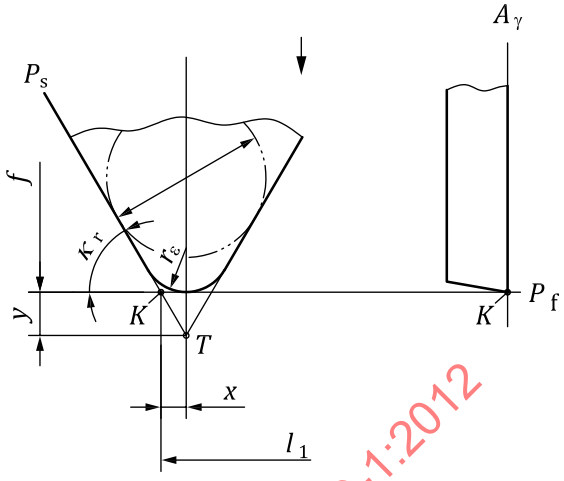


Figure 4 — Cutting edge angle $\kappa_r \leq 90°$, with longitudinal feed for end cutting

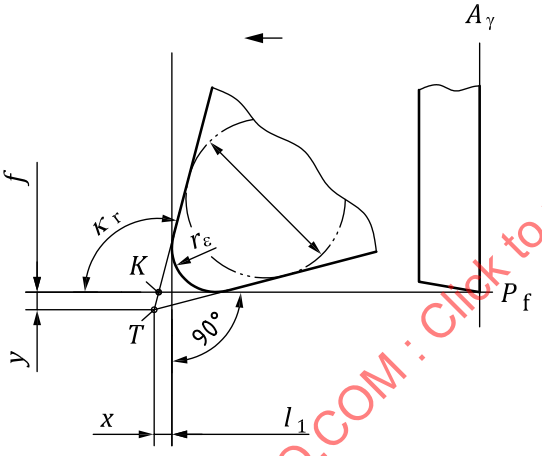


Figure 5 — Cutting edge angle $\kappa_r > 90°$, with transverse feed for side cutting

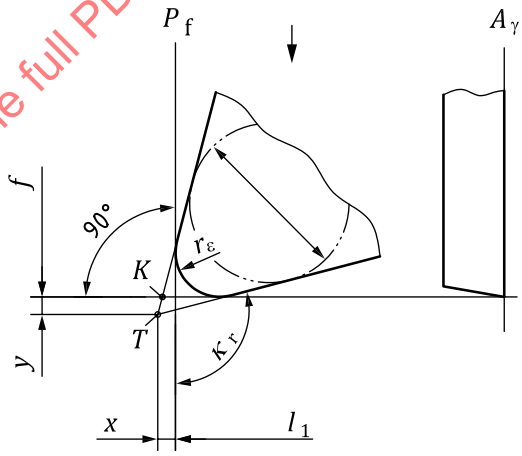


Figure 6 — Cutting edge angle $\kappa_r > 90°$, with longitudinal feed for end cutting

7.1.2 Theoretical cutting edge corner *T*

The intersection of the theoretical extensions of major cutting edge and minor cutting edge is considered the theoretical cutting edge corner, *T*; see Figures 3 to 6.

NOTE The position of the theoretical corner, *T*, is independent of the corner radius, r_ε, of the indexable insert.

7.2 Corner radius, r_ε, of master indexable inserts

The corner radius, r_ε, of the master indexable insert is a function of the size of the tool holder and its associated indexable insert and is, therefore, related to the diameter, d_2, of the inscribed circle in Table 12.

Table 12 gives the values of the corner radius, r_ε, of the master indexable insert (master gauge) and these values shall be used for the definition and testing of length, l_1, dimension, *f*, and height h_1.

Table 12 —

Dimensions in millimetres

d_2	r_ε **Nominal dimension**[a]
6,35	0,4
7,94	
9,525	0,8
12,7	
15,875	1,2
19,05	
25,4	2,4

[a] The correction values x and y in Table 5 are derived from the accurate values of the corner radii r_ε = 0,397 mm; 0,794 mm, 1,191 mm and 2,381 mm, which correspond to the dimensions in inches.

7.3 Length l_1

The length, l_1 (for values, see Table 10) is the distance between the specified point, K, and the shank end (see Figures 2 to 6 and Table 13) measured on a master indexable insert with corner radius, r_ε, in accordance with Table 12.

For tool holders with indexable inserts with a corner radius, r_ε, deviating from Table 4, the modified length, l_1, shall be determined with correction value x as shown in Figures 2 to 5.

The correction value x (see Table 13) corresponds to the distance, measured parallel to the shank, between the specified point, K, and the theoretical corner T.

The modified length is obtained from the length, l_1, given in Table 10 and the difference between the values of x from Table 5 for the new corner radius and the corner radius given in Table 12.

7.4 Dimension f

Dimension f (for values, see Table 10) is the distance between the specified point, K, to the centre of the tool holder shank (see Figures 2 to 6 and illustrations/figures in Table 13), measured on a master indexable insert with corner radius, r_ε, in accordance with Table 12.

For tool holders with indexable inserts with a corner radius, r_ε, deviating from Table 12, the modified dimension, f, shall be determined with correction value, y; for the values, see Table 5, as shown in Figures 3 to 6.

Correction value, y, corresponds to the distance between the specified point, K, and the theoretical cutting-edge corner, T, measured transverse to the shank.

The modified dimension, f, is obtained from the value given in Table 10 and the difference between the y-values given in Table 5 for the new corner radius and the corner radius given in Table 12.

7.5 Tolerances

The tolerances given in Table 10 refer to the length, l_1, and dimension, f, measured on a master indexable insert and, if applicable, on a master shim. Therefore, the tolerances for l_1 and f are not included in the tolerances on a indexable insert and, respectively, the shim.

7.6 Dimension *a*

7.6.1 General

Dimension *a* is related to the determination of the overall length of tool holder.

In general, the overall length, l_1, corresponds with the exception for style K tool holder and the overall width $f + \frac{d_1}{2}$.

For style K, the overall length of the tool holder is the sum of the l_1 and *a* values.

The dimension *a* is defined as the distance between the specified point, *K*, and the tangent on the second corner radius of the indexable insert, measured perpendicular to the shank length; see Figure 2 and Table 13.

7.6.2 Values for dimension *a*

The values for dimension *a* are given in ISO 5609-3 for style K tool holders and apply to indexable inserts with corner radii in accordance with 7.2, with rake angle $\gamma_a = 0°$ and inclination angle $\lambda_s = 0°$.

For tool holders with indexable inserts with corner radii deviating from the values given in Table 12, the modified dimension *a* shall be determined with correction value *x*; for the values of *x*, see Table 13.

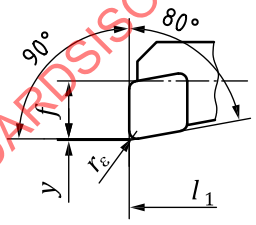
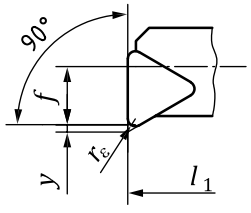
For the rake angle, γ_n, and cutting edge inclination angle, λ_s, varying between −6° and +6°, variations of the values for *a* are less than 0,1 mm and thus negligible.

7.7 Correction values *x* and *y*

The correction values, *x* and *y*, given in Table 13, apply to rake angle, $\gamma_n = 0°$, and cutting edge inclination, $\lambda_s = 0°$. Rake angles, γ_n, and cutting edge inclinations, λ_s varying between −6° and +6° result in variations from the *x*- and *y*-values in the range of 0,001 mm to 0,01 mm, which are significantly smaller than the tolerances on l_1 and *f*. If necessary, the correction values shall be determined.

Table 13 —

Dimensions in millimetres

Style	Illustration/Figure	r_ε	*x*	*y*
F		0,2	—	0,039
		0,4	—	0,076
		0,8	—	0,152
		1,2	—	0,228
		1,6	—	0,305
		2,4	—	0,457
		0,2	—	0,149
		0,4	—	0,291
		0,8	—	0,581
		1,2	—	0,872
		1,6	—	1,162
		2,4	—	1,743