INTERNATIONAL STANDARD

ISO 6987

First edition
1998-07-01

Indexable hard material inserts with rounded corners, with partly cylindrical fixing hole — Dimensions

Plaquettes amovibles en matériaux durs avec arrondi de pointe et trou de fixation partiellement cylindrique — Dimensions

Reference number
ISO 6987:1998(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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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.

International Standard ISO 6987 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 6987 cancels and replaces the ISO 6987-1:1983, ISO 6987-2:1990 and ISO/TR 6987-3:1990, which have been technically revised.

Annexes A, B and C form an integral part of this International Standard. Annex D is for information only.

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Indexable hard material inserts with rounded corners, with partly cylindrical fixing hole — Dimensions

1 Scope

This International Standard specifies the dimensions of hard material inserts with rounded corners, and with a partly cylindrical fixing hole. These inserts are primarily intendend to be mounted on turning and boring tools by a countersunk head screw or any other fixing element, such as a pin lock.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 513:1991, *Application of hard cutting materials for machining by chip removal — Designation of the main groups of chip removal and groups of application.*

ISO 1832:1991, *Indexable inserts for cutting tools — Designation.*

3 Types of insert

The types of indexable hard material insert specified in this International Standard are the following:

– TC: triangular inserts, with 7° normal clearance;

– TP: triangular inserts, with 11° normal clearance;

– SC: square inserts, with 7° normal clearance;

– SP: square inserts, with 11° normal clearance;

– CC: rhombic inserts, with 7° normal clearance and 80° included angle;

– CP: rhombic inserts, with 11° normal clearance and 80° included angle;

– DC: rhombic inserts, with 7° normal clearance and 55° included angle;

– VB: rhombic inserts, with 5° normal clearance and 35° included angle;

– VC: rhombic inserts, with 7° normal clearance and 35° included angle;

– RC: round inserts, with 7° normal clearance;

– RP: round inserts, with 11° normal clearance;

– WC: hexagonal (trigon) inserts, with 7° normal clearance and 80° included angle.

Inserts dealt with in this International Standard are standardized with chip breakers on the face (designated by letter T) and without chip breakers (designated by letter W).

At present, neither the shape nor the dimensions of chip breakers are standardized. Thus, if necessary, special features have to be explained with a diagram or additional specifications.

Tables C.1 to C.4 give the range of sizes for these inserts.

4 Interchangeability

4.1 Tolerances

The indexable hard material inserts which are the subject of this International Standard are provided in tolerance class M and for VC-shape inserts also in tolerance class G in accordance with ISO 1832.

The values of tolerance class G are in accordance with 4.3 of ISO 1832:1991, and the values of tolerance class M are given in annex A.

Other tolerances are included in table 1 for hole dimensions and in tables 3 to 12 for insert dimensions.

4.2 Thickness *s* of inserts with chip breakers

The thickness *s* of inserts with chip breakers is defined as the distance between the cutting edge at the corner and the supporting surface of the insert; see figure 1.

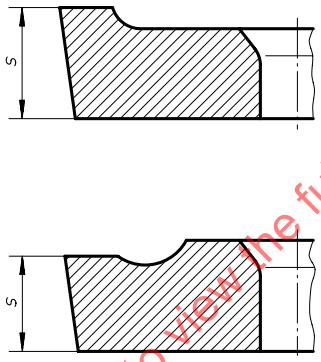


Figure 1

4.3 Fixing hole

In order to guarantee interchangeability when mounting the insert by a countersunk head screw having a head taper angle between 40° and 60°, the form of the hole is partly cylindrical and its dimensions are related to the diameter of the inscribed circle of the insert. Figure 2 and table 1 give the elements of definition of the fixing hole.

The position of point P is given by diameter d_2 (table 1), the distance t, measured from the cutting edge at the corner, and dimension c, measured from the upper face.

The ranges of dimensions t and c are as follows:

$$0{,}05\ d_1 \leqslant t \leqslant 0{,}3\ d_1$$

and

$$0{,}15\ d_1 \leqslant c \leqslant 0{,}3\ d_1$$

These dimensions take into account three cases: indexable inserts with upper faces below the cutting edges [figure 2a)]; with upper faces on the same level as the cutting edges [figure 2b)]; with upper faces above the cutting edges [figure 2c)].

The dimensions of t and c shall be satisfied in all 3 cases.

The diameter d_1 of the cylindrical part of the hole is given in table 1.

The part of the profile between d_1 and P is left at the manufacturer's discretion but shall satisfy the following requirements:

– the use of screws with head taper angle β between 40° and 60° shall be possible;

– the angle of the tangent theoretical taper at point P has the value $\varphi \geqslant 65°$;

– the distance between the contact line with a screw having 40° head taper angle and the contact line with a screw having 60° head taper angle shall be as small as possible.

The part of the profile above point P is left at the manufacturer's discretion.

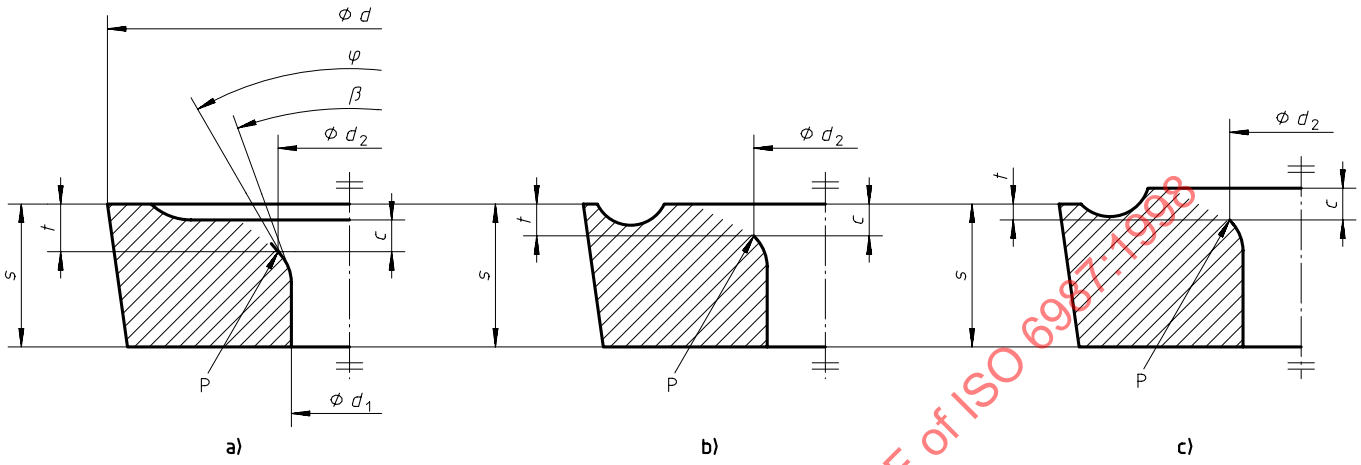


Figure 2

Table 1 — Dimensions of the hole

Dimensions in millimetres

d	for insert shape	T, S, C, D, V, W	4,76	5,56	6,35	7,94	9,525	12,7	15,875	19,05	25,4	–
		R	–	–	6	8	10/12	–	16	20	25	32
d_1 JS13			2,15	2,5	2,8	3,4	4,4	5,5	5,5	6,5	8,6	8,6
d_2 JS13			2,7	3,3	3,75	4,5	6	7,5	7,5	9	12	12

5 Designation and marking

5.1 Designation

The designation of the indexable hard material inserts which form the subject of this International Standard shall conform to ISO 1832.

In addition to this designation, one or both of the following may be indicated:

– the symbol of the group of application, in accordance with ISO 513;

– the commercial designation of the hard material grade.

5.2 Marking

The following symbol, at least, shall be marked on the insert itself (except when this would be difficult to carry out on small inserts):

– symbol of the group of application, or commercial designation of the hard material grade (or both, if possible, on large inserts).

6 Measurement

Annex B indicates the methods of measuring the dimension m of the indexable inserts covered by this International Standard.

7 Recommended dimensions

The choice of the more common dimensions is restricted to the values given in tables 3 to 12. It is strongly recommended that these standard inserts be used wherever possible (first preference). When other inserts are required, their dimensions shall be selected from the non-shaded areas of tables C.1 to C.4 (second preference). Inserts having dimensions given in the shaded areas of this table are not recommended.

NOTE — The m-dimensions are calculated using the exact values of the corner radius r_ε given in table 2, rounded to the third decimal place.

Table 2 — Exact values of r_ε

Designation of r_ε	**02**	**04**	**08**	**12**	**16**	**20**	**24**	**32**
Exact value of r_ε, mm	0,203 2 [1)]	0,397	0,794	1,191	1,588	1,984	2,381	3,175
1) Rounded to the fourth decimal place.								

7.1 Triangular inserts (TC)

TCMW
without chip breakers

TCMT
with chip breakers

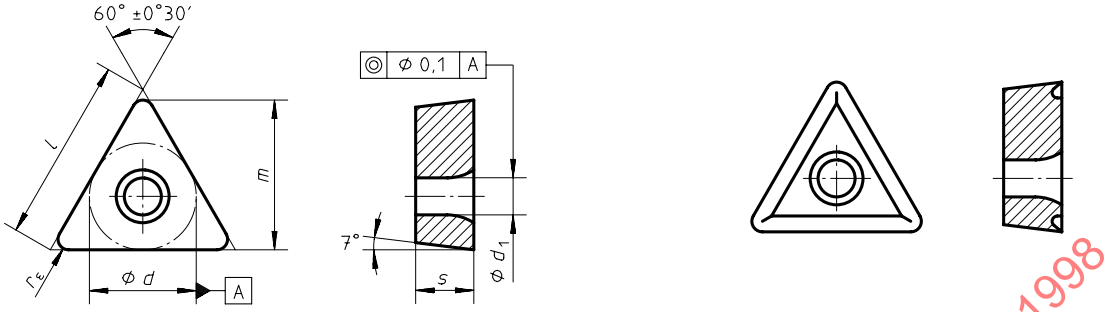


Table 3 — Dimensions of triangular inserts (TC)

Dimensions in millimetres

Inserts		l ≈	d 1)	s 1)	m 1)	r_ε ± 0,1	d_1 JS13
TCMW 090204	TCMT 090204	9,6	5,56	2,38	7,943	0,4	2,5
TCMW 110202	TCMT 110202	11	6,35		9,322	0,2	2,8
TCMW 110204	TCMT 110204				9,128	0,4	
TCMW 130304	TCMT 130304	13,6	7,94	3,18	11,51	0,4	3,4
TCMW 130308	TCMT 130308				11,113	0,8	
TCMW 16T304	TCMT 16T304	16,5	9,525	3,97	13,891	0,4	4,4
TCMW 16T308	TCMT 16T308				13,494	0,8	
TCMW 16T312	TCMT 16T312				13,097	1,2	
TCMW 220404	TCMT 220404	22	12,7	4,76	18,653	0,4	5,5
TCMW 220408	TCMT 220408				18,256	0,8	
TCMW 220412	TCMT 220412				17,859	1,2	
TCMW 220416	TCMT 220416				17,463	1,6	

1) Tolerance on d, s and m in accordance with ISO 1832. See annex A.

7.2 Triangular inserts (TP)

TPMW
without chip breakers

TPMT
with chip breakers

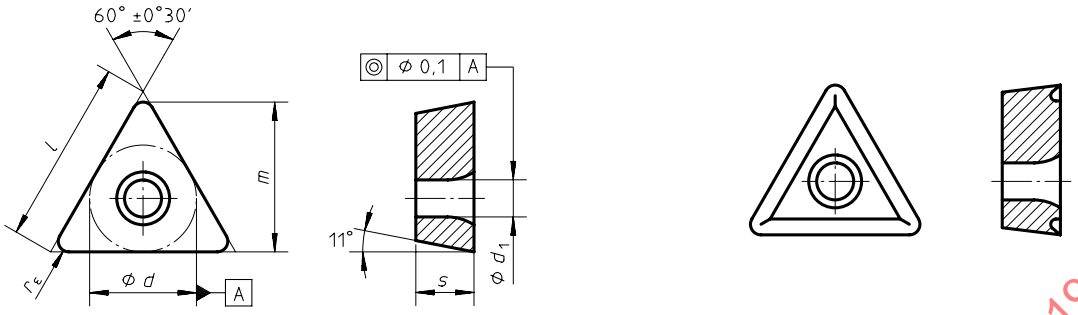


Table 4 — Dimensions of triangular inserts (TP)

Dimensions in millimetres

Inserts		l ≈	d 1)	s 1)	m 1)	r_ε ± 0,1	d_1 JS13
TPMW 090202	**TPMT 090202**	9,6	5,56	2,38	8,131	0,2	2,5
TPMW 090204	**TPMT 090204**				7,943	0,4	
TPMW 110202	**TPMT 110202**	11	6,35	2,38	9,322	0,2	2,8
TPMW 110204	**TPMT 110204**				9,128	0,4	
TPMW 130304	**TPMT 130304**	13,6	7,94	3,18	11,51	0,4	3,4
TPMW 130308	**TPMT 130308**				11,113	0,8	
TPMW 16T304	**TPMT 16T304**	16,5	9,525	3,97	13,891	0,4	4,4
TPMW 16T308	**TPMT 16T308**				13,494	0,8	

1) Tolerance on d, s and m in accordance with ISO 1832. See annex A.

7.3 Square inserts (SC)

SCMW
without chip breakers

SCMT
with chip breakers

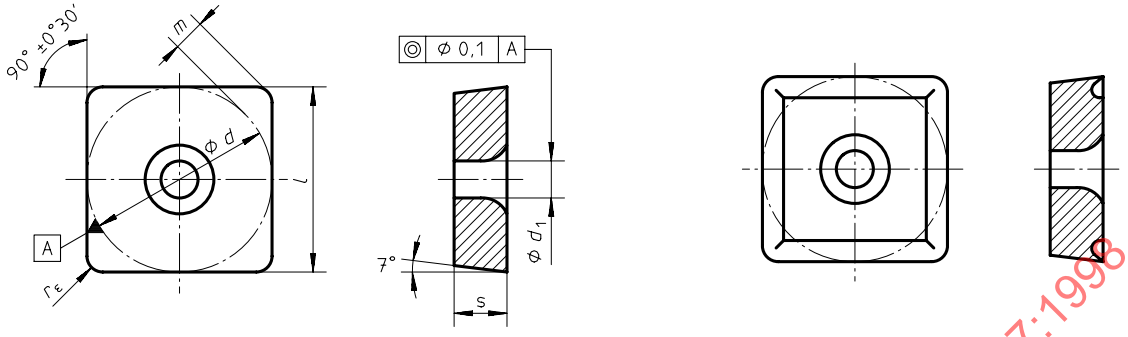


Table 5 — Dimensions of square inserts (SC)

Dimensions in millimetres

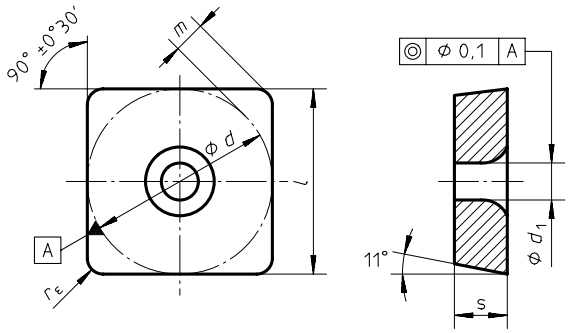
Inserts		d 1)	s 1)	m 1)	r_ε ± 0,1	d_1 JS13
SCMW 09T304	**SCMT 09T304**	9,525	3,97	1,808	0,4	4,4
SCMW 09T308	**SCMT 09T308**			1,644	0,8	
SCMW 120404	**SCMT 120404**	12,7	4,76	2,466	0,4	5,5
SCMW 120408	**SCMT 120408**			2,301	0,8	
SCMW 120412	**SCMT 120412**			2,137	1,2	
SCMW 150512	**SCMT 150512**	15,875	5,56	2,795	1,2	5,5
SCMW 150516	**SCMT 150516**			2,63	1,6	
SCMW 190612	**SCMT 190612**	19,05	6,35	3,452	1,2	6,5
SCMW 190616	**SCMT 190616**			3,288	1,6	
SCMW 190624	**SCMT 190624**			2,959	2,4	

1) Tolerance on d, s and m in accordance with ISO 1832. See annex A.

7.4 Square inserts (SP)

SPMW
without chip breakers

SPMT
with chip breakers



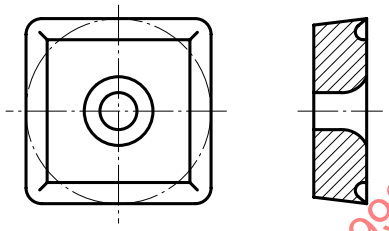


Table 6 — Dimensions of square inserts (SP)

Dimensions in millimetres

Inserts		d 1)	s 1)	m 1)	r_ε ± 0,1	d_1 JS13
SPMW 090304	**SPMT 090304**	9,525	3,18	1,808	0,4	4,4
SPMW 090308	**SPMT 090308**			1,644	0,8	
SPMW 09T304	**SPMT 09T304**	9,525	3,97	1,808	0,4	4,4
SPMW 09T308	**SPMT 09T308**			1,644	0,8	

1) Tolerance on d, s and m in accordance with ISO 1832. See annex A.

7.5 Rhombic inserts with 80° included angle (CC)

CCMW
without chip breakers

CCMT
with chip breakers

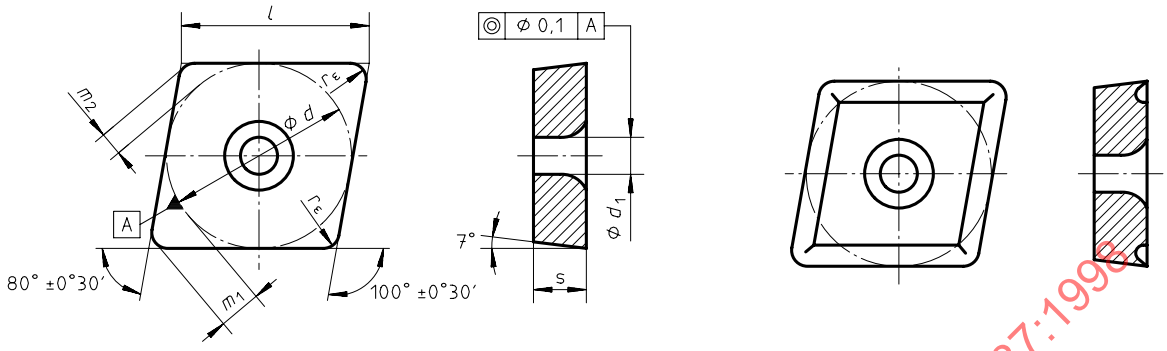


Table 7 — Dimensions of rhombic inserts with 80° included angle (CC)

Dimensions in millimetres

Inserts		l ≈	d 1)	s 1)	m_1 1)	m_2 1)	r_ε ± 0,1	d_1 JS13
CCMW 060202	**CCMT 060202**	6,4	6,35	2,38	1,652	0,908	0,2	2,8
CCMW 060204	**CCMT 060204**				1,544	0,848	0,4	
CCMW 080304	**CCMT 080304**	8,1	7,94	3,18	1,986	1,091	0,4	3,4
CCMW 080308	**CCMT 080308**				1,765	0,97	0,8	
CCMW 09T304	**CCMT 09T304**	9,7	9,525	3,97	2,426	1,333	0,4	4,4
CCMW 09T308	**CCMT 09T308**				2,206	1,212	0,8	
CCMW 120404	**CCMT 120404**	12,9	12,7	4,76	3,308	1,818	0,4	5,5
CCMW 120408	**CCMT 120408**				3,088	1,697	0,8	
CCMW 120412	**CCMT 120412**				2,867	1,576	1,2	
CCMW 160512	**CCMT 160512**	16,1	15,875	5,56	3,749	2,061	1,2	5,5
CCMW 160516	**CCMT 160516**				3,529	1,939	1,6	
CCMW 190612	**CCMT 190512**	19,3	19,05	6,35	4,632	2,545	1,2	6,5
CCMW 190616	**CCMT 190616**				4,411	2,424	1,6	
CCMW 190624	**CCMT 190624**				3,97	2,182	2,4	

1) Tolerance on d_1, s, m_1 and m_2 in accordance with ISO 1832. See annex A.

7.6 Rhombic inserts with 80° included angle (CP)

CPMW
without chip breakers

CPMT
with chip breakers

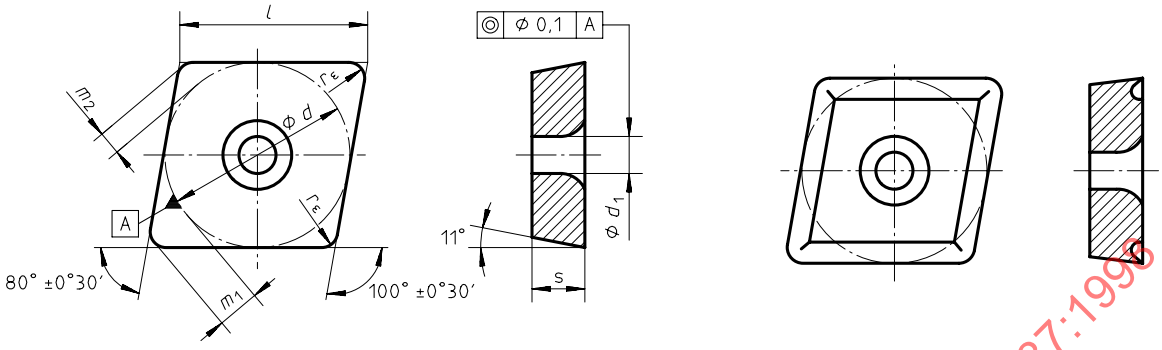


Table 8 — Dimensions of rhombic inserts with 80° included angle (CP)

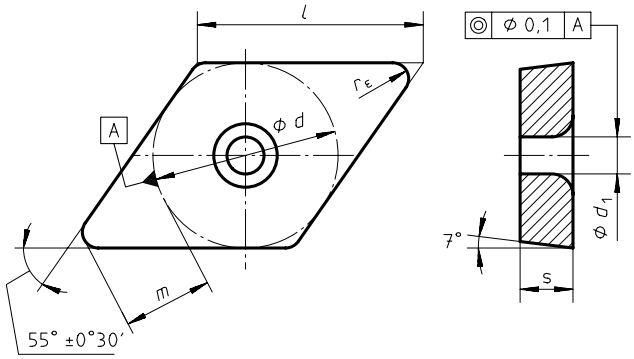
Dimensions in millimetres

Inserts		l ≈	d 1)	s 1)	m_1 1)	m_2 1)	r_ε ± 0,1	d_1 JS13
CPMW 04T102	CPMT 04T102	4,8	4,76	1,98	1,21	0,665	0,2	2,15
CPMW 04T104	CPMT 04T104				1,102	0,606	0,4	
CPMW 050202	CPMT 050202	5,6	5,56	2,38	1,432	0,787	0,2	2,5
CPMW 050204	CPMT 050204				1,324	0,728	0,4	
CPMW 060202	CPMT 060202	6,4	6,35	2,38	1,652	0,908	0,2	2,8
CPMW 060204	CPMT 060204				1,544	0,848	0,4	
CPMW 080304	CPMT 080304	8,1	7,94	3,18	1,986	1,091	0,4	3,4
CPMW 080308	CPMT 080308				1,765	0,97	0,8	
CPMW 090304	CPMT 090304	9,7	9,525	3,18	2,426	1,333	0,4	4,4
CPMW 090308	CPMT 090308				2,206	1,212	0,8	
CPMW 09T304	CPMT 09T304	9,7	9,525	3,97	2,426	1,333	0,4	4,4
CPMW 09T308	CPMT 09T308				2,206	1,212	0,8	

1) Tolerance on d, s and m_1 and m_2 in accordance with ISO 1832. See annex A.

7.7 Rhombic inserts with 55° included angle (DC)

DCMW
without chip breakers



DCMT
with chip breakers

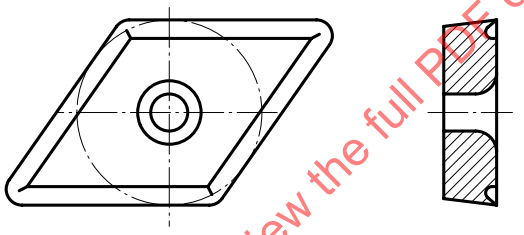


Table 9 — Dimensions of rhombic inserts with 55° included angle (DC)

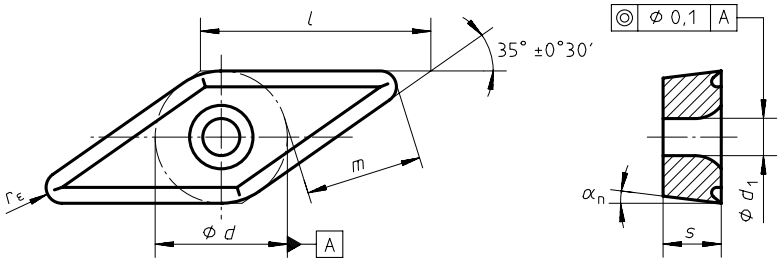
Dimensions in millimetres

Inserts		l ≈	d 1)	s 1)	m 1)	r_ε ± 0,1	d_1 JS13
DCMW 070202	**DCMT 070202**	7,75	6,35	2,38	3,464	0,2	2,8
DCMW 070204	**DCMT 070204**				3,238	0,4	
DCMW 11T304	**DCMT 11T304**	11,6	9,525	3,97	5,089	0,4	4,4
DCMW 11T308	**DCMT 11T308**				4,626	0,8	
DCMW 11T312	**DCMT 11T312**				4,164	1,2	
DCMW 150404	**DCMT 150404**	15,5	12,7	4,76	6,939	0,4	5,5
DCMW 150408	**DCMT 150408**				6,477	0,8	
DCMW 150412	**DCMT 150412**				6,014	1,2	
DCMW 150416	**DCMT 150416**				5,552	1,6	

1) Tolerance on d, s and m in accordance with ISO 1832. See annex A.

7.8 Rhombic inserts with 35° included angle (VB and VC)

With chip breakers (VBMT, VCGT, VCMT)



Without chip breakers (VBMW, VCGW, VCMW)

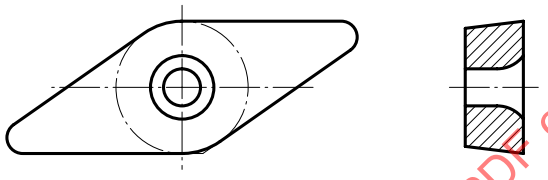


Table 10 — Dimensions of rhombic inserts with 35° included angle (VB and VC)

Dimensions in millimetres

Inserts		l ≈	d 1)	s 1)	m 1)	r_ε ± 0,1	d_1 JS 13	α_n ±1°
VBMW 110302	**VBMT 110302**	11,1	6,35	3,18	6,911	0,2	2,8	5°
VBMW 110304	**VBMT 110304**				6,46	0,4		
VBMW 160404	**VBMT 160404**	16,6	9,525	4,76	10,152	0,4	4,4	
VBMW 160408	**VBMT 160408**				9,229	0,8		
VBMW 160412	**VBMT 160412**				8,306	1,2		
VCGW 110304	**VCGT 110304**	11,1	6,35	3,18	6,46	0,4	2,8	7°
VCMW 110304	**VCMT 110304**							
VCGW 160404	**VCGT 160404**	16,6	9,525	4,76	10,152	0,4	4,4	
VCGW 160408	**VCGT 160408**				9,229	0,8		
VCMW 160404	**VCMT 160404**				10,152	0,4		
VCMW 160408	**VCMT 160408**				9,229	0,8		

1) Tolerance on d, s and m in accordance with ISO 1832. See annex A.

7.9 Round inserts (RC)

RCMT
with chip breakers

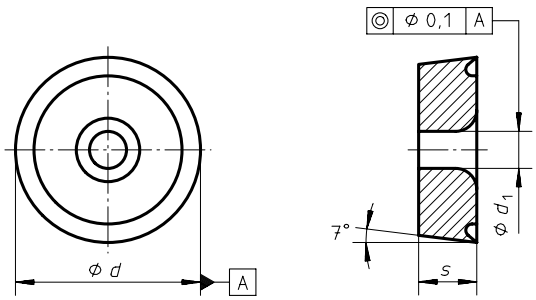


Table 11 — Dimensions of round inserts (RC)

Dimensions in millimetres

Insert	d [1]	s [1]	d_1 JS13
RCMT 0602M0	6	2,38	2,8
RCMT 0803M0	8	3,18	3,4
RCMT 10T3M0	10	3,97	4,4
RCMT 1204M0	12	4,76	4,4
RCMT 1605M0	16	5,56	5,5
RCMT 2006M0	20	6,35	6,5
RCMT 2507M0	25	7,94	8,6
RCMT 3209M0	32	9,52	8,6

1) Tolerance on d and s according to ISO 1832. See annex A.

7.10 Round inserts (RP)

RPMT
with chip breakers

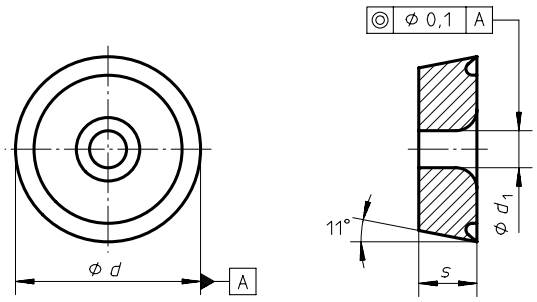


Table 12 — Dimensions of round inserts (RP)

Dimensions in millimetres

Inserts	d [1]	s [1]	d_1 JS13
RPMT 0803M0	8	3,18	3,4
RPMT 10T3M0	10	3,97	4,4

1) Tolerance on d and s in acordance with ISO 1832. See annex A.

7.11 Hexagonal (trigon) inserts with 80° included angle (WC)

WCMT
with chip breakers

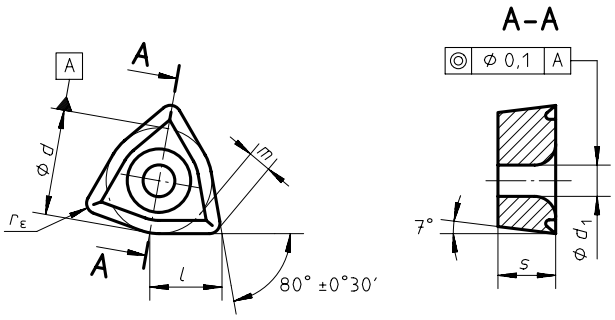


Table 13 — Dimensions of hexagon (trigon) inserts with 80° included angle (WC)

Dimensions in millimetres

Designation	l ≈	d 1)	s 1)	m 1)	r_ε ± 0,1	d_1 JS13
WCMT L3T102	3,26	4,76	1,98	1,21	0,2	2,15
WCMT L3T104				1,102	0,4	
WCMT 030202	3,8	5,56	2,38	1,432	0,2	2,5
WCMT 030204				1,324	0,4	
WCMT 040202	4,34	6,35	2,38	1,651	0,2	2,8
WCMT 040204				1,544	0,4	
WCMT 050304	5,43	7,94	3,18	1,986	0,4	3,4
WCMT 050308				1,765	0,8	
WCMT 06T304	6,52	9,525	3,97	2,426	0,4	4,4
WCMT 06T308				2,205	0,8	
WCMT 080408	8,69	12,7	4,76	3,087	0,8	5,5
WCMT 080412				2,867	1,2	

1) Tolerance in accordance with ISO 1832. See annex A.

Annex A
(normative)

Tolerances for d, m, m_1, m_2 and s (Extract from ISO 1832)

Table A.1 — Tolerances for d, m, m_1, m_2 and s

Dimensions in millimetres

Insert		Tolerance class M on		
Designation	d	d	m, m_1 and m_2	s
CPM. ..T1..	4,76	± 0,05	± 0,08	± 0,05[1)]
CPM. 04.. **WCM. L3..**				± 0,13
TPM. ..02.. **CPM. ..02..**	5,56	± 0,05	± 0,08	± 0,05[1)]
RPM. ..02..			–	
TPM. 09.. **TCM. 09..** **CPM. 05..** **WCM. 03..**			± 0,08	± 0,13
RCM. 06.. **RPM. 06..**	6	± 0,05	–	
TPM. 11.. **TCM. 11..** **CPM. 06..** **CCM. 06..** **WCM. 04..**	6,35	± 0,05	± 0,08	
DCM. 07..			± 0,11	
VBM. 11.. **VCM. 11..**			± 0,16[2)]	
TPM. 13.. **TCM. 13..** **CPM. 08..** **CCM. 08..** **WCM. 05..**	7,94	± 0,05	± 0,08	
RPM. 07..			–	
VCM. 13..			± 0,16[2)]	
RPM. 08.. **RCM. 08..**	8	± 0,05	–	

Table A.1 *(concluded)*

Insert		Tolerance class M on		
Designation	d	d	m, m_1 and m_2	s
TPM. 16.. **TCM. 16..** **SPM. 09..** **SCM. 09..** **CPM. 09..** **CCM. 09..** **WCM. 06..**	9,525	± 0,05	± 0,08	± 0,13
DCM. 11..			± 0,11	
RPM. 09..			–	
VBM. 16.. **VCM. 16..**			± 0,16[2]	
RPM. 10.. **RCM. 10..**	10	± 0,05	–	
RPM. 12..M0 **RCM. 12..**	12	± 0,08	–	
TCM. 22.. **SPM. 12..** **SCM. 12..** **CPM. 12..** **CCM. 12..** **WCM. 08..**	12,7	± 0,08	± 0,13	
DCM. 15..			± 0,15	
RPM. 12..00			–	
SCM. 15.. **CCM. 16..**	15,875	± 0,1	± 0,15	
RCM. 16..	16		–	
SCM. 19.. **CCM. 19..**	19,05		± 0,15	
RCM. 20..	20		–	
RCM. 25..	25	± 0,13	–	
RCM. 32..	32		–	

1) As an exception to ISO 1832.

2) This tolerance is included in an amendment of ISO 1832 : 1991, at present at the stage of draft.

Annex B
(normative)

Methods of measurement of dimension "m"

B.1 Triangular inserts

Dimension m is related to the side opposite the corner that is to be measured. The insert is placed on a surface plate as shown in figure B.1 and checked by means of a dial gauge zeroed with the aid of a gauge block corresponding to the dimension m. The dial gauge then gives a direct reading of the error when applied to the inserts to be measured.

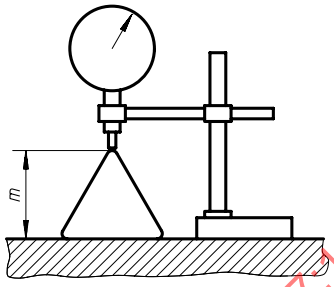


Figure B.1

B.2 Square inserts

Dimension m is checked by reference to the diameter d of a precision roller, where d corresponds to the nominal diameter of the inscribed circle of the insert. The insert is mounted on a 90° vee-block as shown in figure B.2 and checked by means of a dial gauge which has been zeroed to dimension m by means of a roller with the aid of a gauge block. The dial gauge then gives a direct reading of the error when applied to the inserts to be measured. The roller has a tolerance of ± 0,002 mm.

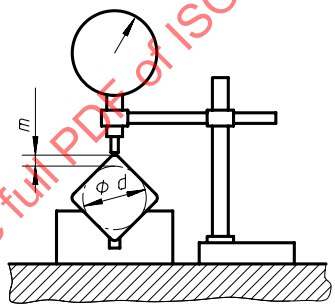
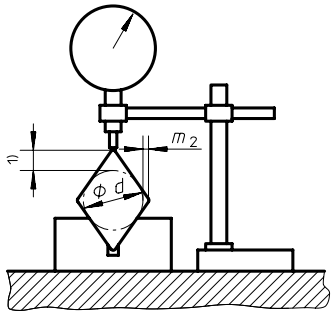


Figure B.2

B.3 Rhombic inserts

Dimension m, m_1 or m_2 is checked by reference to the diameter d of a precision roller, where d corresponds to the nominal size of the inscribed circle of the insert. The insert is mounted on a 35°, 55°, 80° or 100° vee-block as shown in figure B.3 and checked by means of a dial gauge which has been zeroed to dimension m, m_1 or m_2 by means of a roller with the aid of a gauge block. The dial gauge then gives a direct reading of the error when applied to the inserts to be measured. The roller has a tolerance of ± 0,002 mm.



1) m or m_1

Figure B.3

B.4 Round inserts

The diameter d is measured with a micrometer or a similar device.