



**DIAMANTWERKZEUGE FÜR DIE
HERSTELLUNG VON SCHMUCKRINGEN**
UMFANGREICHES WERKZEUGPORTFOLIO

**DIAMOND TOOLS FOR THE
MANUFACTURE OF JEWELLERY RINGS**
EXTENSIVE TOOL PORTFOLIO



DER UNTERSCHIED: MEHR MÖGLICHKEITEN

THE DIFFERENCE:
MORE POSSIBILITIES

- **Vollumfängliches Werkzeugprogramm
für die Schmuckringfertigung**

Complete range of tools for jewellery
ring production

- **Hochpräzise Schneidkanten in
MKD- und PKD-Ausführung**

High-precision cutting edges in
MCD and PCD versions

- **Reduzierte Rüstzeit durch
Präzisionsplattensitz**

Reduced set-up time due to
precision insert seat

Das HORN-Ringprogramm ist eine Reihe von Diamantwerkzeugen für die Vor- und Fertigbearbeitung von Schmuckringen sowie die passenden Haltersysteme für die Außen- und Innenbearbeitung. Um eine sichere Hochglanz-Fertigbearbeitung mit monokristallinem Diamant zu gewährleisten, wurden die polykristallinen Schruppwerkzeuge vollständig neu konfiguriert. Diese sind nun in der Lage, alle Edelmetalle – einschließlich Platin und Iridium – wirtschaftlich zu bearbeiten.

Im Fokus der Ringfertigung stehen Benzinger-Maschinen, insbesondere die Modellreihe „GoRing“. In enger Zusammenarbeit wurde das Werkzeugkonzept entwickelt und über viele Jahre hinweg optimiert. Unsere Kunden schätzen das komfortable und hochpräzise HORN-Wechselsystem, das die Rüstzeiten auf ein Minimum reduziert. Selbstverständlich können und werden die HORN-Werkzeugsysteme auch auf allen anderen Werkzeugmaschinen erfolgreich eingesetzt.

Bewährte Werkzeuge wurden aus dem bisherigen Programm übernommen und umfangreich ergänzt. Die bestehenden Schnittstellen bleiben erhalten und werden durch das HORN-System 11P ergänzt. Dieses bietet neben einer höheren Präzision den Vorteil, dass Außen- und Innenbearbeitungen in einem Werkzeug vereint werden können. Weitere Halter für das System 11P finden Sie in unserem Katalog „Supermini und Mini – Innenbearbeitung“.

Neben unserem Standardprogramm nutzen unsere Kunden zahlreiche Sonderlösungen, die speziell auf ihre jeweiligen Anforderungen zugeschnitten sind.

The HORN ring programme is a range of diamond tools for the pre-finishing and finishing of jewellery rings, as well as the matching holder systems for external and internal finishing. To ensure reliable high-polish finishing with monocrystalline diamond, the polycrystalline roughing tools have been completely reconfigured. These are now capable of economically machining all precious metals, including platinum and iridium.

Benzinger machines, in particular the 'GoRing' model series, are the focus of ring production. The tool concept was developed in close cooperation and optimised over many years. Our customers appreciate the convenient and highly precise HORN exchange system, which reduces set-up times to a minimum. Of course, HORN tool systems can and are also used successfully on all other machine tools.

Proven tools have been carried over from the previous programme and extensively supplemented. The existing interfaces remain unchanged and are supplemented by the HORN 11P system. In addition to higher precision, this offers the advantage that external and internal machining can be combined in a single tool. Further holders for the 11P system can be found in our catalogue 'Supermini and Mini – Internal Machining'.

In addition to our standard range, our customers use numerous special solutions that are customised to their individual requirements.

PKD ist nicht gleich PKD

Not all PCD is the same

PKD ist ein Verbundschneidstoff. Diamantkörner, jedes für sich monokristallin, sind in einer Metallmatrix, in der Regel Kobalt, miteinander versintert. Innerhalb des Sinterprozesses kommt es zu einem interkristallinen Kornwachstum, bei dem im begrenzten Umfang die einzelnen Körner miteinander verwachsen und somit die Verschleißigenschaften im späteren Einsatz positiv beeinflussen.

Die Größe und Qualität der verwendeten Körner sind, neben der Sintertechnologie, Index für die Verschleißfestigkeit. Daraus leitet sich der theoretische Grundsatz ab „je größer das Korn, desto besser der Abrasionswiderstand“. Jedoch leidet dadurch die erreichbare Schneidkantenqualität, Schartigkeit und Schärfe, unabhängig der zur Schneidkantenherstellung verwendeten Fertigungstechnologie. Auch der prozentuale Volumenanteil der metallischen Bindephase steigt und wirkt sich negativ aus.

Das HORN-Hochleistung-PKD setzt sich aus einer ausgefeilten Mixtur unterschiedlicher Größen von Diamantkörnern zusammen. Der Volumenanteil von Diamant sowie die Wirkhärte, Zähigkeit und Schneidenqualität steigen. Strenge Qualitätsstandards und deren Kontrolle sind selbstverständlich und sorgen für maximale Leistung.

PCD is a compound cutting material. Diamond grains, each one of a monocrystalline nature, are sintered to each other in a metal matrix, generally cobalt. During the sintering process, the grains grow within the crystals and the individual grains grow together to a limited extent, thereby affecting the wear properties during subsequent use.

In addition to the sintering technology, the size and quality of the grains used are an indicator of wear resistance. It is possible to derive the following theoretical principle: "the larger the grain, the better the abrasion resistance". However, this compromises the cutting edge quality, chipping and sharpness that can be achieved, irrespective of the manufacturing technology used to produce the cutting edges. The percentage volume fraction of the metallic binding phase also increases and has a negative effect.

HORN high-performance PCD is composed of a sophisticated mixture of different diamond grain sizes. The volume fraction of diamond increases, as do effective hardness, toughness and cutting quality. Strict quality standards and their monitoring are a matter of course and ensure maximum performance.

Monokristalliner Diamant

Monocrystalline Diamond

Neben der hohen Härte von monokristallinen Diamanten ist vor allem das reine und homogene Gefüge Grundvoraussetzung für Ultrapräzisionszerspanung und Hochglanzbearbeitungen mit geometrisch bestimmter Schneide. Die extrem scharfen Schneiden lassen Oberflächengenauigkeiten < Rz 0,02 µm zu. Die Qualität der Schneide ist hierbei das Abbild der erreichbaren Oberflächengüte.

Bei der Herstellung der Werkzeuge wird besondere Beachtung auf die gitterorientierte, richtungsabhängigen Härtewerte der Einkristall-Diamanten gelegt. Nur so kann die maximale Standzeit erreicht werden. Die geometrische Auslegung der Schneide wird für die zu bearbeitenden Werkstoffe optimiert.

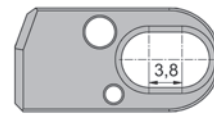
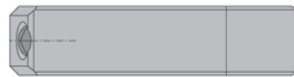
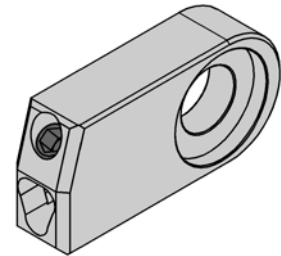
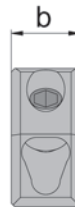
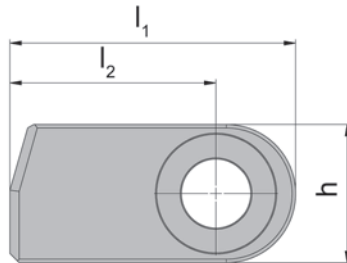
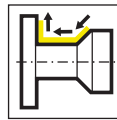
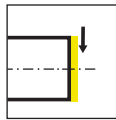
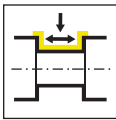
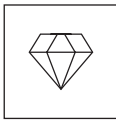
MKD-bestückte Werkzeuge sind prädestiniert für die Finish-Bearbeitung von Nichteisenmetallen und deren Legierungen, Edelmetallen wie Gold und Platin sowie transparenten Kunststoffen wie PMMA und PC. Eisenhaltige Metalle und faserverstärkte Kunststoffe hingegen sind grundsätzlich nicht für die Bearbeitung mit monokristallinem Diamant geeignet.

Ein umfangreiches Standardprogramm an MKD-bestückten Werkzeugen zum Drehen und Fräsen ist ab Lager verfügbar.

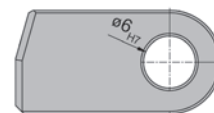
In addition to the high level of hardness demonstrated by monocrystalline diamonds, the pure and homogeneous structure in particular is a basic requirement for ultra- and high-precision machining with geometrically determined cutting edges. The extremely sharp cutting edges allow for surface accuracies of < Rz 0.02 µm. The quality of the cutting edge perfectly reflects the surface quality that can be achieved.

When it comes to manufacturing tools, particular attention is paid to the crystal-system-based, direction-dependent hardness values of monocrystalline diamonds. This is the only way of ensuring that the maximum tool life is achieved. The geometric design of the cutting edge is optimised for the materials to be machined. MCD tools are ideally suited to finishing processes for non-ferrous metals and their alloys, precious metals such as gold and platinum or transparent plastics such as PMMA and PC.

Ferrous metals and fibre-reinforced plastics are generally not suitable for machining with monocrystalline diamond. An extensive standard range of MCD tools for turning and milling are available from stock.

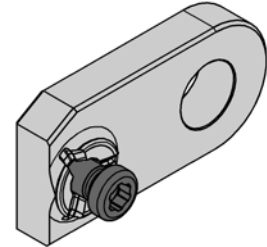
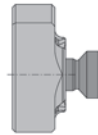
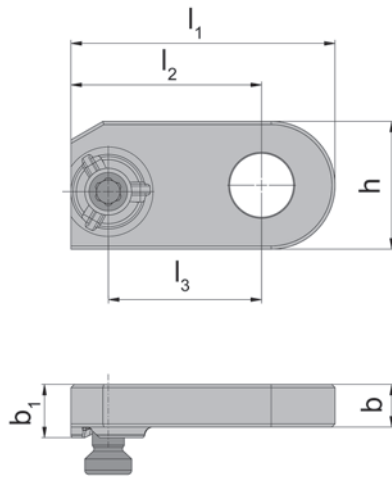
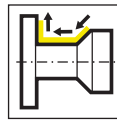
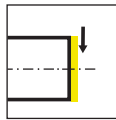
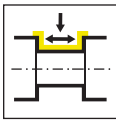
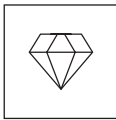


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P0.1R4.1206.3.A.24

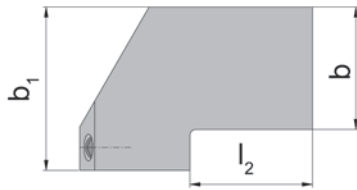
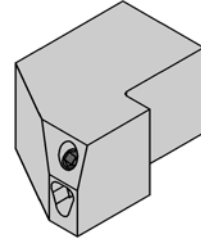
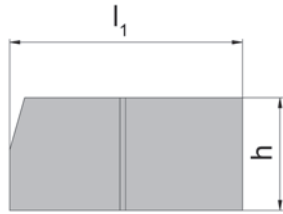
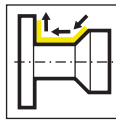
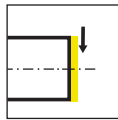
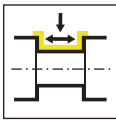
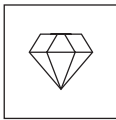
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R = rechts wie gezeichnet
R = right hand version shown

L = links spiegelbildlich
L = left hand version

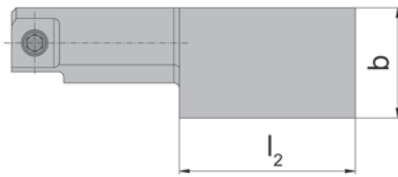
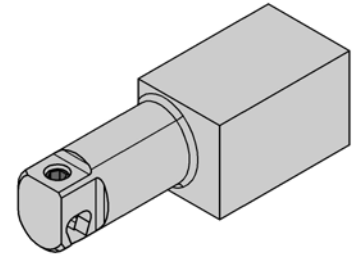
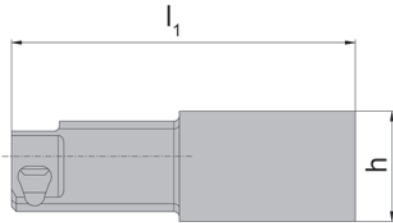
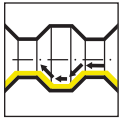
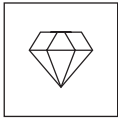
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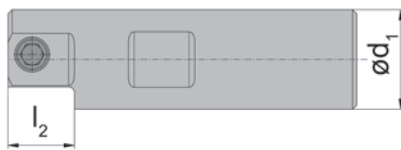
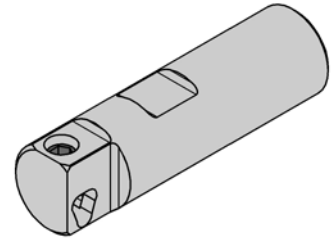
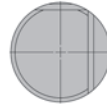
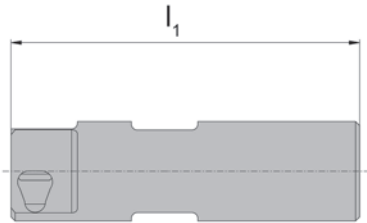
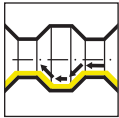
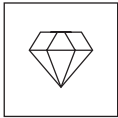
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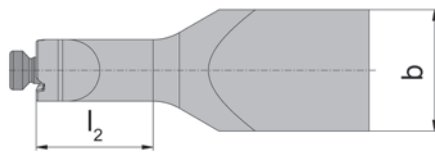
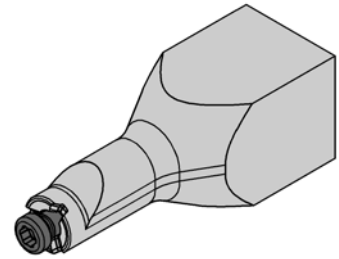
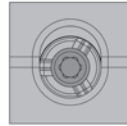
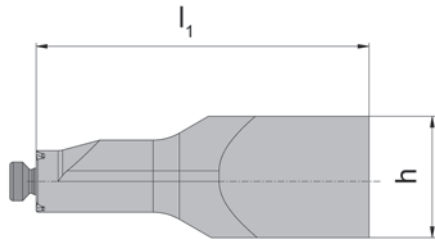
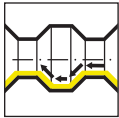
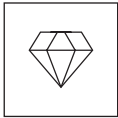
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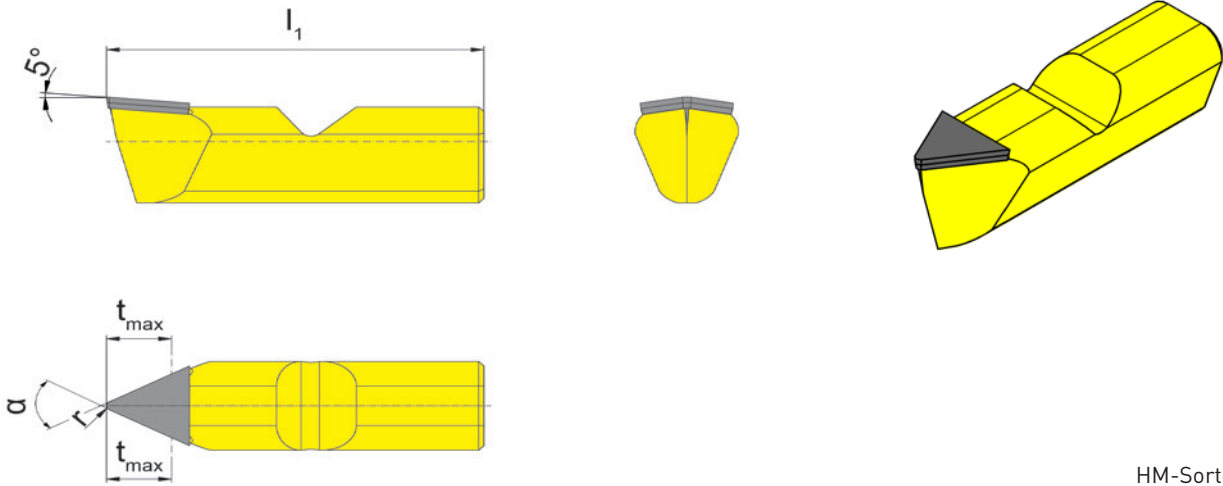
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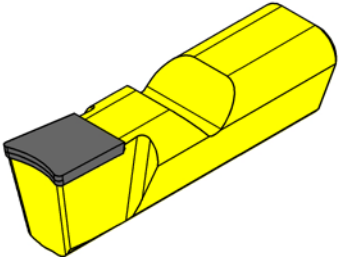
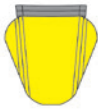
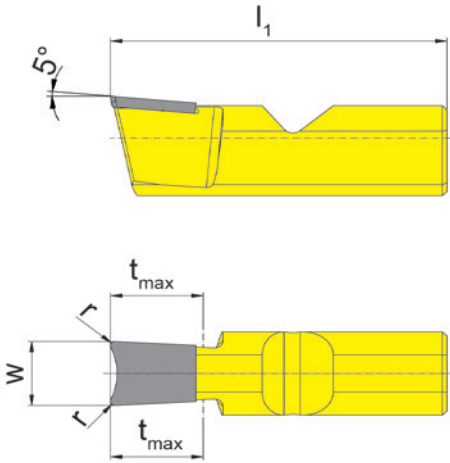


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

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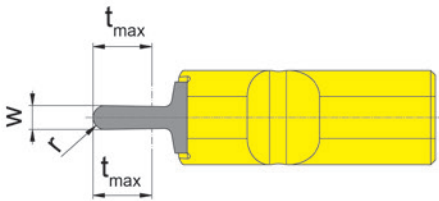
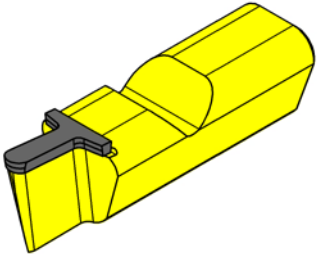
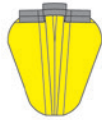
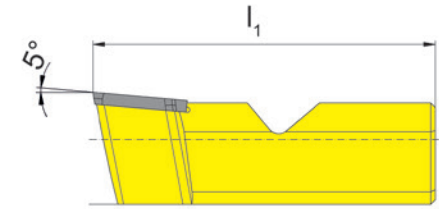
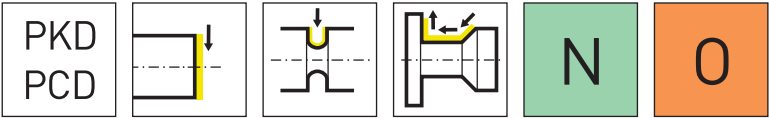


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

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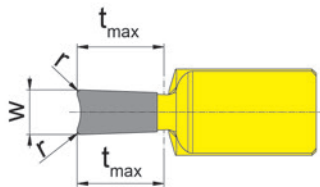
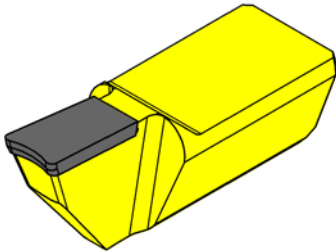
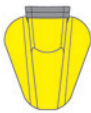
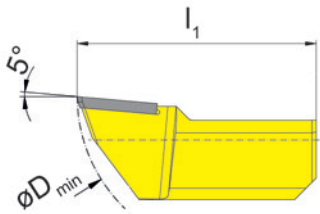


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

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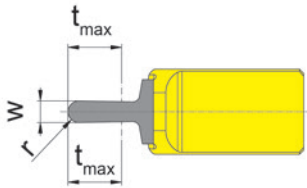
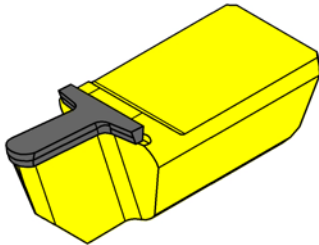
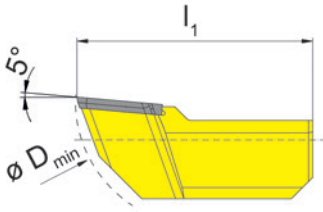
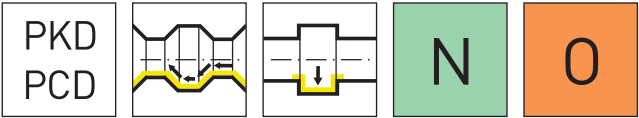


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	t _{max}	l ₁	D _{min}	HIS	PD11
1R4.PY.I.0002.W.20	2	0,2	4	11	12,7	1R403	▲

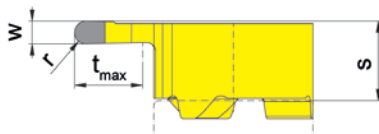
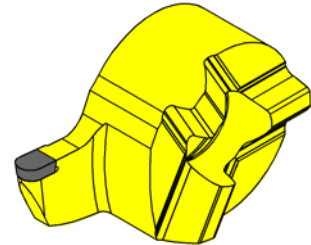
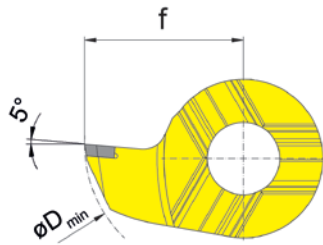
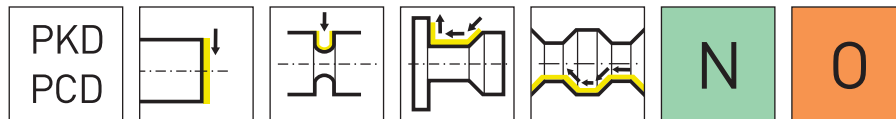


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	t_{max}	l_1	D_{min}	HIS	PD11
1R4.P.Y.I.0005.R.10	1	0,5	3	11	12,7	1R403	▲



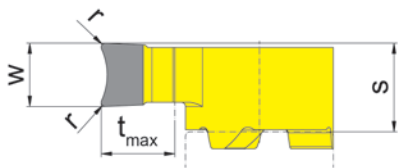
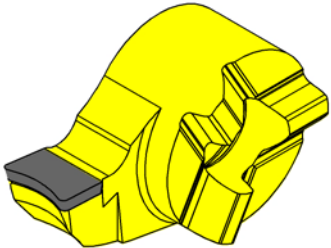
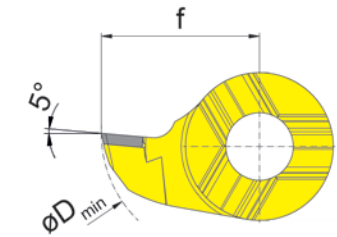
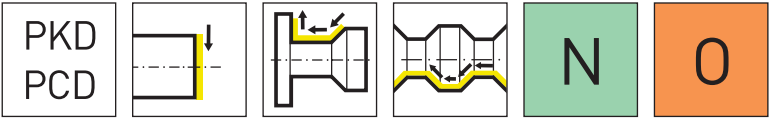
R = rechts wie gezeichnet
R = right hand version shown

L = links spiegelbildlich
L = left hand version

▲ ab Lager
on stock

HM-Sorten
Carbide grades
Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	s	t _{max}	f	D _{min}	HIS	PD11
R11P.P.Y.B.0005.R.10	1	0,5	3,5	3	7	11,5	11P070R	▲
L11P.P.Y.B.0005.R.10	1	0,5	3,5	3	7	11,5	11P070L	▲

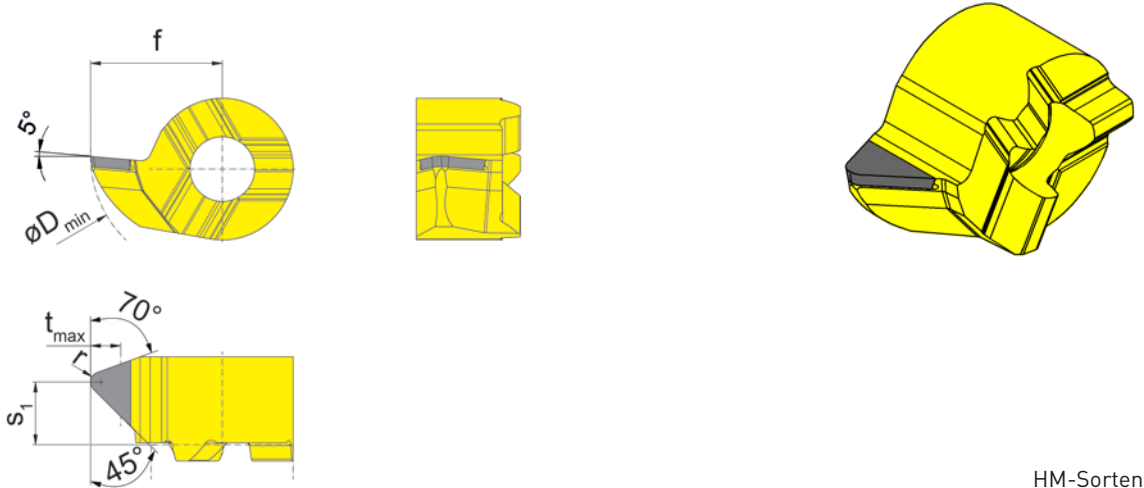


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	s	t _{max}	f	D _{min}	HIS	PD11
R11P.P.Y.B.0002.W.30	3	0,2	4,2	3,2	7,5	13	11P070R	▲



R = rechts wie gezeichnet
R = right hand version shown

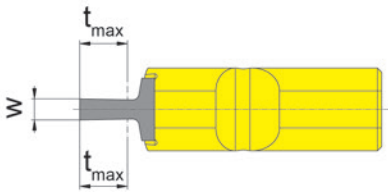
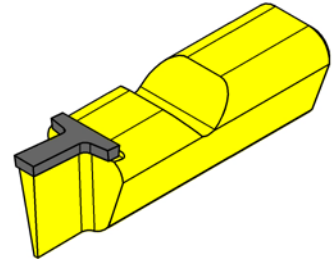
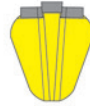
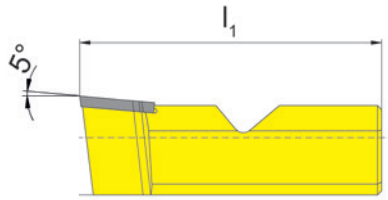
L = links spiegelbildlich
L = left hand version

HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	s	t _{max}	r	D _{min}	HIS	PD11
R11P.P.Y.B.0005.A.30	3,1	1,5	0,5	10,5	11P070R	▲
L11P.P.Y.B.0005.A.30	3,1	1,5	0,5	10,5	11P070L	▲

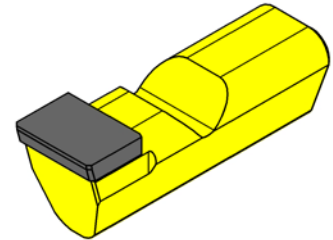
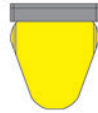
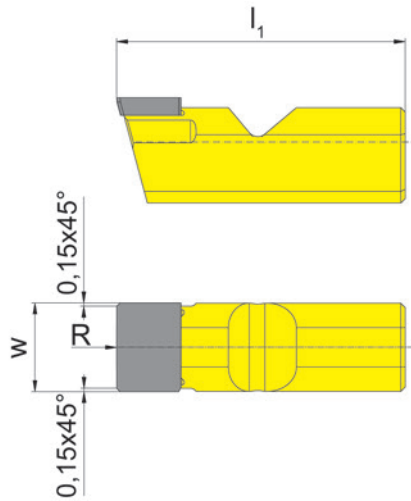


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	t_{max}	l_1	HIS	PD11
1R4.P.Y.A.0000.W.04	0,4	1	14,5	1R402	▲
1R4.P.Y.A.0000.W.06	0,6	1,2	14,5	1R402	▲
1R4.P.Y.A.0000.W.10	1	2,5	14,5	1R402	▲
1R4.P.Y.A.0000.W.20	2	2,5	14,5	1R402	▲
1R4.P.Y.A.0000.W.35	3,5	5,2	15,5	1R402	▲

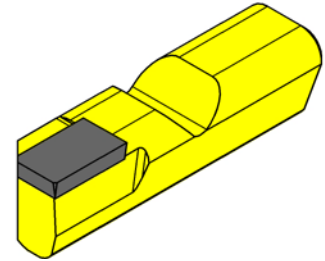
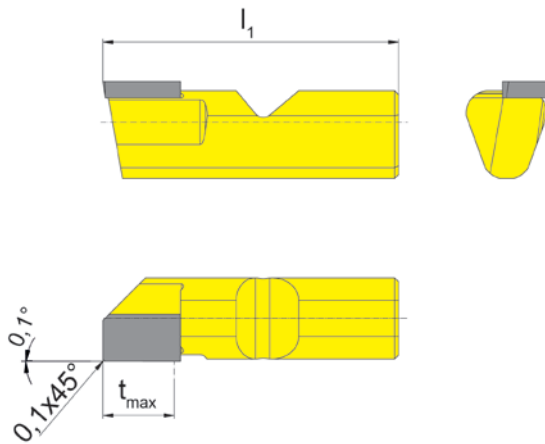
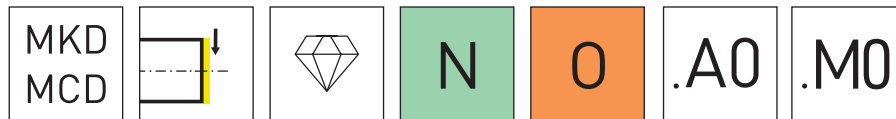


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	R	l ₁	HIS	MD10
1R4.M.A.A.3000.W.40	4	300	13	1R402	▲
1R4.M.K.A.3000.W.40	4	300	13	1R402	▲
1R4.M.M.A.3000.W.40	4	300	13	1R402	▲
1R4.M.W.A.1000.W.40	4	100	13	1R402	▲



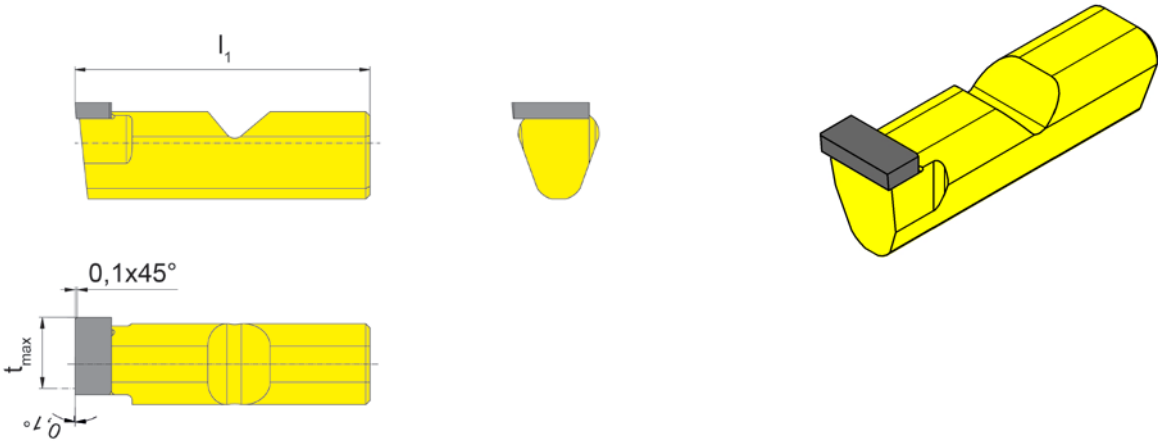
R = rechts wie gezeichnet
R = right hand version shown

L = links spiegelbildlich
L = left hand version

▲ ab Lager
on stock

HM-Sorten
Carbide grades
Δ 4 Wochen
4 weeks

Bestellnummer Part number	t_{max}	l_1	HIS	MD10
R1R4.M.A.A.0000.P.25	3,5	14,5	1R402	▲
R1R4.M.M.A.0000.P.25	3,5	14,5	1R402	▲
L1R4.M.A.A.0000.P.25	3,5	14,5	1R402	▲
L1R4.M.M.A.0000.P.25	3,5	14,5	1R402	▲

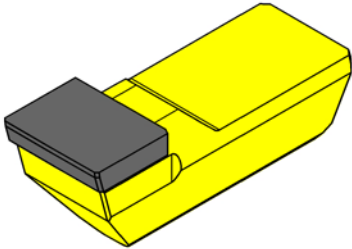
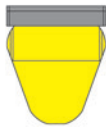
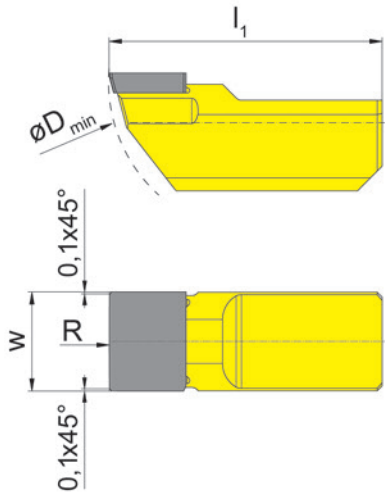


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	t _{max}	l ₁	HIS	MD10
L1R4.M.A.A.0000.P.35	3,5	14,5	1R402	▲
L1R4.M.M.A.0000.P.35	3,5	14,5	1R402	▲

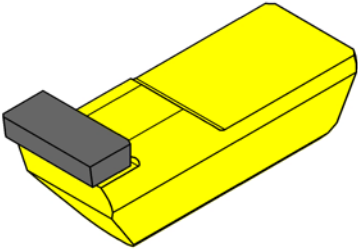
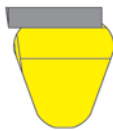
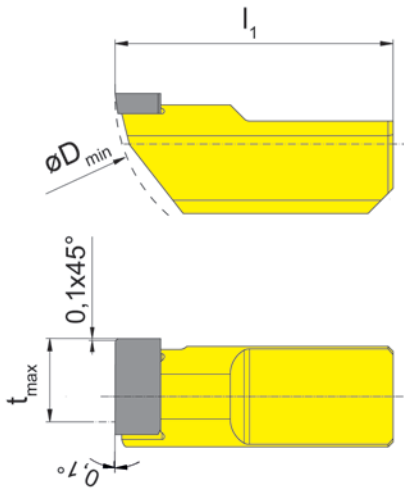


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	R	l ₁	D _{min}	HIS	MD10
1R4.M.Y.I.2000.W.40	4	200	11	12,7	1R403	▲

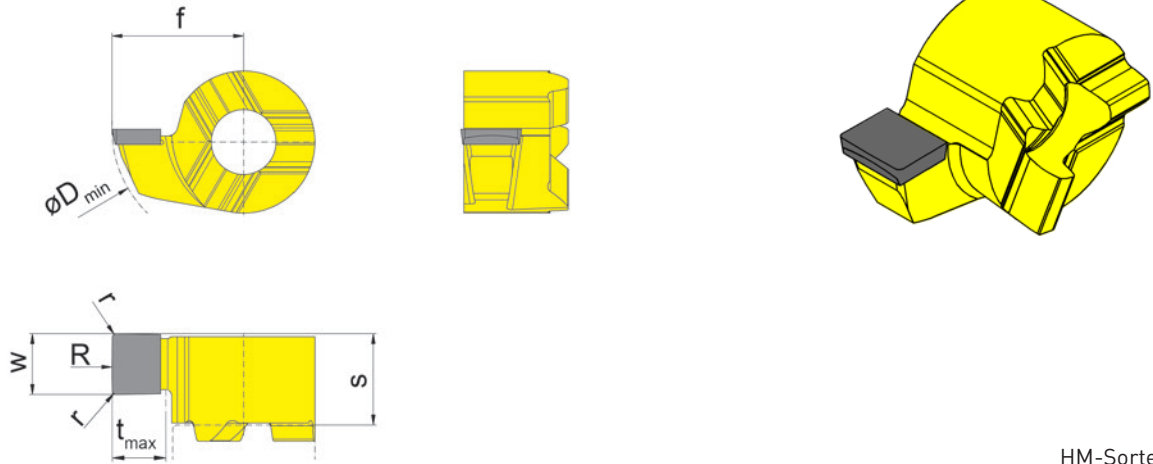
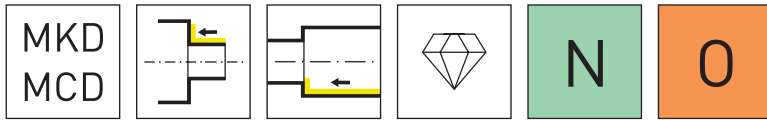


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	t _{max}	l ₁	D _{min}	HIS	MD10
L1R4.M.A.I.0000.P.35	3,5	11	12,7	1R403	▲
L1R4.M.M.I.0000.P.35	3,5	11	12,7	1R403	▲

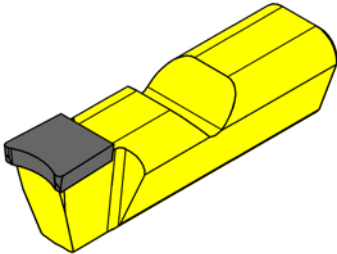
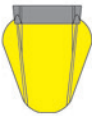
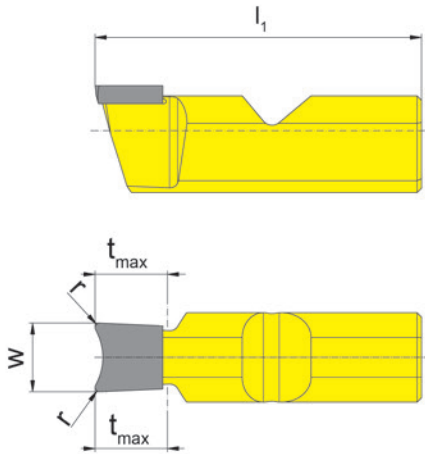
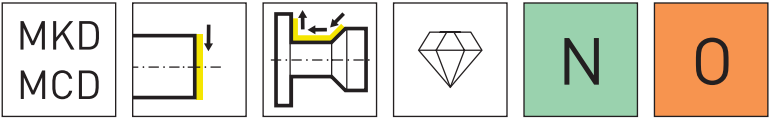


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	R	s	t _{max}	f	D _{min}	HIS	MD10
R11P.M.Y.B.0500.W.30	3	0,2	50	4,5	2,5	6,5	11,5	11P070R	▲

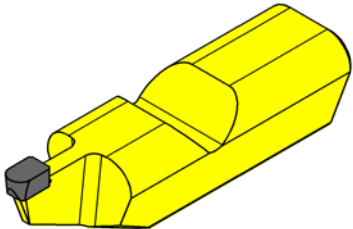
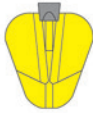
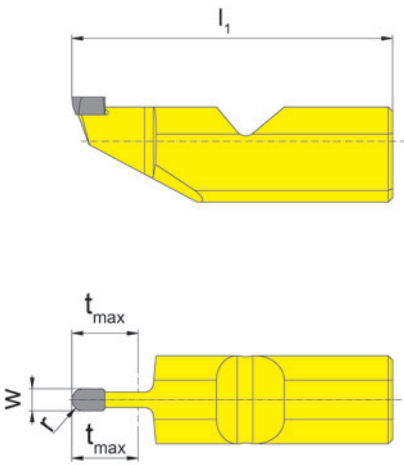


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	t _{max}	l ₁	HIS	MD10
1R4.M.YA.0002.W.30	3,05	0,2	2,8	14,5	1R402	▲

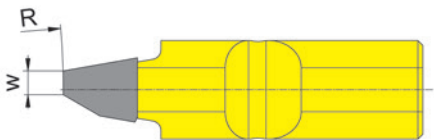
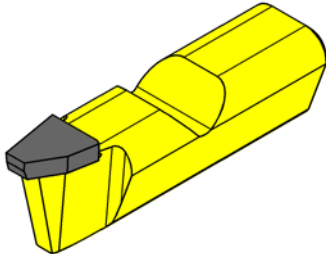
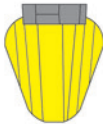
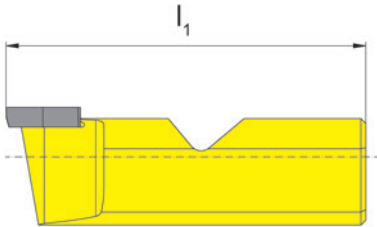


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	t _{max}	l ₁	HIS	MD10
1R4.M.Y.A.0005.R.10	1	0,5	3	14,5	1R402	▲

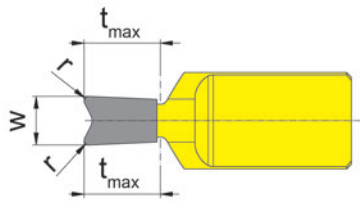
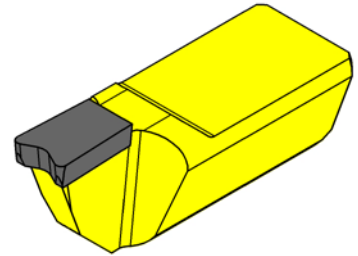
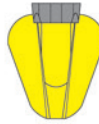
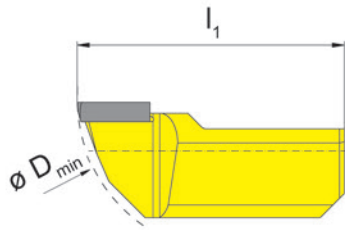
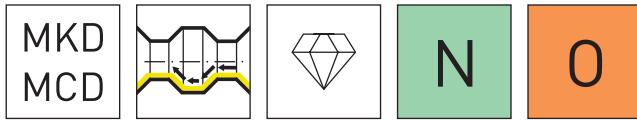


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	R	l ₁	HIS	MD10
1R4.M.M.A.0300.R.10	0,96	30	14,5	1R402	▲

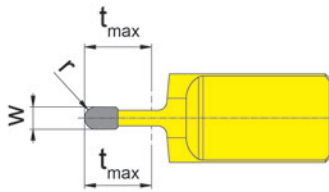
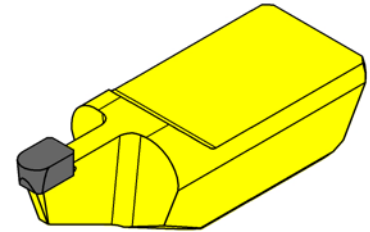
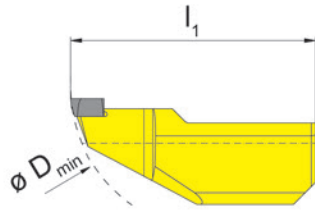
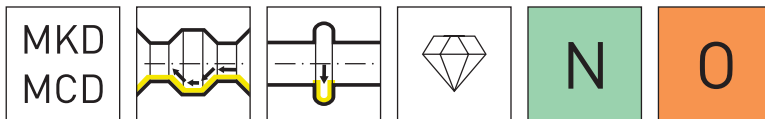


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	t _{max}	l ₁	D _{min}	HIS	MD10
1R4.M.Y.I.0002.W.20	2	0,2	3,2	11	12,7	1R403	▲

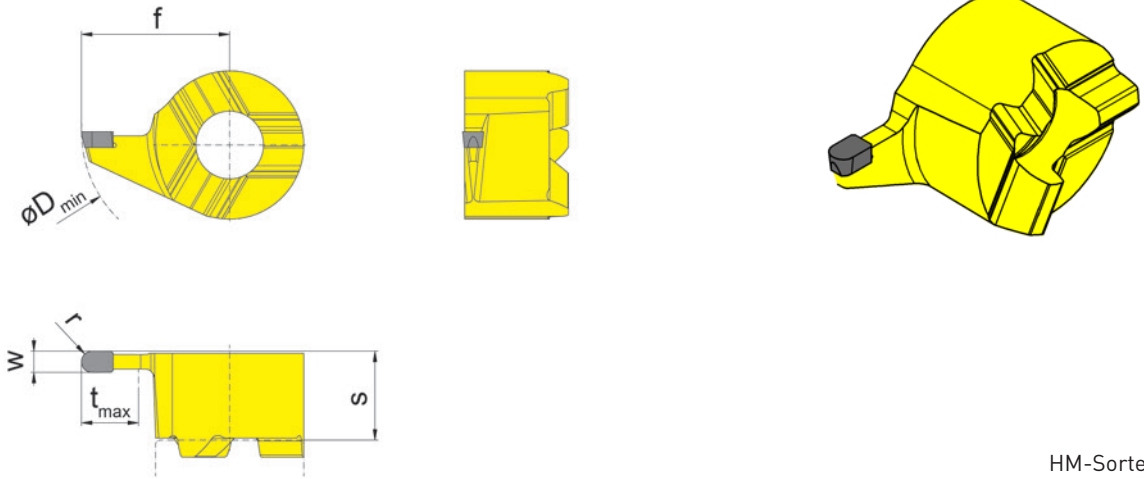
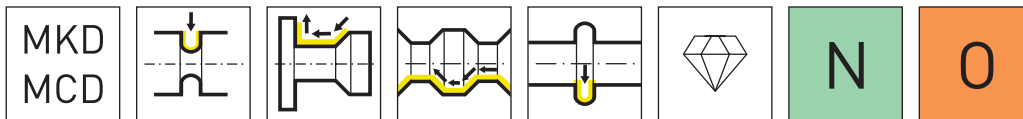


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	t _{max}	l ₁	D _{min}	HIS	MD10
1R4.M.Y.I.0005.R.10	1	0,5	3	11	12,7	1R403	▲

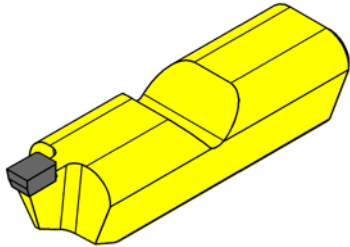
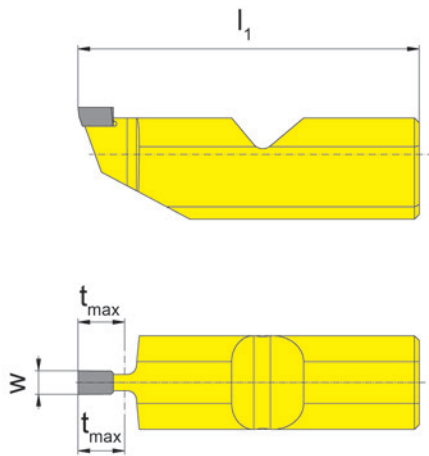


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	r	s	t _{max}	f	D _{min}	HIS	MD10
R11P.M.Y.B.0005.R.10	1	0,5	4,2	3	7	11,5	11P070R	▲

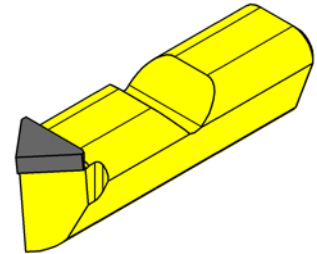
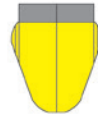
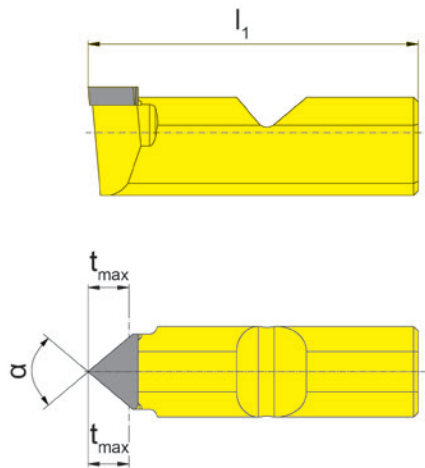
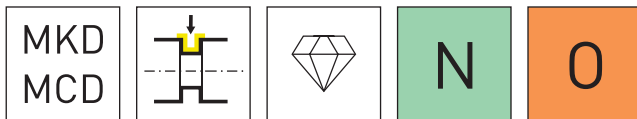


HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	w	t _{max}	l ₁	HIS	MD10
1R4.M.Y.A.0000.W.10	1	2	14,5	1R402	▲
1R4.M.Y.A.0000.W.20	2	2,5	14,5	1R402	▲



HM-Sorten
Carbide grades

▲ ab Lager
on stock

Δ 4 Wochen
4 weeks

Bestellnummer Part number	t _{max}	l ₁	α	HIS	MD10
1R4.M.Y.A.0000.C.30	1,9	14,5	80°	1R402	▲
1R4.M.Y.A.0000.P.30	1,5	14,5	90°	1R402	▲

Mögliche Kombinationen:

Possible combinations:

HIS = Plattensitzgröße / Insert seat

HWS = Trennstelle Werkstückseitig / Interface workpiece side

HMS = Trennstelle Maschinenseitig / Interface machine side

HIS	↔	HWS
HMS	↔	HWS

Beispiel Schneidplatte

Example insert

Bestellnummer Part number	w	r	t _{max}	l ₁	HIS	PD11
1R4.P.Y.A.0002.W.30	3	0,2	4,3	14,5	1R402	▲

Beispiel Klemmhalter

Example toolholder

Bestellnummer Part number	l ₁	b	h	l ₂	HWS
PO.1R4.1206.3.A.24	23,9	6	12	17,9	1R402

Schnittstelle

Interface

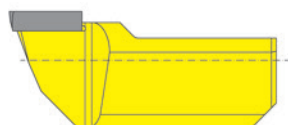
HIS = 1R401 nicht Standard / non-standard



HIS = 1R402 Außenbearbeitung / external machining



HIS = 1R402 Innenbearbeitung / internal machining

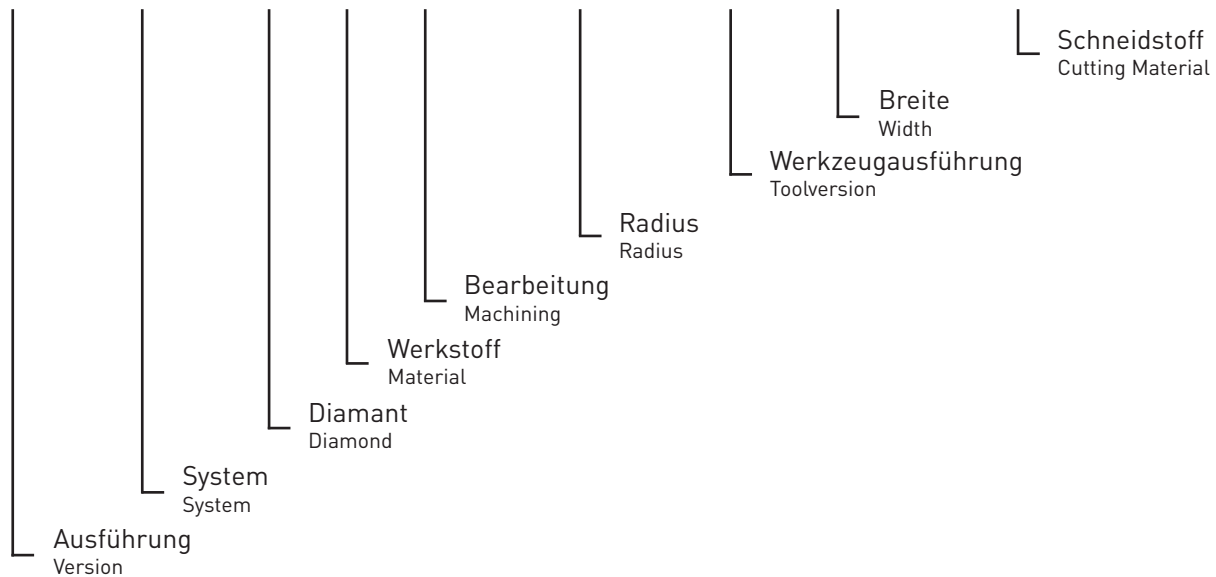


Bezeichnungsschlüssel Schneidplatten

Identification Code Inserts



R	1	R	4	.	M	.	A	.	A	.	0	0	0	0	.	P	.	2	5	.	M	D	1	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---



Ausführung: R = Rechts / right hand
Version: L = Links / left hand

System: 1R4 / 11P
System:

Diamant: M = MKD / MCD
Diamond: P = PKD / PCD

Werkstoff: A = NE-Metall langspanend / Non-ferrous metal, long chipping
Material: K = Kunststoff spröde, klarsichtig / Synthetic, brittle, transparent
M = NE-Metall kurzspanend / Non-ferrous metal, short chipping
W = Kunststoff zäh, langspanend / Synthetic tough, long chipping
X = Mischgeometrie A und K / Mixed geometry A and K
Y = universal NE-Metalle / Universal non-ferrous metals

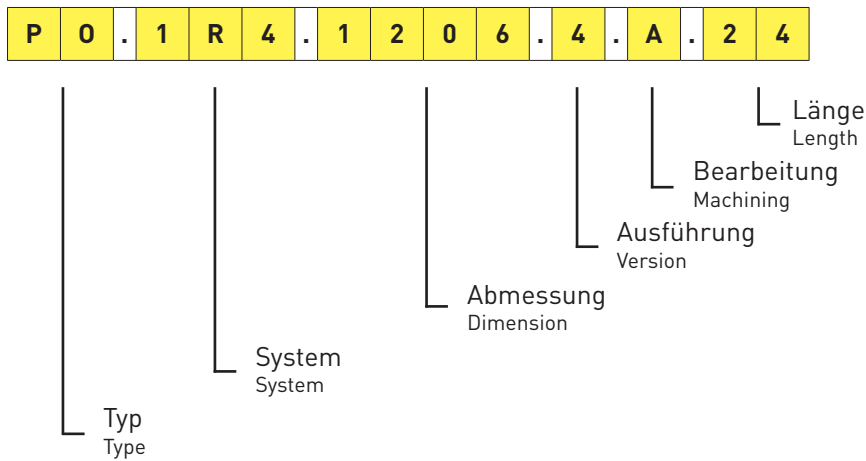
Bearbeitung: A = Aussen / external
Machining: B = Beides / both
I = Innen / internal

Radius: 0010 = R1
Radius:

Werkzeugausführung: A = 45° / C = 80° / D = 55° / P = 90° / T = 60° / V = 35° /
Tool Version: R = Voll Radius full radius / W = Schneidbreite Cutting width

Breite: 1 mm = 10 (gerundet / rounded)
Width:

Schneidstoff: Definition
Cutting material:



Typ: Type:	PO = Posalux RB / LB = rechter / linker Rundschaft right hand / left hand round shank RH / LH = rechter / linker Rechteckschaft right hand / left hand rectangular shank
System: System:	1R4 / 11P
Abmessungen: Dimensions:	Höhe / height Breite / width Durchmesser (gerundet) / diameter (rounded)
Ausführung: Version:	0 = nicht relevant / not relevant 3 = Bohrung / 4 = Senkung / 5 = Langloch /
Bearbeitung: Machining:	A = Aussen / external B = Beides / both I = Innen / internal
Länge: Length:	10 mm = 10 (gerundet / rounded)

Werkstoff Material	Schnittgeschwindigkeit v_c Cutting speed v_c		Empfohlene Kühlung Recommended Coolant
	min	max	
N Al-Knetlegierungen Al-wrought alloys	150	4500	Emulsion Emulsion
untereutektisches Aluminium Aluminium alloys up to 12% Si content	100	3500	Emulsion Emulsion
übereutektisches Aluminium Aluminium alloys with 12-20% Si content	80	1500	Emulsion Emulsion
Magnesium Magnesium	100	4000	Emulsion Emulsion
Kupfer, Bronze, Messing bleifrei Copper, Bronze, Brass without lead	90	1600	Öl Oil
Kupfer OFHC, Wolfram-Kupfer OFHC Copper, Tungsten copper	50	800	Öl Oil
Zink, Messing (MS58) Zinc, Brass (MS58)	100	1800	Öl Oil
Neusilber, Kupfer-Nickel-Legierungen Nickel silver, Copper-nickel-alloys	80	450	Emulsion Emulsion
Titan, Molybdän, Platin, Iridium Titanium, Molybdenum, Platin, Iridium	40	250	Emulsion Emulsion
Graphit Graphite	50	1000	Luft Air
O Hartmetall und Keramik, fertig gesintert Carbide and ceramik, sintered	25	80	Luft Air
Hartmetall und Keramik, vorgesintert Carbide and ceramik, presintered	40	100	Luft Air
O Kunststoffe, Faserverbundwerkstoffe Synthetics, Reinforced plastics	120	1700	Luft Air
GFK GFRP	100	500	Luft Air
CFK CFRP	80	300	Luft Air

Werkstoff Material		v _c		f _n / f _z (mm/U) (mm/rev)	a _p (mm)	Geometrie Geometry	Empfohlene Kühlung Recommended Coolant
		min	max				
N	Ag	50	300	0,010 - 0,06	0,005 - 0,05	M	Öl Oil
	Al / Mg	100	2.500	0,005 - 0,15	0,005 - 0,05	A	Emulsion
	Au	50	300	0,005 - 0,06	0,005 - 0,05	M	Öl Oil
	Cu	50	500	0,005 - 0,08	0,005 - 0,04	A	Öl Oil
	CuNi	40	250	0,010 - 0,06	0,005 - 0,04	M / A	Emulsion
	CuSn	50	300	0,005 - 0,08	0,005 - 0,04	A	Öl Oil
	CuW	40	250	0,010 - 0,07	0,005 - 0,04	A	Öl Oil
	CuZn	50	450	0,005 - 0,10	0,005 - 0,05	M	Öl Oil
	CuZn bleifrei/bleiarm lead-free/low-lead	50	350	0,005 - 0,10	0,005 - 0,05	A	Öl Oil
	Ir / Pd / Pt	30	100	0,005 - 0,05	0,005 - 0,03	A	Emulsion
	Mo	35	120	0,010 - 0,05	0,005 - 0,03	A	Emulsion
	Ni	40	200	0,010 - 0,06	0,005 - 0,03	M / A	Emulsion
	Ti	40	200	0,010 - 0,06	0,005 - 0,03	K	Emulsion
	Zn	80	350	0,005 - 0,12	0,005 - 0,05	A	Emulsion
O	PA	60	220	0,010 - 0,25	0,010 - 0,10	W	Emulsion
	PC	50	200	0,005 - 0,20	0,010 - 0,10	K	Emulsion / Luft Emulsion / Air
	PE	80	350	0,010 - 0,25	0,010 - 0,10	W	Emulsion
	PEEK	60	250	0,010 - 0,25	0,010 - 0,10	W	Emulsion
	PMMA	80	300	0,005 - 0,20	0,010 - 0,10	K	Emulsion / Luft Emulsion / Air
	POM	80	350	0,010 - 0,25	0,010 - 0,10	K	Emulsion
	PTFE	70	300	0,01 - 0,25	0,010 - 0,10	W	Emulsion
	PVC	60	250	0,01 - 0,25	0,010 - 0,10	W	Emulsion



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