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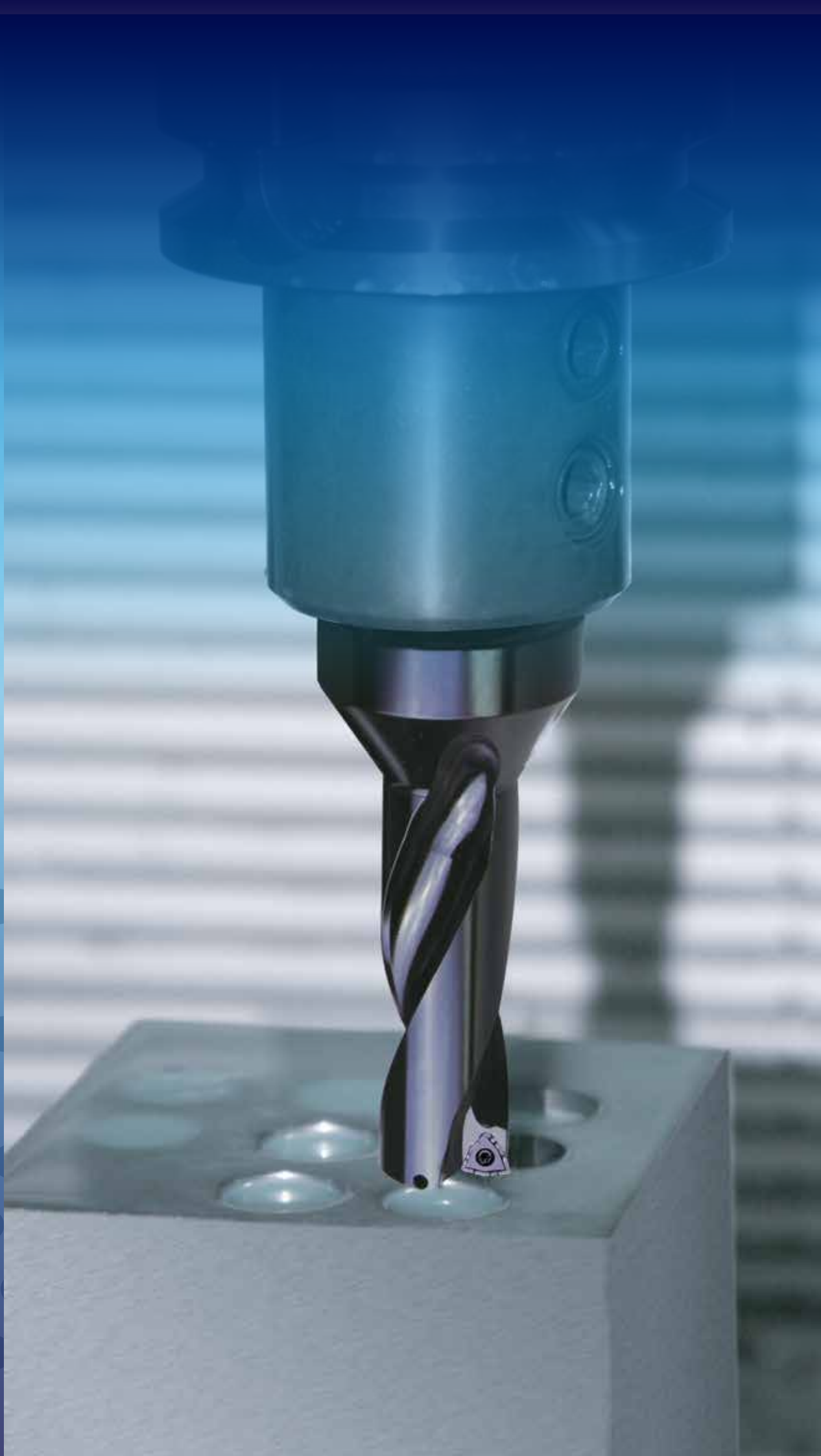
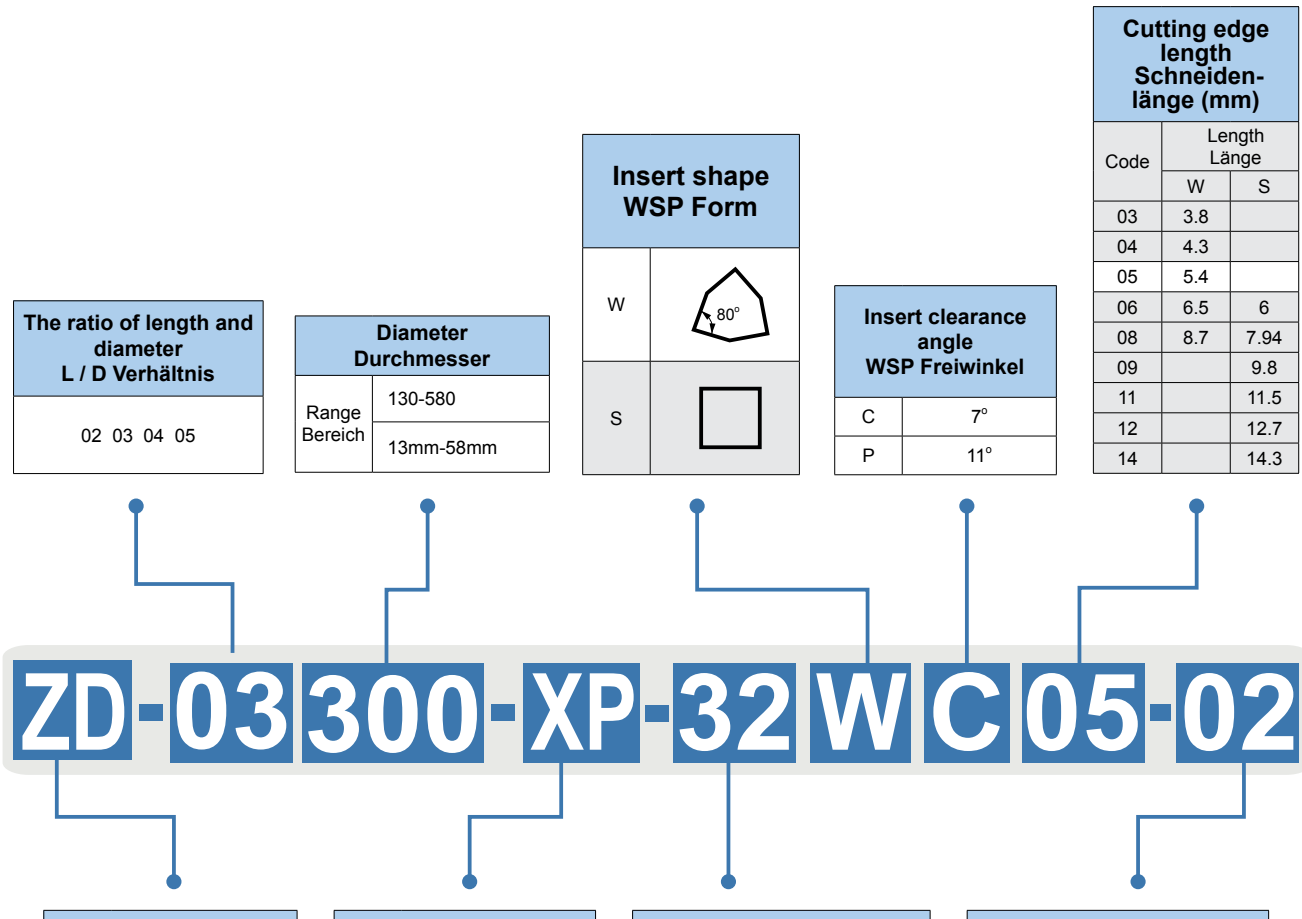
WSP = Wendeschneidplatte VHM = Vollhartmetall



Indexable drill Code Key · ISO Kennzeichnung WSP- Bohrern



The ratio of length and diameter L / D Verhältnis

02	03	04	05

Diameter Durchmesser

Range Bereich	130-580
	13mm-58mm

Insert shape WSP Form

W	80°
S	

Insert clearance angle WSP Freiwinkel

C	7°
P	11°

Cutting edge length Schneiden-länge (mm)

Code	Length Länge	
	W	S
03	3.8	
04	4.3	
05	5.4	
06	6.5	6
08	8.7	7.94
09		9.8
11		11.5
12		12.7
14		14.3

Tool Type Werkzeugtyp

Code	Description Beschreibung
ZD	Indexable drill (WCMX *)
ZTD	Indexable drill (SPGT *)

Coupling structure and Type Kupplungsart

Code	Description Beschreibung
XP	Weldon shank Weldon Shaft

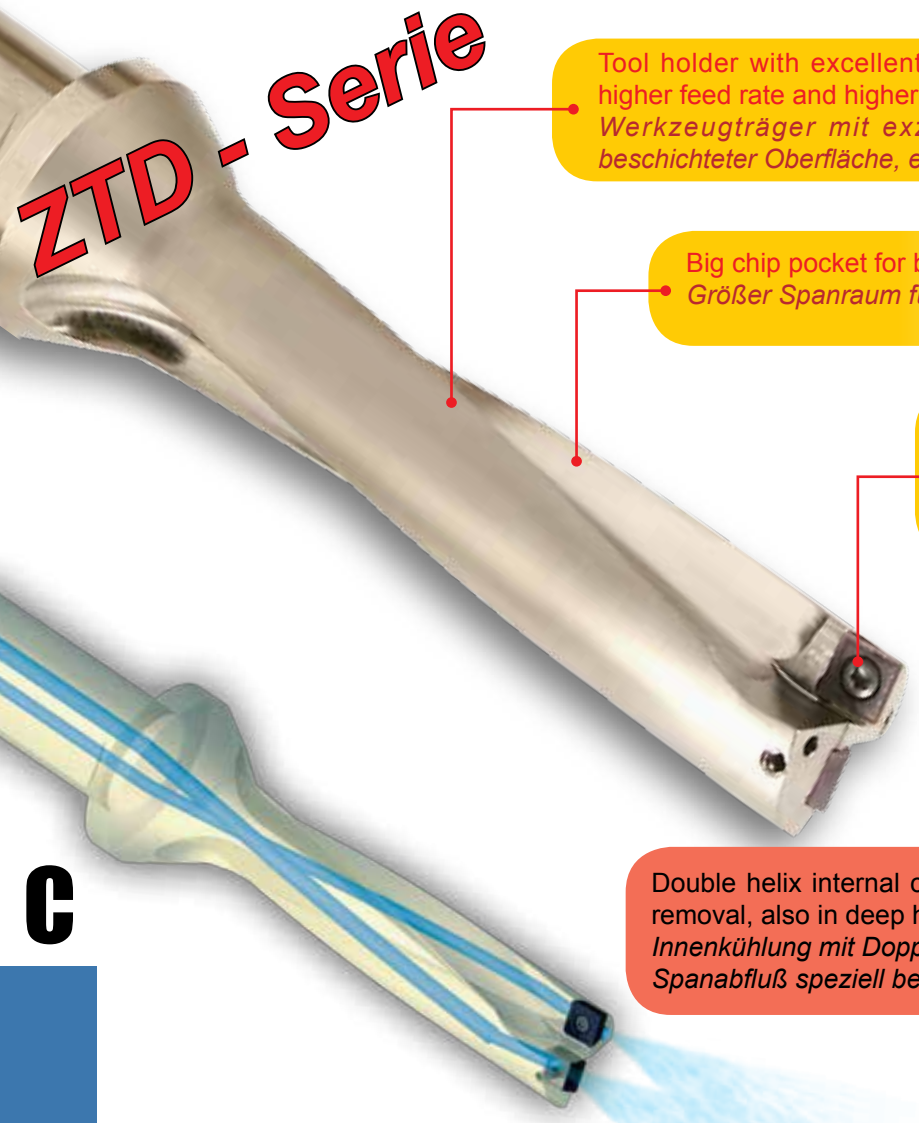
Coupling size(mm) Kupplungsgröße

25	32	40

Number of teeth Anzahl der Zähne

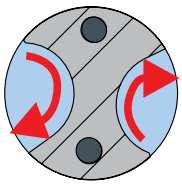
2

ZTD - Serie

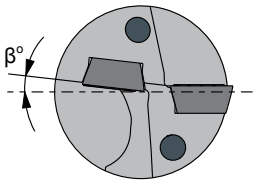


Tool holder with excellent stiffness and special surface coating. For higher feed rate and higher productivity.
Werkzeugträger mit exzellenter Torsionsteifigkeit und speziell beschichteter Oberfläche, ermöglicht höhere Vorschübe und Produktivität

Big chip pocket for better chip removal
Größer Spanraum für optimalen Spanabfluß



Optimised insert seat and clamping. Less vibration and higher tool life.
Optimierter Plattensitz und optimierte Plattenklemmung für vibrationsfreie Bearbeitung mit hohen Standzeiten



Double helix internal cooling for more effective cooling and good chip removal, also in deep hole boring.
Innenkühlung mit Doppelhelixdesign für effektivere Kühlmittelzufuhr und Spanabfluß speziell bei tieferen Bohrungen.

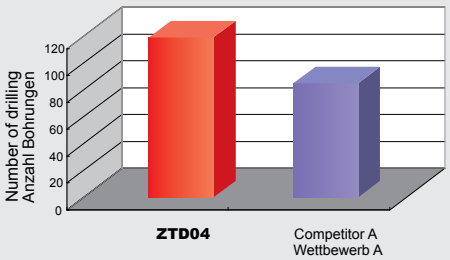
C

Indexable drills
WPS-Bohrer

Example · Beispiel

Type Typ	ZTD04-260-XP25-SP07-02 SPGT07T308-PM /YBG205 (outer insert / Außenschneide) SPGT07T308-PM / YBG212 (inner insert / Innenschneide)
Workpiece Werkstückstoff	50Mn(HB240)
Cooling system Kühlsystem	Doublehelix internal cooling Doppelhelix-Innenkülung
Cutting data Schnittdaten	V_c=130m/min f=210mm/min a_p=90mm
Results Ergebnis	

Comparison
Vergleich



Chips
Span-
bildung

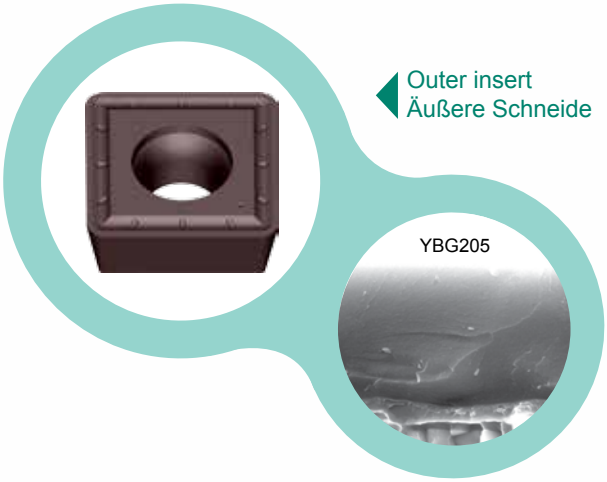
ZTD04-260-XP25-SP07-02

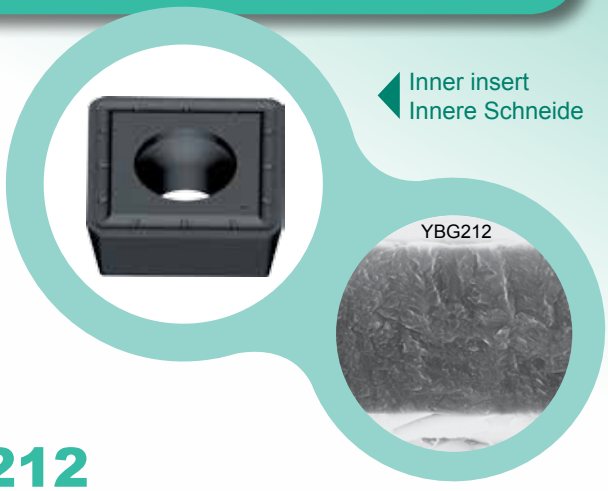
Competitor A
Wettbewerb A

ZTD-Serie

Optimised edge design for stable operation with new chip breaker design / *Optimierte Schneidkante, stabile Bearbeitung, neuartiger Spanbrecher*

Special grades for outer and inner insert for more efficiency in different material / *Optimierte Sorten für Innen- und Außenschneide für höhere Effizienz bei vielen Materialen*





YBG205

New nano coating structure with good hardness and wear resistance, but also good toughness. Ultra fine surface design prevent friction for best chip flow. Excellent thermal and chemical wear resistance. Best choice for all material also for stainless steel and high alloy material.

Neue Nano-Beschichtungsstruktur mit gleichzeitiger Härte und Verschleißfestigkeit bzw. Zähigkeit. Eine ultra glatte Schichtoberfläche vermindert die Reibung und garantiert einen optimierten Spanabfluß. Die exzellente thermische und chemische Widerstandsfähigkeit zeigt diese Sorte besonders bei der Bearbeitung von rostfreien Stählen und warmfesten Legierungen.

YBG212

Special Nano TiAlN coating with smooth surface for less friction and better chipflow / *Speziale Nano TiAlN Beschichtung mit sehr glatter Oberfläche für weniger Reibung und besseren Spanablauf*

In combination with super fine grain size substract good balance between wear resistance and toughness / *In Verbindung mit neuem Superfeinkorn-Substrat die ideale Kombination aus Verschleißfestigkeit und Zähigkeit*

Excellent thermal and oxidation resistence for more stable edge / *Mit sehr guter Temperatur- und Oxidationsbeständigkeit für optimalen Schneidkantenschutz*

For boring operation the cutting speed at inner insert is lower. Therefore the grade must be more tough to prevent breakage. YBG212 is best choice in that case. YBG205 is excellent for higher wear resistance.

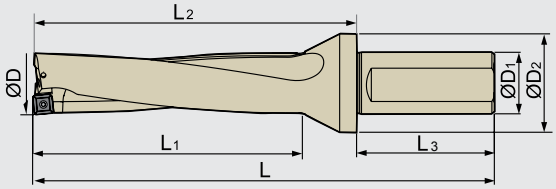
Bei der Bohrbearbeitung ist die Schnittgeschwindigkeit an der Innenschneide niedriger als an der Außenschneide. Mit solch ungünstigen Bearbeitungsbedingungen sollte die Innenschneide eine höhere Zähigkeit haben. Hier ist die YBG212 optimal einzusetzen. Die Außenplatte hat mit der YBG205 eine höhere Verschleißfestigkeit.

Example · Beispiel

		Cooling system Kühlsystem	Doublehelix Internal cooling Doppelhelix-Innenkühlung	
		Type Typ	ZTD04-240-XP25-SP07-02 SPGT07T308-PM/YBG205 (outer insert / Außenschneide) SPGT07T308-PM/YBG212 (inner insert / Innenschneide)	Competitor A Wettbewerb A
Workpiece Werkstückstoff	42CrMo(HRC25)	Compare Vergleich (after 15 min / nach 15 min)		
Cutting data Schnittdaten	V_c=150m/min f_r=0.12mm/μ a_p=80mm			

ZTD02

2D

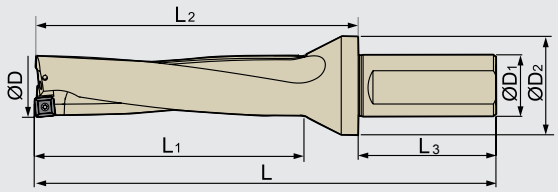


Type Typ	Stock Lager	Dimension Abmessung (mm)							Insert WSP	Screw Schraube	Wrench Schlüssel
		ØD	ØD1	ØD2	L3	L2	L1	L			
ZTD02-130-XP20-SP05-02	●	13	20	25	50	47	32	97	SPGT050204-PM/EM	160M2X4.3	WT06IP
ZTD02-140-XP20-SP05-02	●	14	20	25	50	49	34	99	SPGT050204-PM/EM	160M2X4.3	WT06IP
ZTD02-150-XP20-SP05-02	●	15	20	25	50	51	36	101	SPGT050204-PM/EM	160M2X4.3	WT06IP
ZTD02-160-XP20-SP05-02	●	16	20	25	50	53	38	103	SPGT050204-PM/EM	160M2X4.3	WT06IP
ZTD02-170-XP25-SP06-02	●	17	25	32	56	62	40	118	SPGT060204-PM/EM	160M2.2X5.5	WT07IP
ZTD02-180-XP25-SP06-02	●	18	25	32	56	64	42	120	SPGT060204-PM/EM	160M2.2X5.5	WT07IP
ZTD02-190-XP25-SP06-02	●	19	25	32	56	66	44	122	SPGT060204-PM/EM	160M2.2X5.5	WT07IP
ZTD02-200-XP25-SP06-02	●	20	25	32	56	68	46	124	SPGT060204-PM/EM	160M2.2X5.5	WT07IP
ZTD02-210-XP25-SP06-02	●	21	25	32	56	70	48	126	SPGT060204-PM/EM	160M2.2X5.5	WT07IP
ZTD02-220-XP25-SP07-02	●	22	25	32	56	72	50	128	SPGT07T308-PM/EM	160M2.5X6.5	WT07IP
ZTD02-230-XP25-SP07-02	●	23	25	32	56	74	52	130	SPGT07T308-PM/EM	160M2.5X6.5	WT07IP
ZTD02-240-XP25-SP07-02	●	24	25	32	56	76	54	132	SPGT07T308-PM/EM	160M2.5X6.5	WT07IP
ZTD02-250-XP25-SP07-02	●	25	25	32	56	78	56	134	SPGT07T308-PM/EM	160M2.5X6.5	WT07IP
ZTD02-260-XP25-SP07-02	●	26	25	32	56	80	58	136	SPGT07T308-PM/EM	160M2.5X6.5	WT07IP
ZTD02-270-XP25-SP07-02	●	27	25	32	56	82	60	138	SPGT07T308-PM/EM	160M2.5X6.5	WT07IP
ZTD02-280-XP32-SP09-02	●	28	32	37	60	87	62	147	SPGT090408-PM/EM	160M3.5X8	WT15IP
ZTD02-290-XP32-SP09-02	●	29	32	37	60	89	64	149	SPGT090408-PM/EM	160M3.5X8	WT15IP
ZTD02-300-XP32-SP09-02	●	30	32	37	60	91	66	151	SPGT090408-PM/EM	160M3.5X8	WT15IP
ZTD02-310-XP32-SP09-02	●	31	32	37	60	93	68	153	SPGT090408-PM/EM	160M3.5X8	WT15IP
ZTD02-320-XP32-SP09-02	●	32	32	37	60	95	70	155	SPGT090408-PM/EM	160M3.5X8	WT15IP
ZTD02-330-XP32-SP09-02	●	33	32	37	60	97	72	157	SPGT090408-PM/EM	160M3.5X8	WT15IP
ZTD02-340-XP40-SP11-02	●	34	40	47	70	104	74	174	SPGT110408-PM/EM	160M4X10	WT15IP
ZTD02-350-XP40-SP11-02	●	35	40	47	70	106	76	176	SPGT110408-PM/EM	160M4X10	WT15IP
ZTD02-360-XP40-SP11-02	●	36	40	47	70	108	78	178	SPGT110408-PM/EM	160M4X10	WT15IP
ZTD02-370-XP40-SP11-02	●	37	40	47	70	110	80	180	SPGT110408-PM/EM	160M4X10	WT15IP
ZTD02-380-XP40-SP11-02	●	38	40	47	70	112	82	182	SPGT110408-PM/EM	160M4X10	WT15IP
ZTD02-390-XP40-SP11-02	●	39	40	47	70	114	84	184	SPGT110408-PM/EM	160M4X10	WT15IP
ZTD02-400-XP40-SP11-02	●	40	40	47	70	116	86	186	SPGT110408-PM/EM	160M4X10	WT15IP
ZTD02-410-XP40-SP11-02	●	41	40	47	70	118	88	188	SPGT110408-PM/EM	160M4X10	WT15IP
ZTD02-420-XP40-SP14-02	●	42	40	52	70	130	90	200	SPGT140512-PM/EM	160M5X13	WT20IP
ZTD02-430-XP40-SP14-02	●	43	40	52	70	132	92	202	SPGT140512-PM/EM	160M5X13	WT20IP
ZTD02-440-XP40-SP14-02	●	44	40	52	70	134	94	204	SPGT140512-PM/EM	160M5X13	WT20IP
ZTD02-450-XP40-SP14-02	●	45	40	52	70	136	96	206	SPGT140512-PM/EM	160M5X13	WT20IP
ZTD02-460-XP40-SP14-02	●	46	40	52	70	138	98	208	SPGT140512-PM/EM	160M5X13	WT20IP
ZTD02-470-XP40-SP14-02	●	47	40	52	70	140	100	210	SPGT140512-PM/EM	160M5X13	WT20IP
ZTD02-480-XP40-SP14-02	●	48	40	52	70	142	102	212	SPGT140512-PM/EM	160M5X13	WT20IP
ZTD02-490-XP40-SP14-02	●	49	40	52	70	144	104	214	SPGT140512-PM/EM	160M5X13	WT20IP
ZTD02-500-XP40-SP14-02	●	50	40	52	70	146	106	216	SPGT140512-PM/EM	160M5X13	WT20IP

● Ex Stock / ab Lager ○ On demand / auf Anfrage

ZTD03

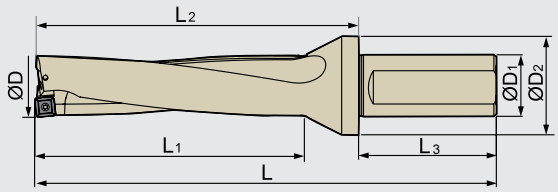
3D



Type Typ	Stock Lager	Dimension Abmessung (mm)							Insert WSP	Screw Schraube	Wrench Schlüssel
		ØD	ØD1	ØD2	L3	L2	L1	L			
ZTD03-130-XP20-SP05-02	●	13	20	25	50	67	44	111	SPGT050204-PM/PE	I60M2.0×4.3	WT06IP
ZTD03-140-XP20-SP05-02	●	14	20	25	50	67	47	114	SPGT050204-PM/PE	I60M2.0×4.3	WT06IP
ZTD03-150-XP20-SP05-02	●	15	20	25	50	64	50	114	SPGT050204-PM/PE	I60M2.0×4.3	WT06IP
ZTD03-160-XP20-SP05-02	●	16	20	25	50	67	53	120	SPGT050204-PM/PE	I60M2.0×4.3	WT06IP
ZTD03-170-XP25-SP06-02	●	17	25	32	56	79	56	135	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD03-180-XP25-SP06-02	●	18	25	32	56	82	59	138	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD03-190-XP25-SP06-02	●	19	25	32	56	84	62	140	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD03-200-XP25-SP06-02	●	20	25	32	56	87	65	143	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD03-210-XP25-SP06-02	●	21	25	32	56	90	68	146	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD03-220-XP25-SP06-02	●	22	25	32	56	93	71	149	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD03-230-XP25-SP07-02	●	23	25	40	56	96	74	153	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD03-240-XP25-SP07-02	●	24	25	40	56	102	77	159	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD03-250-XP25-SP07-02	●	25	25	40	56	102	80	159	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD03-260-XP25-SP07-02	●	26	25	40	56	105	83	162	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD03-270-XP25-SP07-02	●	27	25	40	56	108	86	165	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD03-280-XP25-SP07-02	●	28	25	40	56	111	89	168	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD03-290-XP32-SP07-02	●	29	32	45	60	117	92	178	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD03-300-XP32-SP09-02	●	30	32	45	60	120	95	181	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD03-310-XP32-SP09-02	●	31	32	45	60	123	98	184	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD03-320-XP32-SP09-02	●	32	32	45	60	126	101	187	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD03-330-XP32-SP09-02	●	33	32	45	60	129	104	190	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD03-340-XP32-SP09-02	●	34	32	45	60	132	107	193	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD03-350-XP32-SP09-02	●	35	32	45	60	135	110	196	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD03-360-XP32-SP09-02	●	36	32	45	60	138	113	199	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD03-370-XP40-SP11-02	●	37	40	55	70	147	117	217	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD03-380-XP40-SP11-02	●	38	40	55	70	150	119	220	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD03-390-XP40-SP11-02	●	39	40	55	70	153	122	223	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD03-400-XP40-SP11-02	●	40	40	55	70	160	125	231	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD03-410-XP40-SP11-02	●	41	40	55	70	158	128	229	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD03-420-XP40-SP11-02	●	42	40	55	70	161	131	232	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD03-430-XP40-SP11-02	●	43	40	55	70	169	134	240	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD03-440-XP40-SP14-02	●	44	40	60	70	178	138	248	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD03-450-XP40-SP14-02	●	45	40	60	70	181	141	251	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD03-460-XP40-SP14-02	●	46	40	60	70	184	144	254	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD03-470-XP40-SP14-02	●	47	40	60	70	187	147	257	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD03-480-XP40-SP14-02	●	48	40	60	70	189	149	260	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD03-490-XP40-SP14-02	●	49	40	60	70	192	152	263	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD03-500-XP40-SP14-02	●	50	40	60	70	195	155	266	SPGT140512-PM/EM	I60M5×13	WT20IP

ZTD04

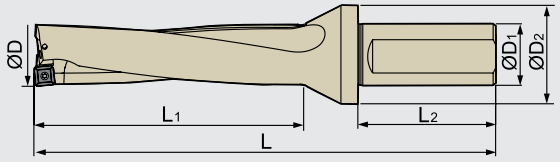
4D



Type Typ	Stock Lager	Dimension Abmessung (mm)							Insert WSP	Screw Schraube	Wrench Schlüssel
		ØD	ØD1	ØD2	L3	L2	L1	L			
ZTD04-130-XP20-SP05-02	○	13	20	25	50	74	57	124	SPGT050204-PM/EM	I60M2.0×4.3	WT06IP
ZTD04-140-XP20-SP05-02	●	14	20	25	50	78	61	128	SPGT050204-PM/EM	I60M2.0×4.3	WT06IP
ZTD04-150-XP20-SP05-02	●	15	20	25	50	82	65	132	SPGT050204-PM/EM	I60M2.0×4.3	WT06IP
ZTD04-160-XP20-SP05-02	●	16	20	25	50	86	69	136	SPGT050204-PM/EM	I60M2.0×4.3	WT06IP
ZTD04-170-XP25-SP06-02	●	17	25	32	56	95	73	152	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD04-180-XP25-SP06-02	●	18	25	32	56	99	77	156	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD04-190-XP25-SP06-02	●	19	25	32	56	103	81	160	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD04-200-XP25-SP06-02	●	20	25	32	56	107	85	163	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD04-210-XP25-SP06-02	●	21	25	32	56	111	89	167	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD04-220-XP25-SP06-02	●	22	25	32	56	115	93	171	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD04-230-XP25-SP07-02	●	23	25	40	56	119	97	176	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD04-240-XP25-SP07-02	●	24	25	40	56	123	101	180	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD04-250-XP25-SP07-02	●	25	25	40	56	127	105	184	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD04-260-XP25-SP07-02	●	26	25	40	56	131	109	188	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD04-270-XP25-SP07-02	●	27	25	40	56	135	113	192	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD04-280-XP25-SP07-02	●	28	32	45	60	143	118	203	SPGT070408-PM/EM	I60M2.5×6.5	WT07IP
ZTD04-290-XP32-SP07-02	●	29	32	45	60	146	121	207	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD04-300-XP32-SP09-02	●	30	32	45	60	150	125	211	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD04-310-XP32-SP09-02	●	31	32	45	60	154	129	215	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD04-320-XP32-SP09-02	●	32	32	45	60	158	133	219	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD04-330-XP32-SP09-02	●	33	32	45	60	162	137	223	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD04-340-XP32-SP09-02	●	34	32	45	60	166	141	227	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD04-350-XP32-SP09-02	●	35	32	45	60	170	145	231	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD04-360-XP32-SP09-02	●	36	32	45	60	174	149	235	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD04-370-XP40-SP11-02	●	37	40	55	70	184	154	254	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD04-380-XP40-SP11-02	●	38	40	55	70	188	158	258	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD04-390-XP40-SP11-02	●	39	40	55	70	196	161	267	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD04-400-XP40-SP11-02	●	40	40	55	70	200	165	271	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD04-410-XP40-SP11-02	●	41	40	55	70	199	169	270	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD04-420-XP40-SP11-02	●	42	40	55	70	208	173	279	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD04-430-XP40-SP11-02	●	43	40	55	70	212	177	283	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD04-440-XP40-SP14-02	●	44	40	60	70	222	182	292	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD04-450-XP40-SP14-02	●	45	40	60	70	226	186	296	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD04-460-XP40-SP14-02	●	46	40	60	70	230	190	300	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD04-470-XP40-SP14-02	●	47	40	60	70	234	194	304	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD04-480-XP40-SP14-02	●	48	40	60	70	237	198	308	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD04-490-XP40-SP14-02	●	49	40	60	70	241	202	312	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD04-500-XP40-SP14-02	●	50	40	60	70	245	206	316	SPGT140512-PM/EM	I60M5×13	WT20IP

ZTD05

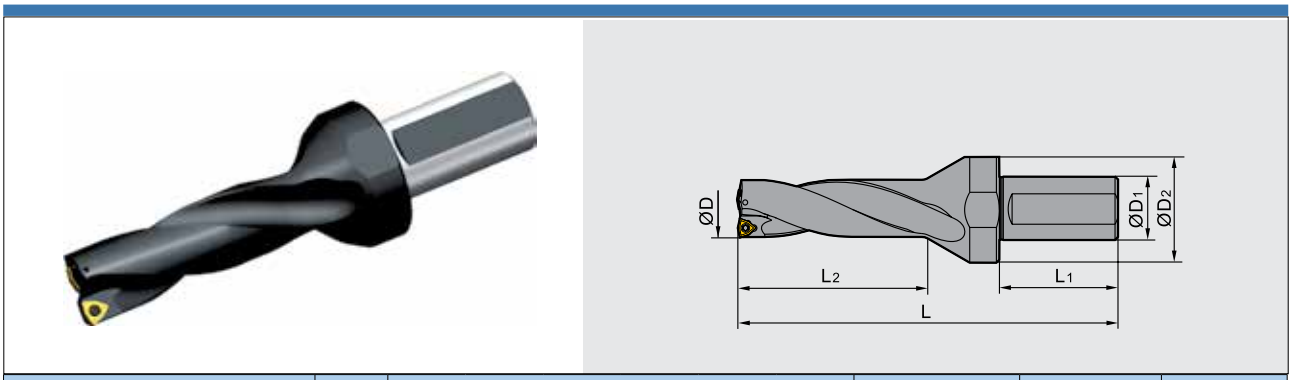
5D



Type Typ	Stock Lager	Dimension Abmessung (mm)						Insert WSP	Screw Schraube	Wrench Schlüssel
		ØD	ØD1	ØD2	L1	L2	L			
ZTD05-170-XP25-SP06-02	●	17	25	32	91	56	169	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD05-180-XP25-SP06-02	●	18	25	32	96	56	174	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD05-190-XP25-SP06-02	●	19	25	32	101	56	179	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD05-200-XP25-SP06-02	●	20	25	32	106	56	184	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD05-210-XP25-SP06-02	●	21	25	32	111	56	189	SPGT060204-PM/EM	I60M2.2×5.5	WT07IP
ZTD05-220-XP25-SP07-02	●	22	25	32	115	56	194	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD05-230-XP25-SP07-02	●	23	25	32	120	56	199	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD05-240-XP25-SP07-02	●	24	25	32	125	56	204	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD05-250-XP25-SP07-02	●	25	25	32	130	56	209	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD05-260-XP25-SP07-02	●	26	25	32	135	56	214	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD05-270-XP25-SP07-02	●	27	25	32	140	56	219	SPGT07T308-PM/EM	I60M2.5×6.5	WT07IP
ZTD05-280-XP32-SP09-02	●	28	32	37	145	60	231	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD05-290-XP32-SP09-02	●	29	32	37	150	60	236	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD05-300-XP32-SP09-02	●	30	32	37	155	60	241	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD05-310-XP32-SP09-02	●	31	32	37	160	60	246	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD05-320-XP32-SP09-02	●	32	32	37	165	60	251	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD05-330-XP32-SP09-02	●	33	32	37	170	60	256	SPGT090408-PM/EM	I60M3.5×8	WT15IP
ZTD05-340-XP40-SP11-02	●	34	40	47	176	70	276	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD05-350-XP40-SP11-02	●	35	40	47	181	70	281	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD05-360-XP40-SP11-02	●	36	40	47	186	70	286	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD05-370-XP40-SP11-02	●	37	40	47	191	70	291	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD05-380-XP40-SP11-02	●	38	40	47	196	70	296	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD05-390-XP40-SP11-02	●	39	40	47	201	70	301	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD05-400-XP40-SP11-02	●	40	40	47	206	70	306	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD05-410-XP40-SP11-02	○	41	40	47	211	70	311	SPGT110408-PM/EM	I60M4×10	WT15IP
ZTD05-420-XP40-SP14-02	○	42	40	52	216	70	326	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD05-430-XP40-SP14-02	○	43	40	52	221	70	331	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD05-440-XP40-SP14-02	○	44	40	52	226	70	336	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD05-450-XP40-SP14-02	○	45	40	52	231	70	342	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD05-460-XP40-SP14-02	○	46	40	52	236	70	346	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD05-470-XP40-SP14-02	○	47	40	52	241	70	351	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD05-480-XP40-SP14-02	○	48	40	52	246	70	356	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD05-490-XP40-SP14-02	○	49	40	52	251	70	361	SPGT140512-PM/EM	I60M5×13	WT20IP
ZTD05-500-XP40-SP14-02	○	50	40	52	256	70	366	SPGT140512-PM/EM	I60M5×13	WT20IP

● Ex Stock / ab Lager ○ On demand / auf Anfrage

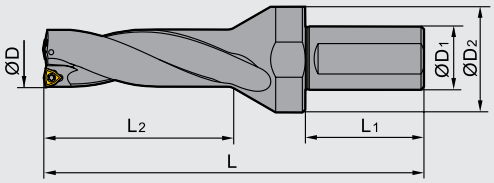
ZD03

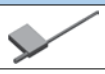


Type Typ	Stock Lager	Basic dimension(mm) Abmessungen						Inserts WSP	Screw Schraube	Wrench Schlüssel
		D	D_1	D_2	L_1	L_2	L			
ZD03-160-XP25-WC03-02	●	16	25	32	56	52	129	WCMX030208	I60M2.5×6.5	WT07IP
ZD03-170-XP25-WC03-02	●	17	25	32	56	55	133	WCMX030208	I60M2.5×6.5	WT07IP
ZD03-180-XP25-WC03-02	●	18	25	32	56	58	137	WCMX030208	I60M2.5×6.5	WT07IP
ZD03-190-XP25-WC03-02	●	19	25	32	56	61	140	WCMX030208	I60M2.5×6.5	WT07IP
ZD03-200-XP25-WC03-02	●	20	25	32	56	64	143	WCMX030208	I60M2.5×6.5	WT07IP
ZD03-210-XP25-WC04-02	●	21	25	45	56	67	153	WCMX040208	I60M2.5×6.5T	WT08IP
ZD03-220-XP25-WC04-02	●	22	25	45	56	70	156	WCMX040208	I60M2.5×6.5T	WT08IP
ZD03-230-XP25-WC04-02	●	23	25	45	56	73	159	WCMX040208	I60M2.5×6.5T	WT08IP
ZD03-240-XP25-WC04-02	●	24	25	45	56	76	162	WCMX040208	I60M2.5×6.5T	WT08IP
ZD03-250-XP25-WC04-02	●	25	25	45	56	79	165	WCMX040208	I60M2.5×6.5T	WT08IP
ZD03-260-XP32-WC05-02	●	26	32	55	60	83	176	WCMX050308	I60M3×7	WT09IP
ZD03-270-XP32-WC05-02	●	27	32	55	60	86	180	WCMX050308	I60M3×7	WT09IP
ZD03-280-XP32-WC05-02	●	28	32	55	60	89	184	WCMX050308	I60M3×7	WT09IP
ZD03-290-XP32-WC05-02	●	29	32	55	60	92	188	WCMX050308	I60M3×7	WT09IP
ZD03-300-XP32-WC05-02	●	30	32	55	60	95	192	WCMX050308	I60M3×7	WT09IP
ZD03-310-XP40-WC06-02	●	31	40	60	70	98	203	WCMX06T308	I60M3×7	WT09IP
ZD03-320-XP40-WC06-02	●	32	40	60	70	101	206	WCMX06T308	I60M3×7	WT09IP
ZD03-330-XP40-WC06-02	●	33	40	60	70	104	209	WCMX06T308	I60M3×7	WT09IP
ZD03-340-XP40-WC06-02	●	34	40	60	70	107	212	WCMX06T308	I60M3×7	WT09IP
ZD03-350-XP40-WC06-02	●	35	40	60	70	110	215	WCMX06T308	I60M3×7	WT09IP
ZD03-360-XP40-WC06-02	●	36	40	60	70	113	218	WCMX06T308	I60M3×7	WT09IP
ZD03-370-XP40-WC06-02	●	37	40	60	70	116	221	WCMX06T308	I60M3×7	WT09IP
ZD03-380-XP40-WC06-02	●	38	40	60	70	119	225	WCMX06T308	I60M3×7	WT09IP
ZD03-390-XP40-WC06-02	●	39	40	60	70	122	228	WCMX06T308	I60M3×7	WT09IP

● Ex Stock / ab Lager ○ On demand / auf Anfrage

ZD03



Type Typ	Stock Lager	Basic dimension(mm) Abmessungen						Inserts WSP	Screw Schraube	Wrench Schlüssel
		D	D_1	D_2	L_1	L_2	L			
ZD03-400-XP40-WC06-02	●	40	40	60	70	125	231	WCMX06T308	I60M3×7	WT09IP
ZD03-410-XP40-WC06-02	●	41	40	60	70	128	234	WCMX06T308	I60M3×7	WT09IP
ZD03-420-XP40-WC08-02	●	42	40	60	70	131	239	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-430-XP40-WC08-02	●	43	40	60	70	134	242	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-440-XP40-WC08-02	●	44	40	60	70	137	245	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-450-XP40-WC08-02	●	45	40	60	70	140	248	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-460-XP40-WC08-02	●	46	40	60	70	143	251	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-470-XP40-WC08-02	●	47	40	60	70	146	253	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-480-XP40-WC08-02	●	48	40	70	70	149	255	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-490-XP40-WC08-02	○	49	40	70	70	152	257	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-500-XP40-WC08-02	●	50	40	70	70	155	259	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-510-XP40-WC08-02	●	51	40	70	70	158	261	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-520-XP40-WC08-02	○	52	40	70	70	161	263	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-530-XP40-WC08-02	○	53	40	70	70	164	265	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-540-XP40-WC08-02	●	54	40	70	70	167	267	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-550-XP40-WC08-02	○	55	40	70	70	170	269	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-560-XP40-WC08-02	○	56	40	70	70	173	271	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-570-XP40-WC08-02	○	57	40	70	70	176	273	WCMX080412	I60M3.5×10.4	WT15IP
ZD03-580-XP40-WC08-02	●	58	40	70	70	179	275	WCMX080412	I60M3.5×10.4	WT15IP

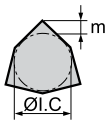
Code key C132-133
ISO Kennzeichen
Cutting data 140
Schnittdaten
Grade selection guide C135
Sortenauswahl
Technical Information C136-139
Technische Information

Inserts Drills Code Key · ISO Kennzeichnung Wendeschneidplatten

Insert shape · Plattenform

Code	Insert shap Plattenform
S	
W	

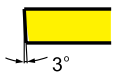
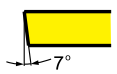
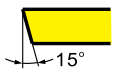
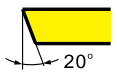
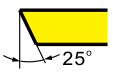
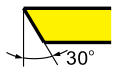
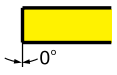
Tolerance · Toleranz



Code	m Tolerance(mm) Toleranz	ØI.C Tolerance(mm) Toleranz	S Tolerance(mm) Toleranz	Code	m Tolerance(mm) Toleranz	ØI.C Tolerance(mm) Toleranz	S Tolerance(mm) Toleranz
A	±0.005	±0.025	±0.025	J	±0.005	±0.05-±0.13	±0.025
F	±0.005	±0.013	±0.025	K	±0.013	±0.05-±0.13	±0.025
C	±0.013	±0.025	±0.025	L	±0.025	±0.05-±0.13	±0.025
H	±0.013	±0.013	±0.025	M	±0.08-±0.18	±0.05-±0.13	±0.13
E	±0.025	±0.025	±0.025	N	±0.08-±0.18	±0.05-±0.13	±0.025
G	±0.025	±0.025	±0.13	U	±0.13-±0.38	±0.08-±0.25	±0.13

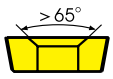
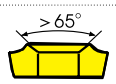
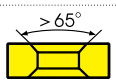
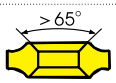
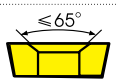
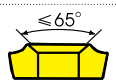
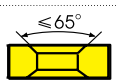
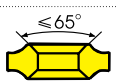
W C M X

Clearance angle of main cutting edge Freiwinkel der Hauptschneide

Code	Clearance angle Freilwinkel	Code	Clearance angle Freiwinkel
A		B	
C		D	
E		F	
G		N	
P		O	Other clearance angle Anderer Freiwinkel

Chipbreaker and clamping system Spanformstufen und Klemmung

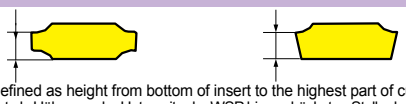
Metric · Metrisch

Code	With / Without hole Mit / Ohne Loch	With / Without chipbreaker Mit / Ohne Spanbrecher	Section plane of Insert Plattenform	Code	With / Without hole Mit / Ohne Loch	With / Without chipbreaker Mit / Ohne Spanbrecher	Section plane of Insert Plattenform
B	✔	-		N	-	-	
H	✔	Single-side Einseitig		R	-	Single-side Einseitig	
C	✔	-		F	-	Double-side Doppelseitig	
J	✔	Double-side Doppelseitig		A	✔	-	
W	✔	-		M	-	Single-side Einseitig	
T	✔	Single-side Einseitig		G	✔	Double-side Doppelseitig	
Q	✔	-		X	---	---	Special Spezial
U	✔	Double-side Doppelseitig					

Length of cutting edge
Schneidenlänge

Code	Length · Länge W	Length · Länge S
03	3.8	
04	4.3	
05	5.4	
06	6.5	6.35
08	8.7	8.0
09		9.525
12		12.7

Insert thickness
Dicke



Thickness is defined as height from bottom of insert to the highest part of cutting edge
Dicke ist definiert als Höhe von der Unterseite der WSP bis zur höchsten Stelle der Scheikante

Code	Insert thickness WSP Dicke (mm)	Code	Insert thickness WSP Dicke (mm)
00	0.79	**05**	5.96
T0	0.99	**T5**	5.95
01	1.59	**06**	6.35
T1	1.98	**T6**	6.75
02	2.38	**07**	7.94
T2	2.58	**09**	9.52
03	3.18	**T9**	9.72
T3	3.97	**11**	11.11
04	4.76	**12**	12.70
T4	4.96		

08 04 12 R – PG

Nose radius
Schneidenradius

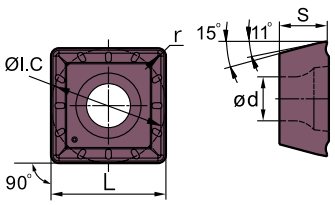
Code	Description Beschreibung
04	0.4mm
08	0.8mm
12	1.2mm

Cutting direction
Vorschubrichtung

Code	Description Beschreibung
R	Right hand / Rechts
L	Left hand / Links
N	Neutral

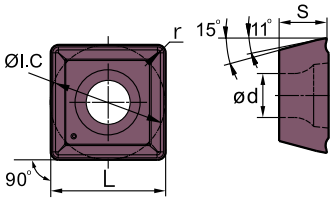
Chipbreaker code
Spanformstufe

ZTD 02 / 03 / 04 / 05



Type Typ	Dimension Abmessung (mm)						Grade Sorte	
	L	ØI.C	s	ød	α	r	YBG205 outer insert Außenschneide	YBG212 inner insert Innenschneide
SPGT050204-PM	5	5	2.4	2.2	15°, 7°	0.4	•	•
SPGT060204-PM	6	6	2.4	2.6	15°, 11°	0.4	•	•
SPGT07T308-PM	7.94	7.94	4	2.8	15°, 11°	0.8	•	•
SPGT090408-PM	9.8	9.8	4.3	4.2	15°, 11°	0.8	•	•
SPGT110408-PM	11.5	11.5	4.8	4.4	15°, 11°	0.8	•	•
SPGT140512-PM	14.3	14.3	5.2	5.75	15°, 11°	1.2	•	•

• ex stock / ab Lager ○ on demand / auf Anfrage



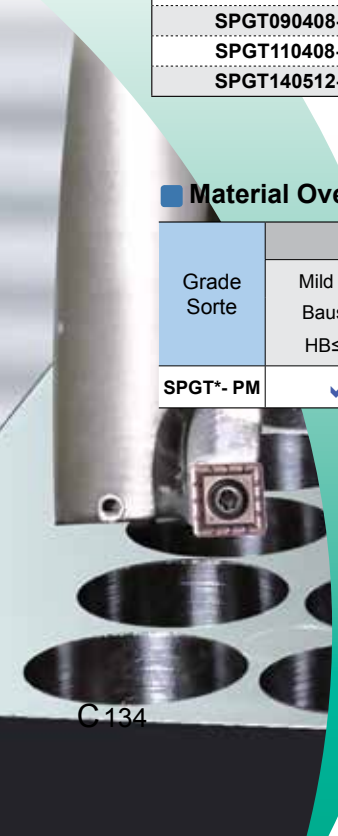
Type Typ	Dimension Abmessung (mm)					Grade Sorte	
	L	ØI.C	s	ød	r	YBG205 outer insert Außenschneide	YBG212 inner insert Innenschneide
SPGT050204-EM	5	5	2.38	2.2	0.4	•	•
SPGT060204-EM	6	6	2.38	2.6	0.4	•	•
SPGT07T308-EM	7.94	7.94	3.97	2.8	0.8	•	•
SPGT090408-EM	9.8	9.8	4.3	4.2	0.8	•	•
SPGT110408-EM	11.5	11.5	4.76	4.4	0.8	•	•
SPGT140512-EM	14.3	14.3	5.2	5.75	1.2	•	•

• ex stock / ab Lager ○ on demand / auf Anfrage

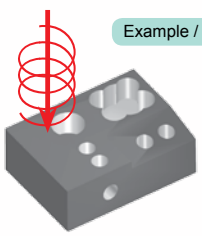
Material Overview · Material Übersicht

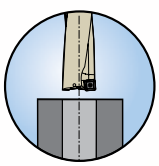
✔ = Very suitable · Sehr empfohlen
✔ = Suitable · Empfohlen

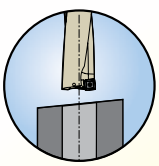
Grade Sorte	Workpiece material · Werkstückstoff										
	Mild steel Baustahl HB≤180	Carbon steel Alloy Steel Kohlenstoff-, Legierter Stahl	Hardened steel · Gehärteter Stahl			Stainless steel Rostfreier Stahl	Cast iron Gusseisen	Nodular cast iron GGG Kugelgra-phitguss	Aluminum alloy Aluleg.	Copper alloy Kupferleg.	Heat resist. alloy Warmfeste Leg.
			~40HRC	~50HRC	~60HRC						
SPGT*- PM	✔	✔				✔	✔	✔			

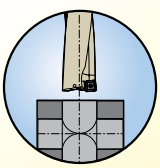


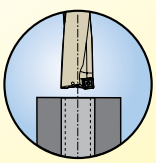
Example / Beispiel



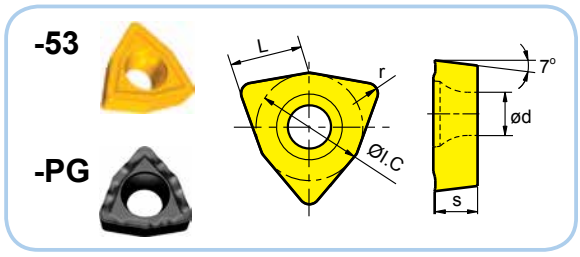

1 General boring
Allgemeine Bohrung


2 Inclined plane
Schiefe Ebene


3 Cross hole
Kreuzbohrung


4 expansion boring
Expansionsbohrung

Indexable inserts for drilling · WSP zum Bohren



Ideal Machining Condition
Gute Bearbeitungsbedingungen

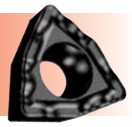
Normal Machining Condition
Normale Bearbeitungsbedingungen

Unfavorable Machining Condition
Ungünstige Bearbeitungsbedingungen

Workpiece Material Werkstoffe							
P	Steel / Stahl	✱	✱	✱	✱	✱	
M	Stainless Steel Rostfreier Stahl	✱	✱			✱	
K	Cast Iron Gusseisen	✱	✱	✱	✱	✱	
N	Non-ferrite material Ne Metalle						✱
S	Heat-resistant steel Warmfester Stahl	✱					

Type Typ	Basic dimension(mm) · Basis Abmessungen					Grade · Sorte					
	L	I.C	s	d	r	YBG202	YBG205	YBG201	YBD252	YBG40	YD201
WCMX030208R-53	3.8	5.56	2.38	2.8	0.8	●		●	●	○	○
WCMX040208R-53	4.3	6.35	2.38	3.1	0.8	●		●	●	○	○
WCMX050308R-53	5.4	7.94	3.18	3.2	0.8	●		●	●	○	○
WCMX06T308R-53	6.5	9.525	3.97	3.7	0.8	●		●	●	○	○
WCMX080412R-53	8.7	12.7	4.76	4.3	1.2	●		●	●	○	○
WCMX030208-D	3.8	5.56	2.38	2.8	0.8				○	○	
WCMX040208-D	4.3	6.35	2.38	3.1	0.8				○	○	
WCMX050308-D	5.4	7.94	3.18	3.2	0.8				○	○	
WCMX06T308-D	6.5	9.525	3.97	3.7	0.8				○	○	
WCMX080412-D	8.7	12.7	4.76	4.3	1.2				○	○	
WCMX030208R-PG	3.8	5.56	2.38	2.8	0.8	●			○		
WCMX040208R-PG	4.3	6.35	2.38	3.1	0.8	●			○		
WCMX050308R-PG	5.4	7.94	3.18	3.2	0.8	●	○		○		
WCMX06T308R-PG	6.5	9.525	3.97	3.7	0.8	●			○		
WCMX080412R-PG	8.7	12.7	4.76	4.3	1.2	●			○		

-PG chipbreaker
-PG Spanbrecher



Unique design of waveform edge ensure high edge strength and good chip breaking performance for machining carbon steel and alloy steel.

Wellenförmige Schneide mit hoher Stabilität und Spankontrolle zur Bearbeitung von Kohlenstoffstahl, legiertem Stahl und Guss

-D chipbreaker
-D Spanbrecher

Inserts for outer positioning with optimized chipbreaker geometriy. And good chip breaking performance for machining,steel, stainless steel, cast iron for common cutting speed .

Optimierte Geometrie als Außenschneide einsetzbar. Gute Spankontrolle bei Stahl, rostfreiem Stahl, Grauguss bei mittleren Schnittgeschwindigkeiten.

-53 chipbreaker
-53 Spanbrecher

Sharp cutting edge benefits to achieve low roughness surface, mainly applicable for low load cutting of aluminum alloy, mild steel, stainless steel and cast iron.

Scharfe Schneidkante zur Erziehlung exclusiver Oberflächen. Zur Bearbeitung von Alulegierungen, Baustahl, rostfreiem Stahl und Grauguss.

● Ex Stock / ab Lager ○ On demand / auf Anfrage

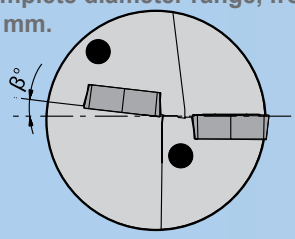
Comparison table for drilling Insert - Grades
Bohrwendeplatten Übersichtstabelle - Sorten

Workpiece material Werkstück Material	ISO	Coating · Beschichtung		Cermet Cermet	uncoated carbide unb. Hartmetall	PCBN & PCD PCBN & PKD
		CVD	PVD			
P Steel · Stahl	P01					
	P10	YBD252	YBG202, YBG205, YBG212			
	P20	YBD252	YBG202, YBG205, YBG212			
	P30	YBD252	YBG202, YBG205, YBG212			
	P40					
M Stainless Steel Rostfreier Stahl	M01					
	M10		YBG202, YBG205, YBG212			
	M20		YBG202, YBG205, YBG212			
	M30		YBG202, YBG205, YBG212			
	M40					
K Cast iron · Grauguss	K01					
	K10	YBD252	YBG202, YBG205, YBG212			
	K20	YBD252	YBG202, YBG205, YBG212			
	K30		YBG202, YBG205, YBG212			
	K40		YBG202, YBG205, YBG212			
N Non-ferrous materials Ne - Metalle	N01					
	N10				YD201	
	N20				YD201	
	N30				YD201	
S Heat-resistant steel Warmfester Stahl	S01					
	S10		YBG202, YBG205			
	S20		YBG202, YBG205			
	S30					
H Hardened material Gehärtete Werkstoffe	H01					
	H10					
	H20					
	H30					

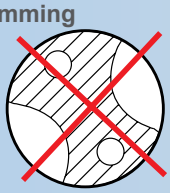
Features of drill · Merkmale der WSP-Bohrer

- Perfect insert assembling angle makes balanced cutting force, low vibration in machining process, thus achieve excellent surface quality.
- Advanced flute design possesses large chip pocket for chip removal.
- Complete diameter range, from 16 mm to 58 mm.

- Perfekte WSP Positionierung für ausgewogene Schnittkraftverteilung. Zur Erzielung guter Oberflächen.
- Fortschrittlicher großer Spanraum für eine gute Spanabfuhr.
- kompletter Durchmesserbereich von 16 mm-58mm

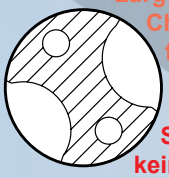


Small chip pocket
Easy to generate chips jamming
kleiner Spanraum, Spanstau.



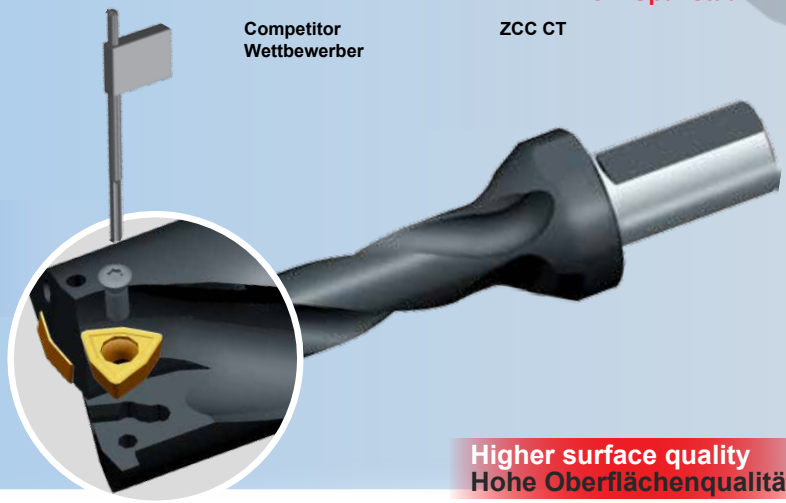
Competitor
Wettbewerber

Large chip pocket
Chip jamming free
Großer Spanraum kein Spanstau

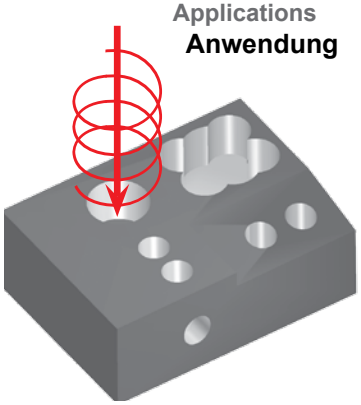


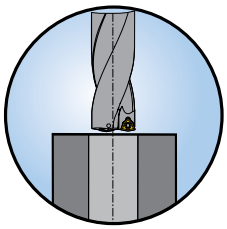
ZCC CT

Insert assembling
WSP Wechsel

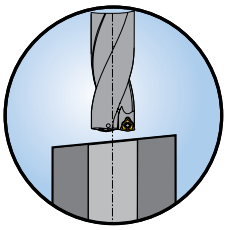


Applications
Anwendung

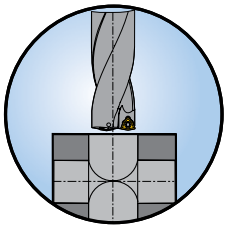




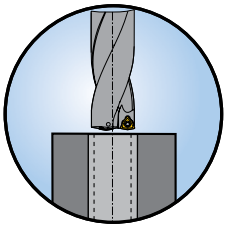
1. Common drilling
Normalbohren



2. Slant face drilling
Schrägbohren

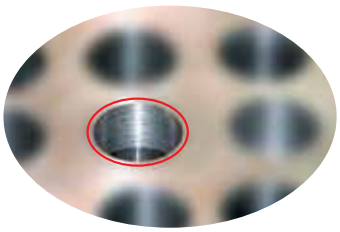


3. Cross-hole drilling
Bohren bei Querbohrungen



4. Counterboring
Aufbohren

Higher surface quality
Hohe Oberflächenqualität



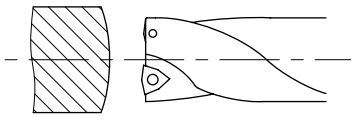
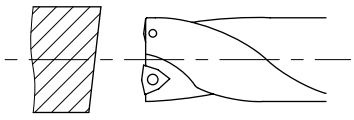
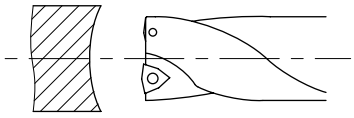
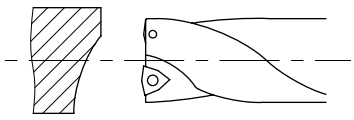
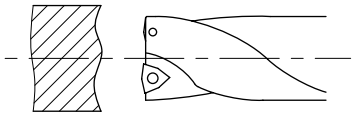
Better chip breaking performance
Gute Spankontrolle

Technical information for shallo drills · Technische Informationen über WSP-Bohrer

■ initial drill penetration · Das Anbohren

Initial drill penetration is an important factor for successful drilling. One way of ensuring good hole quality is to make sure the penetration surface of the workpiece is vertical to the drill centre axis. In addition, an indexable drill can carry out initial penetration of convex, concave, inclined and irregular surfaces when accompanied with an adjustment of feed rates.

Das Anbohren ist ein wichtiger bzw. entscheidener Faktor für das erfolgreiche Bohren. Eine gute Bohrungsqualität und Standzeit erzielt man bei einer ebenen Anbohrfläche vertikal zur Bohrerachse. Beim Anbohren in konkaven, konvexen und unebenen Flächen soll der Vorschub entsprechend reduziert werden.

Workpiece surface Werkstück Oberflächen	Countermeasures Maßnahmen
	For a convex surface, the conditions are relatively good and the centre of the drill ideally makes contact with the workpiece first, thus can adopt normal feed. Bei konvexen Anbohrflächen ist die Bearbeitungsituation realtiv gut. Der erste Kontakt des Bohrers geschieht über die Zentrumsschneide, so daß normale Vorschübe gewählt werden können.
	When penetrating an inclined surface, the cutting edges will be unevenly loaded which may result in the premature drill wear. If the angle of the inclined surface is larger than two degrees, the feed should be reduced to 1/3 of that recommended for the drill. Bei Schrägflächen wird der Bohrer aus dem Zentrum gedrückt. Dadurch wird der Bohrerverschleiß erhöht. Bei einem Winkel von über 2° sollte der Vorschub auf 1/3 der empfohlenen Werte reduziert werden.
	When drilling into concave surface, drill center axis normally tends to off-center, the feed should be reduced to 1/3 of that recommended for the drill. Beim Anbohren in konkaven Flächen kann der Bohrer aus dem Zentrum gedrückt werden. Vorschub auf 1/3 reduzieren.
	When drilling into non-symmetric curved surfaces, the drill tends to deviate from the centre because of penetrating against an inclined surface. The feed should be reduced to lower than that recommended for the initial penetration of concave surfaces. Beim Bohren in asymetrischen Flächen sollte der Vorschub entsprechend reduziert werden, eventuell auf unter die Werte, die für das erste Eindringen in kontakte Flächen empfohlen werden.
	When drilling into irregular surface, there is a risk of the inserts chipping and this may also occur when drilling through the workpiece. Therefore the feed rate should be reduced. Beim Bohren in stark asymetrische Flächen können beim Anbohren und beim Austritt des Bohres aus dem Werkstück Ausbrüche an der Wendeschneidplatte entstehen. Auch hier den Vorschub entsprechend reduzieren.

Calculations for shallow drilling · Berechnungsbeispiele für WSP-Bohrer

• Cutting speed · Schnittgeschwindigkeit (Vc)

$$Vc = \frac{Dc \times \pi \times n}{1000}$$

Vc (m/min): cutting speed · Schnittgeschwindigkeit
Dc (mm): drill diameter · Bohrerdurchm. Ø
n (rev/min): rotating speed · Umdrehungen
π ~ 3,14

• Example · Beispiel

Spindle speed is1600 rev/min, drill diameter is 20mm, thus cutting speed is:
Spindelumdrehung beträgt 1600 u/min, Bohrerdurchmesser ist 20mm, dadurch ist die Schnittgeschw.:

$$Vc = \frac{Dc \times \pi \times n}{1000} = \frac{20 \times 3.14 \times 1600}{1000} = 100\ (m/min)$$

• Feed speed · Vorschub

$$Vf = fr \times n\ (mm/min)$$

Vf (mm/min): feed speed · Schnittgeschwindigkeit
fr (mm/rev): feed rate per revolution · Vorschub pro Umdrehung
n (rev/min): spindle speed · Umdrehungen

• Example · Beispiel

Spindle speed is1500 rev/min, feed rate per revolution is 0.1mm/rev, thus feed speed is:
Spindelumdrehung beträgt 1500 u / min, Vorschub pro Umdrehung = 0,1 mm / rev:

$$Vf = fr \times n = 0.1 \times 1500 = 150\ (mm/min)$$

• Machining time · Bearbeitungszeit

$$Tc = \frac{Id \times i}{n \times f}$$

Tc (min): machining time · Bearbeitungszeit
fr (mm/rev): feed rate per revolution · Vorschub pro Umdrehung
i: number of holes · i: Anzahl der Bohrung.
Id (mm): drilling depth · Bohrtiefe
n (rev/min): spindle speed · Drehzahl

• Example · Beispiel

Calculate the drilling time, with following formular:
drill diameter 20mm, depth 40mm
cutting speed 100m/min
feed rate 0,1/rev

$$n = \frac{Vc \times 1000}{Dc \times \pi} = \frac{100 \times 1000}{20 \times 3.14} = 1600\ (rev/min)$$

Berechnen Sie die Bohrzeit, mit folgender Formel:
Bohrerdurchm. 20mm, Bohrtiefe 40mm
Schnittgeschwindigk. 100m/min
Vorschub pro Umdrehung 0,1/re

$$Tc = \frac{Id \times i}{n \times fr} = \frac{40 \times 1}{1600 \times 0.1} = 0.25\ (min)$$

• Metal removal rate · Zerspanungsvolumen

$$Q = \frac{Vf \times \pi \times Dc^2}{4 \times 1000}$$

Q (cm3/min): metal removal rate · Zerspanungsvolumen
Dc(mm): drill diameter · Bohrerdurchmesser
Vf (mm/min): feed speed · Vorschub
π ~ 3,14

• Example · Beispiel

Drill diameter is 20mm, feed speed is 160mm/min, thus metal removal rate is:
Bohrdurchmesser 20mm, Vorschub ist 160mm/min, dadurch liegt das Zerspanungsvolumen bei:

$$Q = \frac{Vf \times \pi \times Dc^2}{4 \times 1000} = \frac{160 \times 3.14 \times 20^2}{4 \times 1000} = 50.24\ (cm^3/min)$$

Recommended cutting data for shallow drills · Empfohlene Schnittdaten für WSP-Bohrern

ISO	Material	Hardness HB Härte HB	Diameter Ø Durchmesser [mm]	Feed rate Vorschub fn [mm/r]	Cutting speed Schnittgeschwindigkeit Vc [m/min]
P	Carbon steel Kohlenstoff-stahl	80-200	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.09 0.05-0.09 0.06-0.10 0.07-0.11 0.08-0.12	200(170-240)
	Low alloy steel Niedrigleg. Stahl	150-260	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.09 0.05-0.12 0.06-0.14 0.08-0.16 0.10-0.20	170(140-220)
	High alloy steel Hochleg. Stahl	150-320	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.09 0.05-0.12 0.06-0.16 0.08-0.18 0.10-0.22	150(120-180)
	Cast steel Gussstahl	180-250	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.08 0.05-0.08 0.06-0.10 0.07-0.11 0.07-0.12	140(120-170)
M	Stainless steel Ferrite Martensite Rostfreier Stahl	150-270	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.09 0.05-0.12 0.06-0.16 0.08-0.18 0.10-0.22	160(110-230)
	Austenite Austenit	150-275	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.09 0.05-0.11 0.06-0.13 0.08-0.14 0.10-0.16	140(110-220)
K	Malleable cast iron Temperguss	150-230	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.10 0.05-0.14 0.08-0.16 0.10-0.20 0.12-0.24	160(120-220)
	Gray cast iron Grauguss	150-220	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.10 0.05-0.14 0.08-0.16 0.10-0.20 0.12-0.24	200(170-240)
	Nodular cast iron GGG Kugelgra-phitguss	160-250	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.09 0.05-0.12 0.06-0.14 0.08-0.16 0.10-0.20	160(130-200)
N	Al alloy Alulegierung	60-110	16.0-23.0 24.0-30.0 31.0-38.0 39.0-46.0 47.0-58.0	0.05-0.10 0.05-0.14 0.08-0.16 0.10-0.20 0.12-0.24	300(250-350)

Threading pre-hole diameter · Kernlochdurchmesser

- Metric Coarse thread
- Metrisch - Gewinde

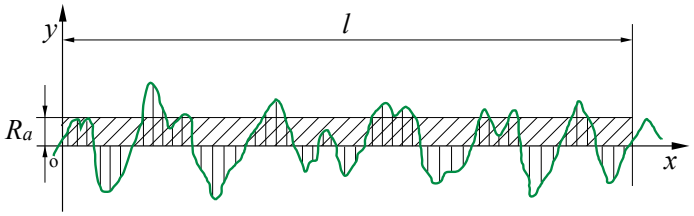
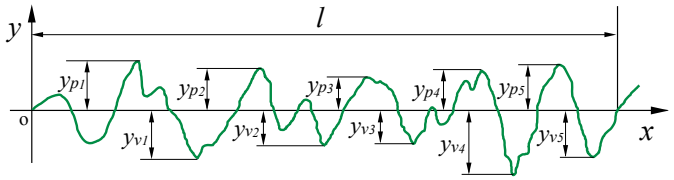
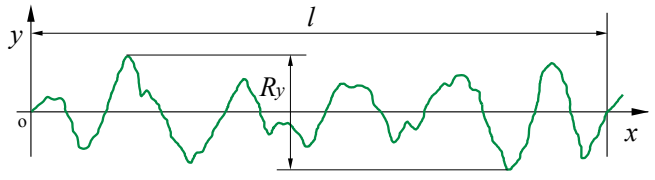
Thread code Gewindebez.	Pre-hole diameter (mm) Kerndurchmesser
M3×0.5	2.5
M3.5×0.6	2.9
M4×0.7	3.3
M5×0.8	4.2
M6×1.0	5.0
M7×1.0	6.0
M8×1.25	6.75
M9×1.25	7.75
M10×1.5	8.5
M11×1.5	9.5
M12×1.75	10.25
M14×2.0	12.0
M16×2.0	14.0
M18×2.5	15.5
M20×2.5	17.5
M24×3.0	21.0
M27×3.0	24.0
M30×3.5	26.5

- Metric fine screw fine
- Metrisch - Feingewinde

Thread code Gewindebez.	Pre-hole diameter (mm) Kerndurchmesser
M3×0.35	2.65
M3.5×0.35	3.15
M4×0.5	3.5
M4.5×0.5	4.0
M5×0.5	4.5
M5.5×0.5	5.0
M6×0.75	5.25
M7×0.75	6.25
M8×1.0	7.0
M8×0.75	7.25
M9×1.0	8.0
M9×0.75	8.25
M10×1.25	8.75
M10×1.0	9.0
M10×0.75	9.25
M11×1.0	10.0
M11×0.75	10.25
M12×1.5	10.5
M12×1.25	10.75
M12×1.0	11.0

Thread code Gewindebez.	Pre-hole diameter (mm) Kerndurchmesser
M14×1.5	12.5
M14×1.0	13.0
M15×1.5	13.5
M15×1.0	14.0
M16×1.5	14.5
M16×1.0	15.0
M17×1.5	15.5
M17×1.0	16.0
M18×2.0	16.0
M18×1.5	16.5
M18×1.0	17.0
M20×2.0	18.0
M20×1.5	18.5
M20×1.0	19.0
M22×2.0	20.0
M22×1.5	20.5
M22×1.0	21.0
M24×2.0	22.0
M24×1.5	22.5
M24×1.0	23.0

Surface roughness · Oberflächenrauhigkeit

Type Typ	Code	Calculation method · Berechnungsmethode	Calculation example (figure) · Meßaufnahme (Abb.)
Arithmetic average deviation of profile Mittlere Rauhtiefe	Ra	Within sampling length l, the arithmetic average absolute value of profile deviation is $Ra = \frac{1}{l}\int_0^l \lvert y(x)\rvert dx$ In the formula, the profile deviation y is the distance between profile points and reference line in the measuring direction. Reference line is the profile least-square average line O. This line divide the profile and make the sum of squares of profile deviation to be the minimum within the sampling length. Der Mittelrauhwert Ra ist der arithmetische Mittelwert der absoluten Beträge der Abstände y des Rauhheitsprofils von der Mittellinie innerhalb der Messstrecke. Dies ist gleichbedeutetend mit der Höhe des Rechtecks, dessen Länge gleich der Gesamtstrecke l ist und das flächengleich mit der Summe der zwischen dem Rauheitsprofil und der Mittellinie eingeschlossenen Fläche ist y=f	
Irregularity ten-point high Gemittelte Rauhtiefe	Rz	Within sampling length l, the sum of the average value of heights of five highest profile peak and the depths of five deepest profile valleys $Rz = \frac{\sum_{i=1}^{5} y_{pi} + \sum_{i=1}^{5} y_{vi}}{5}$ In the formula, ypi means the height of 'i'th highest profile peak. In the formula, yvi means the depth of 'i'th deepest profile valley. Maximum height of profile Ry: the distance between the top profile peak line and the bottom profile valley line in the longitudinal direction within the sampling length l. Die gemittelte Rauhtiefe Rz ist das arithmetische Mittel aus den Einzelrauhtiefen fünf aufeinander grenzender Einzelmessstrecken gleicher Länge. Rz wird ebenfalls in (µm) angegeben.	
Maximum height of profile Maximale Rauhtiefe	Ry	The distance between the inner profile peak line and the bottom profile valley line in the longitudinal direction within the sampling length l. Top profile peak line is the line that parallels to the reference line and passes through the highest point of profile peak. Bottom profile line is the line that parallels to the reference line and passes through the lowest point of profile valley. Die maximale Rauhtiefe Ry ist die größte der auf der Gesamtmeßstrecke l vorkommenden Einzelrauhtiefen, Ry wird auch in (µm) Mikrometer angegeben. (Bemerkung) Um Rz herausfinden, wird ein Anteil ohne außergewöhnliche Höhen und Tiefen als Stichprobenlänge ausgewählt und als Schwachstelle betrachtet.	

Material comparison table · Werkstoffe Vergleichstabelle

ISO	Country and Standard · Standardbezeichnung nach Länder										
	China	USA	Germany		Great Britain		Sweden	France	Italy	Spain	Japan
	GB	AISI/SAE	W.-nr	DIN	BS	EN	SS	AFNOR	UNI	UNE	JIS
P	Alloy steel · Legierter Stahl										
	15	1015	1.0401	C15	080M15	-	1350	CC12	C15C16	F.111	-
	20	1020	1.0402	C22	050A20	2C	1450	CC20	C20C21	F.112	-
	35	1035	1.0501	C35	060A35	-	1550	CC35	C35	F.113	-
	45	1045	1.0503	C45	080M40	-	1650	CC45	C45	F.114	-
	55	1055	1.0535	C55	070M55	-	1655	-	C55	-	-
	60	1060	1.0601	C60	080A62	43D	-	CC55	C60	-	-
	Y15	1213	1.7015	9SMn28	230M07	-	1912	S250	CF9SMn28	11SMn28	SUM22
	-	12L13	1.0718	9SMnPb28	-	-	1914	S250Pb	CF9MnPb28	11SMnPb28	SUM22L
	-	-	1.0722	10SPb20	-	-	-	10PbF2	CF10Pb20	10SPb20	-
	-	1140	1.0726	35S20	212M36	8M	1957	35MF4	-	F210G	-
	Y13	1215	1.0736	9SMn36	240M07	1B	-	S300	CF9SMn36	12SMn35	-
	-	12L14	1.0737	9SMnPb36	-	-	1926	S300Pb	CF9SMnPb36	12SMnP35	-
	55Si2Mn	9255	1.0904	55Si9	250A53	45	2085	55S7	55Si8	56Si7	-
	-	9262	1.0961	60SiCr7	-	-	-	60SC7	60SiCr8	60SiCr8	-
	15	1015	1.1141	Ck15	080M15	32C	1370	XC12	C16	C15K	S15C
	40Mn	1039	1.1157	40Mn4	150M36	15	-	35M5	-	-	-
	25	1025	1.1158	Ck25	-	-	-	-	-	-	S25C
	35Mn2	1335	1.1167	36Mn5	-	-	2120	40Mn5	-	36Mn5	SMn438(H)
	30Mn	1330	1.1170	28Mn6	150M28	14A	-	20M5	C28Mn	-	SCMn1
	35Mn	1035	1.1183	Cf35	060A35	-	1572	XS38TS	C36	-	S35C
	Ck45	1045	1.1191	45	080M46	-	1672	XC42	C45	C45K	S45C
	55	1055	1.1203	Ck55	070M55	-	-	XC45	C50	C55K	S55C
	50	1050	1.1213	Cf53	060A52	-	1674	XC48TS	C53	-	S50C
	60Mn	1060	1.1221	Ck60	080A62	43D	1678	XC60	C60	-	S58C
	-	1095	1.1274	Ck101	060A96	-	1870	-	-	-	SUP4
	-	-	1.3401	X120Mn12	Z120M12	-	-	X120M12	XG120Mn12	X120Mn12	SCMnH/1
	Gr15;45Gr	52100	1.3505	100Cr6	534A99	31	2258	100C6	100Cr6	F.131	SUJ2
	-	ASTM A204Gr.A	1.5415	15Mo3	1501-240	-	2912	15D3	16Mo3KW	16Mo3	-
	-	4520	1.5426	16Mo5	1503-245-420	-	-	-	16Mo5	16Mo5	-
	-	ASTM A350LF5	1.5622	14Ni6	-	-	-	16N6	14Ni6	15Ni6	-
	-	ASTM A353	1.5662	X8Ni9	1501-509;510	-	-	-	X10Ni9	XBNi09	-

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	GB	AISI/SAE	W.-nr	DIN	BS	EN	SS	AFNOR	UNI	UNE	JIS
P	Alloy steel · Legierter Stahl										
	-	2515	1.5680	12Ni19	-	-	-	Z18N5	-	-	-
	-	3135	1.5710	36NiCr6	640A35	111A	-	35NC6	-	-	SNC236
	-	3415	1.5732	14NiCr10	-	-	-	14NC11	16NiCr11	15NiCr11	SNC415(H)
	-	3415 3310	1.5752	14NiCr14	655M13 655A12	36A	-	12NC15	-	-	SNC815(H)
	-	9840	1.6511	36CrNiMo4	816M40	110	-	40NCD3	38CrNiMo4(KB)	35CrNiMo4	-
	-	8620	1.6523	21NiCrMo2	850M20	362	2503	20NCD2	20NiCrMo2	20NiCrMo2	SNCCM220(H)
	-	8740	1.6546	40NiCrMo2	311-Type7	-	-	-	40NiCrMo2(KB)	40NiCrMo2	SNC240
	40CrNiMoA	4340	1.6582	34CrNiMo6	817M40	24	2541	35NCD6	35CrNiMo6(KB)	-	-
	-	-	1.6587	17CrNiMo6	820A16	-	-	18NCD6	-	14CrNiMo13	-
	15Cr	5015	1.7015	15Cr3	523M15	-	-	12C3	-	-	SCr415(H)
	35Cr	5132	1.7033	34Cr4	530A32	18B	-	32C4	34Cr4(KB)	35Cr4	SCr430(H)
	40Cr	5140	1.7035	41Cr4	530M40	18	-	42C4	41Cr4	42Cr4	SCr440(H)
	40Cr	5140	1.7045	42Cr4	-	-	2245	-	-	42Cr4	SCr440
	18CrMn	5115	1.7131	16MnCr15	(527M20)	-	2511	16MC5	16MnCr15	16MnCr15	-
	20CrMn	5155	1.7176	55Cr3	527A60	48	-	55C3	-	-	SUP9(A)
	30CrMn	4130	1.7218	25CrMo4	1717CDS110	-	2225	25CD4	25CrMo4(KB)	55Cr3	SCM420; SCM430
	35CrMo	4137;4135	1.7220	34CrMo4	708A37	19B	2234	35CD4	35CrMo4	34CrMo4	SCM432; SCRRM3
	40CrMoA	4140;4142	1.7223	41CrMo4	708M40	19A	2244	42CD4TS	41CrMo4	41CrMo4	SCM440
	42CrMo 42CrMnMo	4140	1.7225	42CrMo4	708M40	19A	2244	42CD4	42CrMo4	42CrMo4	SCM440(H)
	-	-	1.7262	15CrMo5	-	-	2216	12CD4	-	12CrMo4	SCM415(H)
	-	ASTM A182 F11;F12	1.7335	13CrMo44	1501- 620Gr.27	-	-	15CD3.5; 15CD4.5	14CrMo44	14CrMo45	-
	-	-	1.7361	32CrMo12	722M24	40B	2240	30CD12	32CrMo12	F.124.A	-
	-	ASTM A182 F.22	1.7380	10CrMo910	1501- 622Gr.31;45	-	2218	12CD9;10	12CrMo9,10	TU.H	-
	-	-	1.7715	14MoV63	1503-660-440	-	-	-	-	13MoCrV6	-
	50CrVA	6150	1.8159	50CrV4	735A50	47	2230	50CV4	50CrV4	51CrV4	SUP10
	-	-	1.8509	41CrAlMo7	905M39	41B	2940	40CAD6,12	41CrAlMo7	41CrAlMo7	-
	-	-	1.8523	39CrMoV139	897M39	40C	-	-	36CrMoV12	-	-

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	GB	AISI/ SAE	W.-nr	DIN	BS	EN	SS	AFNOR	UNI	UNE	JIS
P	Tool steel · Werkzeugstahl										
	T10	W.110	1.1545	C105W1	-	-	1880	Y1105	C98KU C100KU	F.515 F.516	-
	T12A	W.112	1.1663	C125W	-	-	-	Y2120	C120KU	(C120)	SK2
	CrV;9SiCr	L3	1.2067	100Cr6	BL3	-	-	Y100C6	-	100Cr6	-
	Cr12	D3	1.2080	X210Cr12	BD3	-	-	Z200Cr12	X210Cr13KU X250Cr12KU	X210Cr12	SKD1
	4Cr5MoVSi	H13	1.2344	X40CrMoV5 1	BH13	-	2242	Z40CDV5	X35CrMoV05KU X40CrMoV51KU	X40CrMoV5	SKD61
	Cr6WV	A2	1.2363	X100CrMoV5 1	BA2	-	2260	Z100CDV5	X100CrMoV51KU	X100CrMoV5	SKD12
	CrWMo	-	1.2419	105WCr6	-	-	2140	105WC13	10WCr6 107WCr5KU	105WCr5	SKS31 SKS2 SKS3
	Cr12W	-	1.2436	X210CrW12	-	-	2312	-	X215CrW12 1KU	X210CrW12	SKD2
	5CrNiMo	S1	1.2542	45WCrV7	BS1	-	2710	-	45WCrV8KU	45WCrSi8	-
	3Cr2W8V	H21	1.2581	X30WCrV9 3 X30WCrV93KU	BH21	-	-	Z30WCV9	X28W09KU X30WCrV9 3KU	X30WCrV9	SKD5
	Cr12MoV	-	1.2601	X165CrMoV 12	-	-	2310	-	X165CrMoW12KU	X160CrMoV12	SKD11
	5CrNiMo	L6	1.2713	55NiCrMoV6	-	-	-	55NCDV7	-	F.250.S	SKT4
	V	W210	1.2833	100V1	BW2	-	-	Y1105V	-	-	SKS43
	W6Mo5Cr4V2Co5	-	1.3243	S6-5-2-5	-	-	2723	Z85WDKCV	HS6-5-2-5	HS6-5-2-5	SKH55
	W18Cr4VCo5	T4	1.3255	S18-1-2-5	BT4	-	-	Z80WKCV 10-05-04-01	X78WCo1805KU	HS18-1-1-5	SKH3
	W6Mo5Cr4V2	M2	1.3343	S6-5-2	BM2	-	2722	Z85WDCV 06-05-04-02	X82WMo0605KU	HS6-5-2	SKH9
	-	M7	1.3348	S2-9-2	-	-Z-	2782	Z100WCWV 09-02-04-02	HS2-9-2	HS2-9-2	-
	W18Cr4V	T1	1.3355	S18-0-1	BT1	-	-	Z80WCV 18-04-01	X75W18KU	HS18-0-1	SKH2
	W6Mo5Cr4V3	M3	-	S6-5-3	-	-	-	-	-	-	SKH52
	-	M42	-	-	BM42	-	-	-	-	-	SKH59

ISO	Country and Standard · Standardbezeichnung nach Länder					Main application Hauptanwendung
	China	USA	Germany	Japan	Daido Steel Co., Ltd (Japan)	
	GB	AISI/SAE	DIN	JIS	DAIDO	
P	Plastic die steel · Gesenkstahl					
	-	P20 mod.		-	PX5N	For mass production of large mirror dies. Automobile tail light, front fender of car, video camera, household electrical appliances etc Große hochglänzende Präzisionsgesenke für die Serienproduktion. Automobilteile, Videokameras, elektr. Haushaltsgeräte ect.
	-	-		-	NAK55	High precision mirror die. Video camera, music disc, Cosmetic Containers, transparent covers, transparent films etc Hochglänzende Präzisionsgesenke für Videokameras, Musik CDs, Kosmetik Behälter, Transparente Abdeckungen.
	-	-		-	NAK80	High precision mirror die. Video camera, music disc, Cosmetic Containers, transparent covers, transparent films etc Hochglänzende Präzisionsgesenke für Videokameras, Musik CDs, Kosmetik Behälter, Transparente Abdeckungen und Beläge.
	3Cr13	420 mod.		SUS420J2 mod.	S-STAR	For ultra-mirror corrosion resistant precise dies. Accessories of camera, CD, lens, watch case. Für ultra-fein spiegelnde korrosionsbeständige Gesenke für Zubehör von Kameras. CD, Linsen, Armbanduhren.
	Cold-working die steel · Kaltarbeitsstahl					
	-	02	-	SKS93	YK30	Stamping die, gauge calipers, paper cutter, auxiliary tools Für Gesenkstempel, Meßkaliber, Papierschneidmesser, Werkzeuge
	9CrWMn	01 mod.	-	SKS3 mod.	GOA	Blanking die, gauge calipers, drawing die, taps, Perforated punch. Für Schnittmatrizen, Meßkaliber, Gewindebohrer, Perforationswerkzeuge, Kaltziehsteine
	Cr12MoV	D2	X165CrMoV12	SKD11	DC11	Blanking die, cold forming die, cold drawing die, forming roller, punch Für Schnittmatrizen, Kaltformpressgesenke, Kaltziehsteine, Formwalzen.
	-	D2 mod.	-	SKD11 mod.	DC53	Blanking die, cold forming die, cold drawing die, forming roll, punch Für Schnittmatrizen, Kaltformpressgesenke, Kaltziehsteine, Formwalzen.
	Hot-working die steel · Warmarbeitsstahl					
	4Cr5MoSiV1	H13	X40CrMoV51	SKD61	DHA1	Aluminum-compression die, connecting parts of compression die, hot stamping die, hot extrusion die, thermal shear cutting blade Aluminium Druckgesenke, Verbindungsstücke für Druckgesenke, Heißpressgesenke, Heiß-Extruder-Gesenke, warmfeste Schnittmesser ect.
	-	-	-	-	DH21	Long life Aluminum compression die Alu-Druckgesenke für lange Lebensdauer
	-	-	-	-	DH31-S	Compression die, Druckgesenke
	-	-	-	-	DH2F	Compression die, plastic die Druckgesenke, Plastik-Gesenke

ISO	Country and Standard · Standardbezeichnung nach Länder										
	China	USA	Germany		Great Britain		Sweden	France	Italy	Spain	Japan
	GB	AISI/ SAE	W.-nr	DIN	BS	EN	SS	AFNOR	UNI	UNE	JIS
M	Stainless steel · Rostfreier Stahl										
	0Cr13; 1Cr12	403	1.4000	X6Cr13	403S17	-	2301	Z6C13	X6Cr13	F.3110	SUS403
	-	-	1.4001	X7Cr14	-	-	-	-	-	F.8401	-
	1Cr13	410	1.4006	X10Cr13	410S21	56A	2302	Z10C14	X12Cr13	F.3401	SUS410
	1Cr17	430	1.4016	X6Cr17	430S15	60	220	Z8C17	X8Cr17	F.3113	SUS430
	2Cr13	410	1.4021	X20Cr13	S62	56B; 56C	-	Z20C13	X20C13	F.3401	SUS410
	-	-	1.4027	G-X20Cr14	420C29	56B	-	Z20C13M	-	-	SCS2
	4Cr13	-	1.4034	X46Cr13	420S45	56D	2304	Z40CM Z38C13M	X40Cr14	F.3405	SUS420J2
	1Cr17Ni2	431	1.4057	X20CrNi172	431S29	57	2321	Z15CNi6.02	X16CNi16	F.3427	SUS431
	Y1Cr17	430F	1.4104	X12CrMoS17	-	-	2383	Z10CF17	X10CrS17	F.3117	SUS430F
	1Cr17Mo	434	1.4113	X6CrMo171	434S17	-	2325	Z8CD17.01	X8CrMo17	-	SUS434
	-	-	1.4313	X5CrNi134	425C11	-	-	Z4CND13.4M	-	-	SCS5
	-	-	1.4408	G-X6CrNiMo1810	316C16	-	-	-	-	F.8414	SCS14
	4Cr9Si2	HW3	1.4718	X45CrSi93	401S45	52	-	Z45CS9	X45CrSi8	F.322	SUH1
	0Cr13Al	405	1.4724	X10CrAl13	403S17	-	-	Z10C13	X10CrAl12	F.311	SUS405
	Cr17	430	1.4742	X10CrAl18	430S15	60	-	Z10CAS18	X8Cr17	F.3113	SUS430
	8Cr20Si2Ni	HNV6	1.4757	X80CrNiSi20	443S65	59	-	Z80CSN20.02	X80CrSiNi20	F.320V	SUH4
	2Cr25N	446	1.4762	X10CrAl24	-	-	2322	Z10CAS24	X16Cr26	-	SUH446
	Austenitic stainless steel · Austenitischer Rostfreier Stahl										
	0Cr18Ni9	304	1.4301	X5CrNi1810	304S15	58E	2332	Z6CN18.09	X5CrNi1810	F.3551; F.3541; F.3504	SUS304
	1Cr18Ni9MoZr	303	1.4305	X10CrNiS189	303S21	58M	2346	Z10CNF18.09	X10CrNiS18.09	F.3508	SUS303
	0Cr19Ni10	304L	1.4306	X2CrNi1911	304S12	-	2352	Z2CN18.10	X2CrNi18.11	F.3503	SCS19
	-	-	1.4308	G-X6CrNi189	304C15	-	-	Z6CN18.10M	-	-	SCS13
	Cr17Ni7	301	1.4310	X12CrNi177	-	-	2331	Z12CN17.07	X12CrNi1707	F.3517	SUS301
	-	304LN	1.4311	X2CrNiN1810	304S62	-	2371	Z2CN18.10	-	-	SUS304LN
	0Cr19Ni9	304	1.4350	X5CrNi189	304S31	58E	-	Z6CN18.09	X5CrNi1810	-	SUS304
	0Cr17Ni11Mo2	316	1.4401	X5CrNiMo1712	316S16	Z6CND17.11	2347	1.4401	X5CrNiMo1712	F.3543	SUS316
	00Cr17Ni13Mo2	316LN	1.4429	X2CrNiMoN17133	-	-	2375	Z2CND17.13	-	-	SUS316LN
	0Cr27Ni12Mo3	316L	1.4435	X2CrNiMo18143	316S12	-	2353	Z2CDN17.13	X2CrNiMo1713	-	SCS16,
	00Cr19Ni13Mo3	317L	1.4438	X2CrNiMo17133	317S12	-	2367	Z2CND19.15	X2CrNiMo18.16	-	SUS317L
	-	329L	1.4460	X8CrNiMo275	-	-	2324	-	-	-	SUS329L; SCH11; SCS11
	1Cr18Ni9Ti	321	1.4541	X6CrNiTi1810	2337	321S12	58B	Z6CNT18.10	X6CrNiTi1811	F.3553	SUS321
	1Cr18Ni11Nb	347	1.4550	X6CrNiNb1810	347S17	58F	2338	Z6CNNb18.1	X6CrNiTi1811	F.3552	SUS347
	Cr18Ni12Mo2Ti	316Ti	1.4571	X6CrNiMoTi17122	320S17	58J	2350	Z6NDT17.12	X6CrNiMoTi17	F.3535	-

ISO	Country and Standard · Standardbezeichnung nach Länder									
	China	USA	Germany		Great Britain		Sweden	France	Italy	Spain	Japan
	GB	AISI/ SAE	W.-nr	DIN	BS	EN	SS	AFNOR	UNI	UNE	JIS
	Austenitic stainless steel · Austenitischer Rostfreier Stahl										
	-	-	1.4581	G-X5CrNiMoNb1810	318C7	-	-	Z4CNDNb1812M	XG8CrNiMo18	-	SCS22
	Cr17Ni12Mo3Nb	318	1.4583	X10CrNiMoNb1812	-	-	-	Z6CNDNb1713B	X6CrNiMoTiNb17	-	-
	1Cr23Ni13	309	1.4828	X15CrNiSi2012	309S24	-	-	Z15CNS20.1	-	-	SUH309
	0Cr25Ni20	310S	1.4845	X12CrNi2521	310S24	-	2361	Z12CN2520	X6CrNi2520	F.331	SUH310
	Cr15Ni36W3Ti	330	1.4864	X12NiCrSi3616	-	-	-	Z12CNS35.1	-	-	SUH330
	-	-	1.4865	G-X40NiCrSi3818	330C11	-	-	-	XG50NiCr3919	-	SCH15
	5Cr2Mn9Ni4N	EV8	1.4871	X53CrMnNiN219	349S54; 321S12	- 58B	-	Z52CMN21.0	X53CrMnNiN219	-	SUH35
	1Cr18Ni9Ti	321	1.4878	X12CrNiTi189	321S320	58C	-	Z6CNT18.12	X6CrNiTi1811	F.3523	SU321

ISO	Country and Standard · Standardbezeichnung nach Länder								
	China	USA	Germany	Great Britain	Sweden	France	Italy	Spain	Japan
K	Nodular cast iron · GGG								
	QT400-18	60-40-18	GGG40	400/17	0717-02	FGS370-17	GS370-17	FGE38-17	FCD400
	QT450-10	65-45-12	--	420/12	--	FGS400-12	GS400-12	FGE42-12	FCD450
	QT500-7	70-50-05	GGG50	500/7	0727-02	FGS500-7	GS500-7	FGE50-7	FCD500
	QT600-3	80-60-03	GGG60	600/7	0732-03	FGS600-2	GS600-2	FGE60-2	FCD600
	QT700-2	100-70-03	GGG70	700/2	0737-01	FGS700-2	GS700-2	FGE70-2	FCD700
	QT800-2	120-90-02	GGG80	800/2	0864-03	FGS800-2	GS800-2	FGE80-2	FCD800
	QT900-2	--	--	900/2	--	--	--	--	--
	Grey cast iron · Grauguss								
	--	NO.60	GG40	--	0140	FGL400	--	--	
	HT350	NO.50	GG35	350	0135	FGL350	G35	FG35	FC350
	HT300	NO.45	GG30	300	0130	FGL300	G30	FG30	FC300
	HT250	NO.35	GG25	250	0125	FGL250	G25	FG25	FC250
	HT200	NO.30	GG20	200	0120	FGL200	G20	FG20	FC200
	HT150	NO.20	GG15	150	0115	FGL150	G15	FG15	FC150
	HT100	--	--	100	0110	--	G10	--	FC100

Fitting dimension tolerance · Passtoleranzen

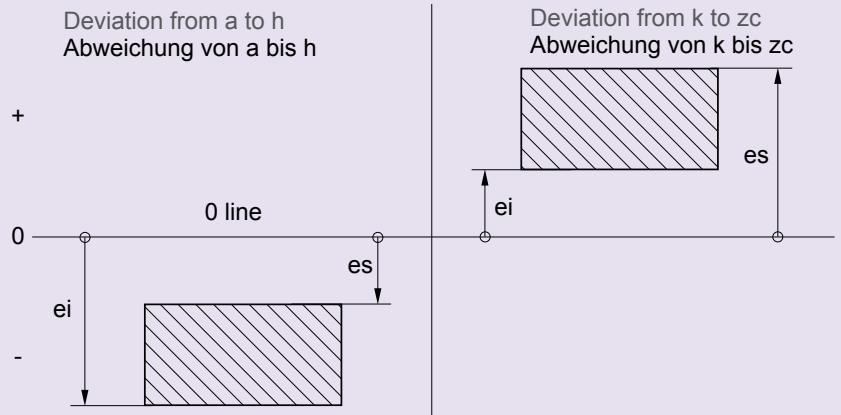
Basic dimensions (mm)		Standard tolerance class of holes · Standard-Toleranzklassen																	
		IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12	IT13	IT14	IT15	IT16	IT17	IT18
>	≤	μm											mm						
---	3	0.8	1.2	2	3	4	6	10	14	25	40	60	0.1	0.14	0.25	0.4	0.6	1	1.4
3	6	1	1.5	2.5	4	5	8	12	18	30	48	75	0.12	0.18	0.3	0.48	0.75	1.2	1.8
6	10	1	1.5	2.5	4	6	9	15	22	36	58	90	0.15	0.22	0.36	0.58	0.9	1.5	2.2
10	18	1.2	2	3	5	8	11	18	27	43	70	110	0.18	0.27	0.43	0.7	1.1	1.8	2.7
18	30	1.5	2.5	4	6	9	13	21	33	52	84	130	0.21	0.33	0.52	0.84	1.3	2.1	3.3
30	50	1.5	2.5	4	7	11	16	25	39	62	100	160	0.25	0.39	0.62	1	1.6	2.5	3.9
50	80	2	3	5	8	13	19	30	46	74	120	190	0.3	0.46	0.74	1.2	1.9	3.	4.6
80	120	2.5	4	6	10	15	22	35	54	87	140	220	0.35	0.54	0.87	1.4	2.2	3.5	5.4
120	180	3.5	5	8	12	18	25	40	63	100	160	250	0.4	0.63	1	1.6	2.5	4	6.3
180	250	4.5	7	10	14	20	29	46	72	115	185	290	0.46	0.72	1.15	1.85	2.9	4.6	7.2
250	315	6	8	12	16	23	32	52	81	130	210	320	0.52	0.81	1.3	2.1	3.2	5.2	8.1
315	400	7	9	13	18	25	36	57	89	140	230	360	0.57	0.89	1.4	2.3	3.6	5.7	8.9
400	500	8	10	15	20	27	40	63	97	155	250	400	0.63	0.97	1.55	2.5	4	6.3	9.7
500	630	9	11	16	22	32	44	70	110	175	280	440	0.7	1.1	1.75	2.8	4.4	7	11
630	800	10	13	18	25	36	50	80	125	200	320	500	0.8	1.25	2	3.2	5	8	12.5
800	1000	11	15	21	28	40	56	90	140	230	360	560	0.9	1.4	2.3	3.6	5.6	9	14
1000	1250	13	18	24	33	47	66	105	165	260	420	660	1.05	1.65	2.6	4.2	6.6	10.5	16.5
1250	1600	15	21	29	39	55	78	125	195	310	500	780	1.25	1.95	3.1	5	7.8	12.5	19.5
1600	2000	18	25	35	46	65	92	150	230	370	600	920	1.5	2.3	3.7	6	9.2	15	23
2000	2500	22	30	41	55	78	110	175	280	440	700	1100	1.75	2.8	4.4	7	11	17.5	28
2500	3150	26	36	50	68	96	135	210	330	540	860	1350	2.1	3.3	5.4	8.6	13.5	21	33

Note:
From IT1 to IT5, the standard tolerance with basic dimension more than 500 mm is as trial.
When the basic dimension 1 mm, the tolerances from IT4 to IT8 are invalid.

Bemerkung:
Für die Standardt Toleranzen IT1 bis IT5 bei Durchmesser über 500 mm ist eine Anpassung notwendig. Bei Basis abmessungen unter 1 mm ist das Toleranzfeld IT4 bis IT8 ungültig.

The shaft lower deviation(ei) and upper deviation (es) can be obtained by basic tolerance and standard tolerance (IT) of shaft.

Toleranz Einheitswelle: Die geringste Abweichung (ei) und die größte Abweichung (es) sind als Basis bzw. Standard-Toleranzen (IT) in der Tabelle angegeben.

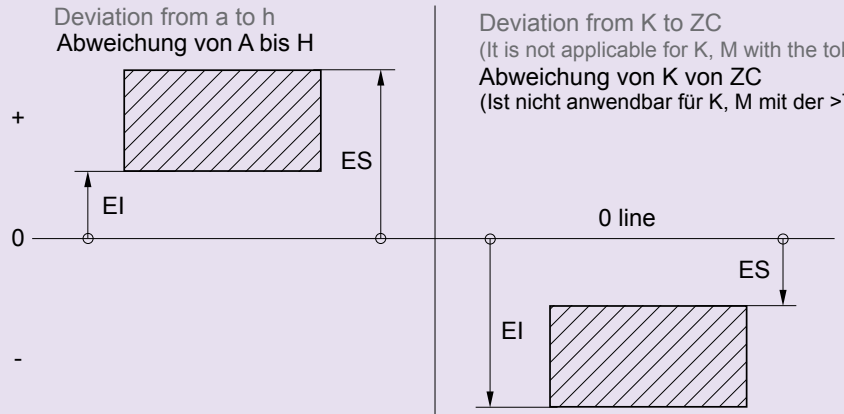


ES= negative (-) basic tolerance of hole
ES= neg(-) Basistoleranz der Bohrung
ei=es-IT

EI= positive (+) basic tolerance of hole
EI= pos(+) Basistoleranz der Bohrung
es=ei+IT

The hole lower deviation(EI) and upper deviation (ES) can be obtained by basic tolerance and standard tolerance (IT) of hole.

Toleranz Einheitsbohrung: Die geringste Abweichung (EI) und die größte Abweichung (ES) sind als Basis bzw. Standard-Toleranzen (IT)- Bohrung in der Tabelle angegeben.



EI= postive (+) basic tolerance of hole
EI= pos(+) Basistoleranz der Bohrung
ES=EI+IT

ES=negitive (-) basic tolerance of hole
ES= neg(-) Basistoleranz der Bohrung
EI=ES+IT

For example: for a hole with diameter 3 mm and tolerance H7, we can find that the lower deviation EI=0 in relation to H7 from the basic tolerance table, and the standard tolerance IT=10μm corresponding to H7, thus the upper deviation ES=EI+IT=10μm. Therefore the hole fitting

dimension is Ø $3^{+0.01}_{0}$mm.

Beispiel: Bei einem Durchmesser von 3mm und einer Toleranz H7 ist bei der Basis Toleranz H7 EI=0 bei der Standard-Toleranz H7 ist es IT=10μm. Die größte Abweichung ist demzufolge: ES=EI+IT=10μm.

Die Bohrungstoleranz ist bei einem Ø $3^{+0.01}_{0}$mm.

- **Basic deviations value of shaft**
- **Basistoleranzwerte Einheitswelle**

Diameter Durchmesser Ø (mm)		Basic deviation value · Basistoleranzwerte											
		Upper deviation es · Höchstabweichung											
		Standard tolerance class · Standard-Toleranzklasse											
>	≤	a	b	c	cd	d	e	ef	f	fg	g	h	js
---	3	-270	-140	-60	-34	-20	-14	-10	-6	-4	-2	0	
3	6	-270	-140	-70	-46	-30	-20	-14	-10	-6	-4	0	
6	10	-280	-150	-80	-56	-40	-25	-18	-13	-8	-5	0	
10	14	-290	-150	-95		-50	-32		-16		-6	0	
14	18												
18	24	-300	-160	-110		-65	-40		-20		-7	0	
24	30												
30	40	-310	-170	-120		-80	-50		-25		-9	0	
40	50	-320	-180	-130									
50	65	-340	-190	-140		-100	-60		-30		-10	0	
65	80	-360	-200	-150									
80	100	-380	-220	-170		-120	-72		-36		-12	0	
100	120	-410	-240	-180									
120	140	-460	-260	-200		-145	-85		-43		-14	0	
140	160	-520	-280	-210									
160	180	-580	-310	-230									
180	200	-660	-340	-240		-170	-100		-50		-15	0	
200	225	-740	-380	-260									
225	250	-820	-420	-280									
250	280	-920	-480	-300		-190	-110		-56		-17	0	
280	315	-1050	-540	-330									
315	355	-1200	-600	-360		-210	-125		-62		-18	0	
355	400	-1350	-680	-400									
400	450	-1500	-760	-440		-230	-135		-68		-20	0	
450	500	-1650	-840	-480									
500	560					-260	-145		-76		-22	0	
560	630												
630	710					-290	-160		-80		-24	0	
710	800												
800	900					-320	-170		-86		-26	0	
900	1000												
1000	1120					-350	-195		-98		-28	0	
1120	1250												
1250	1400					-390	-220		-110		-30	0	
1400	1600												
1600	1800					-430	-240		-120		-32	0	
1800	2000												
2000	2240					-480	-260		-130		-34	0	
2240	2500												
2500	2800					-520	-290		-145		-38	0	
2800	3150												

Die Formel für die Abweichung $=\pm\frac{IT_n}{2}$, ITn ist der IT Wert entsprechend zu "n" zugeordnet.

In the formula Deviation $=\pm\frac{IT_n}{2}$, ITn is the IT value corresponding to ' n'.

Note: 1. If basic dimension ≤1mm, the basic deviation a and b are not adopted.

Bemerkungen: 1. Bei Abmessungen ≤ 1mm, sind die Basisabweichungen a und b nicht berücksichtigt.

μm

Basic deviation value · Basistoleranzwerte Einheitswelle																		
Lower deviationei · geringste Abweichung																		
IT5 IT6	IT7	IT8	IT4 IT7	≤IT3 >IT7	Standard tolerance class · Standard-Toleranzklasse													
j			k		m	n	p	r	s	t	u	v	x	y	z	zn	zb	zc
-2	-4	-6	0	0	+2	+4	+6	+10	+14		+18		+20		+26	+32	+40	+60
-2	-4		+1	0	+4	+8	+12	+15	+19		+23		+28		+35	+42	+50	+80
-2	-5		+1	0	+6	+10	+15	+19	+23		+28		+34		+42	+52	+67	+97
-3	-6		+1	0	+7	+12	+18	+23	+28		+33		+40		+50	+64	+90	+130
												+39	+45		+60	+77	+108	+150
-4	-8		+2	0	+8	+15	+22	+28	+35		+41	+47	+54	+63	+73	+98	+136	+188
										+41	+48	+55	+64	+75	+88	+118	+160	+218
-5	-10		+2	0	+9	+17	+26	+34	+43	+48	+60	+68	+80	+94	+112	+148	+200	+274
										+54	+70	+81	+97	+114	+136	+180	+242	+325
-7	-12		+2	0	+11	+20	+32	+41	+53	+66	+87	+102	+122	+144	+172	+226	+300	+405
								+43	+59	+75	+102	+120	+146	+174	+210	+274	+360	+480
-9	-15		+3	0	+13	+23	+37	+51	+71	+91	+124	+146	+178	+214	+258	+335	+445	+585
								+54	+79	+104	+144	+172	+210	+254	+310	+400	+525	+690
-11	-18		+3	0	+15	+27	+43	+63	+92	+122	+170	+202	+248	+300	+365	+470	+620	+800
								+65	+100	+134	+190	+228	+280	+340	+415	+535	+700	+900
								+68	+108	+146	+210	+252	+310	+380	+465	+600	+780	+1000
-13	-21		+4	0	+17	+31	+50	+77	+122	+166	+236	+284	+350	+425	+520	+670	+880	+1150
								+80	+130	+180	+258	+310	+385	+470	+575	+740	+960	+1250
								+84	+140	+196	+284	+340	+425	+520	+640	+820	+1050	+1350
-16	-26		+4	0	+20	+34	+56	+94	+158	+218	+315	+385	+475	+580	+710	+920	+1200	+1550
								+98	+170	+240	+350	+425	+525	+650	+790	+1000	+1300	+1700
-18	-28		+4	0	+21	+37	+62	+108	+190	+268	+390	+475	+590	+730	+900	+1150	+1500	+1900
								+114	+208	+294	+435	+530	+660	+820	+1000	+1300	+1650	+2100
-20	-32		+5	0	+23	+40	+68	+126	+232	+330	+490	+595	+740	+920	+1100	+1450	+1850	+2400
								+132	+252	+360	+540	+660	+820	+1000	+1250	+1600	+2100	+2600
			0	0	+26	+44	+78	+150	+280	+400	+600							
								+155	+310	+450	+660							
			0	0	+30	+50	+88	+175	+340	+500	+740							
								+185	+380	+560	+840							
			0	0	+34	+56	+100	+210	+430	+620	+940							
								+220	+470	+680	+1050							
			0	0	+40	+66	+120	+250	+520	+780	+1150							
								+260	+580	+840	+1300							
			0	0	+48	+78	+140	+300	+640	+960	+1450							
								+330	+720	+1050	+1600							
			0	0	+58	+92	+170	+370	+820	+1200	+1850							
								+400	+920	+1350	+2000							
			0	0	+68	+110	+195	+440	+1000	+1500	+2300							
								+460	+1100	+1650	+2500							
			0	0	+76	+135	+240	+550	+1250	+1900	+2900							
								+580	+1400	+2100	+3200							

- **Basic deviations value of hole**
- **Basistoleranzwerte Einheitsbohrung**

Diameter Durchmesser Ø (mm)		Basic deviation value · Basis-Toleranzwerte Einheitswelle																				
		Lower deviation EI · geringste Abweichung EI											Upper deviation ES · Höchstabweichung ES									
		Standard tolerance class · Standard-Toleranzklasse											IT6	IT7	IT8	≤IT8	>IT8	≤IT8	>IT8	≤IT8	>IT8	≤IT7
>	≤	A	B	C	CD	D	E	EF	F	FG	G	H	JS	J			K		M		N		P to ZC
---	3	+270	+140	+60	+34	+20	+14	+10	+6	+4	+2	0	In the formula Deviation $=\pm\frac{IT_n}{2}$, ITn is the IT value corresponding to ' n'. Die Formel für die Abweichung $=\pm\frac{IT_n}{2}$, ITn ist der IT Wert entsprechend zu "n" zugeordnet.	+2	+4	+6	0	0	-2	-2	-4	-4	Wenn IT ≥IT7, wird der a Δ wert zuaddiert. If IT ≥IT7, add a Δ value to the relevant value
3	6	+270	+140	+70	+46	+30	+20	+14	+10	+6	+4	0		+5	+6	+10	-1+Δ		-4+Δ	-4	-8+Δ	0	
6	10	+280	+150	+80	+56	+40	+25	+18	+13	+8	+5	0		+5	+8	+12	-1+Δ		-6+Δ	-6	-10+Δ	0	
10	14	+290	+150	+95		+50	+32		+16		+6	0		+6	+10	+15	-1+Δ		-7+Δ	-7	-12+Δ	0	
14	18																						
18	24	+300	+160	+110		+65	+40		+20		+7	0		+8	+12	+20	-2+Δ		-8+Δ	-8	-15+Δ	0	
24	30																						
30	40	+310	+170	+120		+80	+50		+25		+9	0		+10	+14	+24	-2+Δ		-9+Δ	-9	-17+Δ	0	
40	50	+320	+180	+130																			
50	65	+340	+190	+140		+100	+60		+30		+10	0		+13	+18	+28	-2+Δ		-11+Δ	-11	-20+Δ	0	
65	80	+360	+200	+150																			
80	100	+380	+220	+170		+120	+72		+36		+12	0		+16	+22	+34	-3+Δ		-13+Δ	-13	-23+Δ	0	
100	120	+410	+240	+180																			
120	140	+460	+260	+200		+145	+85		+43		+14	0		+18	+26	+41	-3+Δ		-15+Δ	-15	-27+Δ	0	
140	160	+520	+280	+210																			
160	180	+580	+310	+230																			
180	200	+660	+340	+240		+170	+100		+50		+15	0		+22	+30	+47	-4+Δ		-17+Δ	-17	-31+Δ	0	
200	225	+740	+380	+260																			
225	260	+820	+420	+280																			
260	280	+920	+480	+300		+190	+110		+56		+17	0		+25	+36	+55	-4+Δ		-20+Δ	-20	-34+Δ	0	
280	315	+1050	+540	+330																			
315	355	+1200	+600	+360		+210	+125		+62		+18	0		+29	+39	+60	-4+Δ		-21+Δ	-21	-37+Δ	0	
355	400	+1350	+680	+400																			
400	450	+1500	+760	+440		+230	+135		+68		+20	0		+33	+43	+66	-5+Δ		-23+Δ	-23	-40+Δ	0	
450	500	+1650	+840	+480																			
500	560					+260	+145		+76		+22	0					0		-26		-44		
560	630																						
630	710					+290	+160		+80		+24	0					0		-30		-50		
710	800																						
800	900					+320	+170		+86		+26	0					0		-34		-56		
900	1000																						
1000	1120					+350	+195		+98		+28	0					0		-40		-66		
1120	1250																						
1250	1400					+390	+220		+110		+30	0					0		-48		-78		
1400	1600																						
1600	1800					+430	+240		+120		+32	0					0		-58		-92		
1800	2000																						
2000	2240					+480	+260		+130		+34	0					0		-68		-110		
2240	2500																						
2500	2800					+520	+290		+145		+38	0					0		-76		-135		
2800	3150																						

µm

Basic deviation value · Basis-Toleranzwerte Einheitswelle												Δ					
Upper deviation ES · Höchstabweichung ES																	
Standard tolerance class >IT7 · Standard-Toleranzklasse > IT7												Standard tolerance class Standard-Toleranzklasse					
P	R	S	T	U	V	X	Y	Z	ZA	ZB	ZC	IT3	IT4	IT5	IT6	IT7	IT8
-6	-10	-14		-18		-20		-26	-32	-40	-60	0	0	0	0	0	0
-12	-15	-19		-23		-28		-35	-42	-50	-80	1	1.5	1	3	4	6
-15	-19	-23		-28		-34		-42	-52	-67	-97	1	1.5	2	3	6	7
-18	-23	-28		-33		-40		-50	-64	-90	-130	1	2	3	3	7	9
					-39	-45		-60	-77	-108	-150						
-22	-28	-35		-41	-47	-54	-63	-73	-98	-136	-188	1.5	2	3	4	8	12
			-41	-48	-55	-64	-75	-88	-118	-160	-218						
-26	-34	-43	-48	-60	-68	-80	-94	-112	-148	-200	-274	1.5	3	4	5	9	14
			-54	-70	-81	-97	-114	-136	-180	-242	-325						
-32	-41	-53	-66	-87	-102	-122	-144	-172	-226	-300	-405	2	3	5	6	11	16
	-43	-59	-75	-102	-120	-146	-174	-210	-274	-360	-480						
-37	-51	-71	-91	-124	-146	-178	-214	-258	-335	-445	-585	2	4	5	7	13	19
	-54	-79	-104	-144	-172	-210	-254	-310	-400	-525	-690						
-43	-63	-92	-122	-170	-202	-248	-300	-365	-470	-620	-800	3	4	6	7	15	23
	-65	-100	-134	-190	-228	-280	-340	-415	-535	-700	-900						
	-68	-108	-146	-210	-252	-310	-380	-465	-600	-780	-1000						
-50	-77	-122	-166	-236	-284	-350	-425	-520	-670	-880	-1150	3	4	6	9	17	26
	-80	-130	-180	-258	-310	-385	-470	-575	-740	-960	-1250						
	-84	-140	-196	-284	-340	-425	-520	-640	-820	-1050	-1350						
-56	-94	-158	-218	-315	-385	-475	-580	-710	-920	-1200	-1550	4	4	7	9	20	29
	-98	-170	-240	-350	-425	-525	-650	-790	-1000	-1300	-1700						
-62	-108	-190	-268	-390	-475	-590	-730	-900	-1150	-1500	-1900	4	5	7	11	21	32
	-114	-208	-294	-435	-530	-660	-820	-1000	-1300	-1650	-2100						
-68	-126	-232	-330	-490	-595	-740	-920	-1100	-1450	-1850	-2400	5	5	7	13	23	34
	-132	-252	-360	-540	-660	-820	-1000	-1250	-1600	-2100	-2600						
-78	-150	-280	-400	-600													
	-155	-310	-450	-660													
-88	-175	-340	-500	-740													
	-185	-380	-560	-840													
100	-210 -220	-430 -470	-620 -680	-940 -1050													
-120	-250 -260	-520 -580	-780 -840	-1150 -1300													
-140	-300 -330	-640 -720	-960 -1050	-1450 -1600													
-170	-370	-820	-1200	-1850													
	-400	-920	-1350	-2000													
-195	-440 -460	-1000 -1100	-1500 -1650	-2300 -2500													
-240	-550 -580	-1250 -1400	-1900 -2100	-2900 -3200													

Hardness reference table (conversion of hardness and strength for ferrous metal)
Härte Vergleichstabelle (Konversationstabelle von Härte und Zugfestigkeit für Stahl)

Hardness · Härte				Tensile strength Zugfestigkeit N/mm²
Rockwell hardness · Härte		Vickers hardn. · Härte	Brinell hardn. · Härte	
HRC	HRA	HV	HB	
70.0	86.6	1037	—	—
69.5	86.3	1017	—	—
69.0	86.1	997	—	—
68.5	85.8	978	—	—
68.0	85.5	959	—	—
67.5	85.2	941	—	—
67.0	85.0	923	—	—
66.5	84.7	906	—	—
66.0	84.4	889	—	—
65.5	84.1	872	—	—
65.0	83.9	856	—	—
64.5	83.6	840	—	—
64.0	83.3	825	—	—
63.5	83.1	810	—	—
63.0	82.8	795	—	—
62.5	82.5	780	—	—
62.0	82.2	766	—	—
61.5	82.0	752	—	—
61.0	81.7	739	—	—
60.5	81.4	726	—	—
60.0	81.2	713	—	2555
59.5	80.9	700	—	2500
59.0	80.6	688	—	2450
58.5	80.3	676	—	2395
58.0	80.1	664	—	2345
57.5	79.8	653	—	2295
57.0	79.5	642	—	2250
56.5	79.3	631	—	2205
56.0	79.0	620	—	2160
55.5	78.7	609	—	2115
55.0	78.5	599	—	2075
54.5	78.2	589	—	2035
54.0	77.9	579	—	1995
53.5	77.7	570	—	1955
53.0	77.4	561	—	1920
52.5	77.1	551	—	1885
52.0	76.9	543	—	1850
51.5	76.6	534	—	1815

Hardness · Härte				Tensile strength Zugfestigkeit N/mm²
Rockwell hardness · Härte		Vickers hardn. · Härte	Brinell hardn. · Härte	
HRC	HRA	HV	HB	
51.0	76.3	525	501	1780
50.5	76.1	517	494	1750
50.0	75.8	509	488	1720
49.5	75.5	501	481	1690
49.0	75.3	493	474	1660
48.5	75.0	485	468	1630
48.0	74.7	478	461	1605
47.5	74.5	470	455	1575
47.0	74.2	463	449	1550
46.5	73.9	456	442	1525
46.0	73.7	449	436	1500
45.5	73.4	443	430	1475
45.0	73.2	436	424	1450
44.5	72.9	429	418	1430
44.0	72.6	423	413	1405
43.5	72.4	417	407	1385
43.0	72.1	411	401	1360
42.5	71.8	405	396	1340
42.0	71.6	399	391	1320
41.5	71.3	393	385	1300
41.0	71.1	388	380	1280
40.0	70.8	382	375	1260
40.0	70.5	377	370	1245
39.5	70.3	372	365	1225
39.0	70.0	367	360	1210
38.5	—	362	355	1190
38.0	—	357	350	1175
37.5	—	352	345	1160
37.0	—	347	341	1140
36.5	—	342	336	1125
36.0	—	338	332	1110
35.5	—	333	327	1095
35.0	—	329	323	1080
34.5	—	324	318	1065
34.0	—	320	314	1050
33.5	—	316	310	1035
33.0	—	312	306	1020
32.5	—	308	302	1010

Hardness reference table (conversion of hardness and strength for ferrous metal)
Härte Vergleichstabelle (Konversationstabelle von Härte und Zugfestigkeit für Stahl)

Hardness · Härte				Tensile strength Zugfestigkeit N/mm²		Hardness · Härte				Tensile strength Zugfestigkeit N/mm²
Rockwell hardness · Härte		Vickers hardn. · Härte	Brinell hardn. · Härte			Rockwell hardness · Härte		Vickers hardn. · Härte	Brinell hardn. · Härte	
HRC	HRA	HV	HB			HRC	HRA	HV	HB	
32.0	—	304	298	995		24.0	—	249	245	820
31.5	—	300	294	980		23.5	—	246	242	810
31.0	—	296	291	970		23.0	—	243	240	800
30.5	—	292	287	960		22.5	—	240	237	790
30.0	—	289	283	950		22.0	—	237	234	785
29.5	—	285	280	935		21.5	—	234	232	775
29.0	—	281	276	920		21.0	—	231	229	765
28.5	—	278	273	910		20.5	—	229	227	760
28.0	—	274	269	900		20.0	—	226	225	750
27.5	—	271	266	890		19.5	—	223	222	745
27.0	—	268	263	880		19.0	—	221	220	735
26.5	—	264	260	870		18.5	—	218	218	730
26.0	—	261	257	860		18.0	—	216	216	725
25.5	—	258	254	850		17.5	—	214	214	715
25.0	—	255	251	835		17.0	—	211	211	710
24.5	—	252	248	830						

Note: The conversion values for steel in the table are commonly applicable for the steels with carbon from low to high.
Bemerkung: Die in der Tabelle aufgeführten Werte sind für Kohlenstoffstahl anwendbar.

Comparison table for turning inserts chip breaker · Übersichtstabelle der WSP-Spanbrecher

ISO	Application Anwendung	ZCC-CT		Sandvik		Seco		Kennametal		ISCAR		Walter		Mitsubishi		Sumitomo		Tungaloy		Kyocera		Korloy		Ingersoll Tague Tec	
		Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos
Steel · Stahl	Wiper-finishing Wiper-Schlichten	WG		WF WL	WF WK	W-MF2	W-F1	FW MW	FW MW	WF		NF	PF	SW	FW	NLU-W	NLU-W	ASW		WP		VW LW		WS	
	Finishing Schlichten	DF EF	SF HF	PF QF	PF UF 23	FF1 MF1	FF1 F1	FF FN	11 UF LF	SF	PF SM	NF3 NS6	PF4 PF5	FH FS	FJ FV	NSE NSU NLU NFA NFL	NLU NFP NFK	TF TS 17	PF 01	DP GP VF	CF	VG VF VL	VF	FG FC VF	FA SA FG
	Semi-finishing Schlichten-Mittlere Bearbeitung	DM EM	HM	PM QM	PM UM	MF2	F2	FN	MF	NF TF SM	14 16 17 19	NS6	PS5	SH SA	SW SV MV	NSX	NSU NSC NSK	TS TM AS	PS	HQ CQ CJ	CK DP GP VF XP	VQ VC VB	HMP	WT ML	WT
	Medium machining -light roughing Mittlere Bearb.-leichte Schruppbearbeitung	DM PM	HR	PM QM	PR UR	M3 MF3	F2	MN	MF	GN PP NR	17 19	NM4 NM6	PM5	MV MZ MA	MV MW	NGE NGU NUX	NMU NSF	TM DM	PM	GS CS HS PS	HQ XQ GK G	VM	C25	PC MC MT MG MF	PC MT PMR
	Wiper-medium			WR WM	WM	W-M3 W-R4 W-R7	W-F2	MW RW	MW	WG		NM	PM	MW		NGU-W				WQ					
	Roughing Schruppen	DR		PR QR 31		M5 MR5 MR7		RP UN RN		TNM GN	19	NM9		GH MAT MT		NMU NMX	NMU	TH TR TU		PT GT HT	G St-form	HR		RT	
	Single Side roughing Einseitige WSP Schruppen	HDR 31HPR DR LR		HR QR		R8 RR9 -56 -57 -UX		RH RM RP		NM		NR6 NR8		HA HZ HH HV HX		NMP NHG NHP NHU NHW				HX		GH VH VT		HT HD HY HZ RX RH	CMX
Stainless Steel · Rostfreier Stahl	Wiper-finishing Wiper-Schlichten	WG		WF WL WMX	WF WK	W-MF2		FW MW	FW MW	WF			PF	SW	FW	NLU-W	NLU-W								
	Finishing Schlichten	EF DF	EF HF	MF	MF UF	FF1 F2 MF1	F1	FF FP	11 UF LF	NF VL	PF SM	NF4	PF4 PF5	FS	FJ FV	NSU NLU	NSU NLU	SS	SS	GU			VF	EA SF	FG
	Semi-finishing Schlichten-Mittlere Bearbeitung	EF EM	EF EM HF HM	MF MM	MF MM UM	MF3	F2	FP	MF	PP TF	14 16 17 19	NM4	PS5	SH MS	SW SV MV	NEX NUP	NSU	SS SM	PS	MS	CK DP GP VF XP	VP2	HMP		
	Medium machining -light roughing Mittlere Bearbeitung -leichte Schruppbearbeitung	EM DM	EM HM	MM	MM UM	R6 56	F2	MP	HP	PP TF	17 19	NM4 NR4	PM5	MS ES MH	MV MW	NGU	NMU	SA S	PM	MS	HQ XQ GK G	HS VP3	C25	EM SU MT	MT PMR WT
	Wiper medium			WR WM	WM	W-M3		MW RW	MW	WG			PM	MW		NGU -W									
	Roughing Schruppen	ER DR	HR	MR QR PR	MR	R7 R8		MP -P		HTW NR	19	NR4		GH HZ		NMU NMX NHG						VM		ET	CMX
	Single Side roughing Einseitige WSP Schruppen	ER DR HDR LR		HR QR		-56		RP		NM						NMP NHG NHP NHU NHW	NMP NHG NHP NHU NHW								

Comparison table for turning inserts chip breaker · Übersichtstabelle der WSP-Spanbrecher

ISO		Application Anwendung	ZCC-CT		Sandvik		Seco		Kennametal		ISCAR		Walter		Mitsubishi		Sumitomo		Tungaloy		Kyocera		Korloy		Ingersoll Tague Tec	
			Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos
Cast iron · Guss	K	Wiper-finishing Wiper-Schlichten	WG		WF WM	WF	W-MF2	W-F1	FW MW	FW MW	WF						NLU-W	NLU-W								
		Finishing · Schlichten	DF	HF	KF	KF	F1	F1	FF FN	11 UF LF	NF SM	14 19		PS5			NSU	NLU			C		VM			
		Semi-finishing Schlichten-Mittlere Bearbeitung	PM	HM	KF KM	KF KM	M3	F2	FN	MF	GN	14 19	NM5	PS5	GH		NUX NGU	NSU	CM		C Stand. form		B25	HMP		
		Medium machining light roughing Mittlere Bearbeitung-leichte Schruppbearbeitung	DR	HM HR	KM QM	KM	M3	F2	UN	HP	GN NR		NM6	PM5			NUZ NGU NMU	NMU	CM		GC ZS		VK GR	C25	MT MG	MT PMR WT
		Wiper medium					W-M3 W-R4 W-R7		MW	MW	WG		NM	PM			NGU-W									
		Roughing Schruppbearbeitung	DR *NMA	HR	KR QR	KR UR	M5				NR		NR6		GH		NMU				ZS		MA		RT	CMX
Nonferrite Materials Ne-metalle	N	Finishing · Schlichten		LC		AL				LF	NF			PM2												
		Semi-finishing Schlichten-Mittlere Bearbeitung		LC		AL		AL	GP		NF PP	AS						NAG			AH	AH	HA	AK		FL SA
		Medium machining-light roughing Mittlere Bearbeitung-leichtes Schruppbearbeitung		LH		AL		AL	GG-FS MS	HP	NMS													AR		
Heat resist. super alloys & Ti-alloys Warmf. Legi. & Ti-Legierung	S	Finishing · Schlichten	NF EF	NF	NGP	MF	MF1		FS	GT-HP	SF PF	PF SM		PF4	FJ		NSU	NSU					VP1			
		Semi-finishing Schlichten-Mittlere Bearbeitung	NF NM EM	NF	23	MM	MF1 M1		FS MS	GT-MF	SF PF	PF SM		PF5	MJ		NEX NUP	NSU NSK					VP2	AK		
		Medium machining-light roughing Mittlere Bearbeitung-leichte Schruppen	NM EM		MF	MM UM	M1		MS	MT-LF	PP TF			PS5	MS		NMU	NSK					VP3	HMP	SU	
		Roughing Schruppbearbeitung	ER		SR		MR3 MR4		RP		TF HTW NR				GJ								VM			

Coated Cemeted Carbide CVD · beschichtetes Hartmetall CVD

ISO		ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Kyocera	Walter	Iscar	SECO	Korloy	Ingersoll Tague Tec
Steel · Stahl	P	P01	GC4005 GC4205	KCP05 KC9105	AC805P	UE6005 UE6105	T9005 T9105	CA5505	WPP01 WPP05	IC8150 IC9150	TP0500 TK1001		TT8115 TT8125
		P10 YBC151 YBC152 YBC152F YBC252 YBC251 YBC252F	GC1515 GC4015 GC4215 GC4025 GC4225	KCP05 KC9105 KCP10 KC9110	AC810P AC700G	UE6105 UC6110	T9005 T9015 T9115	CA5505 CA5515	WPP10 WPP05	IC8150 IC8250 IC9150 IC9250 IC9015	TP1500 TP0500 TK2001	NC3010	TT8115 TT8125
		P20 YBC252 YBC251 YBC252F YBC351 YBC352 YBC352F	GC4015 GC4215 GC4025 GC4225	KCP10 KCP25 KC9125	AC820P AC900G AC2000	UE6110 UE6020	T9015 T9115 T9025 T9125	CA5525 CA5535	WPP20 WPP10	IC8150 IC8250 IC9250 IC9025	TP2500 TP200	NC3220 NC3120	TT8125 TT3500 TT8115
		P30 YBC252 YBC252F YBC351 YBC352 YBC352F	GC4025 GC4225 GC4035 GC4235	KCP25 KCP30 KC9125 KC8050	AC830P AC820P AC3000	UE6020 UH6035 US735	T9025 T9125 T9035 T9135	CA5535	WPP30 WPP20	IC8250 IC8350 IC9350	TP2500 TP3500	NV3030 NC5330 NC500H	TT5100 TT8135
		P40 YBC351 YBC352 YBC352F	GC4035 GC4235	KCP40 KC9140	AC830P AC3000	UE6035 UH6400	T9035 T9135	CA5535	WPP30 WAP30	IC9350	TP3500 TP40	NC5330	TT8135 TT7100
Stainless Steel Rostfreier Stahl	M	M10 YBM151 YBM153 YBM153 (F)	GC2015 GC1515	KCM15	AC610M		T9115	CA6515	WAM10	IC8250 IC9250 IC6015	TP200 TM2000 TK2001		TT9215 TT9225
		M20 YBM251 YBM253 YBM253 (F)	GC2015 GC2025	KCM15 KCM25 KC9225	AC610M AC630M	US7020	T6020 T9125	CA6515	WAM20	IC8250 IC9350 IC9025 IC6025	TM2000 TP200 TP2500	NC9025	TT5100 TT9225 TT9235
		M30 YBM351 YBM253 YBM253 (F)	GC2025 GC4225 GC4235	KCM25 KCM35 KC8050 KC9225 KV9240	AC630M AC830P AV3000	US735	T6030	CA6525	WAM30 WAM20	IC8305 IC9305 IC9025	TP3500 TM4000		TT5100 TT7100 TT9235
		M40 YBM351	GC4235	KCM35 KC9240 KC9245	AC630M AC830P AC3000	US735	T6030	CA6525	WAM30	IC635	TP3500 TP40		TT7100
Cast iron · Guss	K	K01 YBD052 (F) YBD102 (F)	GC3005 GC3205 GC3210	KCK05	AC405K AC410K	UC5005 UC5105 UC5015 UC5115	T5105	CA4505	WAK10	IC5005		NC6205	TT1300
		K10 YBD052 (F) YBD102 (F) YBD152 (F)	GC4205 GC3210 GC3215 GC4215	KCK05 KCK15 KC9315	AC410K AC415K AC420K AC700G	UC5005 UC5105 UC5015 UC5115	T5105 T5115	CA4505 CA4515 CA4010 CA4115	WAK10 WAK20	IC5005 IC9015 IC9007 IC8150 IC5010 IC428 IC4028 IC9150	TK1001 TK2001 TK1000 TK2000 TP0500	NC6210 NC315K	TT1300 TT7310
		K20 YBD152 (F) YBD252 (F)	GC3210 GC3215 GC4205 GC4215	KCK15 KCK20 KC9315 KC9325	AC420K AC900G	UC5015 UC5115	T5115 T5125 T9125	CA4515 CA4010 CA4115 CA4125	WAK20	IC5010 IC428 IC4028 IC9150	TK2000 TK2001 TP1500 TP200	NC5330	
		K30 YBD252 (F)		KCK20 KC9320 KC9325			T5125	CA4515 CA4120	WAK30		TK2000 TP2500		

Coated Cemeted Carbide PVD · beschichtetes Hartmetall PVD

ISO		ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Walter	Kyocera	Iscar	SECO	Korloy	Ingersoll Tague Tec
Steel · Stahl	P01								PR915				
	P10	YBG102 YBG105	GC1515 GC1125 GC1025	KC5010 KCU10		VP15TF UP20M	AH710	WSM10	PR930 PR1005	IC507 IC570 IC907 IC908 IC520N			TT9030
	P20	YBG202 YBG205	GC1515 GC1125 GC1025	KC5010 KCU10		VP15TF VP20MF UP20M	AH725 SH730 AH120	WSM10 WSM20 WSM21	PR930 PR1005 PR1025 PR1225	IC520N IC530N IC507 IC570 IC907 IC908	TS2000 TS2500		TT7220 TT9020 TT9030
	P30	YBG302	GC1125 GC2035	KC5025 KCU25	AC530U	VP20MF UP20M	AH725 SH730 J740	WSM30	PR660 PR1025	IC3028 IC1008	TS2500	PC5300	TT8020 TT7220 TT9020
	P40		GC2035				J740		PR660	IC3028 IC1008			TT8020
Stainless Steel Rostfreier Stahl	M10	YBG102 YBG105	GC1105 GC1115 GC1025 GC1125 GC1515	KC5010 KCU10	EHZ10 AC510U	VP15TF UP20M	AH710	WSM10	PR915 PR1005	IC520N IC520 IC507 IC570 IC807 IC907	TS2000	PC8110	TT5030 TT9030 TT9020 TT5080
	M20	YBG202 YBG205	GC1105 GC1115 GC1025 GC1125 GC1515	KC5010 KCU10	AC520U	VP15TF VP20MF UP20M	AH120 AH725 SH730	WSM10 WSM20 WSM21	PR915 PR930 PR1025	IC530N IC507 IC807 IC907 IC3028 I C1008	TS2000 TS2500	PC5300	TT9030 TT9080 TT9020
	M30	YBG302	GC1125 GC2035	KC5025 KCU25	AC530U	VP20MF UP20M	AH725 SH730 J740	WSM20 WSM21 WSM30	PR930 PR1025 PR1125	IC3028 IC1008	TS2500	PC9330	TT8020
	M40		GC2035					WSM30	PR1125 PR1225				TT8020
Cast iron Guss	K01												
	K10	YBG102		KC5010 KCU10		VP15TF	GH110 AH110 AH710				TS2000		
	K20	YBG202		KC5025 KCU25		VP15TF	AH120 AH710			IC1008	TS2000 TS2500		
	K30	YBG302								IC1008	TS2500		
Heat resist. super all. & Ti-alloys Warmf. Legi. & Ti-Legierung	S01					VP05RT	AH905						TT5030 TT5080
	S10	YBG102 YBG202 YBG105 YBG205	GC1105 GC1115	KC5010 KCU10 KC5510 KCS10	AC510U EH510Z	VP05RT VP10RT	AH725 AH110	WSM10	PR1305 PR1310 PR1325	IC507 IC807 IC907	TS2000	PC8110	TT5030 TT5080 TT9080
	S20	YBG202 YBG205	GC1205 GC1125 GC1515	KC5010 KCU10 KC5025 KCU25 KC5525	AC520U EH520Z	VP10RT VP15TF	AH725 SH730 AH120	WSM20 WSM21 WSM30	PR1325	IC507 IC807 IC907	TS2000 TS2500	PC5300	TT8020 TT9080
	S30	YBG302			AC520U	VP15TF		WSM30	PR1125	IC3028	TS2500		
Nonferrite Mat. Ne-metalle	N01												
	N10	YBG102 YBG105	GC1125 GC1025 GC1515	KC5410				WXN10		IC520			
	N20			KC5410									

Cutting material comparison table-Turning · Schneidstoff Vergleichstabelle-Drehen

■ Cermet

ISO		ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Walter	Kyocera	Iscar	SECO	Korloy	Ingersoll Tague Tec
Steel · Stahl	P01	YNG051	CT5005	KTP15	T110A				TN30 TN6010 PV30 PV60 PV7010	IC520N		CC105	PV3010 CT3000
	P10	YNG151 YNG151C	CT5005 CT5015 GC1525	HT2 TTI 15 KT315 KT325	T110A T1200A T1500A	NX1010 NX33 NX55 NX99 AP25N VP25N	NS520 NS730 AT520 GT530 GT730		TN30 TN60 PV90 TN6020 PV7020 PV7010 PV7025	IC520N IC530N IC20N	C15M CMP TP1020 TP1030	CN1000 CC115	PV3010 CT3000
	P20	YNG151 YNG251 YNG151C	CT5015 GC1525 CT530	TTI 15 KT315 KT325	T1200A T1500A T2000Z	NX2525 NX33 NX99 AP25N VP25N UP35N	NS520 NS730 NS539 AT530 GT530 GT730 J530		TN60 TN6020 TN90 PV7020 PV90	IC530N IC20N IC30N	C15M CMP	CC125 CN20 CN2000	
	P30				T1200A T3000Z	UP35N VP45N	NS530		TN60 TN90 TN6020	IC30N		CN30	
	P40					VP45N							
Stainless Steel Rostfreier Stahl	M10	YNG151 YNG151C	CT5005 GC1525 CT530	HT2 KTP15 KT315 KT325	T1200A T1500A	NX2525 AP25N			TN60 TN90 TN6020 TN6010 TN7010 TN7025	IC520N IC530N IC20N	C15M		PV3010 CT300
	M20	YNG151	CT5015	HT2	T1200A T1500A T2000Z		J530		TN60 PV90 TN6020 PV7020 TN90	IC520N IC20N IC530N IC30N	C15M TP1020		PV3010 CT300
	M30				T3000Z		J530			IC30N			
	M40												
Cast iron Guss	K01			HT2 KTP15	T110A T1200A T1500A				TN30 PV7005			CN1000	PV3010 CT300
	K10	YNG151 YNG151C	CT5005 CT5015 AT520	HT2 KT315 KT325	T110A T1200A	NX1010 AP25N	NS520 GT520 NC530		TN30 PV30				PV3010 CT300
	K20		CT5015		T110A	NX2525 AP25N	NS520 NS530 GT520						
	K30												
Heat resist. super all. & alloys Warmf. Legi. & Ti-Legierung	S01												
	S10												
	S20												
	S30												
Nonferrite Mat. Ne-metalle	N01		CT5005	HT2 KT325									
	N10		CT5005 CT5015	HT2									
	N20												

Cutting material comparison table-Turning · Schneidstoff Vergleichstabelle-Drehen

■ Carbide uncoated · Hartmetall Unbeschichtet

ISO	ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Walter	Kyocera	Iscar	SECO	Korloy	Ingersoll Tague Tec
Nonferrite Mat. Ne-metalle												
N												
N01	YD101 YD201			H1	RT9005	KS05F						
N10	YD101 YD201	H10 H13A	THM-F HWK10 HWK15 K313 KU10 K68	H1	RT9005 HTI10	KS05F	WK01 WK10	KW10	IC20	KX HX	H01	K10
N20	YD101 YD201		THM-F HWK10 HWK15						IC20	KX HX		

CVD milling grades · CVD Fräsen Klasse

Material / Class		ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Kyocera	Walter	Iscar	SECO	Korloy	Ingersoll Tague Tec
Steel · Stahl	P05		K20W GC4220			F7010							
	P10		K20W GC3040 GC4220 GC4230		ACP100	F7010				IC4100 IC5100	MP1500	NC5330 NCM325	IN6505 IN6520
	P20	YBC301 YBC302 YBC251 YBC253	GC3040 GC4230		CS3000	FH7020	T3130		WKP25 WKP25S	IC4050 IC4100 IC5100 IC5400	MP1500 MP2500 MS2500 T25M	NC5330 NCM325	IN6505 IN6520 IN7035
	P30	YBC301 YBC302 YBM253 YBM351	GC2040 GC4240	KC930M KC935M	CS3000	F7030	T3130		WKP35 WKP35S WTP35	IC4050 IC5400	MK3000 T25M T350M	NCM325	IN7035 IN6530
	P40	YBC401 YBM351	GC2040 GC4240								T350M		IN6530
Stainless Steel · Rostfreier Stahl	M10		GC4230			F7010					MP1500	NCM325 NC5330	IN6520
	M20	YBM251 YBM253	GC4230			F7020	T3130			IC4050	MP1500 MP2500 MS2500 T25M	NCM325 NCM335	IN7035 IN6520 IN6505
	M30	YBM351	GC2040 GC4240	KC930M KC935M		F7030	T3130		WTP35		MP2500 MS2500 T25M T350M	NCM335	IN6530 IN7035 IN6505
	M40		GC2040 GC4240								T350M		IN6530
Cast iron · Guss	K05	YBD152		KCK15		F7010 MC5020				DT7150 IC4100			
	K10	YBD152 YBD252	K20W	KCK15	ACK200	F7010 MC5020	T1115		WAK15	DT7150 IC4100 IC4010	MP1500 MK1500	NC5330	IN6520
	K20	YBD252	K20W		ACK200		T1115		WKP25 WKP25S	DT7150 IC4100	MP1500 MP2500 MS2500 T25M MK1500	NC5330	IN6530 IN6515 IN6520
	K30			KC930M KC935M					WKP35 WKP35S	IC4050	MK3000 MP2500 MS2500		IN6530 IN6515

CVD milling grades · CVD Fräsen Klasse

Material / Class		ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Kyocera	Walter	Iscar	SECO	Korloy	Ingersoll Tague Tec
Super alloys Ti-Legierung	S	S05									MK3000		
		S10											
		S20									MP2500 MS2500 T25M		IN7035 IN6520
		S30	GC2040						WTP35		MM4500 T350M		
Nonferrite materials Ne-metalle	N	N05											
		N10											
		N20									MP2500 25M		
Hadened materiel Hd-metalle	H	H05											
		H10	K20W										
		H20	K20W GC3040										

PVD milling grades · PVD Fräsen Klasse

Material / Class		ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Kyocera	Walter	Iscar	SECO	Korloy	Ingersoll Tague Tec
Steel · Stahl	P	P05			ACZ120	VP05HT	GH130			IC903			
		P10	YBG102	GC1010 GC1025 GC1020	KC522M KC525M KC610M KC643M KC715M	ACZ10M ACZ20W	VP10H	AH120 GH130	PR730 PR1225 PR1525	WHX15 WHH15 WXM15	IC903 IC950 IC1008	F15M	IN2004 IN2006
		P20	YBG202 YBG252	GC1020 GC1025 GC1010 GC2030	KC522M KC525M KC643M KC715M KC725M	ACP200 ACZ330 ACX70 ACW30 AC350 ACZ50M	VP15TF VP20M VP20RT	AH725 AH120 AH130 AH330 AH725 AH730 GH330	PR630 PR830 PR730 PR1225 PR1230 PR1525	WXM15	IC810 IC380 IC830 IC900 IC908 IC910 IC950 IC1008	F25M MP3000	PC3500 PC3600	IN2006 IN1030 IN2004 IN2005 IN2015 IN2030 IN2505 IN2540
		P30	YBG302	GC1030 GC2030	KC530M KC725M KC735M	ACP200 ACP300 ACZ250M ACZ330 ACZ350 ACX70 ACW30 AC350	VP30RT	AH740 AH130 AH140	PR630 PR660 PR830 PR1230	WXM35	IC300 IC328 IC830 IC900 IC928 IC350 IC808 IC908	F30M MP3000	PC3500 PC3600 PC5300 PC3545 PC9570T	IN1030 IN2005 IN2015 IN2030 IN2035 IN2040 IN2505 IN2530 IN4035
		P40		GC1030	KC735M	ACP300 ACZ350		AH140 AH750		WXP45 WSP45 WSP46	IC300 IC328 IC928	F40M	PC5300 PC3545	IN2035 IN2040
Stainless Steel Rostfreier Stahl	M	M10		GC1020	KC522M KC610M KC643M KC715M	ACZ20W ACZ350 EH20Z		AH330 GH110 GH130	PR730 PR1225 PR660 PR1525		PR730 PR660 PR1225 PR1525	F15M	PC8110	IN2505
		M20	YBG202 YBG205 YBG252	GC1020 GC1025 GC1030 GC203	KC522M KC525M KC610M KC715M KC725M	ACP200 ACZ250M ACZ20M ACZ350 EH20Z AC350	VP15TF VP20RT	AH725 AH730 GH110	PR730 PR1025 PR660 PR1225 PR1525	WXM15	PR730 PR660 PR1025 PR1225 PR1525	F25M MP3000	PC5300 PC8110 PC9530	IN2005 IN2015 IN2505
		M30	YBG302	GC1040 GC203	KC525M KC530M KC725M KC735M	ACP300 ACZ250M ACX80 AC350	VP30RT	AH740 AH120 AH130 GH330 GH340				F30M MP3000	PC9530 PC3545 PC9570T	IN1030 IN2015 IN2030 IN2035 IN2530 IN4035
		M40		GC1040	KC530M KC735M	ACP300 ACX80		AH140 AH750 GH330 GH340		WSM35 WSM36 WXM35		F40M	PC3545	IN1030 IN2030 IN2035 IN2530 IN4035
Cast iron · Guss	K	K05		GC1010	KC510M	ACZ10M ACZ120 ACZ310		AH330	PR905 PR1210 PR1510			MH1000	PC8110	IN2510
		K10	YBG102 YBG152	GC1010	KC510M KC520M KC620M KC643M	EH20Z ACZ310		AH120 AH330 AH725	PR905 PR1210 PR1510	WXH15 WHH15 WXM15	IC810 IC950 IC1008	F15M MK2000	PC6510	IN2004 IN2010 IN2510
		K20		GC1020	KC520M KC620M KC725M	ACK300 EH20Z ACX80 ACW30	VP15TF	GH130		WKK25	IC328 IC830 IC950 IC350 IC808 IC908 IC1008	F25M MK2000 MO3000	PC6510 PC5300	IN1030 IN2004 IN2010 IN2015 IN2030 IN2505
		K30		GC1020	KC620M KC725M	ACK300 ACZ250M					IC328 IC830 IC900 IC908 IC350 IC808 IC908	F30M F40M MP3000	PC5300 PC9570T	IN2005 IN2015 IN2030 IN2505

PVD milling grades · PVD Fräsen Klasse

Material / Class		ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Kyocera	Walter	Iscar	SECO	Korloy	Ingersoll Tague Tec
Super alloys Ti-Legierung	S	S05									MH1000 F15M	PC8110	
		S10		KC525M KC643M	ACZ20W	VP15TF		PR905 PR1210 PR1510		IC808	NH1000 F15M F25M	PC5300	
		S20	S30T GC1025 GC1030 GC2030	KC525M KC643M	ACZ20W			PR905 PR1210 PR1510		IC908 IC380 IC900 IC903 IC908 IC928 IC830 IC808	F25M F30M	PC5300 PC3545	IN2005 IN2505
		S30	GC2030	KC725M KC735M	ACZ50M				WSM35 WSM36 WSP45 WSP46 WXM35 WXP45	IC328 IC928 IC830	F40M	PC3545	IN1030 IN2030 IN2035 IN2530 IN4035
Nonferrite materials Ne-metalle	N	N05		KC510M							MH1000 F15M		
		N10	GC1025 GC1030	KC510M KC620M KC522M	EH20Z				WXN15		MH1000 F15M		
		N20	GC1025 GC1030	KC620M KC522M KC525M KC651M							F25M F30M F40M MP3000		
Hadened material Hd-metalle	H	H05				VP05HT				IC903	MH1000 F15M	PC210F	IN2004 IN2006
		H10	GC1010	KC643M		VP10MF			WXH15 WHH15	IC900 IC808	MK2000 F30M MP3000	PC210F	IN2004 IN2005 IN2006
		H20	GC1010 GC1025 GC1030			VP15TF				IC810 IC908	F30M F40M MK2000 MP3000		

Uncoated milling grades · Unbeschichtet Fräsen Klasse

ISO	ZCC-CT	Sandvik	Kennametal	Sumitomo	Mitsubishi	Toshiba Tungaloy	Walter	Kyocera	Iscar	SECO	Korloy	Ingersoll Tague Tec
Nonferrite Mat. Ne-metalle												
N												
N01		H10	K115M K110M				WK10		IC20N		H01	IN04S
N10	YD101		K313	EH520	HTi10		WKM	GW25	IC08	H15	G10	IN10K IN05S
N20	YD201	H13A H10F	KMF	EH520	TF15		KMG40		IC28	H25		IN15K

NOTES / NOTIZEN:

1

175.32-22 A96
175.32-24 A96
175.32-25 A96
175.32-28 A96

A

APKT-KM B188
APKT-LH B186
APKT-PF B186
APKT-PM B186
APKT-PR B186
APMT_PDER B187
APMT_PDR B187

C

CCGT-SF A98
CCGT-USF A98
CCGW A134
CCGX-LC A100
CCGX-LH A100
CCMT A141
CCMT-EF A99
CCMT-EM A99
CCMT-HF A98
CCMT-HM A99
CCMT-HR A100
CCMW A100
CCMW(PCD) A142
CNE-A B188
CNE-B B188
CNEG-NF A61
CNGA A129
CNGA A152
CNGN A153
CNGN(CBN) A138
CNGX A154
CNMA A66
CNMG A66
CNMG-DF A60
CNMG-DM A62
CNMG-DR A63
CNMG-EF A60
CNMG-EM A62
CNMG-ER A64
CNMG-NM A63
CNMG-PM A61
CNMG-SF A60
CNMG-TC A63
CNMG-WG A60
CNMM A65
CNMM-DR A64
CNMM-ER A64
CNMM-HDR A65
CNMM-HPR A65
CNMM-LR A64
CPGT A98
CPGT-SF A101
CPGW A101

D

DCGT-SF A102
DCGT-USF A102
DCGW A135
DCGX-LC A104
DCGX-LH A104
DCMT A143
DCMT-EF A103
DCMT-EM A103
DCMT-HF A102
DCMT-HM A103
DCMT-HR A104
DCMW A104
DCMW(PCD) A144
DNEG-NF A68
DNGA A130
DNGA A154
DNGN A155
DNGN(CBN) A138
DNGX A155
DNMA A71
DNMG A72
DNMG-DF A67
DNMG-DM A69
DNMG-DR A70
DNMG-EF A68
DNMG-EM A70
DNMG-ER A70
DNMG-FM A68
DNMG-NM A70
DNMG-PM A69
DNMG-SF A67
DNMM-DR A72
DNMM-ER A72
DNMM-HDR A72
DNMM-LR A72
DNMX-WG A67
DPGT-SF A105
DPGT-USF A105
DPMW A105

H

HNEX-DF B189
HNEX-DM B189
HNEX-DR B189

K

KNUX A95

L

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																					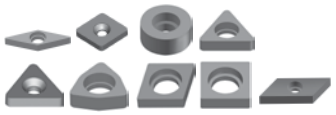											
			CM*x*A/B	CM* x *C	SM* x *	I*M x *	GB*–*M*	DM* x *X	LE M* x *A	L* A	L* B	L* C	L* D	SP*	SPR *	P * *	TM x *	C * RD	C * RA	C* R * T	C* R C	C * AP	D * AP	S * AP	T * AP	V * AP	W * A P	C * BM	D * BM	S * BM	T * BM	V * BM	W* BM	P T* S	W T* P	W H* L	W *RL
D	DCLNR/L			✓	✓										✓				✓									✓							✓	
D	DDJNR/L			✓	✓										✓				✓										✓						✓	
D	DSBNR/L			✓	✓										✓				✓											✓					✓	
D	DTGNR/L			✓	✓										✓				✓												✓				✓	
D	DVVNN			✓	✓										✓				✓													✓			✓	
D	DVJNR/L			✓	✓										✓				✓													✓			✓	
D	DWLNR/L			✓	✓										✓				✓														✓		✓	
P	PCBNR/ L								✓		✓			✓							✓														✓	
P	PCLNR/ L								✓		✓			✓							✓														✓	
P	PDJNR/ L								✓		✓			✓								✓													✓	
P	PDNNR/ L								✓		✓			✓								✓													✓	
P	PSBNR/ L								✓		✓			✓										✓											✓	
P	PSDNN								✓		✓			✓										✓											✓	
P	PSKNR/ L								✓		✓			✓										✓											✓	
P	PSSNR/ L								✓		✓			✓										✓											✓	
P	PTFNR/ L								✓		✓			✓									✓												✓	
P	PTTNR/ L								✓		✓			✓										✓											✓	
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P	PWLNR/ L								✓		✓			✓											✓										✓	
M	MCBNR/ L							✓									✓										✓							✓	
M	MCLNR/ L							✓									✓										✓							✓	
M	MDJNR/ L							✓									✓											✓						✓	
M	MDPNN							✓									✓											✓						✓	
M	MSBNR/ L							✓									✓												✓					✓	
M	MSRNR/ L							✓									✓												✓					✓	

Clamping system Klemmsystem	Tool Type Werkzeug Typ	Page · Seite	Screw Schraube					Screw Schraube		Lever Kniehebel				Shim pin Rohrstift	Spring Feder	Clampin Stud Passstift		Clamp Pratze				Shim Unterlagen											Wrench Schlüssel			
			CM*x*A/B	CM* x *C	SM* x*	I*M x *	GB*–*M*	DM* x *X	LE M* x *A	L* A	L* B	L* C	L* D	SP*	SPR *	P * *	TM x *	C * RD	C * RH	C* R * T	C* R C	C * BM	D * BM	S * BM	T * BM	V * BM	W * BM	R * BM	C * BS	D * BS	V * BS	V * BSC	S * BS	P T* S	W T* P	W H* L	W *RL
M	MSKNR/ L							✓									✓	✓						✓											✓	
M	MSDNN							✓									✓	✓						✓											✓	
M	MTGNR/ L							✓									✓	✓							✓										✓	
M	MTJNR/ L							✓									✓	✓							✓										✓	
M	MTFNR/ L							✓									✓	✓							✓										✓	
M	MVVNN							✓									✓	✓								✓									✓	
M	MVJNR/ L							✓									✓	✓								✓									✓	
M	MWLNR/L							✓									✓	✓									✓								✓	
M	MRGNR/L							✓									✓	✓										✓							✓	
M	MRDNN							✓									✓	✓										✓							✓	
S	SCACR/ L				✓																			✓											✓	
S	SCLCR/ L			✓	✓																			✓					✓					✓	✓	
S	SDACR/ L			✓	✓																			✓						✓				✓	✓	
S	SDJCR/ L			✓	✓																			✓						✓				✓	✓	
S	SDNCN			✓	✓																			✓						✓				✓	✓	
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S	SVABR/ L			✓	✓																										✓			✓	✓	
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S	STACR/ L				✓																														✓	

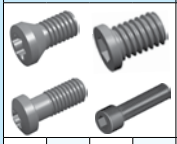
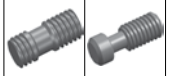
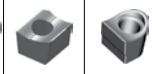
Clamping system Klemmsystem	Tool Type Werkzeug Typ	Page · Seite	Screw Schraube					Screw Schraube		Lever Kniehebel				Shim pin Rohrstift	Spring Feder	Clampin Stud Passstift		Clamp Pratze				Shim Unterlagen												Wrench Schlüssel			
			CM*x*A/B	CM* x *C	SM* x*	l*M x *	GB*-*M*	DM* x *X	LE M* x *A	L* A	L* B	L* C	L* D	SP*	SPR *	P * *	TM x *	C * RD	C * RH	C* R * T	C* R C	C * BS	D * BS	V * BS	S * BS	T * BS	R * BS	K*CC	C*CC	T*CC	D*CC	S*CC	R*CC	P T* S	W T* P	W H* L	W *RL
S	STFCR/ L				✔	✔																			✔										✔	✔	
	STGCR/ L				✔	✔																			✔										✔	✔	
	STTCR/ L				✔	✔																			✔										✔	✔	
	SWACR/L					✔																														✔	
	SRDCN				✔	✔																				✔									✔	✔	
	SRGCR/ L				✔	✔																				✔									✔	✔	
C	CKJNR/ L		✔		✔										✔	✔				✔							✔									✔	
	CKNNR/ L		✔		✔										✔	✔				✔							✔									✔	
	CCLNR/ L			✔	✔										✔														✔							✔	
	CTJNR/ L			✔	✔										✔															✔						✔	
	CTUNR/ L			✔	✔										✔															✔						✔	
	CDJNR/ L			✔	✔										✔																✔					✔	
	CSRNR/ L			✔	✔										✔																	✔				✔	
	CSKNR/ L			✔	✔										✔																	✔				✔	
	CSDNN			✔	✔										✔																	✔				✔	
	CRDNN			✔	✔										✔																		✔			✔	
J	JCLNR/ L			✔	✔										✔														✔							✔	
	JDJNR/ L			✔	✔										✔																✔					✔	
	JSDNN			✔	✔										✔																	✔				✔	

Clamping system Klemmsystem	Tool Type Werkzeug Typ	Page · Seite	Screw Schraube					Screw Schraube		Lever Kniehebel				Shim pin Rohrstift	Spring Feder	Clampin Stud Passstift		Clamp Pratze				Shim Unterlagen												Wrench Schlüssel			
			CM*x*A/B	CM* x *C	SM* x*	I*M x *	GB*-.*M*	DM* x *X	LE M* x *A	L* A	L* B	L* C	L* D	SP*	SPR *	P * *	TM x *	C * RD	C * RH	C* R * T	C* R C	C * BS	D * BS	V * BS	S * BS	T * BS	R * BS	T*CC	C*AP	D*AP	S*APB	T*APB	W*APB	P T* S	W T* P	W H* L	W *RL
P	PCLNR/L								✔	✔		✔		✔															✔						✔	
P	PDSNR/L								✔		✔			✔																✔					✔	
P	PDUNR/L								✔				✔	✔																✔					✔	
P	PSKNR/L								✔		✔			✔																	✔			✔	
P	PTFNR/L								✔		✔			✔																		✔			✔	
P	PWLNR/L								✔	✔	✔			✔																			✔		✔	
S	SCLCR/L				✔	✔																✔												✔	✔	
S	SDQCR/L					✔																													✔		
S	SDUCR/L					✔																													✔		
S	SDZCR/L				✔	✔																	✔												✔	✔	
S	SSKCR/L				✔	✔																			✔										✔	✔	
S	STFCR/L				✔	✔																				✔									✔	✔	
S	SVQCR/L					✔																													✔		
S	SVUCR/L					✔																													✔		
S	SVQBR/L				✔	✔																		✔											✔	✔	
S	SVUBR/L				✔	✔																		✔											✔	✔	
S	SCLPR/L					✔																													✔		
S	SDQPR/L					✔																													✔		
S	SDUPR/L					✔																													✔		
S	STUPR/L					✔																													✔		
S	SCFCR					✔																													✔		
S	SCLCR					✔																													✔		
S	SCLPR/L					✔																													✔		
S	SDQPR/L					✔																													✔		
S	SDUPR/L					✔																													✔		
S	STUPR/L					✔																													✔		
S	SVQCR/L					✔																													✔		
S	SVUCR/L					✔																													✔		

Clamping system Klemmsystem	Tool Type Werkzeug Typ	Page · Seite	Screw Schraube					Screw Schraube		Lever Kniehebel				Shim pin Rohrstift	Spring Feder	Clampin Stud Passstift		Clamp Pratze				Shim Unterlagen												Wrench Schlüssel		
			CM*x*A/B	CM* x *C	SM* x*	I*M x *	GB*–*M*	DM* x *X	LE M* x *A	L* A	L* B	L* C	L* D	SP*	SPR *	P * *	TM x *	C * RD	C * RH	C* R * T	C* R C	MT*-*M	D * BS	V * BS	S * BS	T * BS	R * BS	K*CC	C*CC	T*CC	D*CC	S*CC	R*CC	P T* S	W T* P	W H* L	W *RL
	QE*D QE*S						✔																												✔	
	QECD						✔																												✔	
	QX*D						✔																												✔	
	QE*S						✔																												✔	
	QE*S*N																																			
	QZS*						✔																												✔	
	QFFD R/L QFGD R/L						✔																												✔	
	QF*D R/L QF*S R/L						✔																												✔	
	QFFD*RR QFQD*RR						✔																												✔	
	QF*D RR QF*S RR						✔																												✔	
	QFFD LL QFGD LL						✔																												✔	
	QF*D LL QF*S LL						✔																												✔	
	QFFD R/L-L QFGD R/L-L						✔																												✔	
	QFHD R/L QFHS R/L QFKD R/L						✔																												✔	
	C*-Q*DR/L						✔																												✔	
	C*X-Q*DR/L						✔																												✔	
	QZQ						✔																												✔	
	GQCR/L					✔																												✔		
	S*-QC*R/L					✔																												✔		
	C*-QZS						✔											✔																	✔	
	QZS*						✔											✔																	✔	
	SWR/L				✔	✔																✔												✔		
	SNR/L				✔	✔																✔												✔		
	SWR*16B				✔	✔																✔												✔		
	SNR*16B				✔	✔																✔												✔		

Clamping system Klemmsystem	Tool Type Werkzeug Typ	Page Seite	Screw Schraube				Screw Schraube		Wedge Keil		Shim Unterlagen		Clamp Pratze	Cassette Kassette						Wrench Schlüssel			
			SM* x*XA	I*M * x *	GB*--*M*	LO M* x *	DM* x *X	WM*x*	W*R/L	W*N	LLN*R-ZR	S * BS	WD * *	LSE*R/L	LOF*R/L	LSP*R/L	LTP*R/L	WD-*	CBH*R*	W T * IS	W T * P	W H * L	W T * T
	FMA01		✔	✔								✔								✔		✔	
	FMA02			✔																✔			
	FMA03					✔	✔		✔					✔							✔	✔	
	FMA04			✔																✔			
	FMA04					✔	✔		✔						✔						✔	✔	
	FMA07			✔																✔			✔
	FMA07			✔																✔			✔
	FMA11					✔	✔																
	FMD02			✔																✔			
	FMD02						✔			✔													✔
	FMD03			✔							✔									✔			✔
	FME02			✔																✔			
	FME03					✔		✔	✔							✔							✔
	FME04			✔							✔									✔			
	FMP01					✔		✔	✔								✔			✔			
	FMP02		✔	✔								✔								✔		✔	

Clamping system Klemmsystem	Tool Type Werkzeug Typ	Page Seite	Screw Schraube				Screw Schraube		Wedge Keil		Shim Unterlagen		Clamp Pratze	Cassette Kassette						Wrench Schlüssel			
			SM* x*XA	I*M * x *	GB*--*M*	LO M* x *	DM* x *X	WM*x*	W*R/L	W*N	LLN*R-ZR	S * BS	WD * *	LSE*R/L	LOF*R/L	LSP*R/L	LTP*R/L	WD-*	CBH*R*	W T * IS	W T * P	W H * L	W T * T
	FMP03			✔							✔									✔			✔
	FMR01			✔																✔			
	FMR02			✔																✔			✔
	FMR03			✔																	✔		
	FMR04			✔									✔								✔		✔
	EMP01			✔																	✔		✔
	EMP02			✔																✔			
	EMP03			✔																✔			
	EMP04			✔																✔			
	EMP05			✔																	✔		
	BMR01			✔																✔	✔		
	BMR02			✔																✔			
	BMR03			✔														✔	✔	✔	✔		✔
	BMR04			✔																	✔		✔
	SMP01			✔																✔			

Clamping system Klemmsystem	Tool Type Werkzeug Typ	Page Seite	Screw Schraube				Screw Schraube		Wedge Keil		Shim Unterlagen		Clamp Pratze	Cassette Kassette						Wrench Schlüssel			
																							
			SM* x*XA	I*M * x *	GB*--*M*	LO M* x *	DM* x *X	WM*x*	W*R/L	W*N	LLN*R-ZR	S * BS	WD * *	LSE*R/L	LOF*R/L	LSP*R/L	LTP*R/L	WD-*	CBH*R*	W T * IS	W T * P	W H * L	W T * T
	SMP03			✔																✔	✔		
	FME03																						
	XMR01			✔																	✔		
	XMP01			✔																	✔		
	TMP01			✔									✔							✔			✔
	HMP01			✔																✔			
	HMP01 EC			✔	✔															✔		✔	
	CMZ01			✔																✔			
	CMA01			✔																✔			
	CMD01			✔																✔			
	QCH-XPHT			✔														✔	✔	✔	✔			✔
	QCH-SDMT			✔									✔							✔	✔		
	QCH-WPGT			✔									✔								✔		
	QCH-AZGT			✔																✔	✔		
	QCH-RD			✔																	✔		✔
	QCH-ZOHX			✔																	✔		✔