LMT • TOOLS

BELIN
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Mold & Die
Milling Tools & Inserts

2016

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Networking the Experts!

LMT Tools combines the competences of leading specialists in the field of precision tool technology. This pooled expertise enables LMT Tools to develop and deliver tool solutions worldwide for processing materials ranging from high-strength steel to composite materials.

The extensive product range offers perfect solutions for the automotive, aerospace, general machining, energy technology or mold and die and covers almost all types of applications.

Automotive

Aerospace

General Machining

Energy Technology

Mold and Die

Our core competences:

- Gear cutting
- Threading
- Milling
- Mold and Die
- Drilling
- Reaming
- Turning
- Clamping systems
- Heavy-duty machining

The product range is supplemented by special services such as project engineering, tool management, tool supply systems, reconditioning, kanban or training in the context of the LMT Tools Training Centre and thus ensures all-round support from the start.

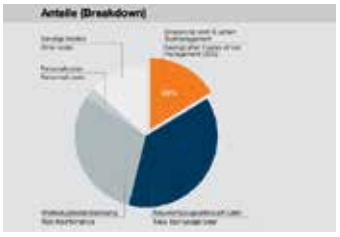
Our Services:

Project Engineering

Tool Management

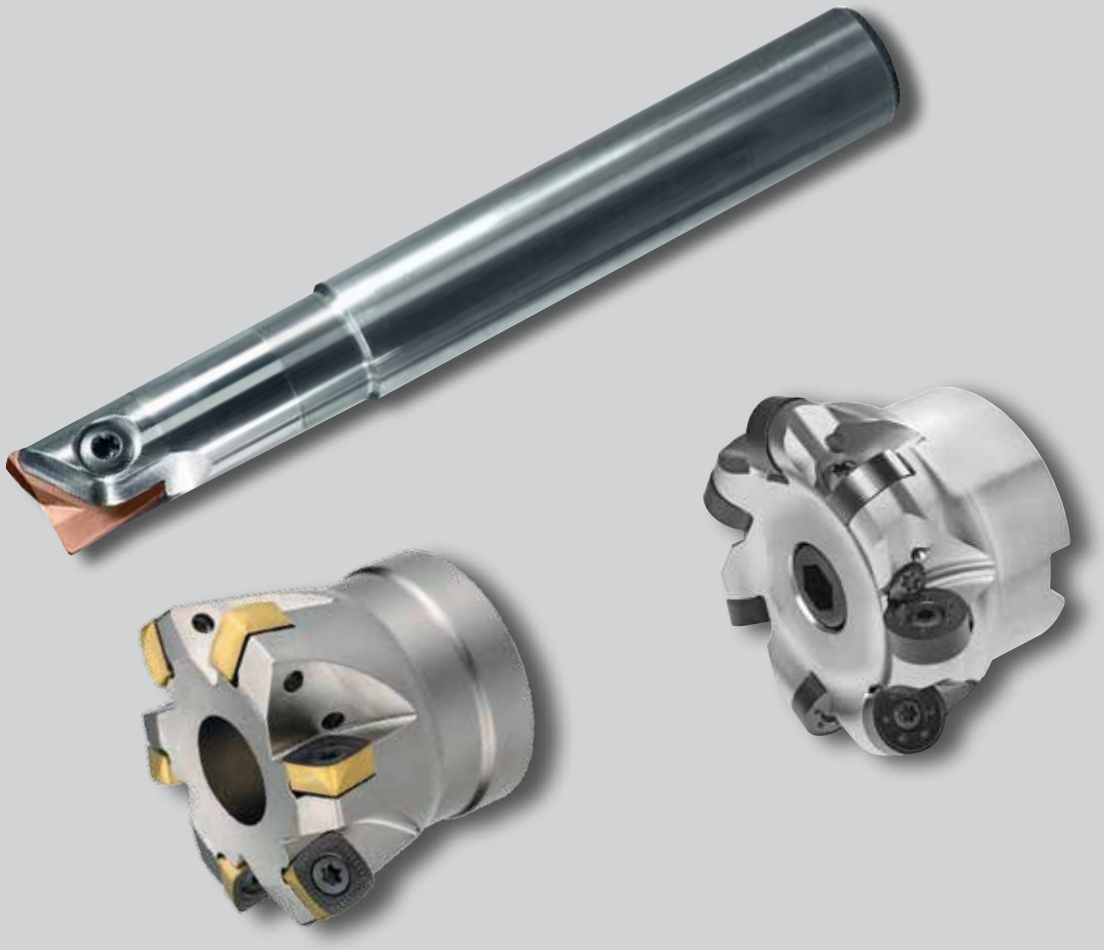
Tool Supply Systems

Reconditioning



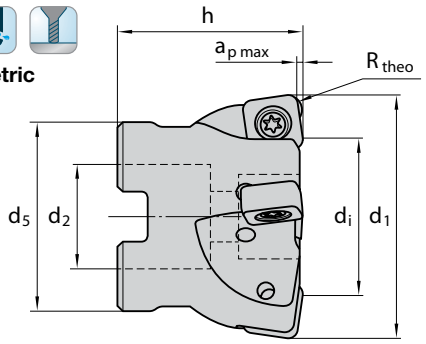
Kanban

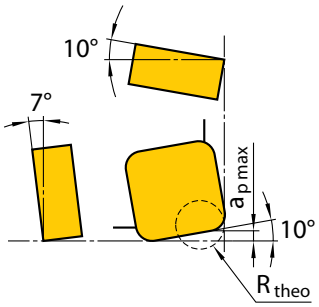
Training



Mold & Die Cutters & Inserts

Metric





d_1	LMT-Code	Ident No.	d_i	h	d_2	d_5	z ⚙	ap max	R theo	Insert	Insert Screw	Torx Driver
50	HFN S12.050AN-IW	7066683	30	40	22	40	4	1.5	3.5	SNKQ 120520 SN	1045123	1048344 T20
50	HFN S12.050AN-I	7066684	30	40	22	40	5	1.5	3.5			
63	HFN S12.063AN-W	7066685	43	50	27	50	5	1.5	3.5			
63	HFN S12.063AN-I	7066686	43	50	27	50	6	1.5	3.5			
80	HFN S12.080AN-IW	7066687	60	50	27	60	6	1.5	3.5			
80	HFN S12.080AN-I	7066688	60	50	27	60	8	1.5	3.5			
100	HFN S12.100AN-IW	7066689	80	50	32	65	7	1.5	3.5			
100	HFN S12.100AN-I	7066690	80	50	32	65	10	1.5	3.5			
125	HFN S12.125AN-W	7066691	105	63	40	90	9	1.5	3.5			
125	HFN S12.125AN	7066692	105	63	40	90	12	1.5	3.5			
160	HFN S12.160AN-W	7066693	140	63	40	130	11	1.5	3.5			
160	HFN S12.160AN	7066694	140	63	40	130	15	1.5	3.5			

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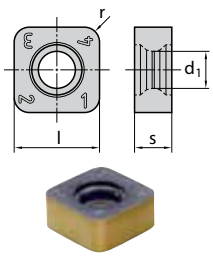
Inch

d_1	Cutter Body No.	EDP No.	dI	h	d_2	d_5	z ⚙	ap max	R theo	Insert	Insert Screw	Torx Driver
2.00	HFN S12.200 AN-I	46200	1.181	1.575	0.750	1.575	5	0.060	0.138	SNKQ 120520	SN1045123	1048344 T20
2.50	HFN S12.250 AN-I	49796	1.693	1.969	1.000	1.969	6	0.060	0.138			
3.00	HFN S12.300 AN-I	49498	2.362	1.969	1.000	2.362	5	0.060	0.138			
4.00	HFN S12.400 AN-I	49582	3.150	1.969	1.500	2.560	7	0.060	0.138			

Torque: 7.6Nm
Maximum Ramp Angle: 1˚

Cutting data recommendations starting page 122

N = Number of cutting edges	l	s	d	r	ISO-Code Cat-No.	Cutting materials Ident No. LCP40M	LCP44M	LCKP10M	LCK10M	For cutter Cat-No.
 N = 8	12.7 (.500)	5.54 (.218)	–	1.98 (.078)	SNKQ 120520 SN	45742	45743	45744	45745	HFN S12

MultiEdge Double 4 Feed – High Feed Cutter
Application Example

BASE (MACHINE CONSTRUCTION)

TOOL:
MultiEdge Double 4 Feed Face Milling Cutter
Cat.-No. HFN S12

INSERT: LCP40M

MATERIAL: 1040

CUTTING DATA:
v_c = 820 SFM
f_z = .071" FPT
v_f = 450 IPM
a_e = 1.750" WOC
a_p = .040" DOC

COOLANT: Dry

Significant increases in productivity and drastic cost savings with high feed mills now reach a new level – with the new LMT Tools MultiEdge Double4Feed High Feed Mill product line. With 8 useable cutting edges per indexable insert, the MultiEdge Double4Feed sets new standards regarding efficiency.

The MultiEdge Double4Feed is an optimal tool for face milling and is available with diameters from 2" to 4".

High feeds are realized from chip thinning, a result of the smaller lead angle. Vibrations are minimized too from reduced side load, due to cutting forces being directed axially into spindle.

Your success: shorter machining times, reduced production costs. We will be happy to advise you with regard to your applications.

Features

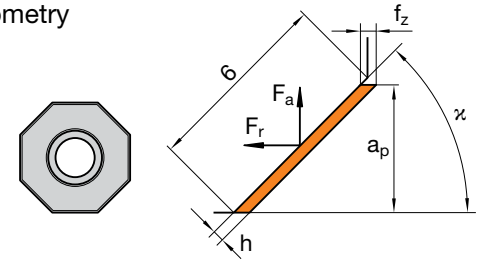
- 8 cutting edges per insert
- High-performance, high feed geometry for face milling operations
- Stable insert geometry for machining steel and cast materials
- Stable cutting due to advanced edge prep design
- Increased performance due to innovative insert grade types as LCP40M, LCP44M, LCKP10M, and LCK10M
- New TERAspeed coating (LCP44M) especially for wet machining of steel materials
- Metric medium and fine pitch bodies available on request.

Advantages

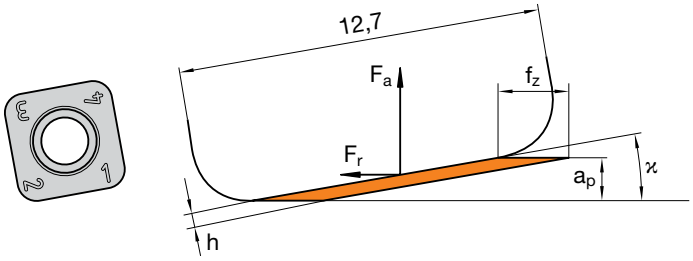
- Reduced tool costs from 8 cutting edges
- Maximum metal removal rate during face milling
- Reduced machining times
- Economic production due to increase in productivity
- Reduced tendency for vibration
- Pocket design assists in chip removal
- Increased tool life compared to conventional face milling operations

MultiEdge Feed Geometry

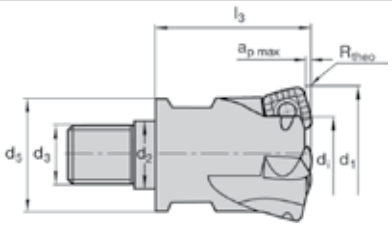
Cutting conditions and chip cross section with conventional geometry

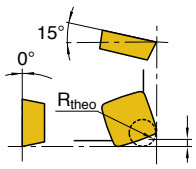


Cutting conditions and chip cross section with MultiEdge Double 4 Feed geometry



ECP V07
ECP V09
IKZ
Metric





All bodies have internal coolant



d_1	d_l	l_3	d_3	d_2	d_5	ap_{max}	R_{theo}	z ⚙	Cutter Body No.	Ident No.	Insert	Insert Screw	Torx Driver
ECP V07													
20	6.9	30	M10	10.5	18	1.0	1.5	2	ECP V07.020TS030-I	1025030	XCNT 070308	1045127	1048326
25	12	33	M12	12.5	21	1.0	1.5	3	ECP V07.025TF033-I	1025031	XCNW 070308	2237513	T 08
32	19	43	M16	17.0	29	1.0	1.5	3	ECP V07.032TH043-I	1025032		M3.0	
32	19	43	M16	17.0	29	1.0	1.5	4	ECP V07.032TH043-IF	1025033			
35	22	43	M16	17.0	29	1.0	1.5	5	ECP V07.035TH043-I	1025034			
ECP V09													
32	17	43	M16	17.0	29	1.2	2.5	3	ECP V09.032TH043-I	1025035	XCNT 09T312	1045105	1048335
32	17	43	M16	17.0	29	1.2	2.5	4	ECP V09.032TH043-IF	1025036	XCNW 09T312	M3.5	T 15
35	20	43	M16	17.0	29	1.2	2.5	4	ECP V09.035TH043-I	1025037			
42	27	43	M16	17.0	29	1.2	2.5	4	ECP V09.042TH043-IW	1025038		1045114	
42	27	43	M16	17.0	29	1.2	2.5	5	ECP V09.042TH043-I	1025039		M3.5	

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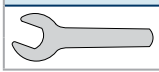
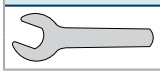
Inch

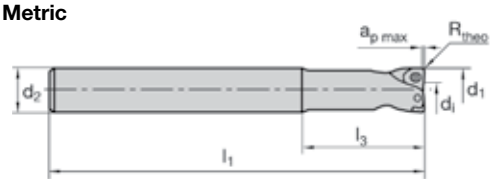
d_1	d_l	l_3	d_3	d_2	d_5	ap_{max}	R_{theo}	z ⚙	Cutter Body No. (inches)*	Ident No.	Insert	Insert Screw	Torx Driver
ECP V07													
0.75	0.24	1.18	M10	0.41	0.67	0.04	0.06	2	ECP V07-075TS118-I	9089007	XCNT 070308	1045127	1048326
1.00	0.49	1.30	M12	0.49	0.83	0.04	0.06	3	ECP V07-100TF130-I	9089008	XCNW 070308	2237513	T 08
												M3.0	
ECP V09													
1.25	0.66	1.69	M16	0.67	1.13	0.05	0.100	4	ECP V09-125TH169-IF	9089010	XCNT 09T312	1045105	1048335
1.50	0.67	1.69	M16	0.67	1.13	0.05	0.100	4	ECP V09-150TH169-I	9095431	XCNW 09T312	M3.5	T 15

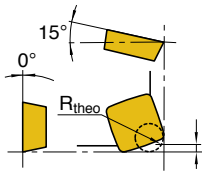
See page 11 for Inserts
See pages 54–55 for Screw-On Shanks
Cutting data recommendations starting page 123

Open End Wrench	Wrench Size	Ident No.	For Head Sizes
	15mm	2146611	20mm, .750"
	17mm	2146612	20mm, 1.00"

Open End Wrench	Wrench Size	Ident No.	For Head Sizes
	24mm	2146615	32mm, 1.25"
	24mm	2146615	42mm, 1.50"

ECP
IKZ
Metric





All bodies have internal coolant

d_1	d_I	l_3	l_1	d_2	ap_{max}	R_{theo}	z	Cutter Body No.	Ident No.	Insert	Insert Screw	Torx Driver
ECP V07												
20	6.9	60	175	20	1.0	1.5	2	ECP V07.020AN175-I	1025060	XCNT 070308	1045127	1048326
25	12.0	75	190	25	1.0	1.5	3	ECP V07.025AN190-I	1025061	XCNW 070308	2237513	T 08
32	19.0	80	210	32	1.0	1.5	3	ECP V07.032AN210-I	1025063		M3.0	
32	19.0	80	210	32	1.0	1.5	4	ECP V07.032AN210-IF-I	1025064			
ECP V09												
32	17.0	80	210	32	1.2	2.5	3	ECP V09.032AN210-I	1025065	XCNT 09T312	1045105	1048335
32	17.0	80	210	32	1.2	2.5	4	ECP V09.032AN210-IF	1025066	XCNW 09T312	M3.5	T 15

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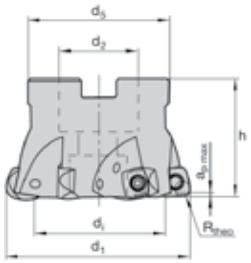
Inch

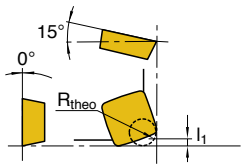
d_1	d_I	l_3	l_1	d_2	ap_{max}	R_{theo}	z	Cutter Body No. (inches)*	Ident No.	Insert	Insert Screw	Torx Driver
ECP V07												
0.75	0.24	2.36	6.89	0.75	0.04	0.06	2	ECP V07.075AD689-I	9089014	XCNT 070308	1045127	1048326
1.00	0.49	2.95	7.48	1.00	0.04	0.06	3	ECP V07.100AE748-I	9089015	XCNW 070308	2237513	T 08
											M3.0	
ECP V09												
1.25	0.66	3.15	8.27	1.25	0.05	0.10	4	ECP V09.125AF827-IF	9089017	XCNT 09T312	1045105	1048335
1.50	0.91	3.50	9.00	1.50	0.05	0.10	4	ECP V09.150AF900-IF	9095050	XCNW 09T312	M3.5	T 15

See page 11 for Inserts

Cutting data recommendations starting page 123

FCP V09
FCP V12
IKZ
Metric





All bodies have internal coolant



d_1	d_l	h	d_2	d_5	ap_{max}	R_{theo}	z ☼	Cutter Body No.	Ident No.	Insert	Insert Screw	Torx Driver
FCP V09												
42	27	40	16	29.6	1.2	2.5	4	FCP V09.042AN-IW	1025040	XCNT 09T312 XCNW 09T312	1045114 M3.5	1048335 T 15
42	27	40	16	29.6	1.2	2.5	5	FCP V09.042AN-I	1025041			
52	37	40	22	39.6	1.2	2.5	5	FCP V09.052AN-IW	1025042			
52	37	40	22	39.6	1.2	2.5	6	FCP V09.052AN-I	1025043			
FCP V12												
42	23	40	16	32	1.9	3.5	3	FCP V12.042AN-IW	1025045	XCNT 120520 XCNW 120520	1045123 M4.5	1048344 T 20
42	23	40	16	32	1.9	3.5	4	FCP V12.042AN-I	1025046			
52	33.1	40	22	39.6	1.9	3.5	4	FCP V12.052AN-IW	1025047			
52	33.1	40	22	39.6	1.9	3.5	5	FCP V12.052AN-I	1025048			
66	47.1	50	27	50	1.9	3.5	6	FCP V12.066AN-IW	1025049			
66	47.1	50	27	50	1.9	3.5	7	FCP V12.066AN-I	1025050			
80	61.2	50	27	60	1.9	3.5	8	FCP V12.080AN-I	1025051			
100	81.2	50	32	65	1.9	3.5	10	FCP V12.100AN-I	1025052			

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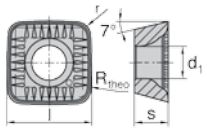
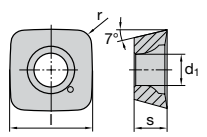
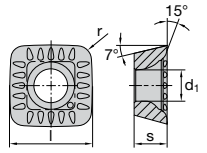
Inch

d_1	d_l	h	d_2	d_5	ap_{max}	R_{theo}	z ☼	Cutter Body No. (inches)*	Ident No.	Insert	Insert Screw	Torx Driver
ECP V09												
2.00	1.41	1.57	0.75	1.56	0.05	0.10	4	FCP V09.200AA158-IW	9089021	XCNT 09T312 XCNW 09T312	1045114 M3.5	1048335 T 15
2.00	1.41	1.57	0.75	1.56	0.05	0.10	5	FCP V09.200AA158-I	9089022			
2.00	1.41	1.57	0.75	1.56	0.05	0.10	6	FCP V09.200AA158-IF	9089023			
ECP V12												
2.00	1.26	1.57	0.75	1.56	0.07	0.14	4	FCP V12.200AA158-IW	9089026	XCNT 120520 XCNW 120520	1045123 M4.5	1048344 T 20
2.00	1.26	1.57	0.75	1.56	0.07	0.14	5	FCP V12.200AA158-I	9089027			
2.50	1.76	1.57	1.00	2.00	0.07	0.14	6	FCP V12.250AB158-I	9089029			
2.50	1.76	1.57	1.00	2.00	0.07	0.14	7	FCP V12.250AB158-IF	9089030			
3.00	2.26	1.97	1.25	2.36	0.07	0.14	5	FCP V12.300AC197-IW	9095685			
3.00	2.26	1.97	1.25	2.36	0.07	0.14	8	FCP V12.300AC197-I	9095686			
4.00	3.24	1.97	1.50	3.15	0.07	0.14	7	FCP V12.400AD197-IW	9089033			
4.00	3.24	1.97	1.50	3.15	0.07	0.14	10	FCP V12.400AD197-I	9089034			

See page 11 for Inserts

Cutting data recommendations starting page 123

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No.															For cutter
							LC280QN[1]	LC280TT	LC240T	LC230F	LC225T	LC225S	LC630T	LC630Q	LW240	LW225	LC610Q	LC610E	LC610T	LC610W	LC610A	BN025	LC603Z	Cat-No.
 N = 4 s = ± 0.02 d = ± 0.01 Chipbreaker	7.94 (.312)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.8 (.032)	XCNT 070308 SN-TR	1058100										1058101		1058106					ECP V07
	9.52 (.375)	3.97 (.156)	9.52 (.375)	3.8 (.150)	1.2 (.047)	XCNT 09T312 SN-TR	1058102										1058103							ECP/FCP V09
	12.7 (.500)	5.56 (.219)	12.7 (.500)	5.2 (.205)	2.0 (.079)	XCNT 120520 SN-TR	1058104										1058105		1058108					FCP V12
 N = 4 Flat Top	7.94 (.312)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.8 (.032)	XCNW 070308 SN	9186492										9186493		9186494					ECP V07
	9.52 (.375)	3.97 (.156)	9.52 (.375)	3.8 (.150)	1.2 (.047)	XCNW 09T312 SN	9186440										9186441		9186442					ECP/FCP V09
	12.7 (.500)	5.56 (.219)	12.7 (.500)	5.2 (.205)	2.0 (.079)	XCNW 120520 SN	9186431										9186432		9186433					FCP V12
 N = 4 Sharp Edge for SS & Exotic Materials Flat Top	7.94 (.312)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.8 (.032)	XCNT 070308 EN-TR	9186375							7011714			9186376		9186377					ECP V07
	9.52 (.375)	3.97 (.156)	9.52 (.375)	3.8 (.150)	1.2 (.047)	XCNT 09T312 EN-TR	9186350							7011717			9186351		9186352					ECP/FCP V09
	12.7 (.500)	5.56 (.219)	12.7 (.500)	5.2 (.205)	2.0 (.079)	XCNT 120520 EN-TR	9186206							7011721			9186207		9186208					FCP V12

[1] LC280QN Two colored multi coating for high performance milling

Cutting material and selection				
P	●	●	●	●
M	●			
K	●	●	●	●
N		●	●	●
S		●	●	●
	LC280QN	**LC610Q**	**LC610T**	**LC630Q**

● = First choice
● = Alternative

			
ISO Code	**XCNT/W 070308**	**XCNT/W 09T312**	**XCNT/W 120520**
$a_{p\ max}$ to get use of all edges Number of cutting edges	.039"	.047"	.059"
Number of cutting edges	4	4	4

Feed correction

$v_f = f_z \cdot z \cdot n \cdot f_2$

a_p (DOC)	f_2 $l_{ges.}$ (Reach) < 4 x d_1	f_2 $l_{ges.}$ (Reach) > 4 x d_1
(50% Dia.) 0.5 x $a_{p\ max}$	.051"	.039"
(75% Dia.) 0.75 x $a_{p\ max}$	.039"	.030"
(Full Dia.) 1.0 x $a_{p\ max}$	.028"	.020"

Calculating formulas

Speed n (min⁻¹):
$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$

Cutting speed
$v_c = \frac{n \cdot \pi \cdot d_1}{1000}$

Feed rate
v_f (inch/min):
$v_f = f_z \cdot z_{eff} \cdot n \cdot f_2$

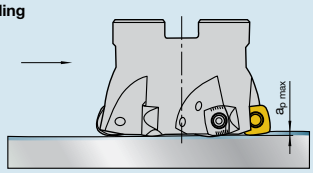
Feed per tooth
$f_z = \frac{v_f}{z_{eff} \cdot n \cdot f_2}$

Chip volume-Q (min):
$Q = \frac{a_e \cdot a_p \cdot v_f}{1000}$

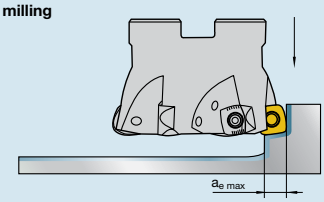
Drive power
$P_e = \frac{Q}{LF}$

v_c = Cutting speed (sfm)
n = Speed (min⁻¹)
d_1 = Cutter dia. (rpm)
v_f = Feed rate (ipm)
f_z = Feed per tooth (kW)
P_e = Drive power (kW)
z_{eff} = Effective number of teeth
f_2 = Correction factor
Q = Chip volume
a_e = Width of cut (inch)
a_p = Depth of cut (inch)
LF = Efficiency factor

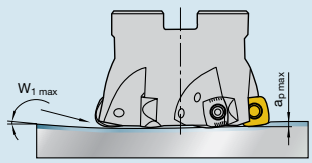
Face milling



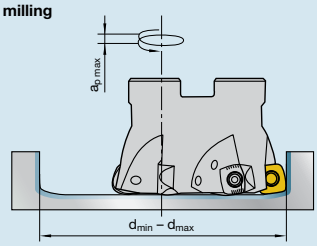
Plunge milling



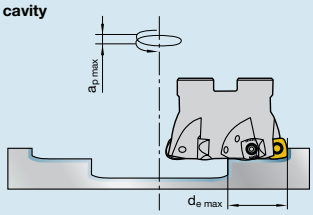
Ramping



Circular milling



Opening cavity



Tool		ECP X07.	ECP V07.	E(F)CP V09.	E(F)CP V12.
$a_{p\ max}$ (inch)		.040"	.040"	.047"	.060"
$a_{e\ max}$ (inch)		.236"	.250"	.315"	.375"
T_{max} (inch)		.020"	.020"	.024"	.032"
Ramping Angle W1					
d_1 (mm)	d_1 (inch)	$W_{1\ max}$ (°)			
16	.625"	3.5			
20	.750"	1.8	4.3		
25	1.00"	1.2	2.4		
32	1.25"		1.5	2.2	
35	1.50"		1.3	1.8	
42	–			1.3	2
52	2.00"			1	1.5
66	2.50"				1
80	3.00"				0.8
100	4.00"				0.6
Circular Milling					
d_1 (mm)	d_1 (inch)	$d_{min} – d_{max}$ (inch)			
16	.625"	.750"–1.22"			
20	.750"	1.102"–1.54"	1.02"–1.54"		
25	1.00"	1.50"–1.93"	1.42"–1.93"		
32	1.25"		1.97"–2.44"	1.89"–2.44"	
35	1.50"		2.20"–2.68"	2.13"–2.68"	
42	–			3.46"–4.02"	2.52"–3.23"
52	2.00"				3.31"–4.02"
66	2.50"				4.41"–5.12"
80	3.00"				5.51"–6.22"
100	4.00"				7.09"–7.80"
Open Cavity Milling					
d_1 (mm)	d_1 (inch)	$d_{e\ max}$ (inch)			
16	.625"	.395"			
20	.750"	.551"	.512"		
25	1.00"	.748"	.709"		
32	1.25"		.984"	.945"	
35	1.50"		1.10"	1.06"	
42	–			1.34"	1.26"
52	2.00"			1.73"	1.65"
66	2.50"				2.20"
80	3.00"				3.54"
100	4.00"				

T_{max}: axial drilling depth

MultiEdge 4 Feed – High Feed Cutter
Application Example

WORK PIECE: Automotive Mold

MATERIAL: P20 (32-38 HRC)

MACHINE: Makino MCC2013 using Tebis Cad/Cam HSK100A 30HP SPINDLE

SITUATION: Customer was in search for a High Feed insert with increase tool life
Result +20%

TOOL: XCNW 120520 SN LC280QN -9186431 -NEW
FCP V12.300 AC197-IW -5 TOOTH

COMPTETITOR TOOL: WDMW 10X610ZRT JC8015
SKS-5300-125R-10

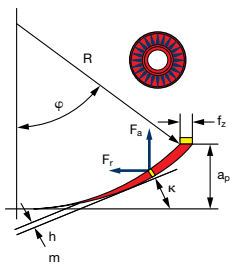
CUTTING DATA:

LMT Fette MultiEdge 4 Feed	**Competitor**
N = 825 RPM	N = 700 RPM
V_c = 650 SFM (198 m/min)	V_c = 550 SFM (168 m/min)
A_p = .040 (1 mm)	A_p = .045 (1.143 mm)
A_e = 2.100 (53 mm)	A_e = 2.100 (53 mm)
F_z = .068 (1.8 mm) per Tooth	F_z = .065 (1.65 mm) per tooth
V_f = 280 in/min (7112 mm/min)	V_f = 228 in/min (5791 mm/min)
Tool Life: 500 meters	Tool Life: 400 meter

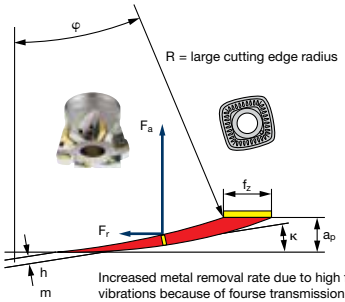
Special Features

- Indexable Inserts with 4 cutting edges and large inscribed circle
- Deep chip-groove with topography at face
- New generation of PVD-coating MultiC
- Precision-sintered Indexable Inserts in various sizes
- Exceptionally thick inserts for high feed rates
- Internal coolant supply

Advantages of MultiEdge 4 Feed Geometry



- Tangential Forces Act Around Radius on Button Inserts
- Radial Forces can create vibration resulting in premature damage to cutting edge.
- Reduced feed rates required to compensate for vibration
- Chip Thinning Effect not as great



Increased metal removal rate due to high feed rate, less disposition to vibrations because of fourse transmission towards spindle direction.

- Cutting forces of 4 Feed Geometry primarily Axial
- Greater chip thinning properties than round insert
- Increased feed rates for productivity

COPY END MILLS, PUMP CASING PRESSURE DIE CASTING MOLD

TOOL:
FCP V12.066 AN-I, d_1 = 66 mm, z = 7

MATERIAL:
Tool steel 1.2842
S7
32 HRC

INSERT:
XCNW 120520 SN, LC280QN

CUTTING DATA:
v_c = 720 SFM
n = 100 RPM
f_z = .070 IPT
v_f = 521 IPM
a_e = 1.770
a_p = .040

ROUGHING Z-SURFACES, WHEEL-DIE

TOOL:
1431 C, d_1= 8 mm, z = 4
LC620ZM

MATERIAL:
Tool steel
P20

CUTTING DATA:
v_c = 500 SFM
n = 6060 RPM
f_z = .008 IPT
v_f = 195 IPM
a_p = .008

FACE MILLING, MACHINE COMPONENT, FLANGE

TOOL:
FCP V09.052 AN-I, d_1 = 52 mm, z = 6

MATERIAL:
316 Stainless Steel, Austenitic

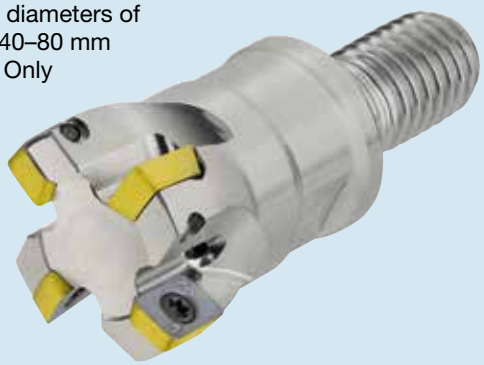
INSERT:
XCNT 09T312 EN-TR, LC280QN

CUTTING DATA:
v_c = 800 SFM
n = 1500 RPM
f_z = .047 IPT
v_f = 423 IPM
a_e = 1.380
a_p = .040

The new insert milling cutter MultiEdge 2 Feed Mini by LMT Fette is used in the machining of small and medium components. The positive high feed geometry of the unified small cutting inserts permits a maximum material removal rate even in less powerful machining centers.

Two different insert geometries in two different cutting material types ensure that almost all materials used in tool and die making can be processed.

The MultiEdge 2Feed mini is available as screw-on type milling cutter with diameters of 16–42 mm with 2–6 inserts and as plug-in milling cutter with diameters of 40–80 mm with up to 9 inserts. All inserts are supplied by an internal coolant supply. Only one insert size is required for all tool diameters.

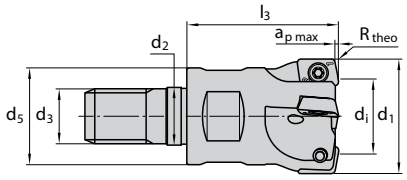


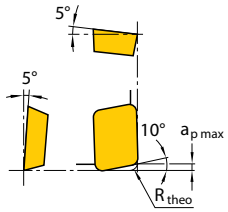
Benefits:
- High material removal rates even on less powerful machining centers
- High feed rates feasible
- Low storage cost for the inserts

Features:
- Universal indexable insert geometry for a broad area of application
- Positive insert geometry for free cutting
- One unified size of inserts
- Internal cooling on all inserts

Multi Edge 2 Feed

Metric





d_1	LMT-Code	Ident No.	d_l	l_3	d_3	d_5	d_2	z ✿	$a_{p\ max}$	R_{theo}	Insert	Insert Screw	Torx Driver
16	EHP X09.016TR028-I	7139270	7	28	M8	13	8.5	2	1	1.3	XDMW 0903SR XDMT 0903ER	2127640	1048326 T8
20	EHP X09.020TR030-I	7139271	11	30	M10	18	10.5	3	1	1.3		1944862	
25	EHP X09.025TR033-I	7139272	16	33	M12	21	12.5	4	1	1.3			
32	EHP X09.032TR043-I	7139273	23	43	M16	29	17	5	1	1.3			
35	EHP X09.035TR043-I	7139274	26	43	M16	29	17	5	1	1.3			
42	EHP X09.042TR043-I	7139275	33	43	M16	29	17	6	1	1.3			

Limited stock of Metric products in U.S. please contact Customer Service for availability

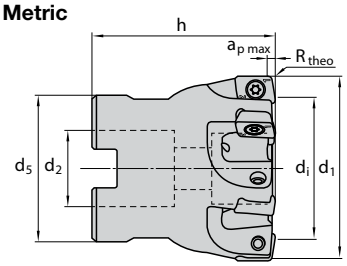
Inch

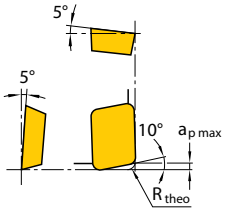
d_1	LMT-Code	Ident No.	d_l	l_3	d_3	d_5	d_2	z ✿	$a_{p\ max}$	R_{theo}	Insert	Insert Screw	Torx Driver
0.75	EHP X09-075TS-I	7179562	0.40	1.18	M10	0.71	0.41	3	0.04	0.051	XDMW 0903SR XDMT 0903ER	1044972	1048326 T8
1.00	EHP X09-100TF-I	7179563	0.65	1.30	M12	0.83	0.49	4	0.04	0.051			
1.25	EHP X09-125TH-I	7186877	0.90	1.69	M16	1.14	0.67	5	0.04	0.051			
1.50	EHP X09-150TH-I	7179564	1.15	1.69	M16	1.14	0.67	5	0.04	0.051			

See page 16 for Inserts

Cutting data recommendations starting page 124

Metric





d_1	LMT-Code	Ident No.	d_l	h	d_5	d_2	z ✿	$a_{p\,max}$	R_{theo}	Insert	Insert Screw	Torx Driver
40	FHP X09.040AN-I	7139276	31	40	32	16	6	1	1.3	XDMW 0903SR	1044972	1048326
42	FHP X09.042AN-I	7139277	33	40	32	16	6	1	1.3	XDMT 0903ER		T8
50	FHP X09.050AN-I	7139278	41	40	40	22	7	1	1.3			
52	FHP X09.052AN-I	7139279	43	40	40	22	7	1	1.3			
63	FHP X09.063AN-I	7139280	54	50	50	27	8	1	1.3			
66	FHP X09.066AN-I	7139281	57	50	50	27	8	1	1.3			
80	FHP X09.080AN-I	7139282	71	50	50	27	9	1	1.3			

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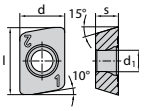
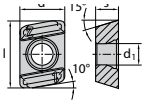
Inch

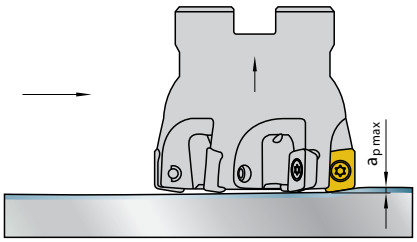
d_1	LMT-Code	Ident No.	d_l	h	d_5	d_2	z ✿	$a_{p\,max}$	R_{theo}	Insert	Insert Screw	Torx Driver
2.00	FHP X09-200AA-IW	7179565	1.65	1.57	1.57	0.75	5	0.04	0.051	XDMW 0903SR	1044972	1048326
2.50	FHP X09-250AA-IW	7179566	2.15	1.97	1.97	0.75	6	0.04	0.051	XDMT 0903ER		T8
3.00	FHP X09-300AB-IW	7179567	2.65	1.97	1.97	1	7	0.04	0.051			

See page 16 for Inserts

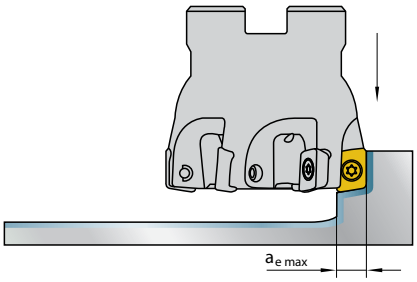
Cutting data recommendations starting page 124

N = Number of cutting edges	l	d	s	d_1	r_{theo}	ISO-Code Cat-No.	Cutting materials Ident No. LCP40M	Cutting materials Ident No. LCKP10M	For cutter Cat-No.
 N = 2	9 (.354)	6 (.236)	3 (.118)	2.8 (.110)	1.3 (.051)	XDMW 0903SR	7139507	7139508	EHP IK FHP IK
 N = 2	9 (.354)	6 (.236)	3 (.118)	2.8 (.110)	1.3 (.051)	XDMT 0903ER	7139507	7139508	EHP IK FHP IK

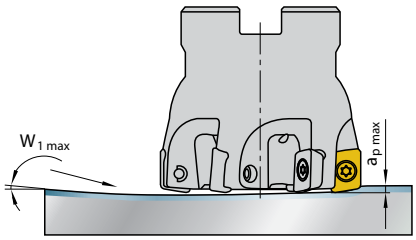
Face milling



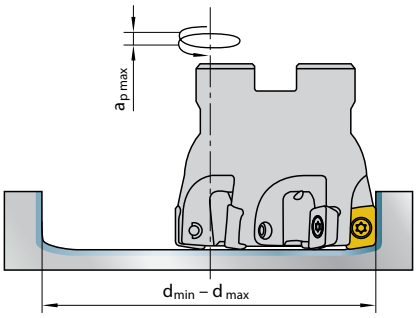
Plunge milling



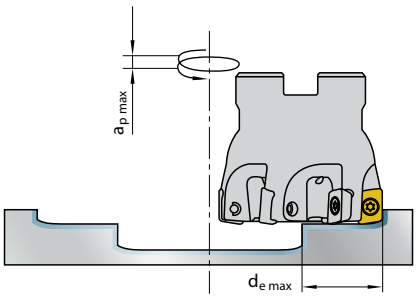
Ramping



Circular milling



Opening cavity



Tool	E(F)HP X09.
Insert	XDMW 0903SR XDMT 0903ER
$a_{p\,max}$ [mm (inch)]	1 (.040")
$a_{e\,max}$ [mm (inch)]	5 (.197")
T_{max} [mm (inch)]	0.5 (.020")

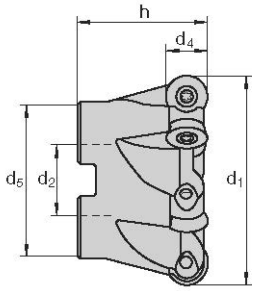
d_1 [mm (inch)]	$W_{1\,max}$ (°) [mm]
16 (.625")	4
20 (.750")	4
25 (1.00")	4
32 (1.25")	2.5
35 (1.50")	2
40 / 42 (2.00")	1.8
50 / 52 (2.50")	1.5
63 / 66 (3.00")	1
80 (3.15")	0.8

d_1 [mm]	$d_{min} - d_{max}$ [mm (inch)]
16	22-31 (.866"-1.220")
20	30-39 (1.181"-1.535")
25	40-49 (1.574"-1.929")
32	54-62 (2.125"-2.440")
35	60-68 (2.362"-2.677")
40	70-78 (2.755"-3.070")
42	74-82 (2.913"-3.228")
50	90-98 (3.543"-3.858")
52	94-102 (3.700"-4.015")
63	116-124 (4.566"-4.881")
66	122-130 (4.803"-5.118")
80	150-158 (5.905"-6.220")

d_1 [mm]	$d_{e\,max}$ [mm (inch)]
16	11 (.433")
20	15 (.590")
25	20 (.787")
32	27 (1.062")
35	30 (1.1811")
40	35 (1.377")
42	37 (1.456")
50	45 (1.771")
52	47 (1.850")
63	58 (2.283")
66	61 (2.401")
80	75 (2.952")

P K

Metric





d_1	Cutter Body No.	EDP No.	d_4	h	d_2	d_5	z ✿	Insert	Insert Screw	Torx Driver
52	FCC R16.052AN 50-05-I-Double 6	7031572	16	50	46	22	5	RNKX... 16	1044990	1048344 T20
63	FCC R16.063AN 50-06-I-Double 6	7082852	16	50	57	27	6			
66	FCC R16.066AN 50-06-I-Double 6	7031573	16	50	57	27	6			
80	FCC R16.080AN 50-07-I-Double 6	7031574	16	50	60	27	7			
100	FCC R16.100AN 55-08-Double 6	7031575	16	55	78	32	8			

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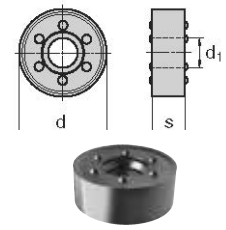
Inch

d_1	Cutter Body No.	EDP No.	dl	h	d_2	d_5	z ✿	ap max	R theo	Insert	Insert Screw	Torx Driver
2.00	FCC R16.2000 05-1	25002	2.000	2.00	0.750	1.75	5	0.25	RN-KX1605 MO	1044990	1048344 T20	1048344 T20
2.50	FCC R16.2500 05-1	61013	2.500	2.00	1.000	2.25	6	0.25				
3.00	FCC R16.3000 05-1	25003	3.000	2.00	1.250	2.36	7	0.25				
4.00	FCC R16.4000 05-1	25004	4.000	2.20	1.500	3.15	8	0.25				

Torque: 7.6Nm
Maximum Ramp Angle: 1°

Cutting data recommendations starting page 124

N = Number of cutting edges	l	d	s	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LCPK20M	Cutting materials Ident No. LCKP20M	For cutter Cat-No.
 N = 2	–	16 (.630)	5.7 (.224)	5.2 (.204)	–	RNKX 1605 MO	46254	46255	HFN S12

More precision and efficiency in mold and die manufacturing
For the new generation of the ACU-Jet Double 6, we primarily optimized the roughing procedure. The ACU-Jet Double 6 technology will deliver perfect results in less time. And this also applies to high-strength materials. The high dimensional accuracy makes it possible to rough-work so that the result is significantly closer to the desired net shape.

In addition, the stability and heat resistance of the tool guarantee an economic tool life of the used inserts. These factors will reduce your machining times and process costs.

ACU-Jet Double 6, same performance, double tool life
As the most recently developed design within the ACU-Jet roughing product line, the ACU-Jet Double 6 now is available in Inch cutter bodies. Its chief attraction is a double sided indexable insert for multiple use. Six positive locking dimples provide a secure position of the insert an optimized utilization of the cutting edge.

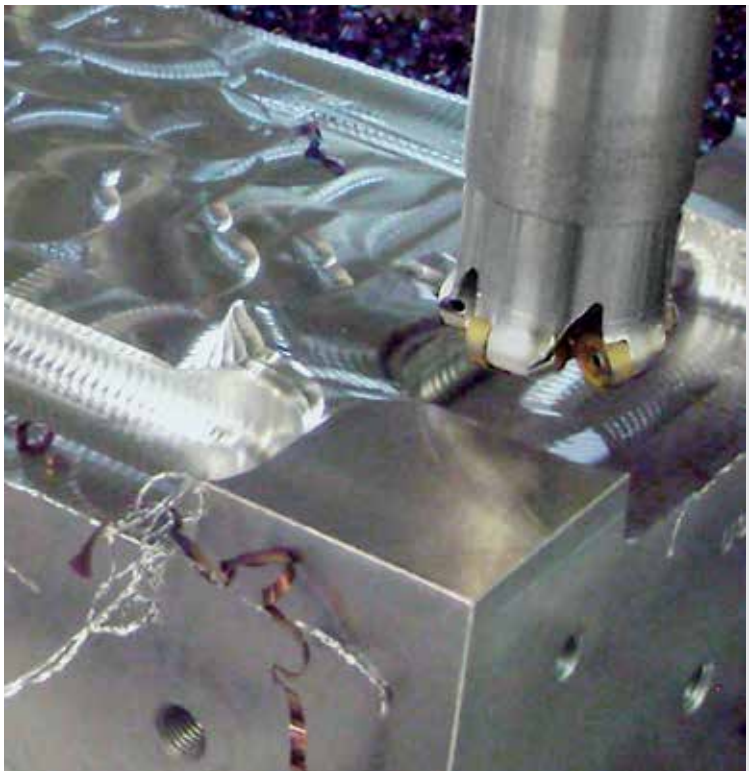
Your advantages:
- Double sided indexable insert up to 12 cutting edges
- Up to 50 % more tool life
- Very stable tool body
- Anti-rotation protection of the inserts for more process safety
- Easy handling

LMT Kieninger offers these featured grades

LCPK20M Coated with HC-P20 PVD-TiAlN
Wear-resistant multi-application grade with good toughness for wet milling and especially for dry milling of steel, cast steel and cast iron.
- Medium to high cutting speeds
- Low to medium depths of cut
- Low to medium chip load

LCKP20M Coated with HC-P20 – PVD-AlTiCr N
Wear-resistant and tough multi-application grade with a coating which is characterized by high toughness and simultaneously high strength. Suitable for wet and dry milling of steel, alloyed and unalloyed tool steels, cast steel and cast iron.
- Medium cutting speeds
- Medium infeeds
- Medium to high chip load

Application Example



MOLD PLATE

TOOL:
ACU-Jet Double6, R16.016AN 50-05-I-AR

INSERT:
RNKX 1605 MO I LCPK20M

MATERIAL:
1.2343 / X38CrMoV5-1

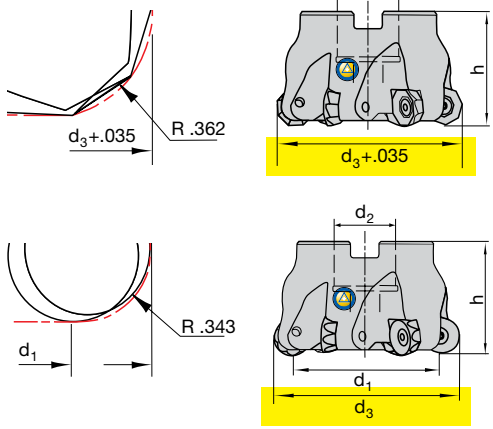
CUTTING DATA:
v_c = 175 m/min (689 SFM)
n = 850 m/min (335 RPM)
f_z = 0,82 mm (.032 IPT)
v_f = 3500 mm/min (138 IPM)
a_e = 48 mm (1.89“ WOC)
a_p = 2 mm (.079“ ADOC)

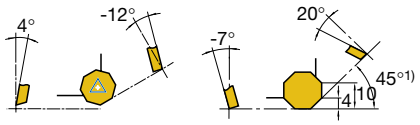
RESULT:
Tool life each insert approx. 180 min.
(6 applications each insert) – Double tool life!

Features

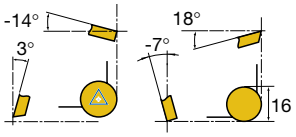
- Universal in application face milling of steel, castings, non-ferrous metals
- Exclusive TWIN*CUT* insert design offers round, and 8 sided for roughing applications

FCT XX TWIN*CUT* – Vario
Inch





8-Sided



Round

d_1	Cutter Body No.	EDP No.	Ident No.	d_3	h	d_2	z ⚙	Insert	Insert	Insert Screw	Torx Driver
1.50	FCTXX R16-150AA	51486	1950270	2.23	1.57	0.75	4	RCKX 1606	OCKX 0606	50255	50258
2.00	FCTXX R16-200AA	51487	1950278	2.73	1.57	0.75	6			M5	T20
2.50	FCTXX R16-250AA	51488	1950279	3.23	1.97	0.75	6				
3.00	FCTXX R16-300AB	51489	1950273	3.73	1.97	1.00	8				
4.00	FCTXX R16-400AD	51490	1950274	4.73	1.97	1.50	10				

See page 22 for Inserts

Cutting data recommendations starting page 125–126

FCT XX TWIN*CUT* – Vario
Metric

d_1	Cutter Body No.	Ident No.	d_3	Insert Dia. d_4	h	d_2	z ⚙	Insert	Insert	Insert Screw	Torx Driver
36	FCTXX R16.036AN	1041016	54.6	16	40	22	4	RCKX 1606	OCKX 0606	1045777	1048344
48	FCTXX R16.066AN	1041026	66	16	50	27	6			M5	T20
50	FCTXX R16.050AN	1041017	68.6	16	50	27	6				
60	FCTXX R16.08AN	1041028	80	16	50	27	6				
63	FCTXX R16.063AN	1041018	81.6	16	50	27	6				
63	FCTXX R16.063AN-F	1041019	81.6	16	50	27	8				
80	FCTXX R16.080AN	1041020	98.6	16	50	32	8				
100	FCTXX R16.100AN	1041022	118.6	16	50	40	10				
125	FCTXX R16.125AN	1041024	143.6	16	63	40	10				

Limited stock of metric products in U.S., please contact Customer Service for availability

TWIN*CUT* VARIO

The TWIN*CUT* VARIO is an excellent example of how cutting theory can be applied in practice. It successfully incorporates the principle of using two axially and radially offset edges to make the cut. The upper and lower rows of cutting edges each have different angles of approach and cutting depths.

This produces a technically superior chip cross-section with significantly reduced width to height relationship, sharply reducing the cutting forces. Power input can be reduced to between 75% and 85% of previous requirements. The improved dynamics of the VARIO's twin offset cutting edges make this possible and gives VARIO a competitive advantage.

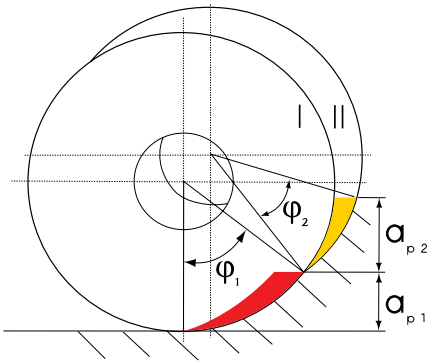
VARIO cutting tools are far superior to conventional button cutters, as they are quiet-running and reduce vibrations. This makes them especially suitable for machining under less stable conditions.

A major benefit of the Vario's innovative design is the versatility of the insert pocket. Vario's pockets will accept both the round and octagonal high-performance inserts.

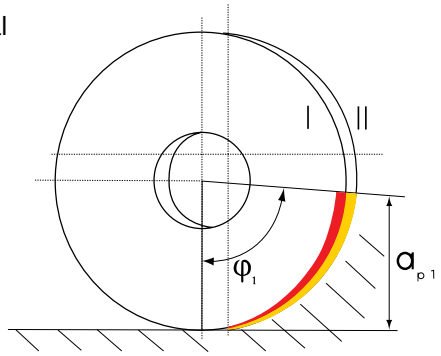
TWIN*CUT* VARIO Features & Benefits

- Broad application range for steel, castings and non-ferrous.
- Option of round or octagonal indexable inserts in same insert pocket. This flexible design helps reduce overall tooling costs.
- Increased insert thickness provides high feed rates and shorter machining times.
- Deep molded chip grooves and special design surface topography, lower horsepower requirements, reduce vibration, lower operating temperatures, yield superior surfaces, and extend tool life.
- Stable insert seating prevents insert rotation and allows precise indexing.
- Either z-axis plunging or ramping is possible making the Vario ideal for cavity milling and ramping.
- Precision sintered insert with eight effective cutting edges lower cost per cutting edge.

TWIN*CUT* VARIO
Geometry

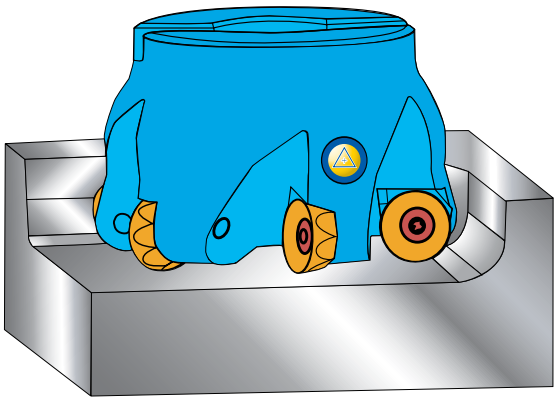


Conventional
Geometry

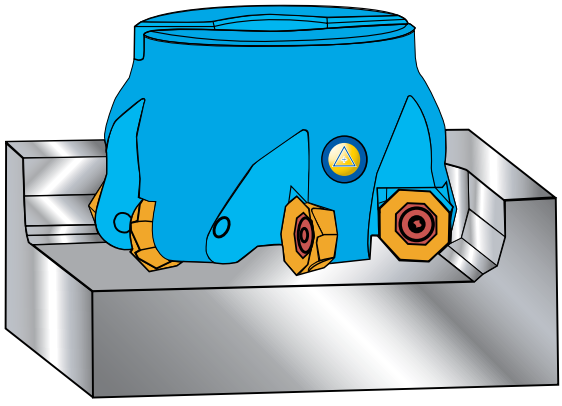


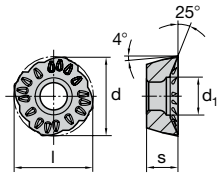
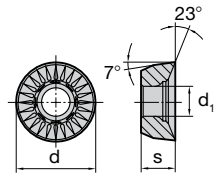
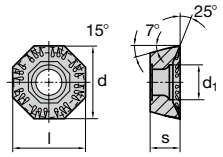
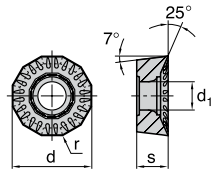
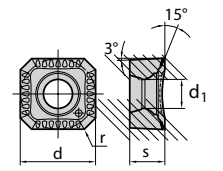
Milling profile with round inserts.

TWIN*CUT* VARIO with RCKX 1606 MO-TR



TWIN*CUT* VARIO with OCKX 0606 AD-TR



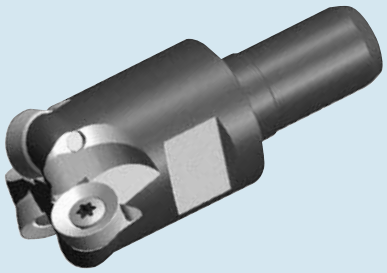
N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No.											For cutter
							LC280QN[2]	LC280TT[1]	LC225S	LC225T	LC240T	LC610Q	LC630S	LC630T	LC440T	LC444W	LC610T	LC615E	Cat-No.
 N = 4	16 (.630)	6.35 (.250)	16 (.630)	5.8 (.228)	0.5 (.020)	XOKX 1606 ZD-TR	1054023			1054020	1054021	1054024					1054022		FCT45 FCTXX
 N = 8	16 (.630)	6.35 (.250)	16 (.630)	5.8 (.228)	–	RCKX 1606 MO-TR	7002762			7002763	1068433						1068435		FCT45 FCTXX
	16 (.630)	6.35 (.250)	16 (.630)	5.8 (.228)	–	RCKX 1606 MO-TRT wide land	7002767	1055730		7002768							1068464		
 N = 8	16 (.630)	6.35 (.250)	16 (.630)	5.8 (.228)	–	OCKX 0606 AD-TR	7002774		1054001		1054003						1054005	2414058	FCT45 FCTXX
	16 (.630)	6.35 (.250)	16 (.630)	5.8 (.228)	0.5 (.020)	OCKX 0606 AD-TRT wide land	7002782	1055731									1054011		
 N = 12	16 (.630)	6.35 (.250)	16 (.630)	5.8 (.228)	0.5 (.020)	XCKX 1606 ZDR-TR					1055677	7002783	1055708	1055709			1055678	1055689	FCT45 FCTXX
 N = 8	–	6.35 (.250)	13.5 (.531)	5.5 (.217)	0.8 (.031)	SAHT 1306 AA ER									9206754	9206755			FCT45

[1] **LC280TT** Roughing geometry with double coating

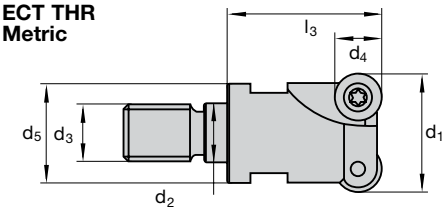
[2] **LC280QN** Two colored multi coating for high performance milling

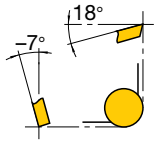
Features

- Large insert thickness, stable cross section, precision ground all-over on the circumference
- Axially, negative
- Double negative insert position with high positive rake angles, smooth start of cutting action and low vibration level operation
- Deep chip groove
- Radially, negative
- Relieved front face for plunge milling and heavy die sinking operations



ECT THR Metric





d_1	d_4	l_3	d_5	d_3	d_2	z ✡	Cutter Body No.	Ident No.	Insert	Insert Screw	Torx Driver
10	5	28	13	M8	8.5	2	ECT R05.010TR028	1040995	RCHX05T1MO	1045604 M1.8	1048434 T06
12	5	28	13	M8	8.5	2	ECT R05.012TR028	1040996			
16	5	25	13	M8	8.5	4	ECT R05.016TR025	1041091			
20	5	26	18	M10	10.5	5	ECT R05.020TS026	1041092			
25	5	33	18	M10	10.5	6	ECT R05.025TS033	1041093			
32	5	43	29	M16	17.0	7	ECT R05.032TH043	1041094			
15	7	23	13	M8	8.5	2	ECT R07.015TR023	1041101	RCHX0702MO	1044972 M2.5	1048326 T08
20	7	30	18	M10	10.5	4	ECT R07.020TS030	1041103			
16	8	25	13	M8	8.5	2	ECT R08.016TR025	1041042	RCHX0803MO	2237513 M3	1048326 T08
20	8	26	18	M10	10.5	3	ECT R08.020TS026	1041095			
25	8	33	18	M10	10.5	4	ECT R08.025TS033	1041096			
20	10	26	18	M10	10.5	2	ECT R10.020TS026	1041045	RCHX10T3MO	1045132 M4	1048335 T15
25	10	33	18	M10	10.5	3	ECT R10.025TS033	1041046			
25	10	33	21	M12	12.5	3	ECT R10.025TF033	1041100			
30	10	43	29	M16	17.0	4	ECT R10.030TH043	1041097			
35	10	43	29	M16	17.0	4	ECT R10.035TH043	1041098	RCHX1205MO	1045123 M4.5	1048344 T20
25	12	33	21	M12	12.5	2	ECT R12.025TF033	1041074			
32	12	43	29	M16	17.0	3	ECT R12.032TH043	1041062			
40	12	43	29	M16	17.0	4	ECT R12.040TH043	1041064			
32	16	43	29	M16	17.0	2	ECT R16.032TH043	1041105	RCHX1606MO	1045777 M5	1048344 T20

Limited stock of Metric products in U.S. please contact Customer Service for availability

ECT THR Inch

d_1	d_4	l_3	d_5	d_3	d_2	z ✡	Cutter Body No.	EDP No.	Ident No.	Insert	Insert Screw	Torx Driver
1.25	.472	1.65	1.02	M16	.670	3	ECT R12-125TH	12734	1950184	RCHX 1205	1045123 M4.5	1048344 T20
1.50	.472	1.65	1.14	M16	.670	3	FCT R12-150TH	52019		RCKT 1205		
1.50	.472	1.65	1.14	M16	.670	4	ECT R12-150TH	12736	1950186			

See page 26 for Inserts
See pages 54–55 for Screw-On Shanks

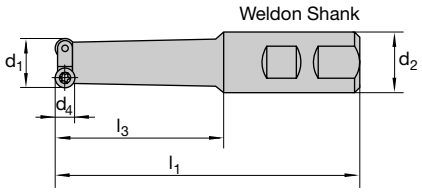
Cutting data recommendations starting page 127

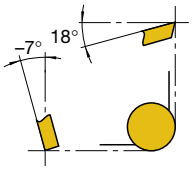
Open End Wrench	Wrench Size	Ident No.	For Head Sizes
	24mm	2146615	1.25", 1.50"

Features

- Milling cutter for copy, face, and contour milling of steel, stainless, and cast iron materials
- Features ramping capabilities
- Straight front end (no taper)

ECT R
Inch



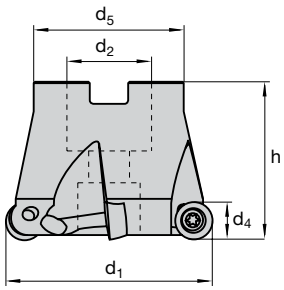


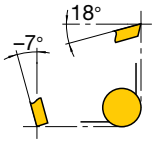
d_1	Cutter Body No.	EDP No.	Weldon Shank/ Cyl Shank	d_4	l_1	l_3	d_2	z ✿	Insert	Insert Screw	Torx Driver
.750	ECT R05 075AD053	51020	Cylindrical	0.197	5.31	2.00	0.750	4	RCHX05T1MO	1045604	1048434
.750	ECT R05 075WD053	51021	Weldon	0.197	5.31	2.00	0.750	4		M1.8	T06
.750	ECT R05 075AD063	51022	Cylindrical	0.197	6.30	3.00	0.750	4			
.750	ECT R05 075WD063	51023	Weldon	0.197	6.30	3.00	0.750	4			
1.00	ECT R12 100WE 040	89352	Weldon	0.47	4.00	1.72	1.00	2	RCHX 1205	50256	50258
1.00	ECT R12 100WE 060	50584	Weldon	0.47	6.00	3.72	1.00	2	RCKT 1205	M4.5	T20
1.00	ECT R12 100WE 080	10603	Weldon	0.47	8.00	5.77	1.00	2			
1.25	ECT R12 125WF 040	50586	Weldon	0.47	4.00	1.72	1.25	3			
1.25	ECT R12 125WF 060	10345	Weldon	0.47	6.00	3.72	1.25	2			
1.25	ECT R12 125WFF 060	89244	Weldon	0.47	6.00	3.72	1.25	3			
1.25	ECT R12 125WF 080	10347	Weldon	0.47	8.00	5.77	1.25	2			
1.25	ECT R12 125WFF 080	50588	Weldon	0.47	8.00	5.77	1.25	3			
1.50	ECT R12 150WG 060	50590	Weldon	0.47	6.00	3.31	1.50	3			
1.50	ECT R12 150WG 080	50592	Weldon	0.47	8.00	5.31	1.50	3			
1.50	ECT R12 150WG 100	50594	Weldon	0.47	10.00	7.31	1.50	3			
1.50	ECT R16 150WE040	50741	Weldon	0.630	4.00	1.75	1.25	2	RCKT 1606	1045777	
1.50	ECT R16 150WF040	50742	Weldon	0.630	4.00	1.75	1.50	2	RCHX 1606	M5	T20
1.50	ECT R16 150WF063	52460	Weldon	0.630	6.30	3.30	1.25	2			

See page 26 for Inserts

Cutting data recommendations starting page 127

FCT Metric





d_1	Cutter Body No.	Ident No.	d_4	h	d_2	d_5	z ⌬	Insert	Insert Screw	Torx Driver
42	FCT R10.042AN	1041087	10	40	16	32.0	5	RCHX10T3MO	1045132	1048335
52	FCT R12.052AN	1041051	12	40	22	39.6	5	RCHX1205MO	1045123	1045344
66	FCT R12.066AN	1041055	12	50	27	48.0	6		M4.5	T20
66	FCT R16.066AN	1041058	16	50	27	48.0	5	RCHX1606MO	1045777	1045344
80	FCT R16.080AN	1041060	16	50	27	50.0	6	RCKT 1606	M5	T20
100	FCT R16.100AN	1041073	16	50	32	65.0	6			
125	FCT R16.125AN	1041075	16	63	40	90.0	8			

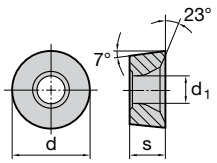
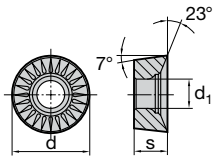
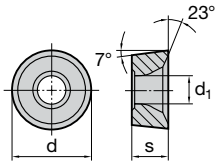
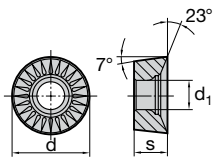
Limited stock of Metric products in U.S. please contact Customer Service for availability

FCT Inch

d_1	Cutter Body No.	EDP No.	Ident No.	d_4	h	d_2	z ⌬	Insert	Insert Screw	Torx Driver
2.00	FCT R12.200AA	89803	1950040	0.47	1.57	0.75	5	RCHX 1205	1045123	1048344
2.50	FCT R12.250AB	89804	1950042	0.47	1.98	1.00	6	RCKT 1205	M4.5	T20
3.00	FCT R12.300AB	50743	–	0.47	1.98	1.00	6			
2.00	FCT R16.200AA	51011	–	0.63	1.57	0.75	3	RCHX 1606	1045777	1048344
3.00	FCT R16.300AB	89813	1950182	0.63	1.98	1.00	6	RCKT 1606	M5	T20
3.00	FCT R16.300ABF	53523	–	0.63	1.98	1.00	7			
3.00	FCT R16.300AC	56257	–	0.63	1.98	1.25	6			
4.00	FCT R16.400AD	89800	2346679	0.63	1.98	1.50	7			

See page 26 for Inserts

Cutting data recommendations starting page 127

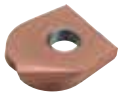
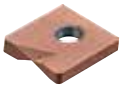
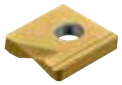
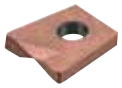
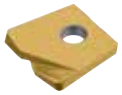
N = Number of cutting edges	d	s	d_1	ISO-Code Cat-No.	Cutting materials Ident No.									For cutter
					LC280TT[1]	LC240T	LC240S	LC225T	LC225S	LW240	LW225	LC610T	LW610	LC603Z[2]	Cat-No.
	5 (.197)	1.98 (.079)	2.1 (.083)	RCHX 05T1 MO		1055635						1055639	1055625	1055750	ECT
	7 (.275)	2.78 (.109)	2.8 (.110)	RCHX 0702 MO		1068443						1068445	1068444	1055751	
	8 (.315)	3.18 (.125)	3.4 (.134)	RCHX 0803 MO		1068387	1068378					1068391	1068374	1055752	
	10 (.394)	3.97 (.156)	4.4 (.173)	RCHX 10T3 MO		1068393	1068388					1068395	1068384	1055753	ECT FCT
	12 (.472)	5.56 (.219)	5.2 (.205)	RCHX 1205 MO		1068375	1068406					1068377	1068404	1055754	
	16 (.630)	6.35 (.250)	5.8 (.228)	RCHX 1606 MO		1068379	1068415					1068383	1068413	1055755	ECT FCT MCT
	12 (.472)	5.56 (.219)	5.2 (.205)	RCHX 1205 MO-TR		1069519	1069517					1069520			ECT FCT
	16 (.630)	6.35 (.250)	5.2 (.205)	RCHX 1606 MO-TR		1069506		1069501				1069509			ECT FCT MCT
 wide land	8 (.315)	3.18 (.125)	3.4 (.134)	RCHX 0803 MO-T								1068397			ECT
	10 (.394)	3.97 (.156)	4.4 (.173)	RCHX 10T3 MO-T								1068398			ECT FCT
	12 (.472)	5.56 (.219)	5.2 (.205)	RCHX 1205 MO-T								1068399			
	12 (.472)	5.56 (.219)	5.8 (.228)	RCHX 1205 MO-T		1068385	1068409								
	16 (.630)	6.35 (.250)	5.8 (.228)	RCHX 1606 MO-T		1068389						2345947			ECT FCT MCT
	12 (.472)	5.56 (.219)	5.2 (.205)	RCMX 1205 MO-T		1068425									ECT FCT
	8 (.315)	3.18 (.125)	3.4 (.134)	RCKT 0803 MO-TT	1055735										ECT
	10 (.394)	3.97 (.156)	4.4 (.173)	RCKT 10T3 MO-TT	1055734										ECT FCT ECT
	12 (.472)	5.56 (.219)	5.2 (.205)	RCKT 1205 MO-TT	1055733										FCT
	16 (.630)	6.35 (.250)	5.8 (.228)	RCKT 1606 MO-TT	1055732										ECT FCT MCT

[1] LC280TT Roughing geometry with double coating

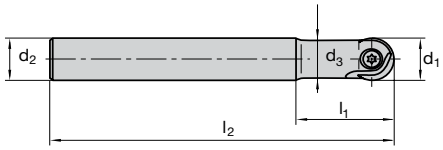
[2] Select LC603Z for Hardened Materials (52Rc-65Rc)

Ball Nose & Backdraft Cutters & Inserts

Available Cutting Geometries with Applications for Ball Nose & Back Draft Cutters

LMT Code	Geometry	Page #	Finishing	Semi-finishing	Roughing	Application
WPR .. -AR		33		▲▲	▲	steel, cast steel, high temperature alloys
WPR ..-CF		34		▲▲	▲	chipbreaker for long-chipping ferrous metals
WPR ..-D		35–36	▲▲▲	▲▲		steel, cast steel, high temperature alloys
WPR ..-DN		36	▲▲▲	▲▲	▲	non-ferrous materials, plastics and graphite, Titanium, Inconel
WPR .. -N		37	▲▲▲	▲▲		steel, cast steel, high temperature alloys and hardened steel up to 60 HRC
WPR .. -NP		38	▲▲▲	▲▲		cast steel, steel (up to 65 HRc), high temperature alloys, cast iron, 12° clearance angle
WPB ..-FB		39	▲▲▲	▲▲		steel, cast steel, high temperature alloys and hardened steel up to 62 HRc
WPV ..-N		43	▲▲▲	▲▲		steel, cast steel, high temperature alloys and hardened steel up to 60 HRC
WPV ..-CF		44		▲▲	▲	chipbreaker for long-chipping ferrous metals
WPB ..-N		45–48	▲▲▲	▲▲		steel, cast steel, high temperature alloys and hardened steel up to 60 HRC
WPB ..-AF		49–50	▲▲▲	▲▲	▲	chipbreaker for long-chipping ferrous metals
WPB ..-HF		51		▲▲	▲	steel, cast steel, high temperature alloys

EBG R
Metric



d_1	Cutter Body No.	Ident No.	l_1	l_2	d_2	d_3	z ✿	Insert	Insert Screw	Torx Driver
12	EBG R12.012AN090	6130568	32	90	12	10.5	2	WPR 12	GWS 12	T20
12	EBG R12.012AN130	6121395	32	130	12	10.5	2			
12	EBG R12.012AN150	6121397	46	150	12	10.5	2			
16	EBG R16.016AN100	6130569	36	100	16	14	2	WPR 16	GWS 16	
16	EBG R16.016AN140	6121385	36	140	16	14	2			
16	EBG R16.016AN160	6121387	53	160	16	14	2			
20	EBG R20.020AN160	6121382	45	160	20	18	2	WPR 20	GWS 20	
20	EBG R20.020AN175	6121375	61	175	20	18	2			
25	EBG R25.025AN160	6121367	45	160	25	22.4	2	WPR 25	GWS 25	T30
25	EBG R25.025AN190	6121369	70	190	25	22.4	2			
30	EBG R30.030AP175	6200387	56	175	32	27	2	WPR 30	GWS 32	
30	EBG R30.030AP210	6121350	80	210	32	27	2			
32	EBG R32.032AN175	6121359	56	175	32	28.6	2	WPR 32	GWS 50	
32	EBG R32.032AN210	6121361	80	210	32	28.6	2			

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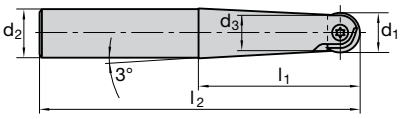
EBG R
Inch

d_1	Cutter Body No.	EDP	Ident No.	l_1	l_2	d_2	d_3	z ✿	Insert	Insert Screw	Torx Driver
0.375	EBG R0375A0500 090N	88114	6121394	1.34	3.54	0.500	0.34	2	WPR 0375	GWS 10	T15
0.375	EBG R0375A0375 150N	10974	6129378		5.91	0.375	0.34	2			
0.500	EBG R0500A0500 130N	88115	6121396	1.26	5.12	0.500	0.41	2	WPR 0500	GWS 12	T20
0.500	EBG R0500A0500 150N	88116	6121398	1.81	5.91	0.500	0.41	2			
0.625	EBG R0625A0625 140N	88117	6121386	1.42	5.51	0.625	0.55	2	WPR 0625	GWS 16	T20
0.625	EBG R0625A0625 160N	88118	6121388	2.09	6.30	0.625	0.55	2			
0.750	EBG R0750A0750 160N	88119	6121374	1.77	6.30	0.750	0.71	2	WPR 0750	GWS 20	T20
0.750	EBG R0750A0750 175N	88120	6121376	2.40	6.89	0.750	0.71	2			
0.750	EBG R0750A0750 210N	88913	6121366	2.36	8.27	0.750	0.71	2			
0.750	EBG R0750A0750 254N	10682	6129152		10.00	0.750	0.71	2			
1.000	EBG R1000A1000 160N	88121	6121368	1.77	6.30	1.000	0.88	2	WPR 1000	GWS 25	T30
1.000	EBG R1000A1000 190N	88122	6121370	2.76	7.48	1.000	0.88	2			
1.000	EBG R1000A1000 230N	88898	6121357	3.14	9.06	1.000	0.88	2			
1.000	EBG R1000A1000 254N	10683	6129583		10.00	1.000	0.88	2			
1.250	EBG R1250A1250 175N	88125	6121360	2.20	6.89	1.250	1.13	2	WPR 1250	GWS 32	
1.250	EBG R1250A1250 210N	88126	6121362	3.15	8.27	1.250	1.13	2			
2.000	EBG R2000A2000 330N	88906	6121393	4.92	12.99	2.000	1.77	2	WPR 2000	GWS 50	2146556

See pages 33–39 for Inserts
See page 32 for Insert Screw Specifications
Cutting data recommendations starting page 128–129

EBG R
Metric



d_1	Cutter Body No.	Ident No.	l_1	l_2	d_2	d_3	z ⚙	Insert	Insert	Insert	Insert Screw	Torx Driver
6	EBG R06.006AR090	6128481	16	90	10	5.3	2	WPR 06	WPV 06	WPB 06	GWS 06	T6
8	EBG R08.008AR085	6130570	50	85	12	7.5	2	WPR 08	WPV 08	WPB 08	GWS 08	T8
8	EBG R08.008AR140	6121409	50	140	12	7.5	2					
10	EBG R10.010AP085	6130571	35	85	12	9	2	WPR 10	WPV 10	WPB 10	GWS 10	T15
10	EBG R10.010AP150	6121401	35	150	12	9	2					
12	EBG R12.012AR110	6130572	60	110	16	10.5	2	WPR 12			GWS 12	T20
12	EBG R12.012AR160	6121402	60	160	16	10.5	2					
16	EBG R16.016AR120	6130573	67	120	20	14	2	WPR 16			GWS 16	
16	EBG R16.016AR175	6121403	67	175	20	14	2					
20	EBG R20.020AS190	6121404	80	190	25	18	2	WPR 20			GWS 20	
25	EBG R25.025AV210	6121405	100	210	32	22.4	2	WPR 25			GWS 25	T30
32	EBG R32.032AW240	6121392	123	240	40	28.6	2	WPR 32			GWS 32	

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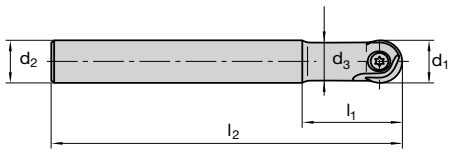
EBG R
Inch

d_1	Cutter Body No.	EDP	Ident No.	l_1	l_2	d_2	d_3	z ⚙	Insert	Insert	Insert	Insert Screw	Torx Driver
0.250	EBG R0250A0375 090T	10525	6128482	1.57	3.54	0.375	0.22	2	WPR 0250	WPV 0250	WPB 0250	GWS 06	T 6
0.312	EBG R0312A0500 140T	88100	6121294	1.97	5.51	0.500	0.30	2	WPR 0312	WPV 0312	WPB 0312	GWS 08	T 8
0.375	EBG R0375A0500 150T	88101	6121295	1.38	5.10	0.500	0.35	2	WPR 0375	WPV 0375	WPB 0375	GWS 10	T 10
0.500	EBG R0500A0625 160T	88102	6121296	2.36	6.30	0.625	0.41	2	WPR 0500			GWS 12	T 20
0.500	EBG R0500A0625 254T	10680	6129150		10.00	0.625	0.41	2	WPR 0500			GWS 12	T 15
0.625	EBG R0625A0750 175T	88103	6121297	2.64	6.89	0.750	0.55	2	WPR 0625			GWS 16	T 20
0.750	EBG R0625A0750 254N	10681	6129151		10.00	0.750	0.55	2	WPR 0625			GWS 20	T 20
0.750	EBG R0750A1000 190T	88104	6121298	3.15	7.48	1.000	0.71	2	WPR 0750			GWS 20	T 20
1.000	EBG R1000A1250 210T	88105	6121299	3.94	8.27	1.250	0.88	2	WPR 1000			GWS 25	T 30
1.250	EBG R1250A1500 240T	88106	6121300	4.84	9.45	1.500	1.17	2	WPR 1250			GWS 32	T 30

See pages 33–39 for Inserts
See page 32 for Insert Screw Specifications
Cutting data recommendations starting page 128–129

EBG R Metric



d_1	Cutter Body No.	Ident No.	(IKZ)* Ident No.	l_1	l_2	d_2	d_3	z ✿	Insert	Insert	Insert Screw	Torx Driver
6	EBG R06.006AN100-C	6130088	–	20	100	6	5.8	2	WPR 06	WPB 06	GWS 06	T6
6	EBG R06.006AN150-C	6130086	–	70	150	6	5.8	2	WPR 06	WPB 06	GWS 06	
6	EBG R06.006AN200-C	6130084	–	100	200	6	5.8	2	WPR 06	WPB 06	GWS 06	
6	EBG R06.006AP100-C	6128437	–	16	100	8	5.3	2	WPR 06	WPB 06	GWS 06	
8	EBG R08.008AN080-C	6131495	–	25	80	8	7.0	2	WPR 08		GWS 08	T8
8	EBG R08.008AN100-C	6121301	–	25	100	8	7.0	2				
8	EBG R08.008AN150-C	6121284	–	40	150	8	7.0	2				
10	EBG R10.010AN080-C-I	–	6131499	35	80	10	8.8	2	WPR 10		GWS 10	T15
10	EBG R10.010AN120-C-I	–	6130392	35	120	10	8.8	2				
10	EBG R10.010AN150-C-I	–	6130393	50	150	10	8.8	2				
12	EBG R12.012AN080-C-I	–	6131500	35	80	12	10.5	2	WPR 12		GWS 12	T20
12	EBG R12.012AN120-C-I	–	6130394	35	120	12	10.5	2				
12	EBG R12.012AN160-C-I	–	6130395	50	160	12	10.5	2				
16	EBG R16.016AN100-C-I	–	6131501	40	100	16	14.0	2	WPR 16		GWS 16	
16	EBG R16.016AN140-C-I	–	6130396	40	140	16	14.0	2				
16	EBG R16.016AN175-C-I	–	6130397	55	175	16	14.0	2				
20	EBG R20.020AN100-C-I	–	6131503	50	100	20	18.0	2	WPR 20		GWS 20	
20	EBG R20.020AN140-C-I	–	6130398	50	140	20	18.0	2				
20	EBG R20.020AN190-C-I	–	6130399	75	190	20	18.0	2				
25	EBG R25.025AN160-C-I	–	6130400	60	160	25	22.4	2	WPR 25		GWS 25	
25	EBG R25.025AN210-C-I	–	6130401	90	210	25	22.4	2				
32	EBG R32.032AN190-C	6121277	–	65	190	32	28.6	2	WPR 32		GWS 32	T30
32	EBG R32.032AN240-C	6121278	–	105	240	32	28.6	2				

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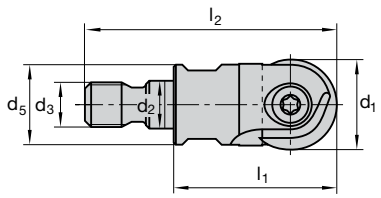
*IKZ=Internal Coolant Supply

EBG R Inch

d_1	Cutter Body No.	Ident No.	(IKZ)* Ident No.	l_1	l_2	d_2	d_3	z ✿	Insert	Insert	Insert Screw	Torx Driver
0.250	EBG R0250A0375 100NC	6128439	–	1.57	3.94	0.375	0.22	2	WPR 0250	WPB 0250	GWS 06	T6
0.250	EBG R0250A0250 100NC-40	6131238	–	1.57	3.94	0.250	0.22	2				
0.250	EBG R0250A0250 150NC-70	6131239	–	2.76	5.91	0.250	0.22	2				
0.250	EBG R0250A0250 200NC-100	6131240	–	3.94	7.88	0.250	0.22	2				
0.250	EBG R0250A0250 200NC-140	6131234	–	5.51	7.88	0.250	0.22	2				
0.312	EBG R0312A0375 100NC	6128633	–	0.99	3.94	0.375	0.28	2	WPR 0312	WPB 0312	GWS 08	T8
0.312	EBG R0312A0375 150NC	6128635	–	1.57	5.91	0.375	0.28	2				
0.312	EBG R0312A0312 200NC-100	6131232	–	3.94	7.88	0.312	0.28	2				
0.375	EBG R0375A0375 120NC	6128636	–	1.38	4.73	0.375	0.35	2	WPR 0375	WPB 0375	GWS 10	T15
0.375	EBG R0375A0375 150NC	6128638	–	1.97	5.91	0.375	0.35	2				
0.375	EBG R0375A0375 200NC-100	–	–	3.94	7.88	0.375	0.35	2				
0.500	EBG R0500A0500 120NC	–	7022522	1.38	4.73	0.500	0.42	2	WPR 0500	WPB 0500	GWS 12	T20
0.500	EBG R0500A0500 160NC	–	7022523	1.97	6.30	0.500	0.42	2				
0.625	EBG R0625A0625 140NC	–	7022524	1.58	5.52	0.625	0.63	2	WPR 0625	WPB 0625	GWS 16	
0.625	EBG R0625A0625 175NC	–	7022525	2.17	6.89	0.625	0.63	2				
0.750	EBG R0750A0750 140NC	–	7022526	1.58	5.52	0.750	0.71	2	WPR 0750	WPB 0750	GWS 20	
0.750	EBG R0750A0750 190NC	–	7022527	2.96	7.48	0.750	0.71	2				
1.000	EBG R1000A1000 160NC	–	7022528	2.37	6.30	1.000	0.89	2	WPR 1000	WPB 1000	GWS 25	T30
1.000	EBG R1000A1000 210NC	–	7022529	3.55	8.27	1.000	0.89	2				
1.250	EBG R1250A1250 190NC	–	7022530	2.56	7.48	1.250	1.13	2	WPR 1250	WPB 1250	GWS 32	
1.250	EBG R1250A1250 240NC	–	7022531	4.14	9.45	1.250	1.13	2				

See Pages 33–39 for Inserts
See page 32 for Insert Screw Specifications
Cutting data recommendations starting page 128–129

EBG R Metric



Product optimization by shortened, compact version

d_1	Cutter Body No.	Ident No.	l_1	l_2	d_2	d_3	d_5	z ✡	IKZ	Insert	Insert	Insert	Insert Screw	Torx Driver
8	EBG R08.008TC025	6131455	25	39.5	6.5	M6	10	2		WPR 08	WPV 08	WPB 08	GWS 08	T 8
10	EBG R10.010TC025	6131457	25	39.5	6.5	M6	9.35	2		WPR 10	WPV 10	WPB 10	GWS 10	T15
12	EBG R12.012TR025	6131451	25	39.5	6.5	M6	10	2		WPR 12			GWS 12	T20
12	EBG R12.012TR026-I	6131459	26	43.5	8.5	M8	13	2	x	WPR 12			GWS 12	
16	EBG R16.016TR026-I	6131461	26	43.5	8.5	M8	13	2	x	WPR 16			GWS 16	
20	EBG R20.020TS030-I	6131463	30	49.5	10.5	M10	18	2	x	WPR 20			GWS 20	
25	EBG R25.025TF040-I	6131465	40	62.0	12.5	M12	21	2	x	WPR 25			GWS 25	T30
32	EBG R32.032TH045-I	6131470	45	69.0	17.0	M16	30	2	x	WPR 32			GWS 32	

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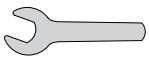
EBG R Inch

d_1	Cutter Body No.	EDP	Ident No.	l_1	l_2	d_2	d_3	d_5	z ✡	IKZ	Insert	Insert Screw	Torx Driver
0.375	EBG R 0375 T0375	13727	9101920	0.984	1.555	0.255	M6	0.368	2		WPR 0375	GWS 10	T15
0.500	EBG R 0500 T0500-I	13728	9101921	0.984	1.555	0.255	M6	0.393	2	x	WPR 0500	GWS 12	T20
0.625	EBG R 0625 T0625-I	13729	9101922	1.023	1.712	0.334	M8	0.511	2	x	WPR 0625	GWS 16	T20
0.750	EBG R 0750 T0750-I	13730	9101924	1.181	1.948	0.413	M10	0.708	2	x	WPR 0750	GWS 20	T20
1.000	EBG R 1000 T1000-I	13731	9101925	1.574	2.440	0.492	M12	0.826	2	x	WPR 1000	GWS 25	T30

See pages 33–39 for Inserts
*IKZ=Internal Coolant Supply

See pages 54–55 for Screw-On Shanks

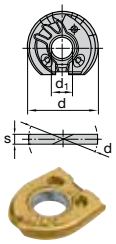
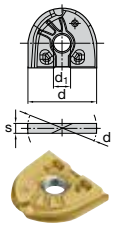
Open End Wrench	Wrench Size	Ident No.	For Head Sizes
	8mm	2146604	8mm, 10mm, 10mm 12mm, .375", .500"
	10mm	2146606	12mm, 16mm, .625"
	15mm	2146611	20mm, .750"
	17mm	2146612	25mm, 1.00"

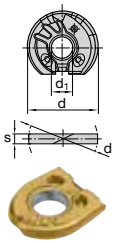
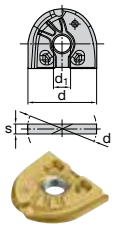
Torque in Nm

EBG R.../ EBG V... Torque Requirements

		Tool type		
Screw Ident. No.	Screw	GRT	GWR	GWV
	SA 40115	manual	---	---
6260409	GWS 06	---	1	1
6119572	GWS 08	---	2	2
6119571	GWS 10	---	3	3
6119559	GWS 12	---	4	4
6119560	GWS 16	---	5	5
6119561	GWS 20	---	6	6
6119562	GWS 25	6.5	6.5	6.5
6119563	GWS 32	6.5	6.5	6.5
		Torque in Nm		

AR Geometry has a helical cutting edge used for roughing and semi-finishing in steel (Up to 54 HRC), cast steel and high temp alloys at extreme metal removal rates

Metric N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No. LCPK30M	For cutter Cat-No.
 N = 2	12	2.5	WPR 12-AR	9076995	EBG R 12
	16	3	WPR 16-AR	6183222	EBG R 16
	20	3	WPR 20-AR	9073919	EBG R 20
 N = 2	25	4	WPR 25-AR	6183218	EBG R 25
	32	5	WPR 32-AR	9074078	EBG R 32

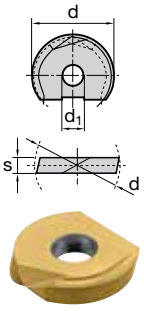
Inch N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No. LCPK30M	For cutter Cat-No.
 N = 2	.500	.098	WPR 0500-AR	9077903	EBG R 0500
	.625	.118	WPR 0625-AR [1]	9073899	EBG R 0625
	.750	.118	WPR 0750-AR [1]	9073919	EBG R 0750
 N = 2	1.000	.157	WPR 1000-AR	9077910	EBG R 1000
	1.250	.196	WPR 1250-AR	7021657	EBG R 1250

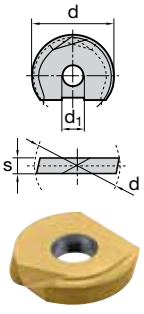
1) Do Not Have Coolant Channels to Cutting Edge

Cutting data recommendations starting page 132

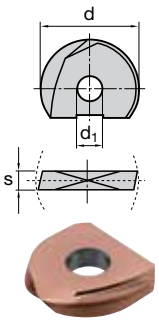
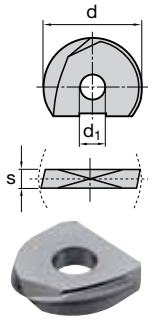
Note: Use holders with IKZ designation to take advantage of inserts with Coolant Channels

CF Geometry has chip control geometry for roughing and semi-finishing long-chipping ferrous materials

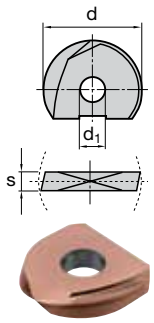
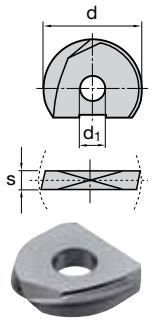
Metric N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No. LC240T	 LC610T	For cutter Cat-No.
 N = 2	8	2	WPR 08-CF	6282698	6122964	EBG R 08
	10	2.5	WPR 10-CF	6282700	6123044	EBG R 10
	12	2.5	WPR 12-CF	6282703	6123025	EBG R 12
	16	3	WPR 16-CF	6282705	6123007	EBG R 16
	20	3	WPR 20-CF	6282709	6123005	EBG R 20
	25	4	WPR 25-CF	6128868	6122985	EBG R 25
	30	5	WPR 30-CF	6282712	6200286	EBG R 30
	32	5	WPR 32-CF	6282714	6122980	EBG R 32

Inch N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No. LC240T	 LC610T	For cutter Cat-No.
 N = 2	0.312	0.06	WPR 0312-CF	6130279	6122842	EBG R 0312
	0.375	0.08	WPR 0375-CF	6130280	6122830	EBG R 0375
	0.500	0.10	WPR 0500-CF	6130281	6122825	EBG R 0500
	0.625	0.12	WPR 0625-CF	6130282	6122817	EBG R 0625
	0.750	0.12	WPR 0750-CF	6130283	6122808	EBG R 0750
	1.000	0.16	WPR 1000-CF	6130284	6122783	EBG R 1000
	1.250	0.20	WPR 1250-CF	6130045	6122774	EBG R 1250
	2.000	0.24	WPR 2000-CF		9132483	EBG R 2500

D – Helical Geometry suitable for semi-finishing and finishing in soft materials (Up to 54 Rc)
DN – Helical Geometry suitable for semi-finishing and finishing in non-ferrous materials and also in Exotic materials (LDN10M)

Metric N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No.				For cutter Cat-No.
				LDN10M	LCKP10M	LCH33M	LDN10M	
 N = 2 **New helical cutting geometry** WPR…D for semi-finishing and finishing of steel, cast steel and high temperature alloy up to 54 HRC	6	1.6	WPR 06-D		7108973			EBG R 06
	8	2	WPR 08-D		7108873	7108874		EBG R 08
	10	2.5	WPR 10-D		7108902	7108904		EBG R 10
	12	2.5	WPR 12-D		7108961	7108963		EBG R 12
	16	3	WPR 16-D		7108845	7108846		EBG R 16
	20	3	WPR 20-D		7108848	7108849		EBG R 20
	25	4	WPR 25-D		7108854	7108855		EBG R 25
	32	5	WPR 32-D		7108861	7108862		EBG R 32
 N = 2 **New helical cutting geometry** WPR…DN for semi-finishing and finishing of non-ferrous metals, plastics, graphite and titanium	6	1.6	WPR 06-DN	6132363			9079232	EBG R 06
	8	2	WPR 08-DN	6131629			9074406	EBG R 08
	10	2.5	WPR 10-DN	6131302			6132330	EBG R 10
	12	2.5	WPR 12-DN	6131303			6132329	EBG R 12
	16	3	WPR 16-DN	6131304			9074409	EBG R 16
	20	3	WPR 20-DN	6131305			6132089	EBG R 20
	25	4	WPR 25-DN	6131306			9074410	EBG R 25
	32	5	WPR 32-DN	6131307			9074411	EBG R 32

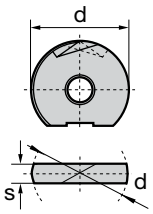
D – Helical Geometry suitable for semi-finishing and finishing in soft materials (Up to 54 Rc)
DN – Helical Geometry suitable for semi-finishing and finishing in non-ferrous materials and also in Exotic materials (LDN10M)

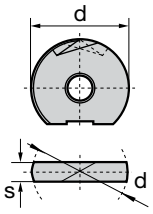
Inch N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No.				For cutter Cat-No.
				LDN10M	LCKP10M	LCH33M	LDN10M	
 N = 2 **New helical cutting geometry** WPR…D for semi-finishing and finishing of steel, cast steel and high temperature alloy up to 54 HRC	0.250	0.063	WPR 0250-D		7131716	7131723		EBG R 0250
	0.375	0.10	WPR 0375-D		7131718	7131725		EBG R 0375
	0.500	0.10	WPR 0500-D		7131719	7131726		EBG R 0500
	0.625	0.12	WPR 0625-D		7131720	7131727		EBG R 0625
	0.750	0.12	WPR 0750-D		7131721	7131728		EBG R 0750
	1.000	0.16	WPR 1000-D		7131722	7131729		EBG R 1000
 N = 2 **New helical cutting geometry** WPR…DN for semi-finishing and finishing of non-ferrous metals, plastics, graphite and titanium	0.250	0.063	WPR 0250-DN	9186899				EBG R 0250
	0.312	0.08	WPR 0312-DN	9186031				EBG R 0312
	0.375	0.10	WPR 0375-DN	9186035				EBG R 0375
	0.500	0.10	WPR 0500-DN	6131308				EBG R 0500
	0.625	0.12	WPR 0625-DN	9186037				EBG R 0625
	0.750	0.12	WPR 0750-DN	9186038				EBG R 0750
	1.000	0.16	WPR 1000-DN	6131309				EBG R 1000

Begin 2011 Q coated inserts upgraded to Z Coating for improved performance

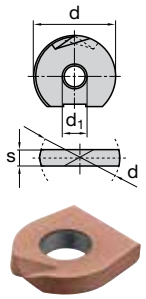
Cutting data recommendations starting page 131

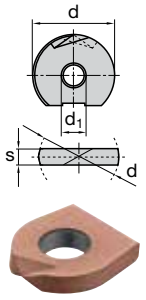
N Geometry is for semi-finishing and finishing of steel, cast steel, steel (up to 54 HRc), cast iron, 7° clearance angle

Metric N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No. LC610T	For cutter Cat-No.
 N = 2 7° Clearance Angle	6	1.6	WPR 06-N		EBG R 06
	8	2	WPR 08-N	9155009	EBG R 08
	10	2.5	WPR 10-N	9155011	EBG R 10
	12	2.5	WPR 12-N	9155014	EBG R 12
	16	3	WPR 16-N	9155016	EBG R 16
	20	3	WPR 20-N	9155020	EBG R 20
	25	4	WPR 25-N	9155022	EBG R 25
	30	5	WPR 30-N	9155024	EBG R 30
	32	5	WPR 32-N	9155026	EBG R 32

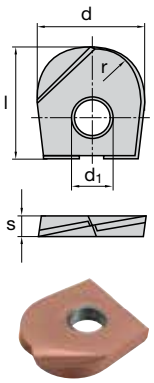
Inch N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No. LC610T	For cutter Cat-No.
 N = 2 7° Clearance Angle	0.312	0.06	WPR 0312-N	6122907	EBG R 0312
	0.375	0.08	WPR 0375-N	6122896	EBG R 0375
	0.500	0.10	WPR 0500-N	6122887	EBG R 0500
	0.625	0.12	WPR 0625-N	6122873	EBG R 0625
	0.750	0.12	WPR 0750-N	6122869	EBG R 0750
	1.000	0.16	WPR 1000-N	6122860	EBG R 1000
	1.250	0.20	WPR 1250-N	6122851	EBG R 1250
	2.000	0.24	WPR 2000-N	6127904	EBG R 2500

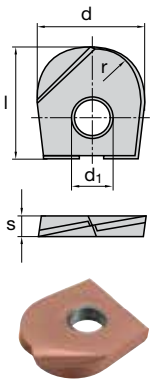
NP Geometry is a High Performance Geometry for finishing of hardened steel, Cast Steel and High Temperature Alloys up to 60HRC-Nano Red Coating provides extended tool life

Metric N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No. LCKP10M	 LCH33M	For cutter Cat-No.
 N = 2 12° Clearance Angle	6	1.6	WPR 06-NP	7108571		EBG R 06
	8	2	WPR 08-NP	7108479	7108486	EBG R 08
	10	2.5	WPR 10-NP	7108490	7108491	EBG R 10
	12	2.5	WPR 12-NP	7108498	7108499	EBG R 12
	16	3	WPR 16-NP	7108501	7108502	EBG R 16
	20	3	WPR 20-NP	7108503	7108505	EBG R 20
	25	4	WPR 25-NP	7108508	7108509	EBG R 25
	30	5	WPR 30-NP	7108512		EBG R 30
	32	5	WPR 32-NP	7108561	7108562	EBG R 32

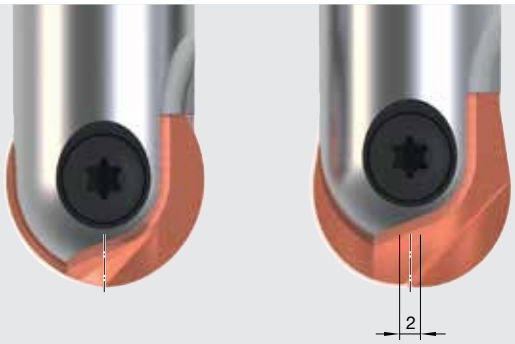
Inch N = Number of cutting edges	d	s	ISO-Code Cat-No.	Cutting materials Ident No. LCKP10M	 LCH33M	For cutter Cat-No.
 N = 2 12° Clearance Angle	0.375	0.08	WPR 0375-NP	7132305	7132313	EBG R 0375
	0.500	0.10	WPR 0500-NP	7132306	7132314	EBG R 0500
	0.625	0.12	WPR 0625-NP	7132307	7132315	EBG R 0625
	0.750	0.12	WPR 0750-NP	7132309	7132316	EBG R 0750
	1.000	0.16	WPR 1000-NP	7132310	7132318	EBG R 1000
	1.250	0.20	WPR 1250-NP	7132311	7132319	EBG R 1250

WPB-FB Flatball geometry reduces semi-finishing and finishing time with increased step overs in steel, cast steel, high temperature alloys and hardened steel up to 62Rc

Metric N = Number of cutting edges	d	l	s	R	ISO-Code Cat-No.	Cutting materials Ident No. LCKP10M	 LBHK95M	For cutter Cat-No.
	6		1.6	2	WPB 06-FB-20	9112332		EBG R 10
	8		2	3	WPB 08-FB-30	9112328		EBG R 12
	10	11.5	2.5	4	WPB 10-FB-40	9097607		EBG R 16
	12	14	2.5	5	WPB 12-FB-50	9097606	9078092	EBG R 20
	16	16	3	7	WPB 16-FB-70	9095870	9078091	
	32	18	3	15	WPB 20-FB-90	9097608	9080149	

Inch N = Number of cutting edges	d	l	s	R	ISO-Code Cat-No.	Cutting materials Ident No. LCKP10M	 LBHK95M	For cutter Cat-No.
	0.500	0.551	0.10	0.187	WPB 0500 FB 0187	9142857		EBG R 0500
	0.750	0.709	0.12	0.312	WPB 0750 FB 0312	9142858		EBG R 0750
	1.000	0.905	0.16	0.437	WPB 1000 FB 0437	9142879		EBG R 1000

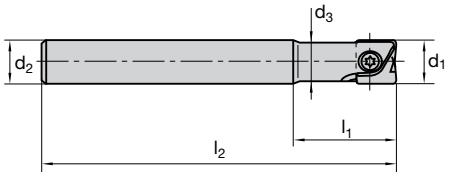
Cutting data recommendations see page 133



FlatBall® features and benefits:

- No zero cutting speed in center
- Significant reduction of wear in center
- Suitable for flat contours
- Improved surface finish at same a_e
- Less machining time at higher a_e

EBG V Metric



d_1	Cutter Body No.	Ident No.	l_1	l_2	d_2	d_3	z ✿	Insert	Insert	Insert Screw	Torx Driver
12	EBG V12.012AN090	6130574	34	92	12	10.5	2	WPB 12	WPV 12	GWS 12	T20
12	EBG V12.012AN130	6121399	34	132	12	10.5	2				
12	EBG V12.012AN150	6121383	48	152	12	10.5	2				
16	EBG V16.016AN100	6130575	38	102	16	14	2	WPB 16	WPV 16	GWS 16	
16	EBG V16.016AN140	6121389	38	142	16	14	2				
16	EBGV16.016AN160	6121391	55	162	16	14	2				
20	EBG V20.020AN160	6121377	47	162	20	18	2	WPB 20	WPV 20	GWS 20	
20	EBG V20.020AN175	6121379	63	177	20	18	2				
25	EBG V25.024AN160	6121371	47	162	25	22.4	2	WPB 25	WPV 25	GWS 25	T30
25	EBG V25.025AN190	6121373	72	192	25	22.4	2				
32	EBG V32.032AN175	6121363	58	177	32	28.6	2		WPV 32	GWS 32	
32	EBG V32.032AN210	6121364	82	212	32	28.6	2				

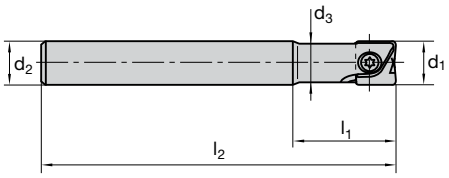
Limited stock of metric products in U.S., please contact Customer Service for availability

EBG V Inch

d_1	Cutter Body No.	EDP	Ident No.	l_1	l_2	d_2	d_3	z ✿	Insert	Insert	Insert Screw	Torx Driver
0.500	EBG V0500A0500 130N	88139	6121400	1.34	5.20	0.500	0.41	2	WPB 0500	WPV 0500	GWS 12	T20
0.500	EBG V0500A0500 150N	88140	6121384	1.89	5.98	0.500	0.41	2				
0.625	EBG V0625A0625 140N	88141	6121390	1.50	5.51	0.625	0.55	2	WPB 0625	WPV 0625	GWS 16	
0.625	EBG V0625A0625 160N	88142	6121381	2.16	6.30	0.625	0.55	2				
0.750	EBG V0750A0750 160N	88143	6121378	1.85	6.30	0.750	0.71	2	WPB 0750	WPV 0750	GWS 20	
0.750	EBG V0750A0750 175N	88144	6121380	2.48	6.89	0.750	0.71	2				
0.750	EBG V0750A0750 210N	88914	6121365	2.36	8.27	0.750	0.71	2				
1.000	EBG V1000A1000 160N	88145	6121372	1.85	6.30	1.000	0.88	2	WPB 1000	WPV 1000	GWS 25	T30
1.000	EBG V1000A1000 190N	88146	6121356	2.83	7.48	1.000	0.88	2				
1.000	EBG V1000A1000 230N	88902	6121358	3.14	9.06	1.000	0.88	2				

See pages 43–51 for Inserts
See page 42 for Insert Screw Specifications
Cutting data recommendations starting page 128–129

EBG V Metric



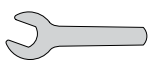
d_1	Cutter Body No.	Ident No.	IKZ Ident No.	l_1	l_2	d_2	d_3	z ✿	Insert	Insert	Insert Screw	Torx Driver
8	EBG V08.008AN080-C	6131510	–	27	82	8	7	2	WPB 08	WPV 08	GWS 08	T8
8	EBG V08.008AN100-C	6130576	–	27	102	8	7	2				
8	EBG V08.008AN150-C	6130577	–	42	152	8	7	2				
10	EBG V10.010AN080-C-I	9074948	6131512	37	82	10	8.8	2	WPB 10	WPV 10	GWS 10	T15
10	EBG V10.010AN120-C-I	6130578	6131511	37	122	10	8.8	2				
10	EBG V10.010AN150-C-I	6130579	6131513	52	152	10	8.8	2				
12	EBG V12.012AN080-C-I	9074949	6131514	37	82	12	10.5	2	WPB 12	WPV 12	GWS 12	T20
12	EBG V12.012AN120-C-I	6128023	6130402	37	122	12	10.5	2				
12	EBG V12.012AN160-C-I	6128030	6130403	52	162	12	10.5	2				
16	EBG V16.016AN100-C-I	–	6131515	42	102	16	14	2	WPB 16	WPV 16	GWS 16	
16	EBG V16.016AN140-C-I	–	6130404	42	142	16	14	2				
16	EBG V16.016AN175-C-I	–	6130405	57	177	16	14	2				
20	EBG V20.020AN100-C-I	–	6131516	52	102	20	18	2	WPB 20	WPV 20	GWS 20	
20	EBG V20.020AN140-C-I	–	6130406	52	142	20	18	2				
20	EBG V20.020AN190-C-I	–	6130407	77	192	20	18	2				
25	EBG V25.025AN160-C-I	–	6130408	62	162	25	22.4	2	WPB 25	WPV 25	GWS 25	T30
25	EBG V25.025AN210-C-I	–	6130409	92	212	25	22.4	2				
32	EBG V32.032AN190-C	6128040	–	67	192	32	28.6	2	WPB 32	WPV 32	GWS 32	
32	EBG V32.032AN240-C	6128041	–	107	242	32	28.6	2				

Limited stock of metric products in U.S., please contact Customer Service for availability
IKZ=Internal Coolant Supply

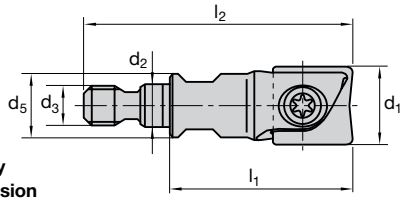
EBG V Inch

d_1	Cutter Body No.	Ident No.	IKZ Ident No.	l_1	l_2	d_2	d_3	z ✿	Insert	Insert	Insert Screw	Torx Driver
0.500	EBG V0500A0500 120NC	–	7022532	1.38	4.73	0.500	0.42	2	WPB 0500	WPV 0500	GWS 12	T20
0.500	EBG V0500A0500 160NC	–	7022533	1.97	6.30	0.500	0.42	2				
0.625	EBG V0625A0625 140NC	–	7022534	1.58	5.52	0.625	0.56	2	WPB 0625	WPV 0625	GWS 16	
0.625	EBG V0625A0625 175NC	–	7022535	2.17	6.89	0.625	0.56	2				
0.750	EBG V0750A0750 140NC	–	7022536	1.58	5.52	0.750	0.70	2	WPB 0750	WPV 0750	GWS 20	
0.750	EBG V0750A0750 190NC	–	7022537	2.96	6.30	1.000	0.89	2				
1.000	EBG V1000A1000 160NC	–	7022538	2.37	6.30	1.000	0.89	2	WPB 1000	WPV 1000	GWS 25	T30
1.000	EBG V1000A1000 210NC	–	7022539	3.55	8.27	1.000	0.89	2				
1.250	EBG V1250A1250 190NC	–	6128694		10.00	1.250	1.13	2	WPB 1250		GWS 25	T20
1.250	EBG V1250A1250 240NC	–	6128696		10.00	1.250	1.13	2				T30

See pages 43–51 for Inserts
See page 42 for Insert Screw Specifications
Cutting data recommendations starting page 128–129

Open End Wrench	Wrench Size	Ident No.	For Head Sizes
	8mm	2146604	8mm, 10mm, 12mm, .375", .500"
	10mm	2146606	16mm, .625"
	15mm	21446611	20mm, .750"
	17mm	2146612	25mm, 1.00"

EBG V Metric



Product optimization by shortened compact version

d_1	Cutter Body No.	Ident No.	l_1	l_2	d_2	d_3	d_5	z ✿	IKZ	Insert	Insert	Insert Screw	Torx Driver
8	EBG V08.008TC025	6131472	25	39.5	6.5	M6	10	2		WPV 08	WPB 08	GWS 08	T 8
10	EBG V10.010TC025	6131474	25	39.5	6.5	M6	9.35	2		WPV 10	WPB 10	GWS 10	T15
12	EBG V12.012TC025	6131476	25	39.5	6.5	M6	10	2		WPV 12	WPB 12	GWS 12	T20
12	EBG V12.012TR028-I	6131478	28	45.5	8.5	M8	13	2	x	WPV 12	WPB 12	GWS 12	
16	EBG V16.016TR028-I	6131480	28	45.5	8.5	M8	13	2	x	WPV 16	WPB 16	GWS 16	
20	EBG V20.020TS032-I	6131482	32	51.5	10.5	M10	18	2	x	WPV 20	WPB 20	GWS 20	
25	EBG V25.025TF042-I	6131484	42	64	12.5	M12	21	2	x	WPV 25	WPB 25	GWS 25	T30
32	EBG V32.032TH047-I	6131486	47	71	17.0	M16	30	2	x	WPV 32	WPB 32	GWS 32	

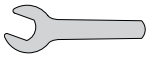
Limited stock of metric products in U.S., please contact Customer Service for availability

EBG V Inch

d_1	Cutter Body No.	EDP	Ident No.	l_1	l_2	d_2	d_3	d_5	z ✿	IKZ	Insert	Insert	Insert Screw	Torx Driver
0.375	EBG V 0375 T0375	13732	9101926	0.98	1.555	0.25	M6	0.39	2		WPV 0375	WPB 0375	GWS 10	T15
0.500	EBG V 0500 T0500-I	26091	7085208	0.98	1.555	0.25	M6	0.368	2		WPV 0500	WPB 0500	GWS 12	T20
0.625	EBG V 0625 T0625-I	13734	9101928	1.10	1.791	0.33	M8	0.51	2	x	WPV 0625	WPB 0625	GWS 16	T20
0.750	EBG V 0750 T0750-I	13735	9101929	1.26	2.027	0.41	M10	0.71	2	x	WPV 0750	WPB 0750	GWS 20	T20
1.000	EBG V 1000 T1000-I	13736	9101930	1.65	2.519	0.49	M12	0.83	2	x	WPV 1000	WPB 1000	GWS 25	T30

See pages 43–51 for Inserts
See pages 54–55 for Screw-On Shanks
IKZ=Internal Coolant Supply

Cutting data recommendations starting page 128–129

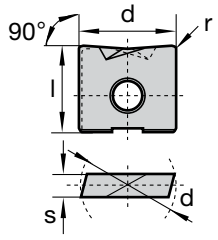
Open End Wrench	Wrench Size	Ident No.	For Head Sizes
	8mm	2146604	8mm, 10mm, 12mm, .375", .500"
	10mm	2146606	16mm, .625"
	15mm	2146611	20mm, .750"
	17mm	2146612	25mm, 1.00"

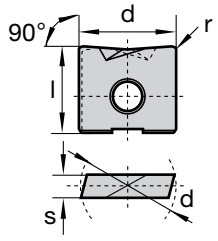
Torque in Nm

EBG R.../ EBG V... Torque Requirements

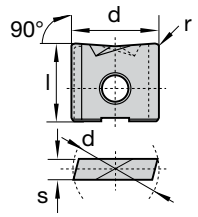
		Tool type		
Ident No.	Screw	GRT	GWR	GWV
	SA 40115	manual	---	---
6260409	GWS 06	---	1	1
6119572	GWS 08	---	2	2
6119571	GWS 10	---	3	3
6119559	GWS 12	---	4	4
6119560	GWS 16	---	5	5
6119561	GWS 20	---	6	6
6119562	GWS 25	6.5	6.5	6.5
6119563	GWS 32	6.5	6.5	6.5
		Torque in Nm		

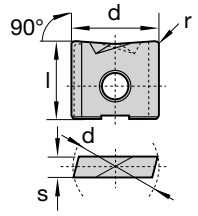
N Geometry for semi-finishing and finishing steel, for steel, cast steel, high temperature alloys and hardened steel up to 60 HRC

Metric N = Number of cutting edges	d	l	s	r	ISO-Code Cat-No.	Cutting materials Ident No. LC610T	 LWNS10M	 LDP05B-PCD	For cutter Cat-No.
 N = 2	8	9.5	2	0.6	WPV 08-N	6122595	6122594		EBG V 08
	10	11.5	2.5	0.8	WPV 10-N	6122669	6122668		EBG V 10
	12	14	2.5	1.0	WPV 12-N	6122665	6122664		EBG V 12
	16	16	3	1.3	WPV 16-N	6122641	6122640		EBG V 16
	20	18	3	1.6	WPV 20-N	6122635	6122634		EBG V 20
	25	23.5	4	2.0	WPV 25-N	6122629	6122628		EBG V 25
	32	28	5	2.5	WPV 32-N	6122605	6122620		EBG V 32

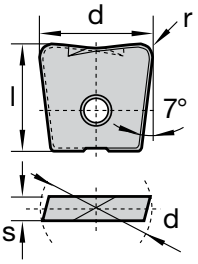
Inch N = Number of cutting edges	d	l	s	r	ISO-Code Cat-No.	Cutting materials Ident No. LC610T	 LWNS10M	 LDP05B-PCD	For cutter Cat-No.
 N = 2	0.375	0.45	0.08	0.031	WPV 0375-N-2	6127876		50890	EBG V 0375
	0.375	0.45	0.08	0.062	WPV 0375-N-4	6127947		50891	
	0.500	0.55	0.10	0.031	WPV 0500-N-2	6127785		50895	EBG V 0500
	0.500	0.55	0.10	0.062	WPV 0500-N-4	6122509		50896	
	0.625	0.62	0.12	0.031	WPV 0625-N-2	6122525		50902	EBG V 0625
	0.625	0.62	0.12	0.062	WPV 0625-N-4	6127786		50903	
	0.750	0.70	0.12	0.031	WPV 0750-N-2	6128965		50904	EBG V 0750
	0.750	0.70	0.12	0.062	WPV 0750-N-4	6127787		50905	
	1.000	0.92	0.16	0.031	WPV 1000-N-2	6127789		50906	EBG V 1000
	1.000	0.92	0.16	0.062	WPV 1000-N-4	6127788		50798	
	1.000	0.92	0.16	0.125	WPV 1000-N-8	6127790		55084	

CF Geometry with chip control geometry for roughing and semi-finishing long chipping ferrous materials

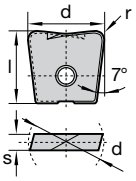
Metric N = Number of cutting edges	d	l	s	r	ISO-Code Cat-No.	Cutting materials Ident No. LC240T	For cutter Cat-No.
 N = 2	8	9.5	2	0.6	WPV 08-N-CF	6282725	EBG V 08
	10	11.5	2.5	0.8	WPV 10-N-CF	6282727	EBG V 10
	12	14	2.5	1.0	WPV 12-N-CF	6282729	EBG V 12
	16	16	3	1.3	WPV 16-N-CF	6282731	EBG V 16
	20	18	3	1.6	WPV 20-N-CF	6282733	EBG V 20
	25	23.5	4	2.0	WPV 25-N-CF	6282735	EBG V 25
	32	28	5	2.5	WPV 32-N-CF	6282737	EBG V 32

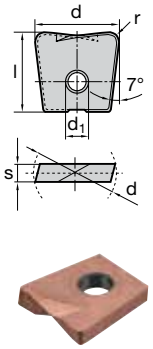
Inch N = Number of cutting edges	d	l	s	r	ISO-Code Cat-No.	Cutting materials Ident No. LC240T	For cutter Cat-No.
 N = 2	0.500	0.55	0.10	0.032	WPV 0500-CF-2	6130285	EBG V 0500
	0.500	0.55	0.10	0.063	WPV 0500-CF-4	6130286	
	0.625	0.62	0.12	0.032	WPV 0625-CF-2	6130287	EBG V 0625
	0.625	0.62	0.12	0.063	WPV 0625-CF-4	6130288	
	0.750	0.70	0.12	0.032	WPV 0750-CF-2	6130289	EBG V 0750
	0.750	0.70	0.12	0.063	WPV 0750-CF-4	6130290	
	1.000	0.92	0.12	0.032	WPV 1000-CF-2	6130291	EBG V 1000
	1.000	0.92	0.16	0.063	WPV 1000-CF-4	6130292	
	1.000	0.92	0.16	0.125	WPV 1000-CF-8	6130293	

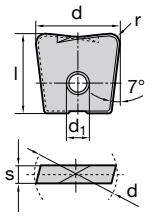
N Geometry for semi-finishing and finishing of steel, cast steel and high temperature alloys up to 54 HRC

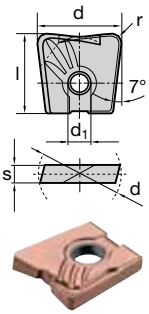
Metric N = Number of cutting edges	d	l	s	r	ISO-Code Cat-No.	Cutting materials Ident No. LC610T	For cutter Cat-No.
 N = 2	8	9.5	2	0.6	WPB 08-N-06	6282927	EBG V 08
	8	9.5	2	1.0	WPB 08-N-10	6282919	
	10	11.5	2.5	0.8	WPB 10-N-08	6282928	EBG V 10
	10	11.5	2.5	1.0	WPB 10-N-10	6282918	
	12	14	2.5	1.0	WPB 12-N-10	6129227	EBG V 12
	12	14	2.5	2.0	WPB 12-N-20	6128106	
	16	16	3	1.0	WPB 16-N-10	6129229	EBG V 16
	16	16	3	1.3	WPB 16-N-13	6282931	
	16	16	3	3.0	WPB 16-N-30	6128110	
	20	18	3	1.0	WPB 20-N-10	6129231	EBG V 20
	20	18	3	1.6	WPB 20-N-16	6282930	
	20	18	3	4.0	WPB 20-N-40	6128114	
	25	23.5	4	1.0	WPB 25-N-10	6129233	EBG V 25
	25	23.5	4	2.0	WPB 25-N-20	6282929	
	25	23.5	4	5.0	WPB 25-N-50	6128118	

N Geometry for semi-finishing and finishing of steel, cast steel and high temperature alloys up to 54 HRC

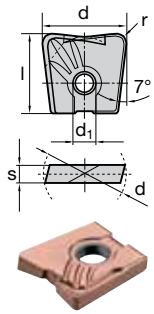
Inch N = Number of cutting edges	d	l	s	r	ISO-Code Cat-No.	Cutting materials Ident No. LC610T	 LDP05B-PCD	For cutter Cat-No.
 N = 2	0.250		0.063	0.032	WPB 0250-N-2		50696	EBG R 0250
	0.375		0.063	0.010	WPB 0375-N	6129886		EBG R 0375
	0.375	0.450	0.08	0.032	WPB 0375-N-2	7031925	54262	EBG R 0375
	0.375	0.450	0.08	0.063	WPB 0375-N-4	7031927	54263	EBG R 0375
	0.500	0.550	0.10	0.032	WPB 0500-N-2	6122370	54264	EBG V 0500
	0.500	0.550	0.10	0.063	WPB 0500-N-4	6122376	54265	
	0.625	0.625	0.12	0.032	WPB 0625-N-2	6127791	54757	EBG V 0625
	0.625	0.625	0.12	0.063	WPB 0625-N-4	6127792	54758	
	0.750	0.700	0.12	0.032	WPB 0750-N-2	6127793	54266	EBG V 0750
	0.750	0.700	0.12	0.063	WPB 0750-N-4	6127794	51150	
	1.000	0.925	0.16	0.032	WPB 1000-N-2	6122374	54267	EBG V 1000
	1.000	0.925	0.16	0.063	WPB 1000-N-4	6122362	54268	
	1.000	0.925	0.16	0.125	WPB 1000-N-8	6127795	54759	

Metric N = Number of cutting edges	d	l	s	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LWNS10M	 LCKP10M	For cutter Cat-No.
 N = 2	8	9,5	2	3	0,6	WPB 08 N 06	6282921	7108320	EBG V 08
	8	9,5	2	3	1	WPB 08 N 10	6282916	7108321	
	10	11,5	2,5	4	0,8	WPB 10 N 08	6282922	7108323	EBG V 10
	10	11,5	2,5	4	1	WPB 10 N 10	6282917	7108324	
	12	14	2,5	5	1	WPB 12 N 10	6129226	7108325	EBG V 12
	12	14	2,5	5	2	WPB 12 N 20	6128105	7108326	
	16	16	3	5	1	WPB 16 N 10	6129228	7108404	EBG V 16
	16	16	3	5	1,3	WPB 16 N 13	6282923	7108406	
	16	16	3	5	3	WPB 16 N 30	6128109	7108407	

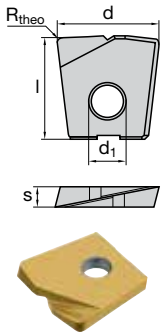
Inch N = Number of cutting edges	d	l	s	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LWNS10M	 LCKP10M	For cutter Cat-No.
  N = 2	0.375	0.450	0.080	–	0.032	WPB 0375-NP-2		7132387	EBG R 0375
	0.375	0.450	0.080	–	0.063	WPB 0375-NP-4		7132388	
	0.500	0.550	0.100	–	0.032	WPB 0500-NP-2		7131503	EBG V 0500
	0.500	0.550	0.100	–	0.063	WPB 0500-NP-4		7132391	
	0.625	0.625	0.120	–	0.032	WPB 0625-NP-2		7132392	EBG V 0625
	0.625	0.625	0.120	–	0.063	WPB 0625-NP-4		7132393	
	0.750	0.700	0.120	–	0.032	WPB 0750-NP-2		7132394	EBG V 0750
	0.750	0.700	0.120	–	0.063	WPB 0750-NP-4		7132395	
	1.000	0.925	0.160	–	0.032	WPB 1000-NP-2		7132397	EBG V 1000
	1.000	0.925	0.160	–	0.063	WPB 1000-NP-4		7132398	
	1.000	0.925	0.160	–	0.125	WPB 1000-NP-8		7132399	

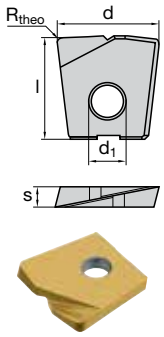
Metric N = Number of cutting edges	d	l	s	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LWNS10M	 LCHK10M	For cutter Cat-No.
 N = 2 (Wiper)	8	6	1.6	2.5	0.5	WPB 06 AF 05		7035106	EBG R 06
	9.3	8	2	3	0.5	WPB 08 AF 05	7107679	7062287	EBG V 08
	9.5	8	2	3	1	WPB 08 AF 10		7035107	
	11.3	10	2.5	4	0.5	WPB 10 AF 05	7107680	9193919	EBG V 10
	11.5	10	2.5	4	1	WPB 10 AF 10	7016821	9153134	
	13.8	12	2.5	5	0.5	WPB 12 AF 05	7107681	7016356	EBG V 12
	14	12	2.5	5	1	WPB 12 AF 10	7016822	9153135	
	14	12	2.5	5	2	WPB 12 AF 20		9153137	
	16	16	3	5	1	WPB 16 AF 10	7016823	9148026	EBG V 16
	16	16	3	5	3	WPB 16 AF 30		9148028	
	18	20	3	5	1	WPB 20 AF 10	7016824	9153138	EBG V 20
	18	20	3	5	2	WPB 20 AF 20		7043485	
	18	20	3	5	4	WPB 20 AF 40		9153169	

All WPR, WPV and WPB inserts are available in grade LDN10M (LC610A) (diamond coated) or PCD/CBN tipped.

Inch N = Number of cutting edges	d	l	s	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LWNS10M	 LCHK10M	For cutter Cat-No.
 N = 2 (Wiper)	0.250	8.0	1.6	2.5	0.032	WPB 0250 AF 2		7148949	EBG R 0250
	0.250	8.0	1.6	2.5	0.062	WPB 0250 AF 4		7148950	
	0.375	11.5	2.5	4	0.032	WPB 0375 AF 2		7148951	EBG R 0375
	0.375	11.5	2.5	4	0.062	WPB 0375 AF 4		7148952	
	0.500	14.0	2.5	5	0.032	WPB 0500 AF 2		7148953	EBG V 0500
	0.500	14.0	2.5	5	0.062	WPB 0500 AF 4		7148954	
	0.625	16.0	3.0	5	0.032	WPB 0625 AF 2		7051668	EBG V 0625
	0.625	16.0	3.0	5	0.062	WPB 0625 AF 4		7051669	
	0.750	18.0	3.0	5	0.032	WPB 0750 AF 2		7051666	EBG V 0750
	0.750	18.0	3.0	5	0.062	WPB 0750 AF 4		7051667	
	1.000	23.5	4.0	6	0.032	WPB 1000 AF 2		7148955	EBG V 1000
	1.000	23.5	4.0	6	0.062	WPB 1000 AF 4		7148956	
	1.000	23.5	4.0	6	0.125	WPB 1000 AF 8		7148957	

WPB-HF High Feed geometry excellent for high feed roughing of steel, cast steel and high temperature alloys.

Metric N = Number of cutting edges	d	l	s	ap_{max}	R_{Theo}	ISO-Code Cat-No.	Cutting materials Ident No. LC630Q	LC610Q	LW610	For cutter Cat-No.
 N = 2	10	11.5	2.5	0.05	0.8	WPB 10-HF		9103211		EBG V 10
	12	14	2.5	0.6	1	WPB 12-HF	6132176			EBG V 12
	16	16	3	0.8	1.5	WPB 16-HF	6132180			EBG V 16
	20	18	3	1	2	WPB 20-HF	6132182			EBG V 20
	25	23.5	4	1.25	2.5	WPB 25-HF		6183263		EBG V 25
	32	26.5	5	1.6	3.2	WPB 32-HF		6183264		EBG V 32

Inch N = Number of cutting edges	d	l	s	ap_{max}	R_{Theo}	ISO-Code Cat-No.	Cutting materials Ident No. LC630Q	LC610Q	LW610	For cutter Cat-No.
 N = 2	0.500	0.55	0.10	0.025	0.045	WPB 0500-HF	6132184		9186039	EBG V 0500
	0.625	0.63	0.12	0.030	0.050	WPB 0625-HF	6132186		9186042	EBG V 0625
	0.750	0.70	0.12	0.040	0.080	WPB 0750-HF	6132188		9186043	EBG V 0750
	1.000	0.93	0.15	0.05	0.062	WPB 1000-HF	7153814			EBG V 1000

WPB-HF – High Feed Insert
Application Example

TOOL:
EBG V12.012AN080-C-I , d_1 = 2

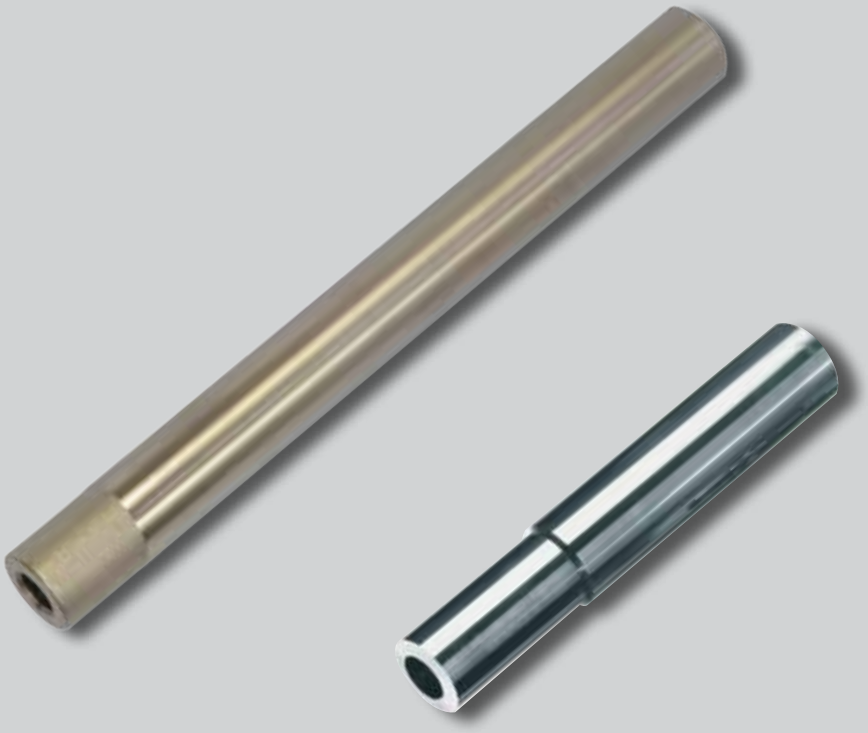
MATERIAL:
Toolox 44

INSERT:
WPB 12-HF, LC630Q

TENSILE STRENGTH:
44 HRC

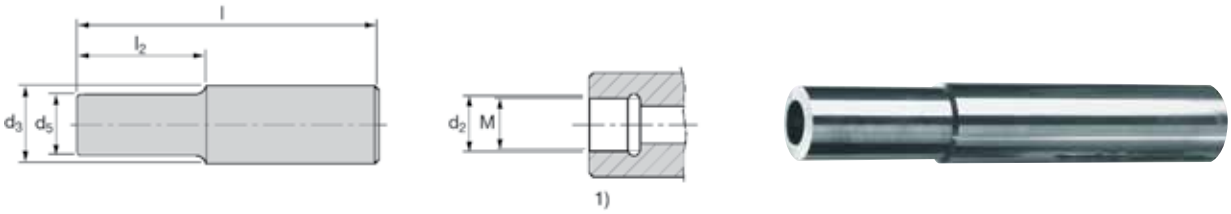
MACHINE:
Machining center
DMU70 eVo/HSK-A63/25 kW
$n_{max.}$ = 18000 max RPM

CUTTING DATA:
v_c = 525 SFM
n = 4240 RPM
f_z = .031 IPT
v_f = 268 IPM
a_e = .315
a_p = .016



ADT Carbide & HSS Holders

ADT – Carbide



Thread M	d_2	Shank d_3	d_5	l	l_2	Cutter Body No.	Ident No.
6	6.5	10	9.7	140	53	ADT T06 140 RZ-C	6129285
6	6.5	10	9.7	110	38	ADT T06 110 RZ-C	6129286
6	6.5	12	9.7	162	52	ADT T06 162 RZ-C	6129287
6	6.5	12	9.7	122	37	ADT T06 122 RZ-C	6129288
8	8.5	16	13	177	57	ADT T08 177 RZ-C	6129289
8	8.5	16	13	142	42	ADT T08 142 RZ-C	6129290
10	10.5	20	18	194	78	ADT T10 194 RZ-C	6129291
10	10.5	20	18	144	54	ADT T10 144 RZ-C	6129292
12	12.5	25	21	210	90	ADT T12 210 RZ-C	6129293
12	12.5	25	21	160	60	ADT T12 160 RZ-C	6129294
16	17	32	28	232	99	ADT T16 232 RZ-C	6129295
16	17	32	28	182	59	ADT T16 182 RZ-C	6129296

ADT-THR Straight – Inch Shank

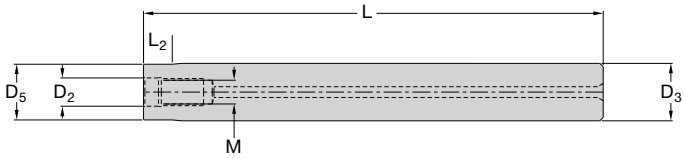
Thread M	d_2	Shank d_3	d_5	l	l_2	Cutter Body No.	Ident No.
6	0.2677	0.3750	0.3740	4.3307	1.4961	ADT T06 110 0375 RZ-C	9111916
6	0.2677	0.3750	0.3740	5.5118	2.0866	ADT T06 140 0375 RZ-C	9111917
6	0.2677	0.5000	0.4331	4.8031	1.4567	ADT T06 122 0500 RZ-C	9111914
6	0.2677	0.5000	0.4331	6.3780	2.0472	ADT T06 162 0500 RZ-C	9111915
8	0.3504	0.6250	0.5433	5.5906	1.6535	ADT T08 142 0625 RZ-C	9111912
8	0.3504	0.6250	0.5433	6.9685	2.2441	ADT T08 177 0625 RZ-C	9111913
10	0.4370	0.7500	0.7087	5.6693	2.1260	ADT T10 144 0750 RZ-C	9111910
10	0.4370	0.7500	0.7087	7.6378	3.0709	ADT T10 194 0750 RZ-C	9111911
12	0.5157	1.0000	0.8898	6.2992	2.3622	ADT T12 160 1000 RZ-C	9111908
12	0.5157	1.0000	0.8898	8.2677	3.5433	ADT T12 210 1000 RZ-C	9111909

ADT-THR Tapered – Inch Shank

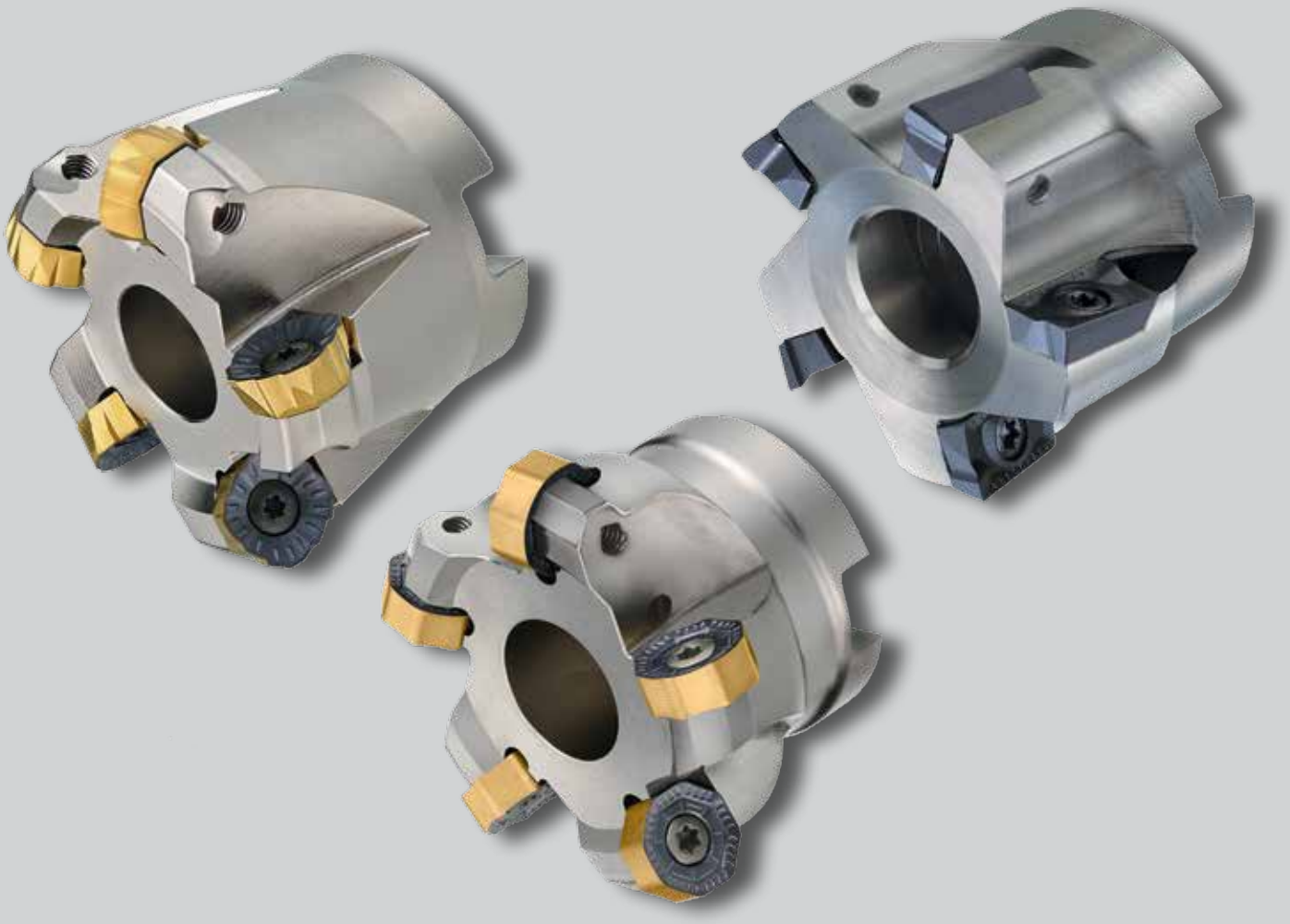
Thread M	d_2	Shank d_3	d_5	l_2	Cutter Body No.	Ident No.
6	0.2677	0.5000	0.3740	3.0315	ADT T06 125 0500 T-C S.C.	9111918
6	0.2677	0.5000	0.3740	5.0000	ADT T06 175 0500 T-C S.C.	9111919
8	0.3504	0.6250	0.4921	3.9370	ADT T08 150 0625 T-C S.C.	9111920
8	0.3504	0.6250	0.4921	4.9213	ADT T08 175 0625 T-C S.C.	9111921
10	0.4370	0.7500	0.6693	3.7008	ADT T10 150 0750 T-C S.C.	9111922
10	0.4370	0.7500	0.6693	5.6693	ADT T10 200 0750 T-C S.C.	9111923
12	0.5157	1.0000	0.7874	4.0945	ADT T12 160 1000 T-C S.C.	9111924
12	0.5157	1.0000	0.7874	6.0630	ADT T12 210 1000 T-C S.C.	9111925

Note: All shanks are h6 tolerance suitable for heat shrinking

ADT – HSS



EDP No.	Description	M (Thread)	D_2	D_3	D_5	L	L_2
25370	ADT T06 500 5.000 HSS SHANK	M6	6.5mm	0.500	0.490	5.000	0.500
25371	ADT T06 500 7.000 HSS SHANK	M6	6.5mm	0.500	0.490	7.000	0.500
25372	ADT T10 750 6.000 HSS SHANK	M10	10.5mm	0.750	0.720	6.000	0.500
25373	ADT T10 750 8.000 HSS SHANK	M10	10.5mm	0.750	0.720	8.000	0.500
25374	ADT T12 1000 6.000 HSS SHANK	M12	12.5mm	1.000	0.970	6.000	0.500
25375	ADT T12 1000 8.000 HSS SHANK	M12	12.5mm	1.000	0.970	8.000	0.500
26669	ADT T12 1250 6.000 HSS SHANK	M16	16.5mm	1.250	1.220	6.000	0.500
26670	ADT T12 1250 8.000 HSS SHANK	M16	16.5mm	1.250	1.220	8.000	0.500
26671	ADT T12 1250 10.000 HSS SHANK	M16	16.5mm	1.250	1.220	8.000	0.500
26672	ADT T12 1500 6.000 HSS SHANK	M16	16.5mm	1.500	1.470	6.000	0.500
26673	ADT T12 1500 8.000 HSS SHANK	M16	16.5mm	1.500	1.470	8.000	0.500
26674	ADT T12 1500 10.000 HSS SHANK	M16	16.5mm	1.500	1.470	8.000	0.500

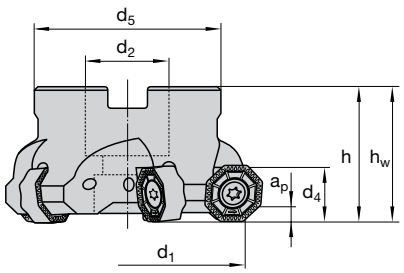


General Milling Cutters & Inserts

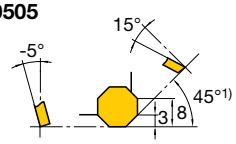
FMN45 Features & Benefits

- Indexable insert with 16 cutting edges (eight cutting edges on each side)
- Large feed rates are possible
- Carbide grades LC225T, LC240T, LC610T
- Cutter available in monobloc version from 2.00" to 6.00" (32mm to 160mm)
- Coolant Fed Body
- Wiper Insert available to achieve better flatness and surface finish

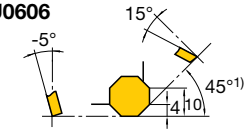
FMN45
Inch
IKZ



ONGU0505



ONGU0606



All bodies have internal coolant



d_1	Cutter Body No.	EDP No.	Ident No.	d_4	h	d_2	d_5	ap_{max} (DOC)	z ✡	Insert	Insert Screw	Torx Driver
2"	FMN45 O06.200AA-I	17001	1950420	.630	1.57	.750	1.57	.157	4	ONGU 0606	1045133	1048422
2"	FMN45 O06.200AA-IF	17002	1950421	.630	1.57	.750	1.57	.157	6			T20
2.5"	FMN45 O06.250AA-I	17005	1950422	.630	1.57	.750	1.97	.157	5			(Torx Plus)
2.5"	FMN45 O06.250AA-IF	17006	1950423	.630	1.97	.750	1.97	.157	8			
3"	FMN45 O06.300AB-I	17007	1950424	.630	1.97	1.00	2.36	.157	7			
3"	FMN45 O06.300AB-IF	17008	1950425	.630	1.97	1.00	2.36	.157	10			
4"	FMN45 O06.400AD-I	17009	1950426	.630	1.97	1.50	2.95	.157	9			
4"	FMN45 O06.400AD-IF	17010	1950427	.630	1.97	1.50	2.95	.157	12			
5"	FMN45 O06.500AD	17011	1950428	.630	2.48	1.50	3.54	.157	11			
5"	FMN45 O06.500AD-F	17012	1950429	.630	2.48	1.50	3.54	.157	15			
6"	FMN45 O06.600AD	17013	1950430	.630	2.48	1.50	5.12	.157	13			
6"	FMN45 O06.600AD-F	17014	1950431	.630	2.48	1.50	5.12	.157	19			

See page 58 for inserts

Inch Cutters with ONGU 0505 Inserts quoted as Special

h_w dimension with wiper insert is h +0.002"

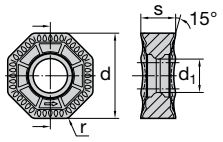
Cutting data recommendations starting page 139

FMN45 Metric											
d_1	Cutter Body No.	Ident No.	d_4	h	d_2	d_5	ap_{max} (DOC)	z ✿	Insert	Insert Screw	Torx Driver
32	FMN45 005.032AN-I	1027400	12.7	40	16	32	3	3	ONGU 0505	1045131 M4	1048335 T15 (Torx Plus)
32	FMN45 005.032AN-IF	1027401	12.7	40	16	32	3	4			
40	FMN45 005.040AN-I	1027402	12.7	40	22	40	3	4			
40	FMN45 005.040AN-IF	1027403	12.7	40	22	40	3	5			
50	FMN45 005.050AN-I	1027404	12.7	40	22	40	3	5			
50	FMN45 005.050AN-IF	1027405	12.7	40	22	40	3	7			
63	FMN45 005.063AN-I	1027406	12.7	40	22	50	3	7			
63	FMN45 005.063AN-IF	1027407	12.7	40	22	50	3	9			
50	FMN45 006.050AN-I	1027420	16	40	22	40	4	4	ONGU 0606	1045133	1048422 T20 (Torx Plus)
50	FMN45 006.050AN-IF	1027421	16	40	22	40	4	6			
63	FMN45 006.063AN-I	1027422	16	40	22	50	4	5			
63	FMN45 006.063AN-IF	1027423	16	40	22	50	4	8			
80	FMN45 006.080AN-I	1027424	16	50	27	60	4	7			
80	FMN45 006.080AN-IF	1027425	16	50	27	60	4	10			
100	FMN45 006.100AN-I	1027426	16	50	32	75	4	9			
100	FMN45 006.100AN-IF	1027427	16	50	32	75	4	12			
125	FMN45 006.125AN	1027428	16	63	40	90	4	11			
125	FMN45 006.125AN-F	1027429	16	63	40	90	4	15			
160	FMN45 006.160AN	1027430	16	63	40	130	4	13			
160	FMN45 006.160AN-F	1027431	16	63	40	130	4	19			

Limited stock of metric products in U.S., please contact Customer Service for availability

Cutting data recommendations starting page 139

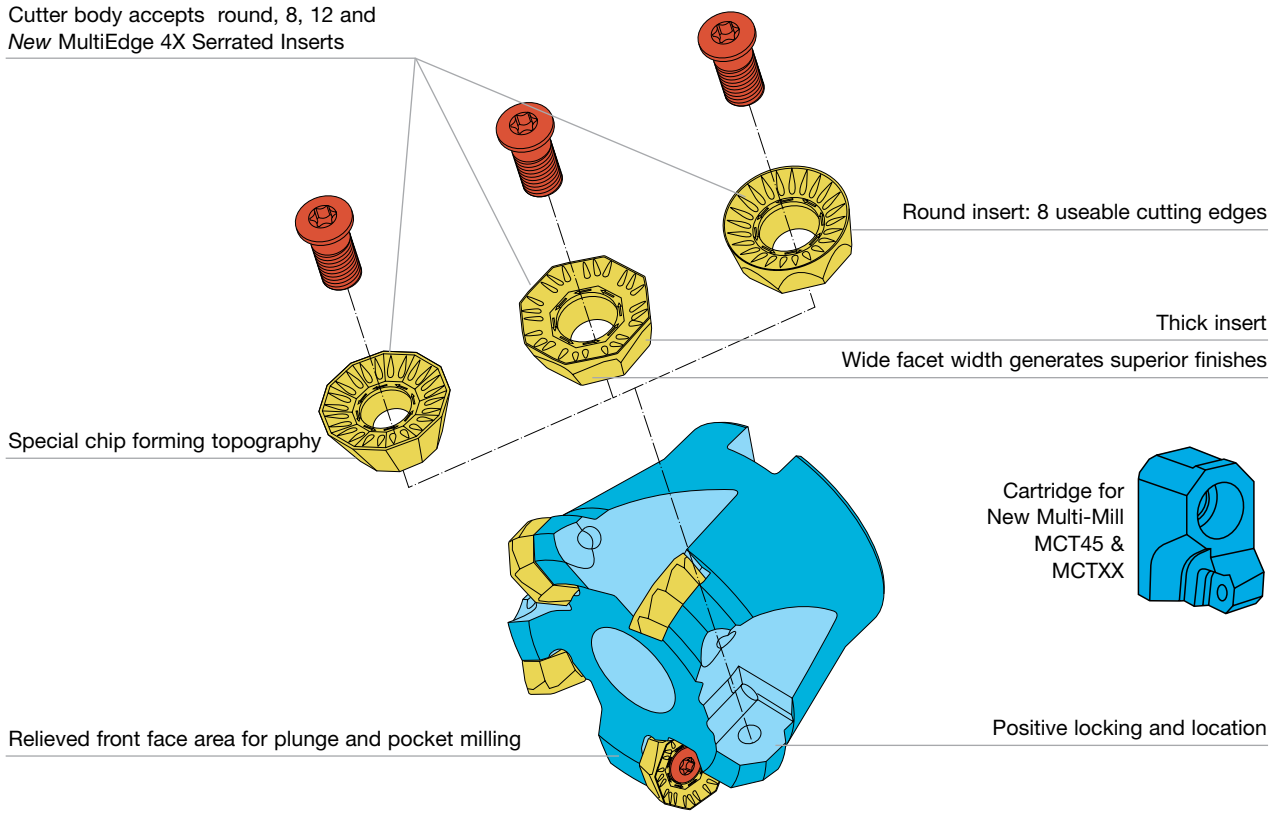
Indexable Inserts

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LC280QN	LC280TT	LC610Q	LCP40M	LC230F	LC225T	LC630T	LW240	LW225	LC610E	LCKP10M	LC610A	BN025	LC603Z	For cutter Cat-No.
 N = 16	–	5.56 (.219)	12.7 (.500)	4.4 (.173)	2 (.079)	ONGU 0505ANEN				1054009		1054017					1054014				FMN45
	–	5.56 (.219)	12.7 (.500)	4.4 (.173)	2 (.079)	ONGU 0506ANEN-SL WP Wiper											1054018[1]				
	–	6.35 (.250)	16 (.630)	6.3 (.248)	2 (.079)	ONGU 0606ANEN				1054008		1054015					1054013				
	–	6.35 (.250)	16 (.630)	6.3 (.248)	2 (.079)	ONGU 0606ANEN-SL WP Wiper											1054016[1]				

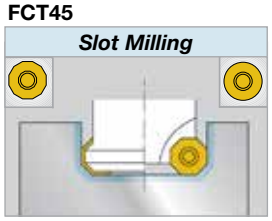
[1] LC610T with additional TiN top layer
Note: Wiper Insert has 4 Cutting Edges Per Side

FCT45 Features & Benefits

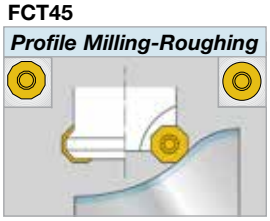
- Exclusive TWIN*CUT* geometry
- Large insert grade offering
- Direct pressed inserts in round, 8, 12 and New MultiEdge 4X Serrated Inserts
- Designed for roughing and finishing
- Deep, positive chip grooves



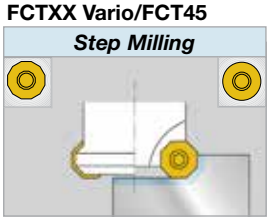
FCT45
Slot Milling



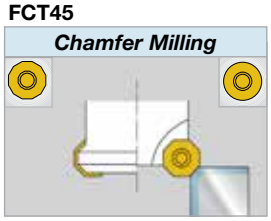
FCT45
Profile Milling-Roughing



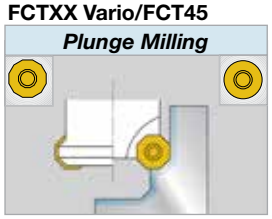
FCTXX Vario/FCT45
Step Milling



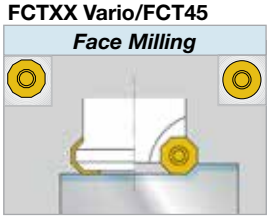
FCT45
Chamfer Milling



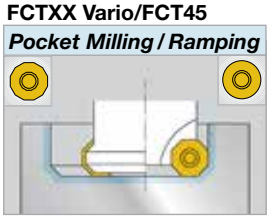
FCTXX Vario/FCT45
Plunge Milling



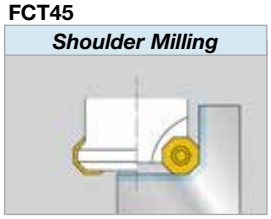
FCTXX Vario/FCT45
Face Milling



FCTXX Vario/FCT45
Pocket Milling / Ramping



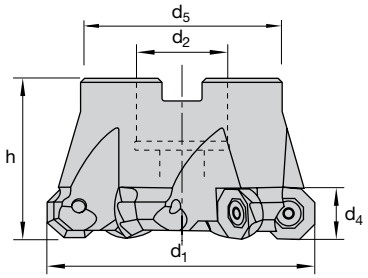
FCT45
Shoulder Milling



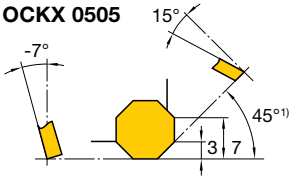
FCT45 Features & Benefits

- Universal milling cutter for face milling of steel, stainless steel and cast iron materials
- Exclusive TWIN*CUT* insert design offers round, 4 sided, and 8 sided for roughing applications

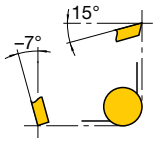
FCT45
Metric



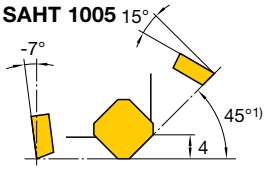
OCKX 0505



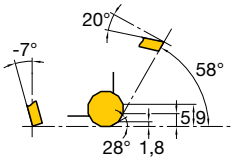
RCKX 1205



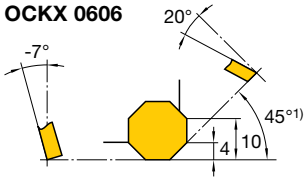
SAHT 1005



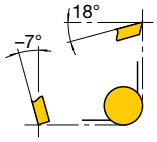
XCKX 1606



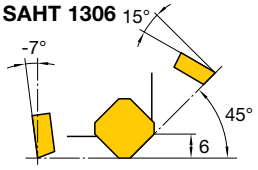
OCKX 0606



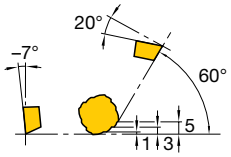
RCKX 1606



SAHT 1306



XOKX 1606



d_1	Cutter Body No.	Ident No.	d_4	h	d_2	d_5	z ✿	Insert	Insert	Insert	Insert	Insert	Insert Screw	Torx Driver
52	FCT45 006.052AN	1041011	16	40	22	40	4	XOKX	RCKX	OCKX	XCKX	SAHT	1045777	1048344
66	FCT45 006.066AN	1041012	16	50	27	48	5	1606	1606	0606	1606	1306	M5	T20
80	FCT45 006.080AN	1041013	16	50	27	60	6							
100	FCT45 006.100AN	1041014	16	50	32	65	7							
125	FCT45 006.125AN	1041015	16	63	40	90	8							
160	FCT45 006.160AN	4053555	16	63	40	95	9							

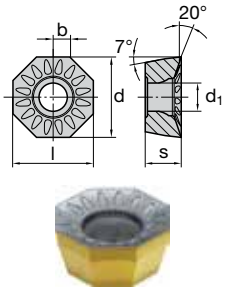
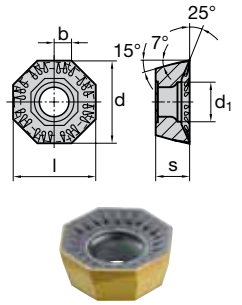
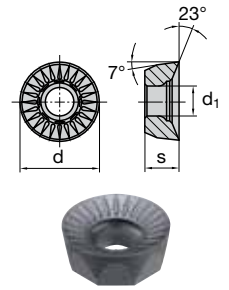
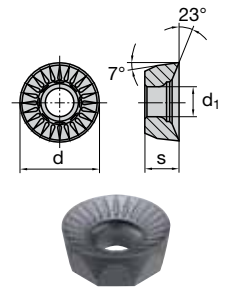
Limited stock of metric products in U.S., please contact Customer Service for availability

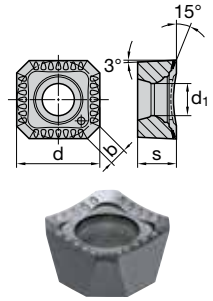
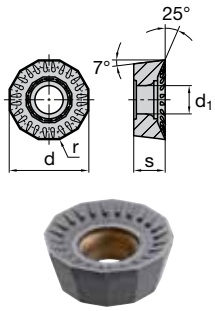
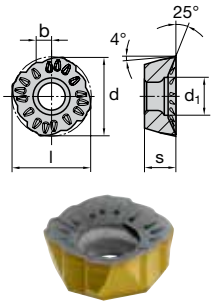
FCT45
Inch

d_1	Cutter Body No.	EDP No.	Ident No.	max doc 8 edge	max doc 12 edge	d_4	h	d_2	z ✿	Insert	Insert	Insert	Insert	Insert	Insert Screw	Torx Driver
2.00	FCT45 O06-200AA	50300	1950259	0.157	0.079	0.63	1.57	0.75	4	XOKX	RCKX	OCKX	XCKX	SAHT	50255	50258
2.50	FCT45 O06-250AA	50302	1950260	0.157	0.079	0.63	1.97	0.75	4	1606	1606	0606	1606	1306	M5	T20
3.00	FCT45 O06-300AB	50304	1950261	0.157	0.079	0.63	1.97	1.00	5							
4.00	FCT45 O06-400AD	50306	1950262	0.157	0.079	0.63	1.97	1.50	7							
5.00	FCT45 O06-500AD	50308	1950263	0.157	0.079	0.63	2.48	1.50	8							

See page 61–62 for Inserts

Cutting data recommendations starting page 138–139

N = Number of cutting edges	l	d	s	d_1	b	ISO-Code Cat-No.	Cutting materials Ident No. LC280QN	LC240T	LC225T	LCK10M	LC610Q	LC610T	For cutter Cat-No.
 N = 8	12 (.472)	12 (.472)	5.56 (.219)	4.4 (.173)	0.5 (.020)	OCKX 0505 AD-TR	7002759	1054050		7047992	7002761	1054055	FCT45
 N = 8	16 (.630)	16 (.630)	6.35 (.250)	5.8 (.228)	0.5 (.020)	OCKX 0606 AD-TR	7002774	1054003	7002770	7047993	7002781	1054005	FCT45
	16 (.630)	16 (.630)	6.35 (.250)	5.8 (.228)	0.5 (.020)	OCKX 0606 AD-TRT	7002782			7047994		1054011	
	–	12 (.472)	5.56 (.219)	4.4 (.173)	–	RCKX 1205 MO-TR	7002749	1068470		7047995	7002758	1068475	FCT45
	–	16 (.630)	6.35 (.250)	5.8 (.228)	–	RCKX 1606 MO-TR	7002762	1068433	7002764	7047996	7002763	1068435	FCT45
	–	16 (.630)	6.35 (.250)	5.8 (.228)	–	RCKX 1606 MO-TRT	7002767		7002768	7047997		1068464	

N = Number of cutting edges	l	d	s	d_1	b	ISO-Code Cat-No.	Cutting materials Ident No.									For cutter Cat-No.
							LC280QN	LC240T	LC225T	LC440T	LC444W	LCK10M	LC610Q	LC610T	LW610	
 N = 4	10 (.394)	10 (.394)	5.56 (.219)	4.4 (.173)	0.8 (.031)	SAHT 1005 AA ER		9197815		9206751	9206752	7048354	7002745	9197816	9206753	FCT45
	13.5 (.531)	13.5 (.531)	6.35 (.250)	5.5 (.217)	0.8 (.031)	SAHT 1306 AA EN		1054040		9206754	9206755	7048355	7002747	1054045	9206774	
 N = 12	16 (.630)	16 (.630)	6.35 (.250)	5.8 (.228)	0.5 (.020)	XCKX 1606 ZDR-TR		1055677					7002783	1055678		FCT45
 N = 4	16 (.630)	16 (.630)	6.35 (.250)	5.8 (.228)	0.5 (.020)	XOKX 1606 ZD-TR	1054023	1054021	1054020				1054024	1054022		FCT45

Milling of Austempered Cast Iron Class 2

APPLICATION: Rough and Finish Face Milling in a single pass

CUSTOMER: General Machining Shop

MACHINE: CAT 40 Taper – 30 HP

STARTING SITUATION: Customer was unable to achieve tight surface finish requirements with existing competitors milling tools

PROBLEM: Operation requires both rough and finish face mills to achieve required RMS finish. Customer is also reporting reduced tool life with competitor's tooling.

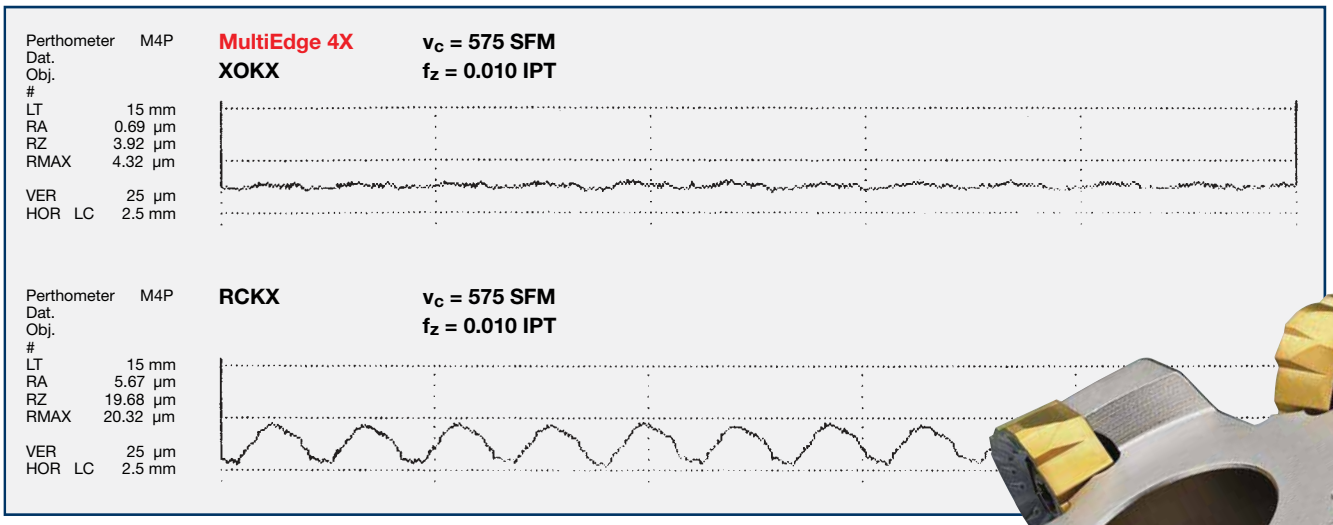
SOLUTION: FCT45 Face Mill with XOKX 1606 inserts to rough and finish in one pass

CUSTOMER BENEFIT: Increase in productivity through reduced cycle times and fewer tool changes

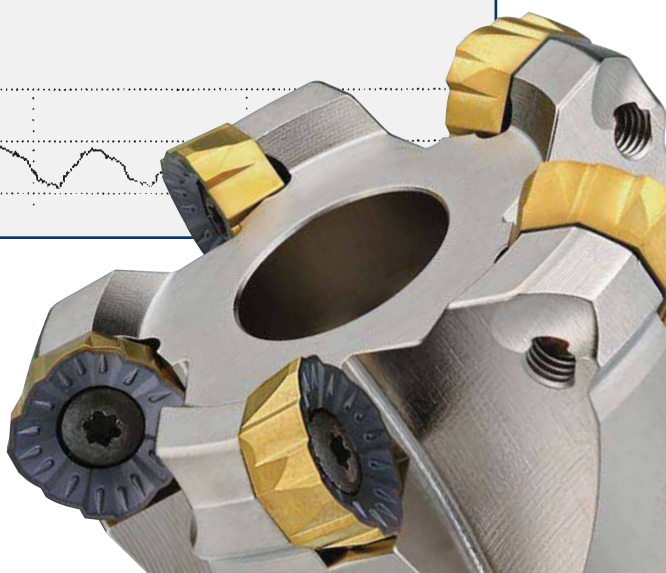
TARGET MARKETS: Production shops looking to increase efficiency

TOOL LIFE / EXPECTENCY:
Competitor (1-2 parts), LMT (18-20 parts)

CUTTING DATA:
- Face Mill: 4.00" FCT45 O06-400AD
- Insert: XOKX 1606 ZD TR LC610T
- Speed: 350 SFM (334 RPM)
- Feed: .012" FPT (28 IPM)
- DOC: .125"
- WOC: 3.00"
- Surface Finish Requirement: 42 RMS

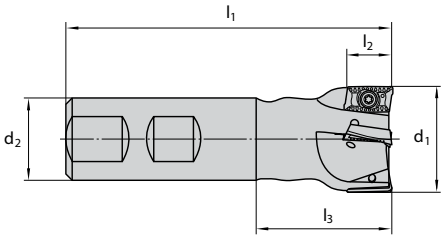


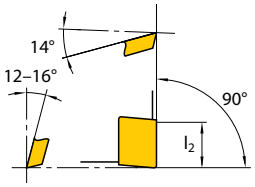
Surface quality



DIN 1835 B

Metric





d_1	LMT-Code	Ident No.	l_2	l_1	l_3	d_2	z ✪	Insert	Insert Screw	Torx Driver
20	EMU90 A12.020BN-I	1045090	12	86	36	20	2	ADHX 12 . . .	2237513	T08
25	EMU90 A12.025BI-I	1045092	12	86	36	20	3	ADKX 12 . . .		1048326
32	EMU90 A12.032BG-I	1045093	12	96	40	25	4			
32	EMU90 A12.032BG-IF	1045094	12	96	40	25	5			
40	EMU90 A12.040BF-I	1045095	12	110	50	32	6			

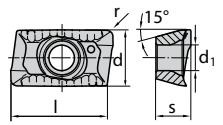
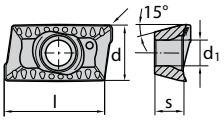
Limited stock of metric products in U.S., please contact Customer Service for availability

Inch

d_1	LMT-Code	Ident No.	l_2	l_1	l_3	d_2	z ✪	Insert	Insert Screw	Torx Driver
0.750	EMU90 A12.075WDI	7168965	0.472	3.250	1.220	0.750	2	ADHX 12 . . .	2237513	T08
1.000	EMU90 A12.100WDI	7168966	0.472	3.250	1.220	1.000	3	ADKX 12 . . .		1048326
1.250	EMU90 A12.125WEI	7168967	0.472	3.500	1.220	1.000	4			
1.250	EMU90 A12.125WEIF	7168968	0.472	3.500	1.220	1.000	5			

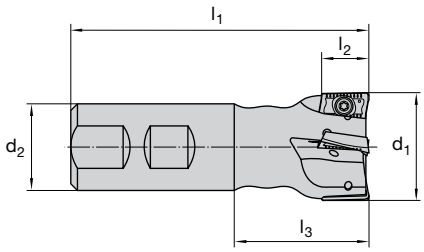
See page 65 for Inserts

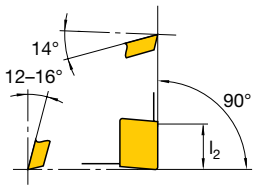
Cutting data recommendations starting page 140

N = Number of cutting edges	l	d	s	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LC240T	LCM40M	LCM44M	LCK10M	LC610T	LW610	For cutter Cat-No.
  N = 2	12.7	7.4	4.76	3.4	0.8	ADHX 120408 FR-ALC					1069074	7019511	FMU90 IK
	12.7	7.4	4.76	3.4	1.2	ADHX 120412 FR-ALC					1069079	7019512	
	12.7	7.4	4.76	3.4	1.6	ADHX 120416 FR-ALC					1069084	7019513	
	12.7	7.4	4.76	3.4	2	ADHX 120420 FR-TR					1069089	7019514	
  N = 2	12.7	7.4	4.76	3.4	0.8	ADKX 120408 SR-TR	1069070	7054285	7054286	7048193	1069071		FMU90 IK
	12.7	7.4	4.76	3.4	1.2	ADKX 120412 SR-TR	1069075	7054287	7054288	7048194	1069076		
	12.7	7.4	4.76	3.4	1.6	ADKX 120416 SR-TR	1069080	7054289	7054290	7048195	1069081		
	12.7	7.4	4.76	3.4	2	ADKX 120420 SR-TR	1069085	7054291	7054292	7048196	1069086		
	12.7	7.4	4.76	3.4	4[1)]	ADKX 120440 SR-TR	7017226						

1) From corner radius r > 2, subsequent machining must be carried out on the plate in the corner area.

EMU90 IK
Inch





All bodies have Internal Coolant

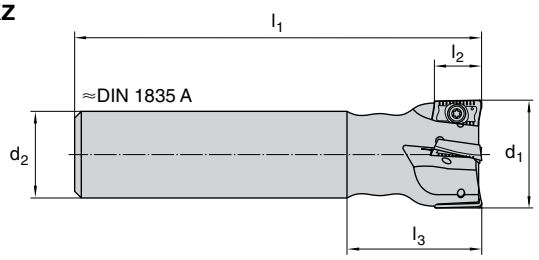
d_1	Cutter Body No.	EDP No.	Ident No.	doc l_2	l_1	l_3	d_2	z ✿	Insert	Insert Screw	Torx Driver
1.00	EMU90 A17-100WEI	12911	1950345	0.650	4.000	1.720	1.000	2	ADKX 1705	89973	50259
1.00	EMU90 A17-100SEI	12912	1950346	0.650	6.000	1.720	1.000	2		M3.5	T15
1.25	EMU90 A17-125WFI	12914	1950348	0.650	4.000	1.720	1.250	2		89974	
1.25	EMU90 A17-125SFI	12915	1950349	0.650	6.000	1.720	1.250	2		M3.5	
1.25	EMU90 A17-125WFI	12917	1950351	0.650	4.000	1.720	1.250	3			
1.25	EMU90 A17-125SCFI	12918	1950352	0.650	6.000	1.720	1.250	3			
1.50	EMU90 A17-150WGI	12919	1950353	0.650	4.500	1.720	1.500	3			
1.50	EMU90 A17-150SGI	12920	1950354	0.650	6.000	1.720	1.500	3			
1.50	EMU90 A17-150WGIF	12922	1950356	0.650	4.500	1.720	1.500	4			
1.50	EMU90 A17-150SGIF	12923	1950357	0.650	6.000	1.720	1.500	4			

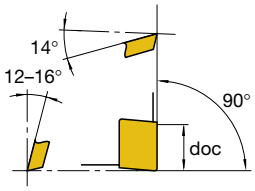
EMU90 IK
Metric

d_1	Cutter Body No.	Ident No.	l_2	l_1	l_3	d_2	z ✿	Insert	Insert Screw	Torx Driver
20	EMU90 A11.020BN-IF	1045046	10.5	86	36	20	2	ADKX 1103	2237513	1048326
25	EMU90 A11.025BN-IF	1045047	10.5	96	40	25	3		M3.0	T8
32	EMU90 A11.032BN-IF	1045048	10.5	110	50	32	5			
40	EMU90 A11.040BF-IF	1045049	10.5	110	50	32	6			
25	EMU90 A17.025BN-IF	1045050	16.5	96	40	25	2	ADKX 1705	1045114	1048335
32	EMU90 A17.032BN-IF	1045053	16.5	110	50	32	3		M3.5	T15
40	EMU90 A17.040BF-IF	1045054	16.5	110	50	32	4			

See page 62–70 for Inserts
Cutting data recommendations starting page 140
Limited stock of metric products in U.S., please contact Customer Service for availability

EMU90
Inch
IKZ





All bodies have Internal Coolant

d_1	Cutter Body No.	EDP No.	Ident No.	doc l_2	l_1	l_3	d_2	z ✿	Insert	Insert Screw	Torx Driver
1.00	EMU90 A17-100SEI	12913	1950347	0.650	10.00	1.720	1.000	2	ADKX 1705	89973 M3.5	50259 T15
1.25	EMU90 A17-125SFI	12916	1950350	0.650	10.00	1.720	1.000	2		89974	
1.50	EMU90 A17-150SGI	12921	1950355	0.650	10.00	1.720	1.250	3		M3.5	

EMU90
Metric

d_1	Cutter Body No.	Ident No.	doc l_2	l_1	l_3	d_2	z ✿	Insert	Insert Screw	Torx Driver
20	EMU90 A11.020AN-IF	1045040	10.5	200	36	20	2	ADKX 1103	2237513	1048326
25	EMU90 A11.025AN-IF	1045041	10.5	200	40	25	3	ADHX 1103	M3.5	T8
32	EMU90 A11.032AN-IF	1045042	10.5	250	50	32	5	ADMX 1103		
25	EMU90 A17.025AN-IF	1045043	16.5	200	40	25	2	ADKX 1705	1045114	1048335
32	EMU90 A17.032AN-IF	1045044	16.5	250	50	32	3		1045114	T15
40	EMU90 A17.040AF-IF	1045045	16.5	250	50	32	4		M3.5	

See page 62–70 for Inserts
Limited stock of metric products in U.S., please contact Customer Service for availability

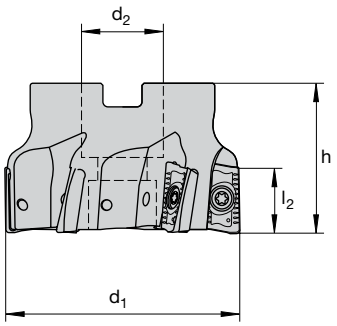
Cutting data recommendations starting page 140

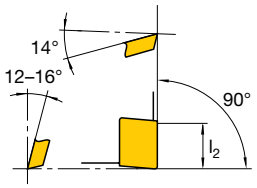
FMU90 (11415-IK)

Application

- High performance milling cutter for face, slot and square shoulder milling of steel, stainless and non-ferrous materials
- High positive axial rake angle provides quiet and smooth cutting action

FMU90
Inch
IK





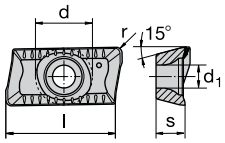
All bodies have internal coolant

d_1	Cutter Body No.	EDP No.	Ident No.	l_2	h	d_2	z	Insert	Insert Screw	Torx Driver
2.00	FMU90 A17-200AAI	12903	1950280	0.650	1.575	0.750	4	ADKX	89974	50259
2.00	FMU90 A17-200AAIF	12904	1950281	0.650	1.575	0.750	5	1705_ _	M3.5	T15
2.50	FMU90 A17-250ABI	12905	1950282	0.650	1.575	1.000	5			
2.50	FMU90 A17-250ABIF	12906	1950283	0.650	1.575	1.000	6			
3.00	FMU90 A17-300ACI	12907	1950284	0.650	1.969	1.250	5			
3.00	FMU90 A17-300ACIF	12908	1950285	0.650	1.969	1.250	8			
4.00	FMU90 A17-400ADI	12909	1950286	0.650	1.960	1.500	6			
4.00	FMU90 A17-400ADIF	12910	1950287	0.650	1.990	1.500	9			
5.00	FMU90 A17-500ADIF	18801	9187004	0.670	1.970	1.500	9			
6.00	FMU90 A17-600AEIF	18804	9186523	0.670	1.970	2.000	10			

FMU90
Metric

d_1	Cutter Body No.	Ident No.	l_2	h	d_2	z	Insert	Insert Screw	Torx Driver
40	FMU90 A17.040AN-IF	1045035	16.5	36	16	4	ADKX	1045114	1048335
50	FMU90 A17.050AN-IF	1045036	16.5	40	22	5	1705_ _	M 3.5	T15
63	FMU90 A17.063AN-IF	1045037	16.5	40	22	6			
80	FMU90 A17.080AN-IF	1045038	16.5	50	27	8			
100	FMU90 A17.100AN-IF	1045039	16.5	50	32	9			

See page 69–70 for Inserts
Cutting data recommendations starting page 140
Limited stock of metric products in U.S., please contact Customer Service for availability

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LC240Q	LC240T	LC240S	LC230E	LC225T	LC225S	LC630T	LW240	LW225	LC440T	LC444W	LC610E	LC610T	LC610A	LW610	LC603Z	For cutter Cat-No.
 N = 2	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	0.8 (.031)	ADKX 170508 SR-TR		2412980					2413978						2414004				FMU90
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.2 (.047)	ADKX 170512 SR-TR		2412982					2413980						2414005				
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.6 (.062)	ADKX 170516 SR-TR		2412984					2413982						2414006				
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	2 (.079)	ADKX 170520 SR-TR		2412986					2413984						2414007				
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	3.2 (.125)	ADKX 170532 SR-TR							2413228										
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	6.4 (.250)	ADKX 170564 SR-TR							2413230										
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	0.8 (.031)	ADHX 170508 FR-ALC													2414009		9206028		
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.2 (.047)	ADKX 170512 FR-ALC													7019835		7019836		
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.6 (.063)	ADHX 170516 FR-ALC													7019837		7019838		
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	2.0 (.078)	ADKX 170520 FR-ALC													7019839		7019840		
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	3.1 (.122)	ADHX 170531 FR-ALC													7019841		7019842		
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	4.0 (.157)	ADKX 170540 FR-ALC													7011958		7011957		

Note: ALC Geometry for Aluminum Milling
*When r > 2.0 (.078") Body must be modified for Clearance

Application Examples

Material: 4140 Pre-Hard
Hardness: 27-32 HRC

LMT-Fette UNIVEX PREMIUM Face Milling Cutter
FMU90 A17-200
Ø 2.00" 5 teeth
with inserts
Insert Grade LC630T

Cutting Data

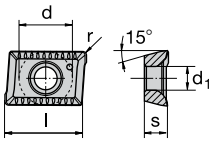
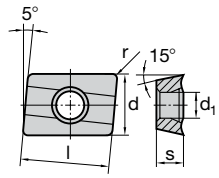
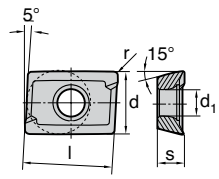
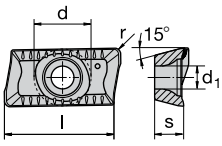
sfm	=	825	ipm	=	40
rpm	=	1,600	woc	=	1.400"
ipt	=	.006"	doc	=	.400"

Material: 4140 Pre-Hard
Hardness: 27-32 HRC

LMT-Fette UNIVEX PREMIUM End Mill
Cat. Desc. EMU90
Ø 1.00" 2 teeth
with inserts
Insert Grade LC630T

Cutting Data

sfm	=	1,100	ipm	=	53
rpm	=	2,130	woc	=	.020"
ipt	=	.005"	doc	=	.500"

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LC240Q	LC240T	LC240S	LC230E	LC225T	LC225S	LC630T	LW240	LW225	LC440T	LC444W	LC610E	LC610T	LC610A	LW610	For cutter Cat-No.
 N = 2	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.5 (.020)	ADKX 110305 SR-TR		2413010					2413970						2414000			EMU90IK
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.8 (.031)	ADKX 110308 SR-TR		2413012					2413972						2414001			
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	1.2 (.047)	ADKX 110312 SR-TR		2413014					2413974						2414002			
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	1.6 (.063)	ADKX 110316 SR-TR		2413016					2413976						2414003			
 N = 2	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.5 (.020)	ADHX 110305 ER 1196-82	1068011	1069402	1069459				2410308	1069457					1069490		1069445	EMU90IK
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.8 (.031)	ADHX 110308 ER 1196-82 R03							1960108								1960070	
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	1.5 (.059)	ADHX 110315 ER 1196-82 R06							2410309	1960074						1960073		
 N = 2	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.5 (.020)	ADHX 110305 FR-ALC 1196-82 ALC													1069534		1069533	EMU90IK
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	0.8 (.031)	ADHX 170508 FR-ALC													2414009			FMU90
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.2 (.047)	ADHX 170512 FR-ALC															9206028	
 N = 2	17.5 (.689) (.031)	5.6 (.221)	9.62 (.379)	3.8 (.150)	0.8	ADKX 170508 SR-TR		2412980					2413978						2414004			FMU90
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.2 (.047)	ADKX 170512 SR-TR		2412982					2413980						2414005			
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.6 (.062)	ADKX 170516 SR-TR		2412984					2413982						2414006			
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	2 (.079)	ADKX 170520 SR-TR		2412986					2413984						2414007			
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	3.2 (.125)	ADKX 170532 SR-TR							2413228									
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	6.4 (.250)	ADKX 170564 SR-TR							2413230									

Note: Larger Radii ALC Inserts See Page 37

ALUMINUM COMPONENT GUIDE COLUMN

TOOL:
FMU90 IK, d_1 = 20, z = 5

MATERIAL:
3.2315 / EN AW-6082 (Al Si1MgMn)

INSERT:
ADHX 170508SR-ALC, LW610

CUTTING DATA:
v_c = 3288 SFM
n = 6350 RPM
f_z = 0.006"
v_f = 187 IPM
woc = 0.394"
doc = 0.197"

INJECTOR

TOOL:
EMU90 IK, d1 = 1/2", z = 2

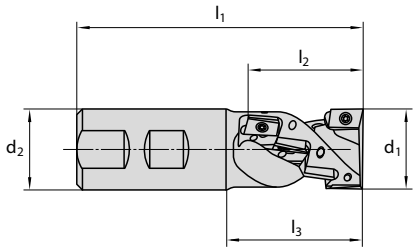
MATERIAL:
4140

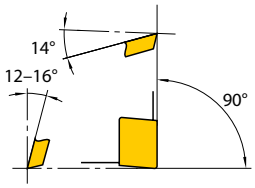
INSERT:
ADKX 060204 SR, LC610T

CUTTING DATA:
v_c = 705 SFM
n = 5700 RPM
f_z = 0.002"
v_f = 22.5 IPM
woc = 0.472"
doc = 0.148"

DIN 1835B

Metric





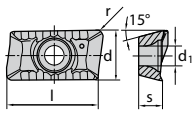
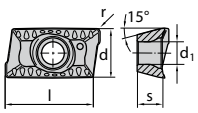
d_1	LMT-Code	Ident No.	No. of Inserts	l_2	l_1	l_3	d_2	z ✪	Insert	Insert Screw	Torx Driver
20	ERU90 A09.020BN-I	7097646	6	25	86	36	20	2	ADHX 09 . . .	2127640	1048326
25	ERU90 A09.025BN-I	7097647	8	33	100	44	25	2	ADKX 09 . . .		T8
32	ERU90 A09.032BN-I	7097649	15	41	115	55	32	3			
32	ERU90 A09.032BN-I	7097651	8	45	115	55	32	2	ADHX 12 . . .	2237513	
40	ERU90 A09.040BN-I	7097653	15	55	140	70	40	3	ADKX 12 . . .		

Inch

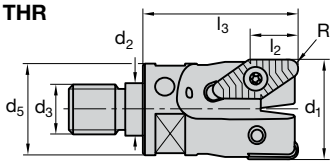
d_1	LMT-Code	Ident No.	No. of Inserts	l_2	l_1	l_3	d_2	z ✪	Insert	Insert Screw	Torx Driver
0.750	ERU90 A09.075WDI	7170123	6	1.00	3.50	1.47	0.75	2	ADHX 09 . . .	2127640	1048326
1.000	ERU90 A09.100WEI	7170124	8	1.30	4.00	1.72	1.00	2	ADKX 09 . . .		T8
1.250	ERU90 A12.125WFI	7170125	8	1.80	4.50	2.22	1.25	2	ADHX 12 . . .	2237513	
1.500	ERU90 A12.150WGI	7170126	15	2.20	5.50	2.81	1.50	3	ADKX 12 . . .		

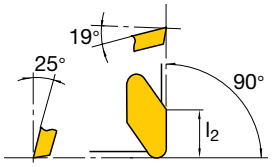
See Page 65 & 72 for Inserts
See pages 54-55 for Screw-On Shanks

Cutting data recommendations starting page 140, 142 & 143

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	LC240T	LCM40M	LCM44M	LCK10M	LC610T	LW610	For cutter Cat-No.
  N = 2	9.52	5.56	3.18	2.8	0.8	ADHX 090308 FR-ALC					1069059	7019458	EMU90 IK
	9.52	5.56	3.18	2.8	1.2	ADHX 090312 FR-ALC					1069064	7019459	
	9.52	5.56	3.18	2.8	1.6	ADHX 090316 FR-ALC					1069069	7019510	
  N = 2	9.52	5.56	3.18	2.8	0.4	ADKX 090304 SR-TR	1069050			7048189	1069051		EMU90 IK
	9.52	5.56	3.18	2.8	0.8	ADKX 090308 SR-TR	1069055	7054279	7054280	7048190	1069056		
	9.52	5.56	3.18	2.8	1.2	ADKX 090312 SR-TR	1069060	7054281	7054282	7048191	1069061		
	9.52	5.56	3.18	2.8	1.6	ADKX 090316 SR-TR	1069065	7054283	7054284	7048192	1069066		

EMZ 90 THR
IKZ



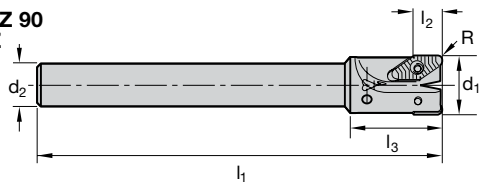


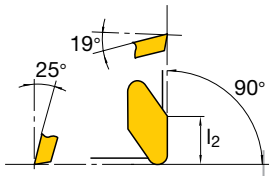
d_1	R	l_3	l_2	d_5	d_3	d_2h6	z ✡	Cutter Body No.	Ident No.	Insert	Insert Screw	Torx Driver
20	0.4	30	10	18	M10	10.5	2	EMZ90 V11.020TS030-I	1043246	VPGT 110304-ALM	1044972	1048326 T8
25	1.2	40	13.5	21	M12	12.5	2	EMZ90 V16.025TF040-I	1043247	VPGT 160412-ALM	1051312	1048335
32	3	50	15	29	M16	17	2	EMZ90 V22.032TH050-I	1043248	VCGT 220530-ALM	1045766	T15
35	3	50	15	29	M16	17	2	EMZ90 V22.035TH050-I	1043250			
42	3	50	15	29	M16	17	3	EMZ90 V22.042TH050-I	1043249			

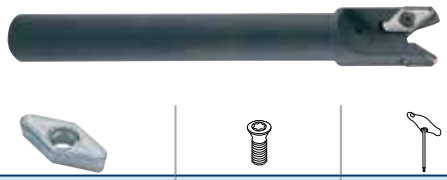
d_1	R	l_3	l_2	d_5	d_3	d_2h6	z ✡	Cutter Body No. (inches)*	Ident No.	Insert	Insert Screw	Torx Driver
1.00	0.05	1.57	0.53	0.83	M12	0.49	2	EMZ90 V16.100TF-I	1950301	VPGT 160412-ALM	1051312	1048335
1.25	0.12	1.97	0.59	1.02	M16	0.67	2	EMZ90 V22.125TH-I	1950302	VCGT 220530-ALM	1045766	
1.50	0.12	1.97	0.59	1.02	M16	0.67	2	EMZ90 V22.150TH-I	1950303			

See Page 75 for Inserts
See pages 54-55 for Screw-On Shanks
Cutting data recommendations starting page 144–145

EMZ 90
IKZ





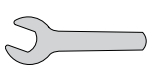


Overhang and infeed parameters to be choosen in accordance to application.

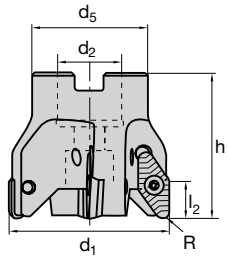
d_1	R	l_3	l_2	l_1	d_2	z ✡	Cutter Body No.	Ident No.	Insert	Insert Screw	Torx Driver
20	0.4	30	10	175	16	2	EMZ90 V11.020AJ-I	1043242	VPGT 110304-ALM	1044972	1048326 T8
25	1.2	40	13.5	200	20	2	EMZ90 V16.025AI-I	1043243	VPGT 160412-ALM	1051312	1048335
32	3.0	50	15	220	25	2	EMZ90 V22.032AG-I	1043244	VCGT 220530-ALM	1045766	T15
35	3.0	50	15	220	25	2	EMZ90 V22.035AG-I	1043251			

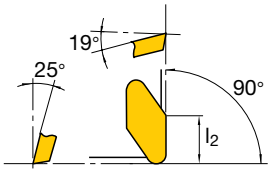
d_1	R	l_3	l_2	l_1	d_2	z ✡	Cutter Body No. (inches)*	Ident No.	Insert	Insert Screw	Torx Driver
1.00	0.05	2.00	0.53	8.00	0.75	2	EMZ90 V16-100SA-I	0054651	VPGT 160412-ALM	1044972	1048326
1.00	0.05	1.58	0.53	7.88	1.00	2	EMZ90 V16-100SB-I	1950291	VPGT 160412-ALM	1051312	1048335
1.00	0.05	2.00	0.53	4.28	1.00	2	EMZ90 V16-100WB-I	0054286	VPGT 160412-ALM		
1.25	0.05	2.00	0.53	8.00	1.00	2	EMZ90 V16-125SB-I	0054294	VPGT 160412-ALM		
1.25	0.05	2.00	0.53	4.28	1.25	2	EMZ90 V16-125WC-I	0054287	VPGT 160412-ALM		
1.50	0.05	2.00	0.53	8.00	1.00	2	EMZ90 V16-150SC-I	0054295	VPGT 160412-ALM		
1.50	0.05	2.00	0.53	4.88	1.25	2	EMZ90 V16-150WC-I	0054288	VPGT 160412-ALM		
1.25	0.12	2.00	0.59	8.62	1.00	2	EMZ90 V22-125SB-I	1950292	VCGT 220530-ALM	1045766	
1.50	0.12	2.00	0.59	8.62	1.00	2	EMZ90 V22-150SB-I	1950293	VCGT 220530-ALM		

See page 75 for Inserts
Cutting data recommendations starting page 144

Open End Wrench	Wrench Size	Ident No.	For Head Sizes
	15mm		20mm, .750"
	17mm	2146612	25mm, 1.00"
	19mm	2146613	32mm, 1.25"
	19mm	2146613	42mm, 1.50"

FMZ 90 IKZ



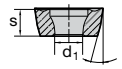
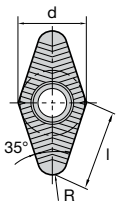


d_1	R	l_2	h	d_2	d_5	z ☼	Cutter Body No.	Ident No.	Insert	Insert Screw	Torx Driver
42	3	15	55	16	32.0	3	FMZ90 V22.042AN-I	1043253	VCGT 220530-ALM	1045766	1048335
52	3	15	55	22	40.0	3	FMZ90 V22.052AN-I	1043254		M5	T15
66	3	15	60	27	48.0	4	FMZ90 V22.066AN-I	1043255			
80	3	15	60	27	60.0	4	FMZ90 V22.080AN-I	1043256			
100	3	15	65	32	80.0	5	FMZ90 V22.100AN-I	1043257			
125	3	15	70	40	100.0	6	FMZ90 V22.125AN-I	1043258			

d_1	R	l_2	h	d_2	d_5	z ☼	Cutter Body No. (inches)*	Ident No.	Insert	Ident No.	Ident No.
1.50	0.05	0.53	2.12	0.75	1.26	3	FMZ90 V16.150AA-I	1950294	VPGT 160412-ALM	1051312	1048335
2.00	0.05	0.53	2.12	0.75	1.75	4	FMZ90 V16.200AA-I	0053521		M4	T15
2.00	0.12	0.59	2.12	0.75	1.57	3	FMZ90 V22.200AA-I	1950295	VCGT 220530-ALM	1045766	
2.50	0.12	0.59	2.12	0.75	1.750	4	FMZ90 V22.250AA-I	1950296		M5	
2.50	0.12	0.59	2.12	1.00	2.200	4	FMZ90 V22.250	0018680			
3.00	0.12	0.59	2.12	1.00	–	3	FMZ90 V22.300AB-I	0054794			
3.00	0.12	0.59	2.12	1.00	2.36	4	FMZ90 V22.300ABE-I	1950297			
3.00	0.12	0.59	2.12	1.00	2.29	5	FMZ90 V22.300ABF-I	0054781			
4.00	0.12	0.59	2.12	1.50	3.15	5	FMZ90 V22.400AD-I	1950298			

See Page 75 for Inserts

Cutting data recommendations starting page 144–145

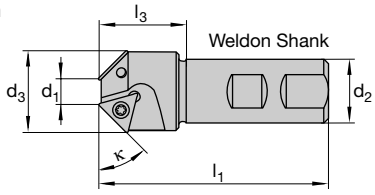
N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LC610T	Cutting materials Ident No. LWNS10M	For cutter Cat-No.
	11.61 (.457)	3.18 (.125)	6.35 (.250)	2.8 (.110)	0.4 (.016)	VPGT110304-ALM (11° Clearance Angle)	1069756	1069755	EMZ90 FMZ90
	16.60 (.654)	4.76 (.187)	9.52 (.375)	4.4 (.173)	1.2 (.047)	VPGT160412-ALM (11° Clearance Angle)	1069758	1069757	
	22.10 (.866)	5.56 (.219)	12.70 (.500)	5.5 (.217)	3.0 (.118)	VCGT220530-ALM (7° Clearance Angle)	1069760	1069759	

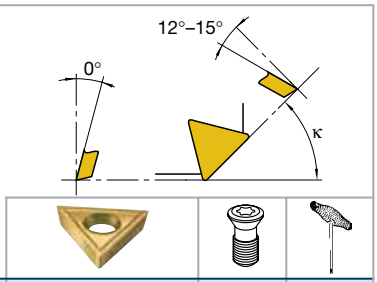
EFZ45/60

Application

- Chamfer-countersinking mills for both manual and CNC machines
- Positive cutting geometry provides free-cutting action on a wide variety of materials
- Available in 45° and 60° chamfer angles
- Uses industry standard inserts

ERT90
Inch





d_1	Cutter Body No.	EDP	Dimensions (inches) K	d_3	l_1	l_3	d_2	No. Teeth	Euro Ref. No.	Insert	Insert Screw	Torx Driver
0.05	EFZ45 T11-047WB	50480	45°	0.63	2.16	0.79	0.50	1	1950224	TCMT 110202	89972	89978
0.24	EFZ45 T11-244WC	50482		0.83	3.15	1.26	0.63	2	1950226			
0.41	EFZ45 T16-409WE	50484		1.26	3.74	1.26	1.00	2	1950228	TCMT 16T304	89974	50259
0.21	EFZ60 T11-213WB	50486	60°	0.63	2.76	0.79	0.50	1	1950230	TCMT 110202	89972	89978
0.57	EFZ60 T11-567WC	50488		0.98	3.15	1.26	0.63	2	1950232			
0.63	EFZ60 T16-630WE	50490		1.26	3.74	1.42	1.00	2	1950233	TCMT 16T304	89974	50259

See page 77 for Inserts

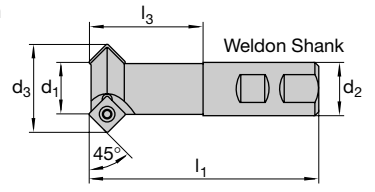
Cutting data recommendations starting page 142–143

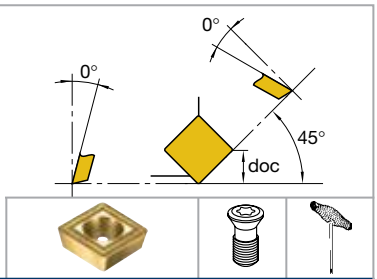
EFP45

Application

- Multiple application chamfer milling cutter for steel, stainless and non-ferrous materials
- Positive cutting action provides smooth and quiet cutting
- Unique design chamfers top and bottom bores; mill “V” grooves; chamfer T slots; and chamfer slots

EFP45
Inch

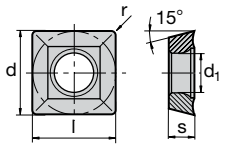
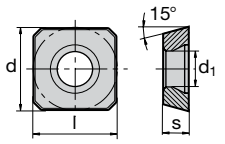
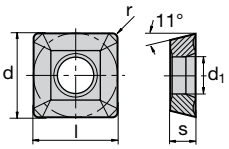
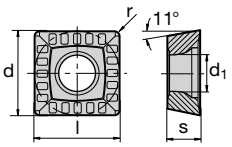
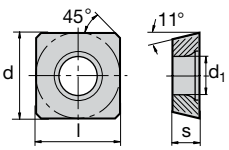
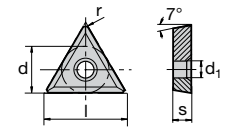


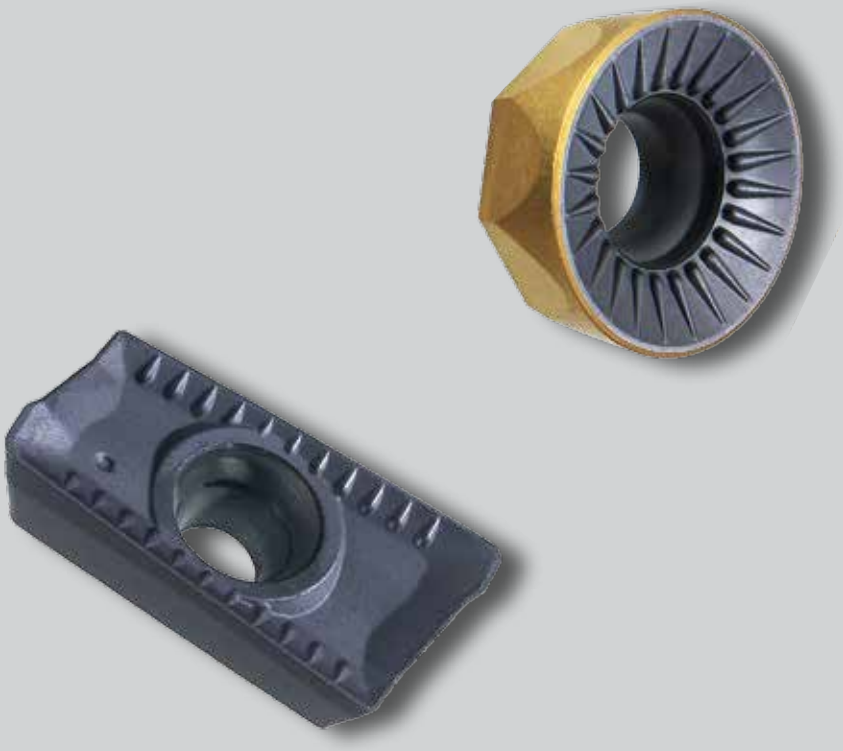


d_1	Cutter Body No.	EDP	Dimensions (inches) d_3	l_1	l_3	d_2	No. Teeth	Euro Ref. No.	Insert	Insert Screw	Torx Driver
0.63	EFP45 S09-063WC	50476	1.13	3.35	1.46	0.63	2	1950135S	SDMT 090308	60712	50259
1.26	EFP45 S12-126WF	50478	1.94	4.92	2.56	1.25	3	1950136	SPMT 120408	89971	50258

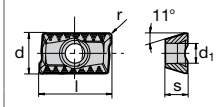
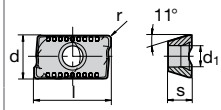
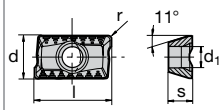
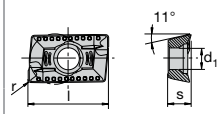
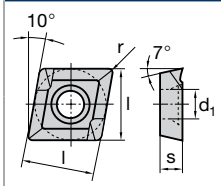
See page 77 for Inserts

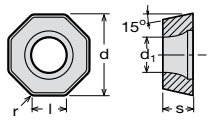
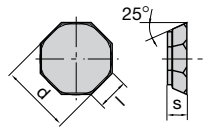
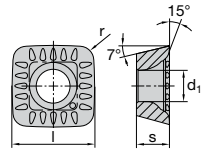
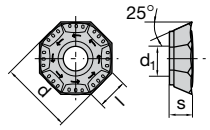
Cutting data recommendations starting page 142–143

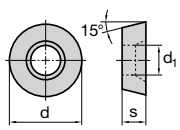
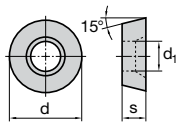
N = Number of cutting edges	l	s	d	d_1	b/r	ISO-Code	Cutting materials Ident No. LC240T	LC230E	LC240S	LC225T	LC225S	LW240	LW225	LC440T	LC444W	LC615E	LC610T	LC610A	LW610	For cutter Cat-No.
 N = 4	9.52 (.375)	3.18 (.125)	9.52 (.375)	4 (.157)	0.8 (.031)	SDMT 090308 (SDMT 322)					6406726								1069160	EFZ45
 N = 4	9.52 (.375)	3.18 (.125)	9.52 (.375)	4 (.157)	0.8 (.031)	SDMW 090308 (SDMW 322)	1069127		1069439	6406733	1069126								1069106	EFZ45
 N = 4	9.52 (.375)	3.18 (.125)	9.52 (.375)	4 (.157)	0.8 (.031)	SPMT 120408SN (SPMT 432)	2308343		1069299						6406965		1055660		1069295	EFZ45
 N = 4	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.2 (.205)	0.8 (.031)	SPMT 120408SN-BP (SPMT 432)				6406962										EFZ45
 N = 4	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.2 (.205)	0.8 (.031)	SPMW 120408 (SPMW 432)	1069128		1069437	6406966						6400590	1069232		1069231	EFZ45
 N = 3	11 (.433)	2.4 (.094)	6.35 (.250)	2.8 (.110)	0.2 (.008)	TCMT 110202 1166-00					1052102						1055661		1052107	EFZ45T11 EFZ60T11 EFZ30T16 EFZ45T16 EFZ60T16
	16.5 (.650)	3.97 (.156)	9.52 (.375)	4.3 (.169)	0.4 (.016)	TCMT 16T304 1166-10					1052103						1055662		1052109	



ISO & Other Milling Inserts

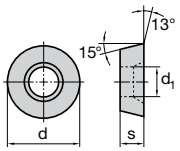
N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No. LC240Q	LC240T	LC230E	LC225T	LC240S	LC225S	LC630T	LW225	LC440T	LC430T	LC444W	LC615E	LC610T	LC610A	LW610	LW630	For cutter Cat-No.
 N = 2	10.96 (.431)	3.5 (.138)	6.6 (.260)	2.8 (.110)	0.5 (.020)	APKT 100305 PDSR-BM											1067520							EMH90 FMH90
	10.96 (.431)	3.5 (.138)	6.6 (.260)	2.8 (.110)	0.5 (.020)	APKT 100305 PDSR-BP	1052345	1052343		6401076					1067504								
 N = 2	16.33 (.643)	4.36 (.172)	–	4.5 (.177)	0.6 (.024)	APKT 15T306 PDTR-BP																	
	–	–	–	–	–	APKT 15T306 PDSR-BP												6400575					
 N = 2	17.3 (.681)	5.26 (.207)	9.52 (.375)	4.5 (.177)	0.8 (.031)	APKT 160408 PDSR-BM											1067522						EMH90 FMH90 MMH90
 N = 2	17.3 (.681)	5.26 (.207)	9.52 (.375)	4.5 (.177)	0.8 (.031)	APKT 160408 PDSR-BP	1067517	1067507		6401085	1067506		6413391		1067503				1067512			1067515	EMH90 FMH90 MMH90
	17.3 (.681)	5.26 (.207)	9.52 (.375)	4.5 (.177)	1.6 (.062)	APKT 160416 PDSR				6401089			6413393										EMH90 FMH90 MMH90
	17.3 (.681)	5.26 (.207)	9.52 (.375)	4.5 (.177)	2.4 (.094)	APKT 160424 PDSR				6401092			5015425										EMH90 FMH90 MMH90
	17.3 (.681)	5.26 (.207)	9.52 (.375)	4.5 (.177)	3.2 (.125)	APKT 160432 PDSR				6401095			5015426										EMH90 FMH90 MMH90
 N = 2 s = ± 0.025 d = ± 0.01	7.94 (.313)	2.78 (.109)	–	3.4 (.134)	0.3 (.012)	CCHX 080203 1196-44															1069325		ESP90
	9.52 (.375)	3.18 (.125)	–	4.4 (.173)	0.4 (.016)	CCHX 090304 1196-54															1069390		
	12.7 (.500)	3.97 (.156)	–	5.5 (.217)	0.5 (.020)	CCHX 12T305 1196-64														1069399			

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No.																For cutter Cat-No.
							LC240Q	LC240T	LC230E	LC225T	LC240S	LC225S	LW240	LW225	LC440T	LC430T	LC444W	LC615E	LC610T	LC610A	LW610	LW630	
 N = 8	6.58 (.259)	5.56 (.219)	15.88 (.625)	5.5 (.217)	0.8 (.031)	ODMW 060508 EN											6406180						
	6.58 (.259)	5.56 (.219)	15.88 (.625)	5.5 (.217)	0.8 (.031)	ODMW 060508 SN				6406181								6400577					
 N = 8	7.4 (.291)	4.76 (.187)	18.1 (.713)	–	–	OFEN 070405 SN				6406184								6400578					
 N = 8	7.4 (.291)	4.76 (.187)	18.1 (.713)	–	–	OFER 070405 SN-BP				6406187													
 N = 8	7.4 (.291)	3.97 (.156)	12.7 (.500)	4.6 (.181)	–	OFEX 05T305 SN-BP				6406190													

N = Number of cutting edges	l	s	d	d_1	b/r	ISO-Code Cat-No.	Cutting materials Ident No.															For cutter Cat-No.
							LC280TT[1]	LC240T	LC240S	LC230E	LC225T	LC225S	LC630T	LW240	LW225	LC440T	LC444W	LC610E	LC610T	LC603X	LW610	LC603Z[2]	
	–	2.38 (.094)	7.6 (.299)	2.8 (.110)	–	RDHX 0702 MO 1195-11		1068607	1070024													ECZ
	–	2.78 (.109)	9.6 (.378)	3.8 (.150)	–	RDHX 0902 MO 1195-21		1068609	1070025											1068660		
	–	3.97 (.156)	11.6 (.457)	5 (.197)	–	RDHX 11T3 MO 1195-31		1068610	1070026											1068704		
	–	4.76 (.187)	15.6 (.614)	5.2 (.205)	–	RDHX 1504 MO 1195-41		1068611	1070027											1068740		
	–	1.5 (.059)	5 (.197)	2 (.079)	–	RDHX 0501 MO 1195-01		1055505	1068369									1055639			1055756	ECZ
	–	2.38 (.094)	7 (.276)	2.7 (.106)	–	RDHX 0702 MO 1195-09		1055617										1055619			1055757	
	–	2.38 (.094)	8 (.315)	2.8 (.110)	–	RDHW 0802 MO 1195-15		1068612	1070129									1068621			1055758	ECZ
	–	3.18 (.125)	10 (.394)	3.8 (.150)	–	RDHW 1003 MO 1195-25		1068613	1070137									1068623		1070132	1055759	
	–	3.97 (.156)	12 (.472)	5 (.197)	–	RDHW 12T3 MO 1195-35 ECZ/FCZ Cutters		1068614	1070147									1068625		1070142	1055760	ECZ FCZ
	–	3.97 (.156)	12 (.472)	3.8 (.150)	–	RDHX 12T3 MO 1195-36 ACU-Jet		1070159	1070156									1070160			1055761	
	–	4.76 (.187)	16 (.630)	5.2 (.205)	–	RDHW 1604 MO 1195-45		1068616	1070167									1068627		1070162	1055762	
	–	4.76 (.187)	16 (.630)	5.2 (.205)	–	RDHW 1604 MO-T		2340525														

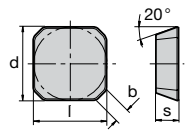
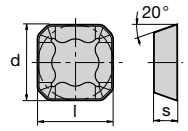
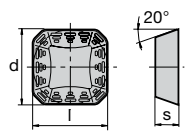
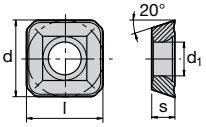
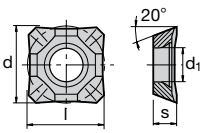
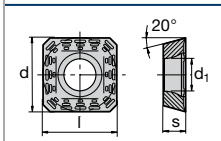
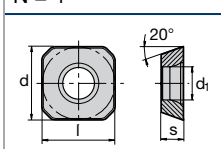
[1] LC280TT Roughing geometry with double coating

[2] Select LC603Z for Hardened Materials (52Rc-65Rc)

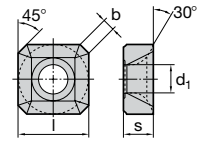
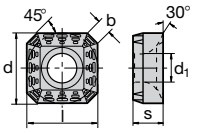
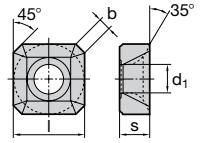
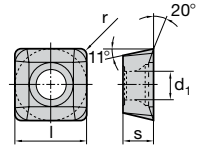
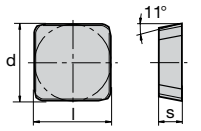
N = Number of cutting edges	l	s	d	d_1	b/r	ISO-Code Cat-No.	Cutting materials Ident No.															For cutter Cat-No.
							LC280TT[1]	LC240T	LC240S	LC230E	LC225T	LC225S	LC630T	LW240	LW225	LC440T	LC444W	LC610E	LC610T	LC610A	LW610	LC603Z[2]	
	–	2.38 (.094)	7 (.276)	2.7 (.106)	–	RDKT 0702 MO-TT	1055741															ECZ
	–	2.38 (.094)	8 (.315)	2.8 (.110)	–	RDKT 0802 MO-TT	1055740															
	–	3.18 (.125)	10 (.394)	3.8 (.150)	–	RDKT 1003 MO-TT	1055739															
	–	3.18 (.125)	10 (.394)	3.8 (.150)	–	RDKT 1003 MO													1070173		1070172	
	–	3.97 (.156)	12 (.472)	5 (.197)	–	RDKT 12T3 MO-TT	1055737															ECZ FCZ
	–	3.97 (.156)	12 (.472)	3.8 (.150)	–	RDKX 12T3 MO-TT	1055738															
	–	3.97 (.156)	12 (.472)	3.8 (.150)	–	RDKX 12T3 MO													1070179		1070178	
	–	4.76 (.187)	16 (.630)	5.2 (.205)	–	RDKT 1604 MO-TT	1055736															
	–	4.76 (.187)	16 (.630)	5.2 (.205)	–	RDKT 1604 MO													1070183		1070182	

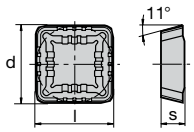
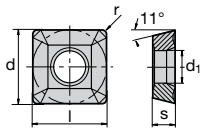
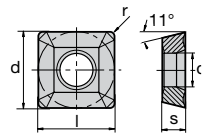
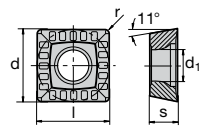
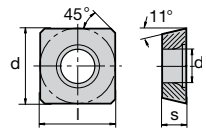
[1] LC280TT Roughing geometry with double coating

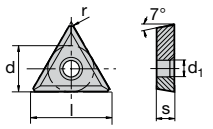
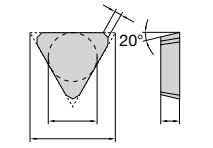
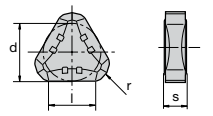
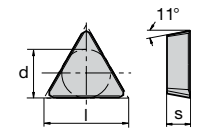
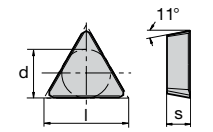
[2] Select LC603Z for Hardened Materials (52Rc-65Rc)

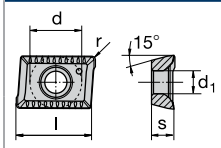
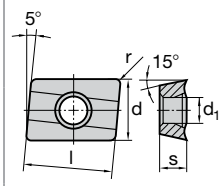
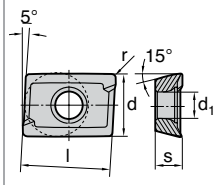
N = Number of cutting edges	l	s	d	d_1	b/r	ISO-Code Cat-No.	Cutting materials Ident No.												For cutter Cat-No.
							LC240Q	LC240T	LC230E	LC225T	LC225S	LW240	LW225	LC440T	LC444W	LC615E	LC610T	LC610A	LW610	
 N = 4	12.7 (.500)	3.18 (.125)	12.7 (.500)	–	1.4 (.055)	SEKN 1203AFEN	1067514	1067487							1067526		1067474		1067468	FMH45
	12.7 (.500)	3.18 (.125)	12.7 (.500)	–	1.4 (.055)	SEAN 1203AFSN 1193-15		1055643												
	12.7 (.500)	3.18 (.125)	12.7 (.500)	–	1.4 (.055)	SEKN 1203AFSN								1067508		6400580				
	12.7 (.500)	4.76 (.187)	12.7 (.500)	–	1.4 (.055)	SEKN 1204AFEN									1067527		1067475		1067486	FMH45A
	12.7 (.500)	4.76 (.187)	12.7 (.500)	–	1.4 (.055)	SEKN 1204AF	1067518	1067492						1068498						
	12.7 (.500)	4.76 (.187)	12.7 (.500)	–	1.4 (.055)	SEKN 1204AFSN				6406761						6400581				
 N = 4	12.7 (.500)	3.18 (.125)	12.7 (.500)	–	1.4 (.055)	SEKR 1203AFSN		1055650		6406771				1067509						FMH45
	12.7 (.500)	4.76 (.187)	12.7 (.500)	–	1.4 (.055)	SEKR 1204AFSN		1055652		6406776										FMH45A
 N = 4	12.7 (.500)	3.18 (.125)	12.7 (.500)	–	1.4 (.055)	SEKR 1203AFSN-BM									1067529					FMH45
	12.7 (.500)	4.76 (.187)	12.7 (.500)	–	1.4 (.055)	SEKR 1204AFSN-BM									1067531					FMH45A
 N = 4	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.5 (.217)	–	SEHT 1204AFSN	1067495							1067513	6406751					FMH45B
 N = 4	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.5 (.217)	–	SEHT 1204AFFN-ALC											6406749	6406748	1068537	FMH45B
 N = 4	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.5 (.217)	–	SEHT 1204AFSN-BM									1067533					FMH45B
 N = 4	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.5 (.217)	–	SEKW 1204AFEN									6406780					FMH45B
	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.5 (.217)	–	SEKW 1204AFSN	1067497		6406783							6400582	1069339			

Note: ALC-LW610 High Polish for Aluminum Milling

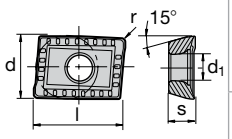
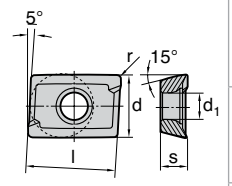
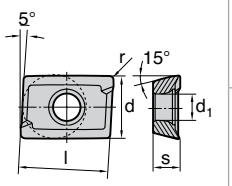
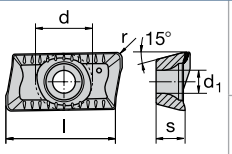
N = Number of cutting edges	l	s	d	d_1	b/r	ISO-Code Cat-No.	Cutting materials Ident No.														For cutter Cat-No.
							LC240Q	LC240T	LC240S	LC230E	LC225T	LC225S	LW240	LW225	LC440T	LC430T	LC444W	LC612E	LC610T	LC610A	LW610	
	12.7 (.500)	5.56 (.219)	–	5.2 (.205)	2 (.079)	SNHX 1205 AE 1187-18										1067543						FMV45
	12.7 (.500)	3.18 (.125)	–	5.2 (.205)	2 (.079)	SNHX 1205 AESN-BM											1067537					FMV45
 N=4	12.7 (.500)	5.56 (.219)	–	5.2 (.205)	2 (.079)	SNHX 1205 AE-ALC 1187-18 ALC													1052255	1052235		FMV45
 N=4	9.52 (.375)	4.76 (.187)	–	4.4 (.173)	0.6 (.024)	SPKX 090406 1187-05		1055658											1069548			FMT90
	12.7 (.500)	5.56 (.219)	–	5.2 (.205)	0.8 (.031)	SPKX 120508 1187-15		1052247	1052246									2346047	1052659		1052242	11260-12 FMT90 MMT90
 N=4	12.7 (.500)	3.8 (.150)	12.7 (.500)	–	–	SPKN 1203 EDSR													1066620			MMP75
	12.7 (.500)	3.8 (.150)	12.7 (.500)	–	–	SPKN 1203 EDST					6406932							6400585				MMP75
	15.88 (.625)	4.76 (.187)	15.88 (.625)	–	–	SPKN 1504 EDSR					6406938							6400595				11260-12 FMT90 MMT90

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No.											For cutter Cat-No.
							LC240T	LC230E	LC240S	LC225T	LC225S	LW240	LW225	LC440T	LC444W	LC615E	LC610T	LW610	
 N = 4	12.7 (.500)	3.18 (.125)	12.7 (.500)	–	–	SPKR 1203 EDSR				6406941									MMP75
 N = 4	12.7 (.500)	3.18 (.125)	12.7 (.500)	–	–	SPKT 120508				6406945									
 N = 4	6.35 (.250)	3.18 (.125)	6.35 (.250)	3.4 (.134)	0.4 (.016)	SPMT 060304				6406958									EFZ45
	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.2 (.205)	0.8 (.031)	SPMT 120408 SN 1196-12	2308343		1069299						6406965		1055660	1069295	
 N = 4	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.2 (.205)	0.8 (.031)	SPMT 120408 SN-BP				6406962									EFZ45
 N = 4	12.7 (.500)	4.76 (.187)	12.7 (.500)	5.2 (.205)	0.8 (.031)	SPMW 120408	1069128		1069437	6406966						6400590	1069232	1069231	EFZ45

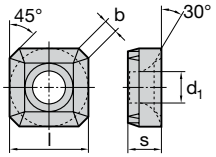
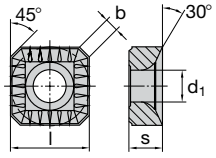
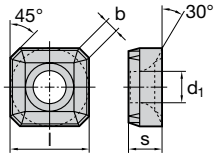
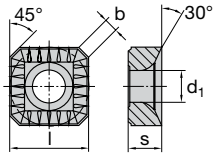
N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No.											For cutter Cat-No.
							LC240T	LC230E	LC240S	LC225T	LC225S	LW240	LW225	LC440T	LC444W	LC615E	LC610T	LW610	
 N = 3	11 (.433)	2.4 (.094)	6.35 (.250)	2.8 (.110)	0.2 (.008)	TCMT 110202 1166-00											1056661	1052107	EFZ45T11 EFZ60T11 EFZ30T16 EFZ45T16 EFZ60T16
	16.5 (.650)	3.97 (.156)	9.52 (.375)	4.3 (.169)	0.4 (.016)	TCMT 16T304 1166-10											1055662	1052109	
 N = 3	22 (.866)	4.76 (.187)	12.7 (.500)	–	1.6 (.063)	TEAN 2204 ZZ 1172-25												1055403	
 N = 3	12 (.472)	4.76 (.187)	12.7 (.500)	–	2 (.079)	TNHF 1204ANSW BKL										6400587			
 N = 3	16.5 (.650)	3.18 (.125)	9.52 (.375)	–	–	TPAN 1603 PDR 1172-11												1055362	MMP90
	16.5 (.650)	3.18 (.125)	9.52 (.375)	–	–	TPKN 1603 PDR	1055326										1055320		
 N = 3	22 (.866)	4.76 (.187)	12.7 (.500)	–	–	TPKN 2204 PDER											1055323		MMP90
	22 (.866)	4.76 (.187)	12.7 (.500)	–	–	TPKN 2204 PDSR	1055328												

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No.														For cutter Cat-No.
							LC240Q	LC240T	LC240S	LC230E	LC225T	LC225S	LC630T	LW240	LW225	LC430T	LC444W	LC610E	LC610T	LW630	LW610	
 N = 2	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.5 (.020)	ADKX 110305 SR-TR		2413010					2413970						2414000			EMU90IK
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.8 (.031)	ADKX 110308 SR-TR		2413012					2413972						2414001			
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	1.2 (.047)	ADKX 110312 SR-TR		2413014					2413974						2414002			
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	1.6 (.063)	ADKX 110316 SR-TR		2413016					2413976						2414003			
 N = 2	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.5 (.020)	ADHX 110305 ER 1196-82	1068011	1069402	1069459				2410308			1067541			1069490		1069445	EMU90IK
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.8 (.031)	ADHX 110308 ER 1196-82 R03							1960108									
	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	1.5 (.059)	ADHX 110315 ER 1196-82 R06							2410309							1960073		
 N = 2	11.1 (.437)	3.18 (.125)	7.94 (.312)	3.4 (.134)	0.5 (.020)	ADHX 110305 FR-ALC 1196-82 ALC													1069534		1069533	EMU90IK

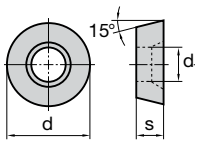
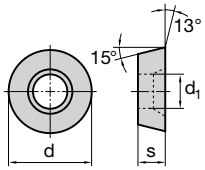
Note: ALC LW610 High Polish for Aluminum Milling

N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No.														For cutter Cat-No.
							LC240T	LC240S	LC230E	LC225T	LC225S	LC630T	LW240	LW225	LC440T	LC444W	LC610E	LC610T	LC610A	LW610	LC603Z	
	9.52 (.375)	2.87 (.113)	6.35 (.250)	2.8 (.110)	0.4 (.016)	ADKX 090304 PESR-BP 1196-87	1055004											1055006				EMU90 ERU90
	11.1 (.437)	3.18 (.125)	7.94 (.313)	3.4 (.134)	0.5 (.020)	ADKX 110305 PESR-BP 1196-88	1055010											1055012		1055011		
	12.7 (.500)	3.97 (.156)	9.52 (.375)	4 (.157)	0.6 (.024)	ADKX 12T306 PE 1196-89	1055016											1055018				ERU90 FRU90
	9.52 (.375)	2.87 (.113)	6.35 (.250)	2.8 (.110)	0.4 (.016)	ADHX 090304 FR-ALC 1196-80												1069532		1069531		EMU90 ERU90
	11.1 (.437)	3.18 (.125)	7.94 (.313)	3.4 (.134)	0.5 (.020)	ADHX 110305 FR-ALC 1196-82												1069534		1069533		
	12.7 (.500)	3.97 (.156)	9.52 (.375)	4 (.157)	0.6 (.024)	ADHX 12T306 FR-ALC 1196-84												1069536		1069535		ERU90 FRU90
 N = 2	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	0.8 (.031)	ADKX 170508 FR-ALC												2414009				FMU90
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.2 (.046)	ADKX 170512 FR-ALC														9206028		
 N = 2	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	0.8 (.031)	ADKX 170508 SR-TR	2412980					2413978						2414004				FMU90
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.2 (.046)	ADHX 170512 SR-TR	2412982					2413980						2414005				
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	1.6 (.062)	ADKX 170516 SR-TR	2412984					2413982						2414006				
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	2 (.079)	ADKX 170520 SR-TR	2412986					2413984						2414007				
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	3.2 (.125)	ADKX 170532 SR-TR						2413228										
	17.5 (.689)	5.6 (.221)	9.62 (.379)	3.8 (.150)	6.4 (.250)	ADKX 170564 SR-TR						2413230										

ALC LW610 has high polish for aluminum milling
Note: Larger Radii ALC Inserts See Page 37

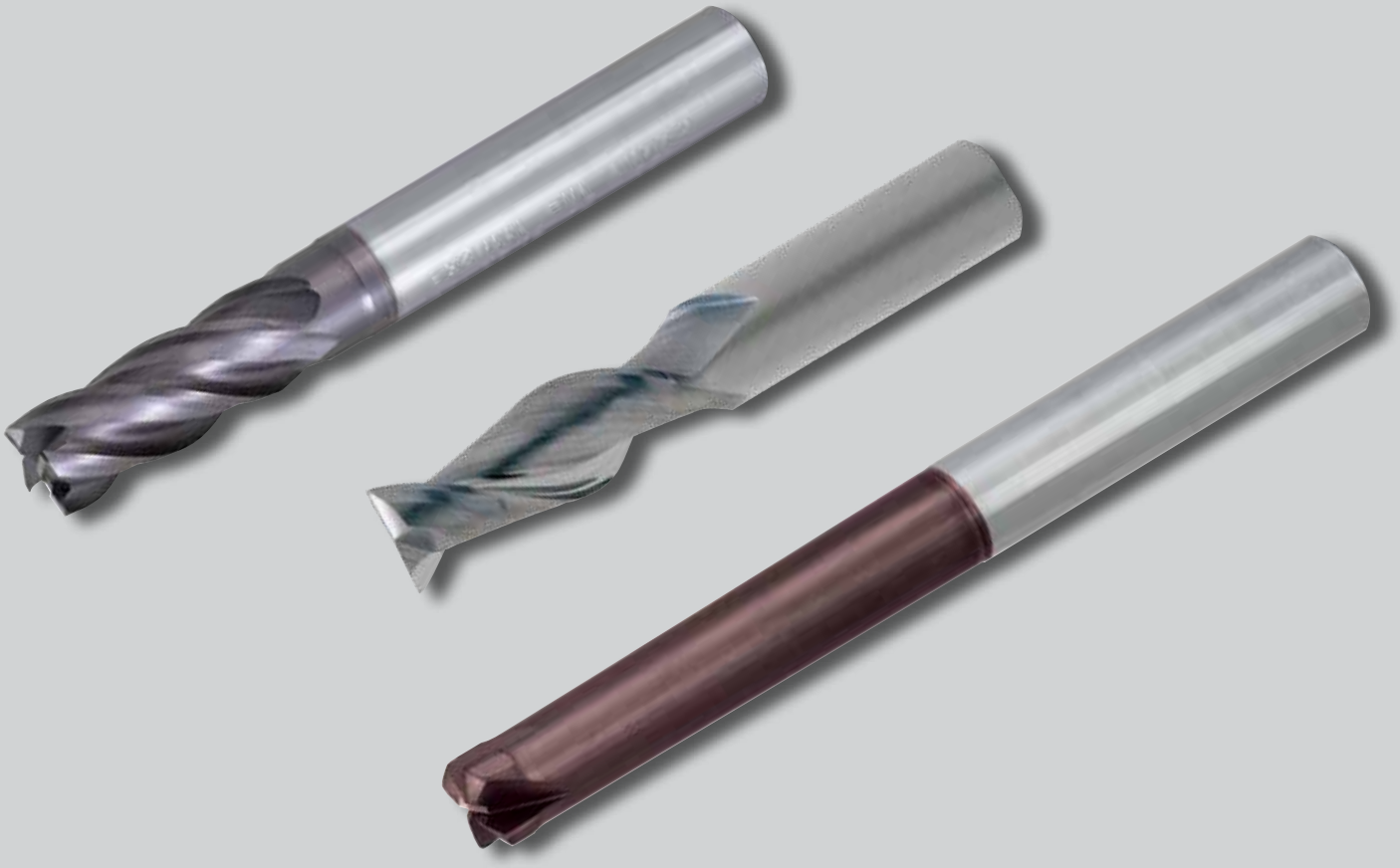
N = Number of cutting edges	l	s	d	d_1	r	ISO-Code Cat-No.	Cutting materials Ident No.														For cutter Cat-No.
							LC280TT[1]	LC240Q	LC240T	LC240S	LC230E	LC225T	LC225S	LC630T	LW240	LW225	LC440T	LC444W	LC612E	LC610T	LC615E	LW610	
 N = 4	9.52 (.375)	4.76 (.187)	–	4.4 (.173)	1.5 (.059)	SNKX 0904 AN 1187-00			1052316											1052317		1052236	ERT90
	12.7 (.500)	5.56 (.219)	–	5.2 (.205)	2 (.079)	SNKX 1205 AN 1187-10		1052301	1052230			1052228		1052238				1052234	89365	1052339			ERT90
 N = 4	12.7 (.500)	5.56 (.219)	–	5.2 (.205)	2 (.079)	SNKX 1205 AN-TR 1187-10 TR		1052260	1052248			1052239								1052251			ERT90
 N = 4	9.52 (.375)	4.76 (.187)	–	4.4 (.173)	1.5 (.059)	SNKX 0904 AN-TT wide land	1055743																ERT90
	12.7 (.500)	5.44 (.214)	–	5.2 (.205)	2 (.079)	SNKX 1205 AN-T 1187-12 wide land			1052303			1052314								1052309	55955	1052254	ERT90
 N = 4	12.7 (.500)	5.56 (.219)	–	5.2 (.205)	2 (.079)	SNKX 1205 AN-TT wide land	1055742																ERT90

[1] LC280TT Roughing geometry with double coating

N = Number of cutting edges	d	s	d_1	ISO-Code Cat-No.	Cutting materials Ident No.															For cutter Cat-No.
					LC280TT[1]	LC240Q	LC240T	LC240S	LC230E	LC225T	LC225S	LC630T	LW240	LW225	LC440T	LC444W	LC612E	LC610T	LC615E	LW610	
	5 (.197)	1.50 (.059)	2.0 (.079)	RDHX 0501 MO		1055505	1068369											1055639		1055756	ECZ ECC
	7 (.276)	2.38 (.094)	2.7 (.106)	RDHX 0702 MO		1055617												1055619		1055757	
	8 (.315)	2.38 (.094)	2.8 (.110)	RDHW 0802 MO		1068612	1070129											1068621		1055758	ECZ ECC
	10 (.394)	3.18 (.125)	3.8 (.150)	RDHW 1003 MO		1068613	1070137											1068623	1070132	1055759	
	12 (.472)	3.97 (.156)	5.0 (.197)	RDHW 12T3 MO ECZ/FCZ Cutters		1068614	1070147											1068625	1070142	1055760	ECZ FCZ ECC FCC
	12 (.472)	3.97 (.156)	3.8 (.150)	RDHX 12T3 MO ECC/FCC Acu-Jet Cutters		1070156	1070156											1070160		1055761	
	16 (.630)	4.76 (.187)	5.2 (.205)	RDHW 1604 MO		1068616	1070167											1068627	1070162	1055762	
	16 (.630)	4.76 (.187)	5.2 (.205)	RDHW 1604 MO-T		2340525															
	7 (.276)	2.38 (.094)	2.7 (.106)	RDKT 0702 MO-TT	1055741																ECZ ECC
	8 (.315)	2.38 (.094)	2.8 (.110)	RDKT 0802 MO-TT	1055740																
	10 (.394)	3.18 (.125)	3.8 (.150)	RDKT 1003 MO-TT	1055739																
	10 (.394)	3.18 (.125)	3.8 (.150)	RDKT 1003 MO														1070173	1070172		
	12 (.472)	3.97 (.156)	5.0 (.197)	RDKT 12T3 MO-TT ECZ/FCZ Cutters	1055737																FCZ ECC FCC
	12 (.472)	3.97 (.156)	3.8 (.150)	RDKX 12T3 MO-TT ECC/FCC Acu-Jet Cutters	1055738																
	12 (.472)	3.97 (.156)	3.8 (.150)	RDKX 12T3 MO ECC/FCC Acu-Jet Cutters														1070179	1070178		
	16 (.630)	4.76 (.187)	5.2 (.205)	RDKT 1604 MO-TT	1055736																
	16 (.630)	4.76 (.187)	5.2 (.205)	RDKT 1604 MO														1070183	1070182		

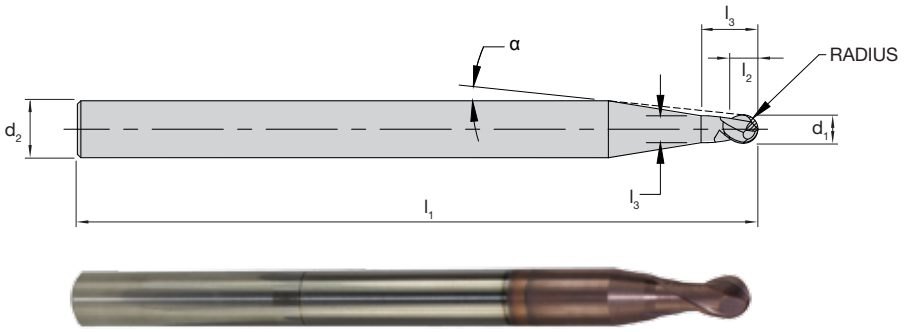
[1] LC280TT Roughing geometry with double coating

[2] Select LC603Z for Hardened Materials (52Rc-65Rc)



Solid Carbide Endmills

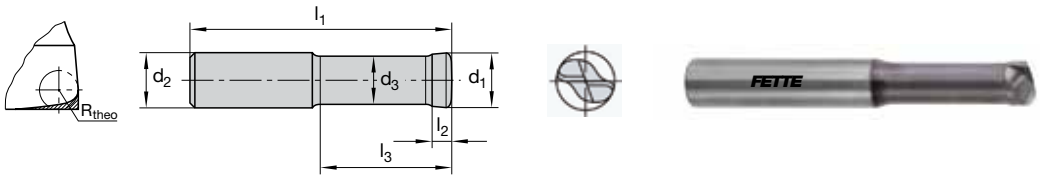
Solid Carbide
Inch



Ident No.	Description	d_1	l_1	l_2	d_2	l_3
27487	0.0625 x 0.0625 x.250 x 3 SC RH BALLNOSE	1/16	3.00	1/16	1/4	1/8
27488	0.094 x 0.094 x 0.25 x 3 SC RH BALLNOSE	3/32	3.00	3/32	1/4	3/16
27489	0.125 x 0.125 x 0.25 x 3 SC RH BALLNOSE	1/8	3.00	1/8	1/4	1/4
27490	0.188 x 0.188 x 0.25 x 3 SC RH BALLNOSE	3/16	3.00	3/16	1/4	3/8
27491	0.250 x 0.25 x 0.25 x 3 SC RH BALLNOSE	1/4	3.00	1/4	1/4	1/2
27492	0.312 x 0.312 x 0.312 x 4 SC RH BALLNOSE	5/16	4.00	5/16	5/16	5/8
27493	0.375 x 0.375 x 0.375 x 4 SC RH BALNOSE	3/8	4.00	3/8	3/8	3/4
27494	0.500 x 0.500 x 0.500 x 4.5 SC RH BALLNOSE	1/2	4.50	1/2	1/2	1.00

Cutting data recommendations starting page 146

Solid Carbide, center cutting
Inch



Cat.-No.	**1430 C**
Type	2Feed HSC
Helix angle	λ = 0°
Straight shank	DIN 6535 HA
Coating	AL2 PLUS
Cutting materials	LC620T

d_1	R_{theo}	l_2	l_1	l_3	d_3	z ✿	d_2 (h6)	$a_{p\ max.}$	Length	Ident No.
short										
0.187	0.019	0.075	2.00	0.66	0.16	2	0.250	0.009	Short	10388
0.250	0.025	0.104	2.50	0.77	0.21	2	0.250	0.013	Short	10390
0.312	0.031	0.120	2.50	0.94	0.26	2	0.312	0.016	Short	10392
0.375	0.038	0.136	2.50	1.06	0.31	2	0.375	0.019	Short	10394
0.500	0.050	0.167	3.50	1.42	0.42	2	0.500	0.025	Short	10396
extra long										
0.187	0.019	0.075	3.00	1.50	0.16	2	0.250	0.009	Extra Long	10389
0.250	0.025	0.104	3.25	1.75	0.21	2	0.250	0.013	Extra Long	10391
0.312	0.031	0.120	3.50	2.10	0.26	2	0.312	0.016	Extra Long	10393
0.375	0.038	0.136	4.00	2.25	0.31	2	0.375	0.019	Extra Long	10395
0.500	0.050	0.167	4.50	2.50	0.42	2	0.500	0.025	Extra Long	10397

Cutting data recommendations starting on page 147

Application Examples

Material: 4140 Pre-Hard
Hardness: 27-32 HRC

LMT-Fette HSC FEED™ Mill
Cat. Desc. 1430 HSC FEED™ Mill
Ø 1/2" 2 flute
Cutting Material LC620T

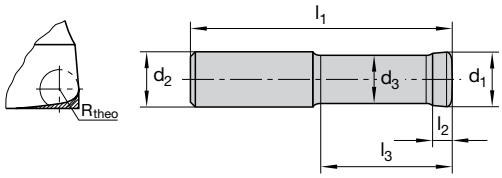
Cutting Data
sfm = 1,100
rpm = 9,000
ipt = .030"
ipm = 540
woc = .200"
doc = .024"

HSC FEED was used instead of a radius end mill for Z-level-roughing of a chissel die.

Feed rate could be doubled to v_f (IPM) = 365, without changing speed of

v_c (SFM) = 492 and tool life was 4 times higher.

Solid Carbide, center cutting
Metric

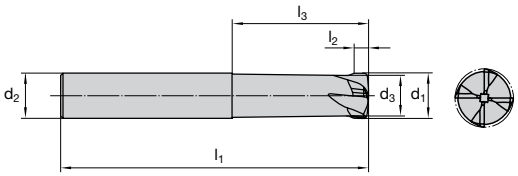


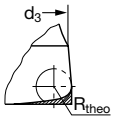
Cat.-No.	**1430 C**
Type	2Feed HSC
Helix angle	λ = 0°
Straight shank	DIN 6535 HA
Coating	AL2 PLUS
Cutting materials	LC620T

d_1	R_{theo}	l_2	l_1	l_3	d_3	z ⚙	d_2 (h6)	$a_{p\ max.}$	Ident No.
extra short									
1	0.1	0.35	40	2	0.8	3	2	0.05	1300994
2	0.2	0.7	40	4	1.6	4	2	0.1	1300995
3	0.3	1	50	6	2.5	6	2	0.15	1300996
4	0.4	1.5	57	8	3.4	6	2	0.2	1301100
5	0.5	2	57	10	4.2	6	2	0.25	1301101
6	0.6	2.5	57	12	5	6	2	0.3	1301102
8	0.8	3	63	16	6.7	8	2	0.4	1301103
10	1	3.5	72	20	8.5	10	2	0.5	1301104
12	1.2	4	83	24	10	12	2	0.6	1301105
14	1.4	4.5	83	28	11.8	14	2	0.7	1301106
short									
1	0.1	0.35	40	4	0.8	3	2	0.05	1300997
2	0.2	0.7	40	8	1.6	4	2	0.1	1300998
3	0.3	1	57	12	2.5	6	2	0.15	1300999
4	0.4	1.5	57	15	3.4	6	2	0.2	1110170
5	0.5	2	57	17.5	4.2	6	2	0.25	1110171
6	0.6	2.5	57	19	5	6	2	0.3	1110172
8	0.8	3	63	24	6.7	8	2	0.4	1110173
10	1	3.5	72	28.5	8.5	10	2	0.5	1110174
12	1.2	4	83	34	10	12	2	0.6	1110175
16	1.6	5.5	92	39	13.5	16	2	0.8	1110176
20	2	7	104	48	17	20	2	1.0	1110177
long									
4	0.4	1.5	70	24	3.4	6	2	0.2	1300988
5	0.5	2	70	30	4.2	6	2	0.25	1300989
6	0.6	2.5	80	35	5	6	2	0.3	1300990
8	0.8	3	80	40	6.7	8	2	0.4	1300991
10	1	3.5	90	45	8.5	10	2	0.5	1300992
12	1.2	4	100	50	10	12	2	0.6	1300993
extra long									
4	0.4	1.5	80	34	3.4	6	2	0.2	1110180
5	0.5	2	80	37	4.2	6	2	0.25	1110181
6	0.6	2.5	80	42	5	6	2	0.3	1110182
8	0.8	3	90	51	6.7	8	2	0.4	1110183
10	1	3.5	100	56.5	8.5	10	2	0.5	1110184
12	1.2	4	110	61	10	12	2	0.6	1110185
16	1.6	5.5	130	77	13.5	16	2	0.8	1110186
20	2	7	150	94	17	20	2	1.0	1110187

Cutting data recommendations starting on page 147

Solid Carbide, center cutting
suitable for NC



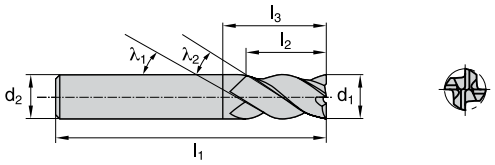


Cat.-No.	**1431 C**
Type	4Feed HSC
Standard	FETTE Standard
Helix angle	λ = 0°
Straight shank	DIN 6535 HA
Coating	Nanosphere Red
Cutting materials	LC620ZM

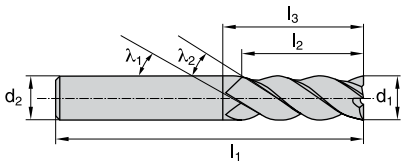
d_1 h10	R_{theo}	l_2	l_1	l_3	d_3	d_2 (h6)	z	$a_{p\ max.}$	Ident No.
extra short									
4	0.4	1.5	57	8	3.55	6	4	0.2	9207993
5	0.5	2	57	10	4.4	6	4	0.25	9207994
6	0.6	2.5	57	12	5.3	6	4	0.3	9207995
8	0.8	3	63	16	7.1	8	4	0.4	9207996
10	1	3.5	72	20	8.9	10	4	0.5	9207997
12	1.2	4	83	24	10.7	12	4	0.6	9207998
short									
4	0.4	1.5	57	15	3.55	6	4	0.2	9207999
5	0.5	2	57	17.5	4.4	6	4	0.25	9208000
6	0.6	2.5	57	19	5.3	6	4	0.3	9208002
8	0.8	3	63	24	7.1	8	4	0.4	9208003
10	1	3.5	72	28.5	8.9	10	4	0.5	9208004
12	1.2	4	83	34	10.7	12	4	0.6	9208005
long									
6	0.6	2.5	80	35	5.3	6	4	0.3	9208006
8	0.8	3	80	40	7.1	8	4	0.4	9208007
10	1	3.5	90	45	8.9	10	4	0.5	9208008
12	1.2	4	100	50	10.7	12	4	0.6	9208009

Cutting data recommendations starting on page 147

Solid Carbide, center cutting
Inch



z = 4 teeth



z = 4 teeth

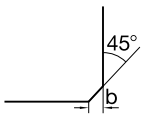
Cat.-No.	**1521 C**
Type	DHC
Standard	DIN 6527 A / DIN 6528
Helix angle	λ_1 / λ_2 = 35° / 38°
Straight shank	DIN 6535 HA (Cylindrical)
Coating	AL2 Plus (TiAlN)
Cutting materials	LC630T
Special features	Edge protection chamfer or corner radius

d_1	Std Cutter EDP #	.010" Radius EDP #a	.015" Radius EDP #	.030" Radius EDP #	.060" Radius EDP #	d_2 (h6)	l_1	l_2
short								
0.187 (3/16)	49620	49621				0.187	2.00	0.375
0.250 (1/4)	49622		49623	49624		0.250	2.00	0.500
0.375 (3/8)	49625		49626	49627		0.375	2.00	0.625
0.500 (1/2)	49628			49629	49630	0.500	2.50	0.625
0.625 (5/8)	49631			49632	49633	0.625	3.00	0.750
0.750 (3/4)	49634			49635	49636	0.750	3.00	1.000
1.00	49637			49638	49639	1.000	4.00	1.500
long								
0.187 (3/16)	49640	49641				0.187	2.000	0.500
0.250 (1/4)	49642		49643	49644		0.250	2.500	0.625
0.375 (3/8)	49645		49646	49647		0.375	2.500	1.000
0.500 (1/2)	49648			49649	49650	0.500	3.000	1.250
0.625 (5/8)	49651			49652	49653	0.625	3.500	1.250
0.750 (3/4)	49654			49655	49656	0.750	4.000	1.500
1.00	**49657**			49658	49659	1.000	5.000	2.000

*Note: Check for availability

Cutting data recommendations starting on page 149

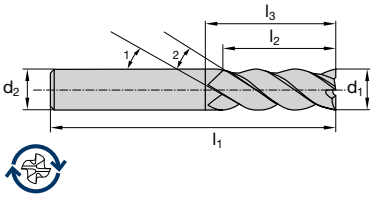
Edge protection chamfer (Standard Cutters)



d_1	b
0.187	0.004
0.250–0.500	0.008
0.625–0.750	0.012

For DHC Endmills See pages 146-147

Solid Carbide, center cutting
Metric

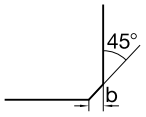


Cat.-No.	1521 C	1522 C
Type	DHC	
Standard	DIN 6527 A / DIN 6528	DIN 6527 B
Helix angle	λ_1 / λ_2 = 35° / 38°	
Straight shank	DIN 6535 HA	DIN 6535 HB
Coating	AL2 Plus	
Cutting materials	LC630T	
Special features	Edge protection chamfer	

d_1 h10	l_2	l_1	l_3	d_2 (h6)	Ident No.	Ident No.
short						
4	5	54	8	6	1190000	1190010
5	6	54	10	6	1190001	1190011
6	7	54	16	6	1190002	1190012
8	9	58	20	8	1190003	1190013
10	11	66	24	10	1190004	1190014
12	12	73	26	12	1190005	1190015
14	14	75	28	14	1190006	1190016
16	16	82	32	16	1190007	1190017
18	18	84	34	18	1190008	1190018
20	20	92	40	20	1190009	1190019
long						
4	8	54	12	6	1110700	1110705
5	10	54	15	6	1110701	1110706
6	13	57	21	6	1110223	1110231
8	19	63	27	8	1110224	1110232
10	22	72	32	10	1110225	1110233
12	26	83	38	12	1110226	1110234
14	26	83	38	14	1110227	1110235
16	32	92	44	16	1110228	1110236
18	34	92	44	18	1110229	1110237
20	38	104	54	20	1110230	1110238

Cutting data recommendations starting page 149

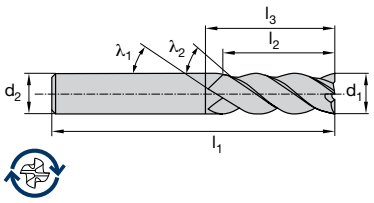
Edge protection chamfer



d_1	b
4	0.1
5	0.15
6 – 12	0.2
14 – 20	0.3

INOX design suited for Stainless Steel and Titanium

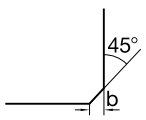
Solid Carbide, center cutting
Metric



Cat.-No.					1525 C	1565 C
Type					DHC INOX	
Standard					DIN 6527 A / DIN 6528	DIN 6527 B
Helix angle					λ_1 / λ_2 = 41° / 44°	
Straight shank					DIN 6535 HA	DIN 6535 HB
Coating					AL2 Plus	
Cutting materials					LC630T	
Special features					Edge protection chamfer	
d_1 h10	**l_2**	**l_1**	**l_3**	**d_2 (h6)**	**Ident No.**	**Ident No.**
short						
4	5	54	8	6	9097019	9097052
5	6	54	10	6	9097020	9097053
6	7	54	12	6	9097021	9097054
8	9	58	16	8	9097022	9097055
10	11	66	20	10	9097023	9097056
12	12	73	24	12	9097024	9097057
14	14	75	28	14	9097025	9097058
16	16	82	32	16	9097026	9097059
18	18	84	36	18	9097027	9097060
20	20	92	40	20	9097028	9097061
long						
4	8	54	12	6	9096396	9096407
5	10	54	15	6	9096397	9096408
6	13	57	21	6	9096398	9096409
8	19	63	27	8	9096399	9096410
10	22	72	32	10	9096401	9096412
12	26	83	38	12	9096402	9096413
14	26	83	38	14	9096403	9096414
16	32	92	44	16	9096404	9096415
18	32	92	44	18	9096405	9096416
20	38	104	54	20	9096406	9096417

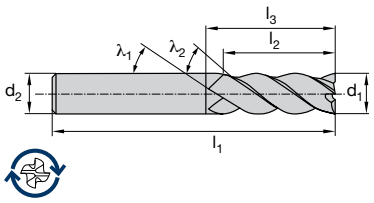
Cutting data recommendations starting page 150

Edge protection chamfer



d_1	b
4	0.1
5	0.15
6 – 12	0.2
14 – 20	0.3

Solid Carbide, center cutting
Metric



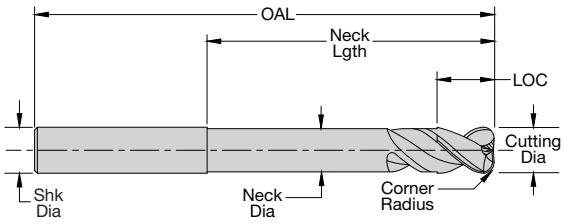
Ident No.	Ident No. w/Weldon Flat	Cutting Diameter d_1	Shank Diameter d_2	l_2	l_1	Number of Flutes	l_3	Neck Diameter	Corner Radius
MXQ2650000	MXQ2650000W	1/8	1/8	1/4	2	4			Square
MXQ2650001	MXQ2650001W	1/8	1/8	1/4	2	4			0.015
MXQ2650002	MXQ2650002W	1/8	1/8	1/2	2	4			Square
MXQ2650003	MXQ2650003W	1/8	1/8	1/2	2	4			0.015
MXQ2650004	MXQ2650004W	3/16	3/16	5/16	2	4			Square
MXQ2650005	MXQ2650005W	3/16	3/16	5/16	2	4			0.015
MXQ2650006	MXQ2650006W	3/16	3/16	9/16	2-1/2	4			Square
MXQ2650007	MXQ2650007W	3/16	3/16	9/16	2-1/2	4			0.015
MXQ2650008	MXQ2650008W	1/4	1/4	3/8	2-1/2	4			Square
MXQ2650009	MXQ2650009W	1/4	1/4	3/8	2-1/2	4			0.015
MXQ2650010	MXQ2650010W	1/4	1/4	3/8	2-1/2	4			0.03
MXQ2650011	MXQ2650011W	1/4	1/4	3/4	2-1/2	4			Square
MXQ2650012	MXQ2650012W	1/4	1/4	3/4	2-1/2	4			0.015
MXQ2650013	MXQ2650013W	1/4	1/4	3/4	2-1/2	4			0.03
MXQ2650014	MXQ2650014W	1/4	1/4	3/8	3	4	1-1/8	0.235	0.015
MXQ2650015	MXQ2650015W	1/4	1/4	3/8	3	4	1-1/8	0.235	0.03
MXQ2650016	MXQ2650016W	5/16	5/16	7/16	2	4			Square
MXQ2650017	MXQ2650017W	5/16	5/16	7/16	2	4			0.015
MXQ2650018	MXQ2650018W	5/16	5/16	1	3	4			Square
MXQ2650019	MXQ2650019W	5/16	5/16	1	3	4			0.015
MXQ2650020	MXQ2650020W	3/8	3/8	1/2	2-1/2	4			Square
MXQ2650021	MXQ2650021W	3/8	3/8	1/2	2-1/2	4			0.015
MXQ2650022	MXQ2650022W	3/8	3/8	1/2	2-1/2	4			0.03
MXQ2650023	MXQ2650023W	3/8	3/8	1-1/8	3	4			Square
MXQ2650024	MXQ2650024W	3/8	3/8	1-1/8	3	4			0.015
MXQ2650025	MXQ2650025W	3/8	3/8	1-1/8	3	4			0.03
MXQ2650026	MXQ2650026W	3/8	3/8	1/2	3-1/2	4	1-5/8	0.353	0.015
MXQ2650027	MXQ2650027W	3/8	3/8	1/2	3-1/2	4	1-5/8	0.353	0.03
MXQ2650028	MXQ2650028W	1/2	1/2	5/8	2-1/2	4			Square
MXQ2650029	MXQ2650029W	1/2	1/2	5/8	2-1/2	4			0.015
MXQ2650030	MXQ2650030W	1/2	1/2	5/8	2-1/2	4			0.03
MXQ2650031	MXQ2650031W	1/2	1/2	5/8	2-1/2	5			Square
MXQ2650032	MXQ2650032W	1/2	1/2	5/8	2-1/2	5			0.015
MXQ2650033	MXQ2650033W	1/2	1/2	5/8	2-1/2	5			0.03
MXQ2650034	MXQ2650034W	1/2	1/2	1-1/4	3	4			Square
MXQ2650035	MXQ2650035W	1/2	1/2	1-1/4	3	4			0.015
MXQ2650036	MXQ2650036W	1/2	1/2	1-1/4	3	4			0.03
MXQ2650037	MXQ2650037W	1/2	1/2	1-1/4	3	5			Square
MXQ2650038	MXQ2650038W	1/2	1/2	1-1/4	3	5			0.015
MXQ2650039	MXQ2650039W	1/2	1/2	1-1/4	3	5			0.03
MXQ2650040	MXQ2650040W	1/2	1/2	5/8	4	4	1-3/4	0.475	Square
MXQ2650041	MXQ2650041W	1/2	1/2	5/8	4	4	1-3/4	0.475	0.03

continued on next page

Ident No.	Ident No. w/Weldon Flat	Cutting Diameter d_1	Shank Diameter d_2	l_2	l_1	Number of Flutes	l_3	Neck Diameter	Corner Radius
MXQ2650042	MXQ2650042W	1/2	1/2	5/8	4	4	1-3/4	0.475	0.06
MXQ2650043	MXQ2650043W	1/2	1/2	5/8	4	5	1-3/4	0.475	Square
MXQ2650044	MXQ2650044W	1/2	1/2	5/8	4	5	1-3/4	0.475	0.03
MXQ2650045	MXQ2650045W	1/2	1/2	5/8	4	5	1-3/4	0.475	0.06
MXQ2650046	MXQ2650046W	5/8	5/8	3/4	3	4			Square
MXQ2650047	MXQ2650047W	5/8	5/8	3/4	3	4			0.03
MXQ2650048	MXQ2650048W	5/8	5/8	1-3/8	3-1/2	4			Square
MXQ2650049	MXQ2650049W	5/8	5/8	1-3/8	3-1/2	4			0.03
MXQ2650050	MXQ2650050W	3/4	3/4	1-1/8	3	4			Square
MXQ2650051	MXQ2650051W	3/4	3/4	1-1/8	3	4			0.03
MXQ2650052	MXQ2650052W	3/4	3/4	1-1/8	3	4			0.06
MXQ2650053	MXQ2650053W	3/4	3/4	1-1/8	3	4			0.12
MXQ2650054	MXQ2650054W	3/4	3/4	1-1/8	3	5			Square
MXQ2650055	MXQ2650055W	3/4	3/4	1-1/8	3	5			0.03
MXQ2650056	MXQ2650056W	3/4	3/4	1-1/8	3	5			0.06
MXQ2650057	MXQ2650057W	3/4	3/4	1-1/8	3	5			0.12
MXQ2650058	MXQ2650058W	3/4	3/4	1-1/2	4	5			0.12
MXQ2650059	MXQ2650059W	3/4	3/4	1-5/8	4	4			Square
MXQ2650060	MXQ2650060W	3/4	3/4	1-5/8	4	4			0.03
MXQ2650061	MXQ2650061W	3/4	3/4	1-5/8	4	4			0.06
MXQ2650062	MXQ2650062W	3/4	3/4	1-5/8	4	4			0.12
MXQ2650063	MXQ2650063W	3/4	3/4	1-5/8	4	5			Square
MXQ2650064	MXQ2650064W	3/4	3/4	1-5/8	4	5			0.03
MXQ2650065	MXQ2650065W	3/4	3/4	1-5/8	4	5			0.06
MXQ2650066	MXQ2650066W	3/4	3/4	1-5/8	4	5			0.12
MXQ2650067	MXQ2650067W	3/4	3/4	1-1/8	5	4	2-3/8	0.713	0.03
MXQ2650068	MXQ2650068W	3/4	3/4	1-1/8	5	4	2-3/8	0.713	0.06
MXQ2650069	MXQ2650069W	3/4	3/4	1-1/8	5	4	2-3/8	0.713	0.12
MXQ2650070	MXQ2650070W	3/4	3/4	1-1/8	5	5	2-3/8	0.713	0.03
MXQ2650071	MXQ2650071W	3/4	3/4	1-1/8	5	5	2-3/8	0.713	0.06
MXQ2650072	MXQ2650072W	3/4	3/4	1-1/8	5	5	2-3/8	0.713	0.12
MXQ2650073	MXQ2650073W	3/4	3/4	1-1/8	6	4	3-1/8	0.713	0.03
MXQ2650074	MXQ2650074W	3/4	3/4	1-1/8	6	4	3-1/8	0.713	0.06
MXQ2650075	MXQ2650075W	3/4	3/4	1-1/8	6	4	3-1/8	0.713	0.12
MXQ2650076	MXQ2650076W	3/4	3/4	1-1/8	6	5	3-1/8	0.713	0.03
MXQ2650077	MXQ2650077W	3/4	3/4	1-1/8	6	5	3-1/8	0.713	0.06
MXQ2650078	MXQ2650078W	3/4	3/4	1-1/8	6	5	3-1/8	0.713	0.12
MXQ2650079	MXQ2650079W	1	1	1-1/4	4	4			0.03
MXQ2650080	MXQ2650080W	1	1	1-1/4	4	4			0.12
MXQ2650081	MXQ2650081W	1	1	1-1/4	4	5			0.03
MXQ2650082	MXQ2650082W	1	1	1-1/4	4	5			0.12
MXQ2650083	MXQ2650083W	1	1	1-1/4	4	5			0.19
MXQ2650084	MXQ2650084W	1	1	1-1/4	4	5			0.25
MXQ2650085	MXQ2650085W	1	1	1-1/2	4	5			0.12
MXQ2650086	MXQ2650086W	1	1	2	5	4			0.03
MXQ2650087	MXQ2650087W	1	1	2	5	4			0.12
MXQ2650088	MXQ2650088W	1	1	2	5	4			0.19
MXQ2650089	MXQ2650089W	1	1	2	5	4			0.25
MXQ2650090	MXQ2650090W	1	1	2	5	5			0.03
MXQ2650091	MXQ2650091W	1	1	2	5	5			0.12
MXQ2650092	MXQ2650092W	1	1	2	5	5			0.19
MXQ2650093	MXQ2650093W	1	1	2	5	5			0.25
MXQ2650094	MXQ2650094W	1	1	1-1/4	6	5	3-1/8	0.96	0.06
MXQ2650095	MXQ2650095W	1	1	1-1/4	6	5	3-1/8	0.96	0.12
MXQ2650096	MXQ2650096W	1	1	1-1/4	6	5	3-1/8	0.96	0.25
MXQ2650097	MXQ2650097W	1	1	1-1/4	7	5	4-1/8	0.96	0.06
MXQ2650098	MXQ2650098W	1	1	1-1/4	7	5	4-1/8	0.96	0.12
MXQ2650099	MXQ2650099W	1	1	1-1/4	7	5	4-1/8	0.96	0.25

Cutting data recommendations starting page 151

Solid Carbide
Inch

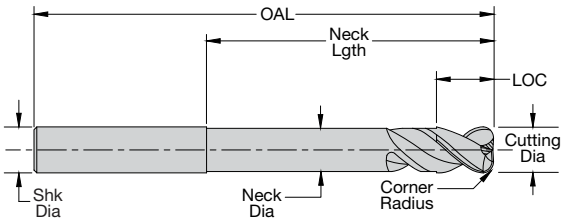


Helix angle	36°
Coating	Enduraspeed
Cutting materials	K10
Special features	Variable Index, Exotic Metals & Stainless Steel

Cutting Dia. d_1	Overall Length	Length of Cut	No. of Flutes	Square EDP No.	.030 Rad EDP No.	.060 RAD EDP No.	Ball EDP No.
0.250	2.000	0.375	4	EMC601604	EMC601624	EMC601640	EMC601714
	2.500	0.750	4	EMC601904	EMC601924	EMC601940	EMC602014
0.375	2.000	0.500	4	EMC601608	EMC601628	EMC601644	EMC601718
	2.500	1.125	4	EMC601908	EMC601928	EMC601944	EMC602018
0.500	2.500	0.625	4	EMC601612	EMC601632	EMC601648	EMC601722
	3.000	1.250	4	EMC601912	EMC601932	EMC601948	EMC602022
0.625	3.000	0.750	4	EMC601614	EMC601634	EMC601650	EMC601724
	3.500	1.625	4	EMC601914	EMC601934	EMC601950	EMC602024
0.750	3.000	1.125	4	EMC601616	EMC601636	EMC601652	EMC601726
	4.000	1.625	4	EMC601916	EMC601936	EMC601952	EMC602026
1.000	3.000	1.250	4	EMC601618	EMC601638	EMC601654	EMC601728
	4.000	2.000	4	EMC601918	EMC601938	EMC601954	EMC602028

Cutting data recommendations starting page 153

Solid Carbide
Inch



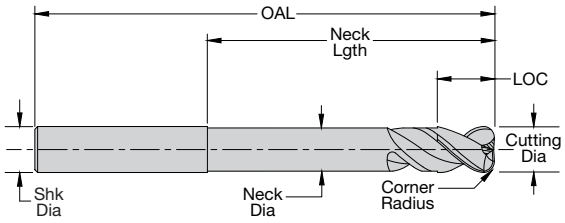
Helix angle	36°
Coating	Enduraspeed
Cutting materials	–
Special features	Exotic Metals & Stainless Steel

Cutting Dia. d_1	Overall Length	Length of Cut	No. of Flutes	Square EDP No.	.030 Rad EDP No.	.060 RAD EDP No.	Ball EDP No.
0.250	2.000	0.375	5	EMC604000	EMC604004	EMC604006	EMC604010
	2.500	0.750	5	EMC604100	EMC604104	EMC604106	EMC604110
0.375	2.000	0.500	5	EMC604012	EMC604016	EMC604018	EMC604024
	2.500	1.125	5	EMC604112	EMC604116	EMC604118	EMC604124
0.500	2.500	0.625	5	EMC604026	EMC604030	EMC604032	EMC604042
	3.000	1.250	5	EMC604126	EMC604130	EMC604132	EMC604142
0.625	3.000	0.750	5	EMC604044	EMC604046	EMC604048	EMC604060
	3.500	1.625	5	EMC604144	EMC604146	EMC604148	EMC604160
0.750	3.000	1.125	5	EMC604062	EMC604064	EMC604066	EMC604078
	4.000	1.625	5	EMC604162	EMC604164	EMC604166	EMC604178
1.000	3.000	1.250	5	EMC604080	EMC604082	EMC604084	EMC604096
	5.000	2.000	5	EMC604180	EMC604182	EMC604184	EMC604196

Cutting data recommendations starting page 153

ONSRUD TVS-7 / TVM-7 – EMC for Exotic Metals and Stainless Steels

Solid Carbide
Inch

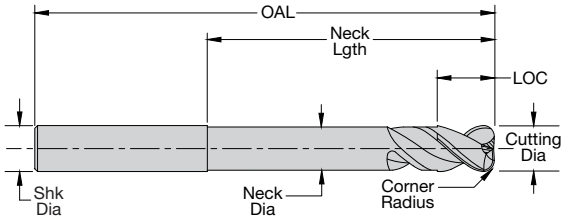


Helix angle	40°
Coating	Enduraspeed
Cutting materials	–
Special features	Exotic Metals & Stainless Steel

Cutting Dia. d_1	Overall Length	Length of Cut	No. of Flutes	Square EDP No.	.030 Rad EDP No.	.060 RAD EDP No.
0.500	2.500	0.625	7	EMC700051	EMC700055	EMC700057
	3.000	1.250	7	EMC700107	EMC700111	EMC700113
0.625	3.000	0.750	7	EMC700065	EMC700067	EMC700069
	3.500	1.625	7	EMC700121	EMC700123	EMC700125
0.750	3.000	1.125	7	EMC700079	EMC700081	EMC700083
	4.000	1.625	7	EMC700135	EMC700137	EMC700139
1.000	4.000	1.250	7	EMC700093	EMC700095	EMC700097
	5.000	2.000	7	EMC700149	EMC700151	EMC700153

Cutting data recommendations starting page 153

Solid Carbide
Inch



Helix angle	40°
Coating	None or ZRN
Cutting materials	–
Special features	Aluminum and Non-Ferrous

Cutting Dia. d_1	Overall Length	Length of Cut	No. of Flutes	Square EDP No.	.015 Rad EDP No.	.030 Rad EDP No.	.060 RAD EDP No.	Ball EDP No.
0.250	2.000	0.375	2	AMC700102	AMC700106	AMC700110	AMC700114	AMC700138
	2.000	0.375	2	AMC700103	AMC700107	AMC700111	AMC700115	AMC700139
	2.000	0.750	2	AMC700752	AMC700756	AMC700760	AMC700764	AMC700788
	2.000	0.750	2	AMC700753	AMC700757	AMC700761	AMC700765	AMC700789
0.3125	2.500	0.563	2	AMC400014	AMC400016			AMC400018
	2.500	0.563	2	AMC400015	AMC400017			AMC400019
	2.500	0.813	2	AMC400032	AMC400034			AMC400036
	2.500	0.813	2	AMC400033	AMC400035			AMC400037
0.375	2.500	0.500	2	AMC700202	AMC700206	AMC700210	AMC700214	AMC700238
	2.500	0.500	2	AMC700203	AMC700207	AMC700211	AMC700215	AMC700239
	2.500	1.000	2	AMC700852	AMC700856	AMC700860	AMC700864	AMC700888
	2.500	1.000	2	AMC700853	AMC700857	AMC700861	AMC700865	AMC700889
0.500	3.000	0.625	2	AMC700302	AMC700306	AMC700310	AMC700314	AMC700338
	3.000	0.625	2	AMC700303	AMC700307	AMC700311	AMC700315	AMC700339
	3.000	1.250	2	AMC700952	AMC700956	AMC700960	AMC700964	AMC700988
	3.000	1.250	2	AMC700953	AMC700957	AMC700961	AMC700965	AMC700989
0.625	3.000	0.750	2	AMC700402		AMC700410	AMC700414	AMC700438
	3.000	0.750	2	AMC700403		AMC700411	AMC700415	AMC700439
	4.000	1.625	2	AMC701052		AMC701060	AMC701064	AMC701088
	4.000	1.625	2	AMC701053		AMC701061	AMC701065	AMC701089
0.750	3.000	1.000	2	AMC700502		AMC700510	AMC700514	AMC700538
	3.000	1.000	2	AMC700503		AMC700511	AMC700515	AMC700539
	4.000	1.625	2	AMC701152		AMC701160	AMC701164	AMC701188
	4.000	1.625	2	AMC701153		AMC701161	AMC701165	AMC701189
1.000	4.000	1.250	2	AMC700602		AMC700610	AMC700614	AMC700638
	4.000	1.250	2	AMC700603		AMC700611	AMC700615	AMC700639
	5.000	2.500	2	AMC701252		AMC701260	AMC701264	AMC701288
	5.000	2.500	2	AMC701253		AMC701261	AMC701265	AMC701289

ZRN Coated Uncoated

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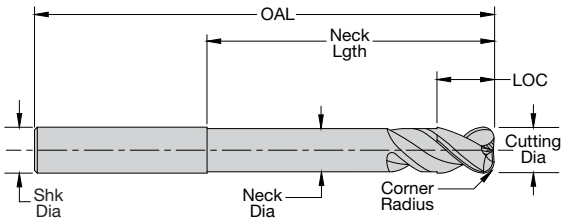
Solid Carbide
Inch



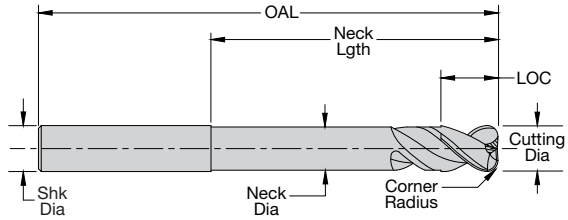
Helix angle	40°
Coating	None or ZRN
Cutting materials	–
Special features	Aluminum and Non-Ferrous

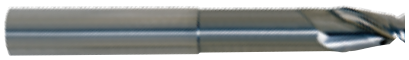
Cutting Dia. d_1	Overall Length	Length of Cut	No. of Flutes	Square EDP No.	.015 Rad EDP No.	.030 Rad EDP No.	.060 RAD EDP No.	Ball EDP No.
0.250	2.000	0.375	3	AMC703102	AMC703106	AMC703110	AMC703114	AMC703138
	2.000	0.375	3	AMC703103	AMC703107	AMC703111	AMC703115	AMC703139
	2.000	0.750	3	AMC703752	AMC703756	AMC703760	AMC703764	AMC703788
	2.000	0.750	3	AMC703753	AMC703757	AMC703761	AMC703765	AMC703789
0.3125	2.500	0.563	3	AMC400050	AMC400052			AMC400054
	2.500	0.563	3	AMC400051	AMC400053			AMC400055
	2.500	0.813	3	AMC400068	AMC400070			AMC400074
	2.500	0.813	3	AMC400069	AMC400071			AMC400075
0.375	2.500	0.500	3	AMC703202	AMC703206	AMC703210	AMC703214	AMC703238
	2.500	0.500	3	AMC703203	AMC703207	AMC703211	AMC703215	AMC703239
	2.500	1.000	3	AMC703852	AMC703856	AMC703860	AMC703864	AMC703888
	2.500	1.000	3	AMC703853	AMC703857	AMC703861	AMC703865	AMC703889
0.500	3.000	0.625	3	AMC703302	AMC703306	AMC703310	AMC703314	AMC703338
	3.000	0.625	3	AMC703303	AMC703307	AMC703311	AMC703315	AMC703339
	3.000	1.250	3	AMC703952	AMC703956	AMC703960	AMC703964	AMC703988
	3.000	1.250	3	AMC703953	AMC703957	AMC703961	AMC703965	AMC703989
0.625	3.000	0.750	3	AMC703402		AMC703410	AMC703414	AMC703438
	3.000	0.750	3	AMC703403		AMC703411	AMC703415	AMC703439
	4.000	1.625	3	AMC704052		AMC704060	AMC704064	AMC704088
	4.000	1.625	3	AMC704053		AMC704061	AMC704065	AMC704089
0.750	3.000	1.000	3	AMC703502		AMC703510	AMC703514	AMC703538
	3.000	1.000	3	AMC703503		AMC703511	AMC703515	AMC703539
	4.000	1.625	3	AMC704152		AMC704160	AMC704164	AMC704188
	4.000	1.625	3	AMC704153		AMC704161	AMC704165	AMC704189
1.000	4.000	1.250	3	AMC703602		AMC703610	AMC703614	AMC703638
	4.000	1.250	3	AMC703603		AMC703611	AMC703615	AMC703639
	5.000	2.500	3	AMC704252		AMC704260	AMC704264	AMC704288
	5.000	2.500	3	AMC704253		AMC704261	AMC704265	AMC704289

ZRN Coated Uncoated

Cutting data recommendations starting page 154

Solid Carbide
Inch





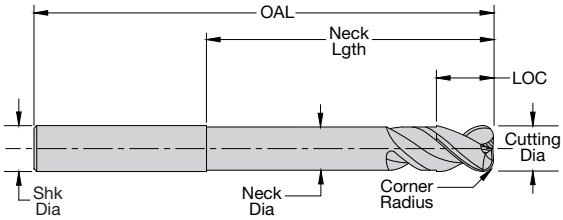
Helix angle	40°
Coating	None or ZRN
Cutting materials	–
Special features	Aluminum and Non-Ferrous

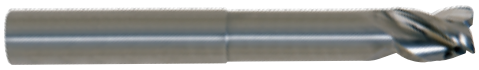
Cutting Dia. d_1	Overall Length	Length of Cut	Neck Length	No. of Flutes	Square EDP No.	.015 Rad EDP No.	.030 Rad EDP No.	.060 RAD EDP No.	Ball EDP No.
0.250	4.000	0.375	1.500	2	AMC712102	AMC712106	AMC712110	AMC712114	AMC712138
	4.000	0.375	1.500	2	AMC712103	AMC712107	AMC712111	AMC712115	AMC712139
	4.000	0.750	1.750	2	AMC712752	AMC712756	AMC712760	AMC712764	AMC712788
	4.000	0.750	1.750	2	AMC712753	AMC712757	AMC712761	AMC712765	AMC712789
0.375	4.000	0.500	1.750	2	AMC712202	AMC712206	AMC712210	AMC712214	AMC712238
	4.000	0.500	1.750	2	AMC712203	AMC712207	AMC712211	AMC712215	AMC712239
	4.000	1.000	2.250	2	AMC712852	AMC712856	AMC712860	AMC712864	AMC712888
	4.000	1.000	2.250	2	AMC712853	AMC712857	AMC712861	AMC712865	AMC712889
0.500	4.000	0.625	2.125	2	AMC712302	AMC712306	AMC712310	AMC712314	AMC712338
	4.000	0.625	2.125	2	AMC712303	AMC712307	AMC712311	AMC712315	AMC712339
	5.000	1.250	3.125	2	AMC712952	AMC712956	AMC712960	AMC712964	AMC712988
	5.000	1.250	3.125	2	AMC712953	AMC712957	AMC712961	AMC712965	AMC712989
0.625	4.000	0.750	2.125	2	AMC712402		AMC712410	AMC712414	AMC712438
	4.000	0.750	2.125	2	AMC712403		AMC712411	AMC712415	AMC712439
	6.000	1.625	3.125	2	AMC713052		AMC713060	AMC713064	AMC713088
	6.000	1.625	3.125	2	AMC713053		AMC713061	AMC713065	AMC713089
0.750	4.000	1.000	2.125	2	AMC712502		AMC712510	AMC712514	AMC712538
	4.000	1.000	2.125	2	AMC712503		AMC712511	AMC712515	AMC712539
	6.000	1.625	3.125	2	AMC713152		AMC713160	AMC713164	AMC713188
	6.000	1.625	3.125	2	AMC713153		AMC713161	AMC713165	AMC713189
1.000	5.000	1.250	2.125	2	AMC712602		AMC712610	AMC712614	AMC712638
	5.000	1.250	2.125	2	AMC712603		AMC712611	AMC712615	AMC712639
	6.000	2.500	3.125	2	AMC713252		AMC713260	AMC713264	AMC713288
	6.000	2.500	3.125	2	AMC713253		AMC713261	AMC713265	AMC713289

ZRN Coated Uncoated

Cutting data recommendations starting page 154

Solid Carbide
Inch





Helix angle	40°
Coating	None or ZRN
Cutting materials	–
Special features	Aluminum and Non-Ferrous

Cutting Dia. d_1	Overall Length	Length of Cut	Neck Length	No. of Flutes	Square EDP No.	.015 Rad EDP No.	.030 Rad EDP No.	.060 RAD EDP No.	Ball EDP No.
0.250	4.000	0.375	1.500	3	AMC715102	AMC715106	AMC715110	AMC715114	AMC715138
	4.000	0.375	1.500	3	AMC715103	AMC715107	AMC715111	AMC715115	AMC715139
	4.000	0.750	1.750	3	AMC715752	AMC715756	AMC715760	AMC715764	AMC715788
	4.000	0.750	1.750	3	AMC715753	AMC715757	AMC715761	AMC715765	AMC715789
0.375	4.000	0.500	1.750	3	AMC715202	AMC715206	AMC715210	AMC715214	AMC715238
	4.000	0.500	1.750	3	AMC715203	AMC715207	AMC715211	AMC715215	AMC715239
	4.000	1.000	2.250	3	AMC715852	AMC715856	AMC715860	AMC715864	AMC715888
	4.000	1.000	2.250	3	AMC715853	AMC715857	AMC715861	AMC715865	AMC715889
0.500	4.000	0.625	2.125	3	AMC715302	AMC715306	AMC715310	AMC715314	AMC715338
	4.000	0.625	2.125	3	AMC715303	AMC715307	AMC715311	AMC715315	AMC715339
	5.000	1.250	3.125	3	AMC715952	AMC715956	AMC715960	AMC715964	AMC715988
	5.000	1.250	3.125	3	AMC715953	AMC715957	AMC715961	AMC715965	AMC715989
0.625	4.000	0.750	2.125	3	AMC715402		AMC715410	AMC715414	AMC715438
	4.000	0.750	2.125	3	AMC715403		AMC715411	AMC715415	AMC715439
	6.000	1.625	3.125	3	AMC716052		AMC716060	AMC716064	AMC716088
	6.000	1.625	3.125	3	AMC716053		AMC716061	AMC716065	AMC716089
0.750	4.000	1.000	2.125	3	AMC715502		AMC715510	AMC715514	AMC715538
	4.000	1.000	2.125	3	AMC715503		AMC715511	AMC715515	AMC715539
	6.000	1.625	3.125	3	AMC716152		AMC716160	AMC716164	AMC716188
	6.000	1.625	3.125	3	AMC716153		AMC716161	AMC716165	AMC716189
1.000	5.000	1.250	2.125	3	AMC715602		AMC715610	AMC715614	AMC715638
	5.000	1.250	2.125	3	AMC715603		AMC715611	AMC715615	AMC715639
	6.000	2.500	3.125	3	AMC716252		AMC716260	AMC716264	AMC716288
	6.000	2.500	3.125	3	AMC716253		AMC716261	AMC716265	AMC716289

ZRN Coated Uncoated

Cutting data recommendations starting page 154

Technical Data

ISO Example

S E K N

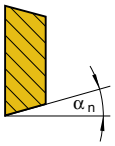
1 2 3 4

1 Insert Shape

A	85°
B	82°
C	80°
D	55°
E	75°
H	120°
K	55°
L	90°
M	86°
O	135°
P	108°
R	
S	90°
T	60°
V	35°
W	80°

Note 1:
In case of more than one angle, always use smallest angle.

2 Clearance Angle

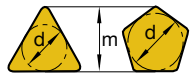


	α_n
A	3°
B	5°
C	7°
D	15°
E	20°
F	25°
G	30°
N	0°
P	11°
O	Normal clearance angles, which require a special description.

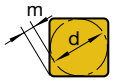
3

Tolerances (inches)

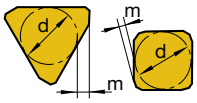
	m	s	d
A	±0.0002	±0.001	±0.001
C	±0.0005		
E	±0.001		
F	±0.0002		±0.0005
G	±0.001	±0.005	±0.001
H	±0.0005	±0.001	±0.0005
J	±0.0002		See Table 5
K	±0.0005		
L	±0.001		
M	See Table 4	±0.005	
N		±0.001	
U		±0.005	



Corner rounding, uneven number of sides



Corner rounding, even number of sides



Chamfered inserts

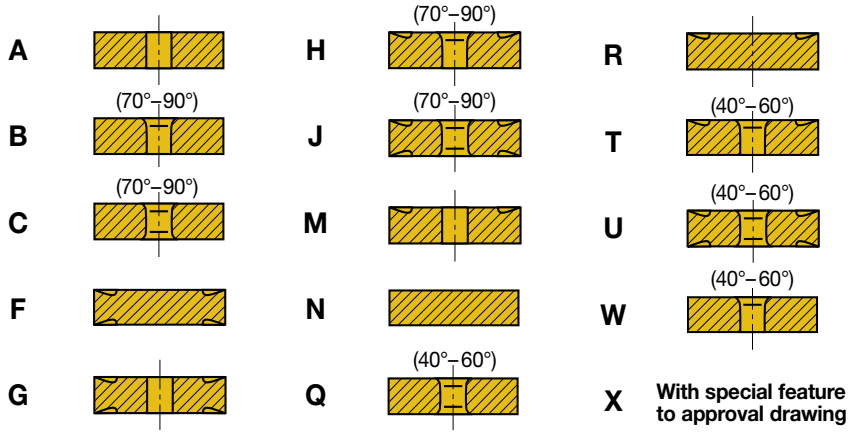
Table 4-m

d		M, N	U
Over .154	**Up to .394**		
		±0.003	±0.005
.394	.590	±0.005	±0.008
.590	.787	±0.006	±0.011
.787	1.024	±0.007	±0.015
1.024	1.260	±0.008	±0.015

Table 5-d

d		J, K, L, M	U
Over .154	**Up to .394**		
		±0.002	±0.003
.394	.590	±0.003	±0.005
.590	.787	±0.004	±0.007
.787	1.024	±0.005	±0.001
1.024	1.260	±0.006	±0.001

4 Cutting Face, Clamp Style



With special feature to approval drawing

( ) Cone angle for screw

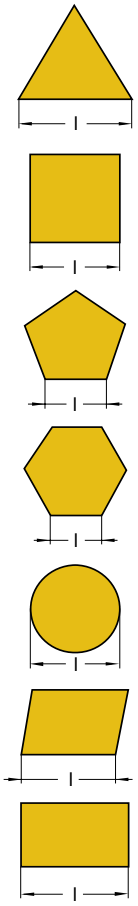
12 03 AF S N

5 6 7 8 9

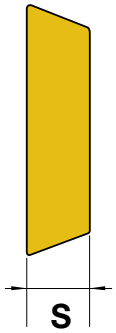
5 Cutting Edge Length

l = Length

	l
06	.250
07	.312
09	.375
11	.433
12	.500
15	.625
16	.649
19	.750
22	.866
25	1.00
31	1.25
38	1.50



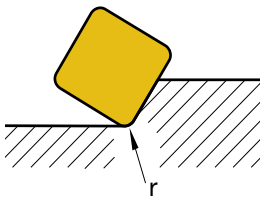
6 Thickness



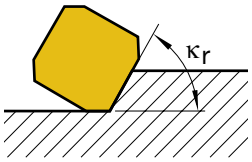
	S (Inches)
02	.094
03	.125
T3	.156
04	.187
05	.219
06	.250
07	.312
08	.315
09	.375

7 A Cutting Edge Corner

Radius inserts



For chamfer face milling inserts



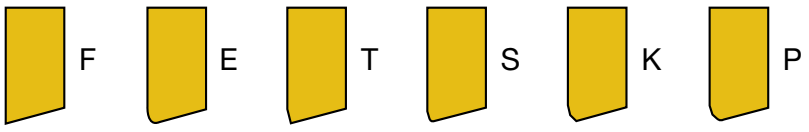
	Corner radius-r (Inches)
00	sharp-edged
02	0.007
04	0.015
08	0.031
12	0.047
16	0.062
20	0.078

	Approach angle κr
A	45°
D	60°
E	75°
F	85°
P	90°
Z	Special

7 B

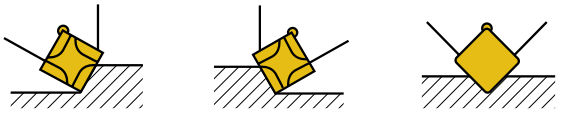
A	3°
B	5°
C	7°
D	15°
E	20°
F	25°
G	30°
N	0°
P	11°
O	Clearance of face milling edge

8 Cutting Edge Corner*



Sharp-edged | Rounded | Chamfered | Chamfered and Rounded | Doubled Chamfered | Double Chamfered and Rounded

9 Direction of Cut*



R RH cut only

L LH cut only

N RH and LH cut

*This reference letter is not always used

Cutting Material Grades	Description of Cutting Materials for Mold and Die Industry
LC225S	**HC-P25 PVD-TiCN Plus coated** Highly wear-resistant multiple-application grade with high toughness For wet and dry milling of steel, stainless cast steel and cast iron High cutting speeds Low to medium cut depths Low to medium chip load
LC225T	**HC-P25 PVD TiAlN Al2Plus coated** Highly wear-resistant multiple-application grade with high toughness For wet and dry milling of steel, cast steel and cast iron High cutting speeds Low to medium depths of cut Low to medium chip load
LC230F	The very tough carbide substrate guarantees this universal steel milling grade's high machining security for a from soft gummy carbon steels to alloy tool steels and alternative for Austenitic Stainless. A modern MT-CVD multilayer Al2O3 – coating ensures dry machining. An outer TiN layer makes wet machining also possible.
LC240S	**HC-P40 PVD TiCN Plus coated** Wear-resistant grade with high toughness for wet and dry milling of steel, stainless steel, cast steel and cast iron Medium cutting speeds Medium to high chip load
LC240T	**HC-P40 PVD TiAlN Al2Plus coated** Wear-resistant grade with high toughness, for wet and in particular dry milling of steel, cast steel and cast iron Medium to high cutting speeds Medium to high load
LC280QN	**HC-P40 PVD TiAlN Al2Plus/TiN double coated** Wear-resistant grade with high toughness and particularly stable micro-geometry, for wet and particular dry milling of steel and cast steel, unstable conditions Medium to high cutting speeds Highest chip load High chip load
LC603Z	**HC-K03 PVD-TiAlN AlX coated** Extremely wear-resistant grade, particularly suitable for finishing of cold and hot forming tool steel. Suitable for hard machining. Also suitable for cast iron and non-ferrous metals High cutting speeds. Low chip-forming cross-sections Low to medium chip load
LC610A	**HC-K10 CVD diamond coated** Diamond-coated carbide for graphite machining suitable for roughing and finishing, can be used for 3- and 5-axis as well as for high speed cutting
LC610Q	**HC-K 10 PVD- AL Cr N coated** Highly wear-resistant coated milling grad with high cutting edge stability for fine machining alloyed and unalloyed tool steels. High stability and wear-resistance specifically by high temperatures. Suitable for dry machining and high speed cutting up to 54 HRC. Low to medium depths of cut Low to medium chip load
LC610W	**HC-K 10 PVD TiCN coated** Highly wear-resistant coated milling grade with high cutting edge stability for fine machining of alloyed and unalloyed tool steels, high-strength materials and cast iron at medium cutting speeds. Low to medium depths of cut Low to medium chip load
LC610T	**HC-K 10 PVD TiAlN Al2Plus coated** Highly wear-resistant coated milling grade with high cutting edge stability for fine machining of alloyed and unalloyed tool steels, high-strength materials, non-ferrous metals and cast iron at high cutting speeds. Low to medium depths of cut Low to medium chip load
LC620T	**HC-K20 fine-grain PVD TiAlN Al2Plus coated** Highly wear-resistant grade with high toughness for wet and dry machining of steel, cast steel, cast iron and non-ferrous metals. Suitable also for hard machining Medium to high cutting speeds Medium depths of cut, Medium tooth feeds

Cutting Material Grades	Description of Cutting Materials for Mold and Die Industry
LC620Z	**HC-K20 fine-grain PVD TiAlN AlX coated** Highly wear-resistant grade with high toughness for wet and dry machining of steel, cast steel, cast iron and non-ferrous metals. Suitable also for hard machining Medium to high cutting speeds Medium depths of cut, Medium chip load
LC630T	**HC-K30 TiAlN AL2Plus coated** Highly wear-resistant milling grade with high cutting edge stability for machining of alloyed and unalloyed tool steels, high-strength materials, stainless steels and cast iron at medium cutting speeds Medium depths of cut Medium chip loads
LC630Q	**HC-K30 PVD-AL Cr N coated** Highly wear-resistant milling grade with high toughness for dry machining alloyed and unalloyed steels up to 54 Rc and cast iron at medium cutting speeds Medium Depths of Cut Medium to Heavy Chip loads
LC730Z	**HC-K20 fine-grain PVD TiAlN AlX coated** Highly wear-resistant ultra fine grain grade with high toughness for wet and dry machining of steel, cast steel, cast iron and non-ferrous metals. Suitable also for hard machining Medium to high cutting speeds Medium depths of cut, Medium chip load
LCP40M	Suited for high feed rates. A combination of tough carbide substrate with a double layer PVD coating. The inserts are coated with AL6 and have an additional TiN-layer allowing for easier wear detection.
LCP44M	A combination of tough carbide substrate with the temperature resistant coating TERA speed AlTiNCVD) is ideal for wet steel milling operations. The multilayer coating architecture provide the feature to minimized thermal crack initiation and prevent crack growth.
LCKP10M	These indexable inserts are made of a tough, wear resistant, micro-grain substrate. The AL2Plus coating is extremely resistant to oxidation. Particularly well suited for high performance cutting of gray cast iron and steel materials at higher cutting speeds and with reduced infeeds.
LCK10M	TERAspeed (AlTiN-CVD) coated micro-grain carbide grade for milling cast iron materials. Especially well suited for dry machining at high cutting speeds due to the high temperature resistance.
LW225	**HW-P25 uncoated** Wear-resistant, uncoated multiple-application material with high strength, for wet and dry milling of alloyed materials (cast iron, in some cases also nodular cast iron) Moderate cutting speeds Low to medium depths of cut Low to medium chip load
LW240	**HW-P40 uncoated** Extra-tough uncoated carbide grade for medium to heavy milling of steel and cast steel Low to medium cutting speeds Medium to high chip For wet and dry milling
LW610	**HW-K 10 micro-grain uncoated** Milling grade with high wear resistance for machining of grey cast iron, aluminium alloys, and non-ferrous metals at medium to higher cutting speeds, even under unfavourable machining conditions
DP	**Polycrystalline diamond (PCD)** Highly wear-resistant uncoated milling grade for machining of aluminium, bronze, non-ferrous metals, fibre-reinforced composite materials, plastics, certain ceramics and carbides (soft, prior to sintering) at high cutting speeds Low to medium depths of cut Low to medium chip load
BN	**Cubical boron nitride (CBN)** Very highly wear-resistant uncoated milling grade for machining of hardened materials with HRC >45, cast iron at high cutting speeds Low to medium depths of cut Low to medium chip load

"K" Factors		
Work Material	**Hardness BHN**	**"K" factor**
steel, wrought and cast (plain carbon, alloy steels, and tool steels)	85-200	1.64
	201-254	1.58
	254-288	1.28
	287-327	1.10
	328-371	.88
	372-481	.69
	492-550	.59
	561-515	.54
precipitation, hardening stainless steels	150-450	1.27-.42
cast irons (grey, ductile and malleable)	150-175	2.27
	110-190	2.00
	176-200	1.89
	201-250	1.52
	251-300	1.27
	301-320	1.19
stainless steels, wrought and cast (ferritic, austenitic, & martensitic)	135-275	1.54-.76
	288-421	.74-.50
titanium	250-375	1.33-.87
high-temperature alloys nickel, and cobalt based	200-380	.83-.48
iron base	180-320	.91-.53
nickel alloys	80-360	.91-.53
aluminum alloys	30-150 (500kg)	6.25-3.33
magnesium alloys	40-90 (500kg)	10.0-6.67
copper	150	3.33
copper alloys	100-150	3.33
	151-240	2.0

Conversion millimeter – inches

Diameters	
mm	**inch**
1	0.039
2	0.079
3	0.118
4	0.157
5	0.197
6	0.236
8	0.315
10	0.394
12	0.472
14	0.551
16	0.630
18	0.709
20	0.787
25	0.984
32	1.260
40	1.575
50	1.969
52	2.047
63	2.480
66	2.598
80	3.150
100	3.937
125	4.921
160	6.299
200	7.874
250	9.843
315	12.402
400	15.748
500	19.685

Conversion Charts			
doc		**speed**	
mm	**inch**	**sfm**	**m/min**
0.254	.010	300	91
0.381	.015	400	122
0.762	.030	500	152
1.270	.050	600	183
2.540	.100	800	244
3.175	.125	1000	305
3.810	.150	1200	366
6.350	.250	2000	610
9.525	.375	4000	1219
12.700	.500	10000	3048
Chipload IPT		**Surface Finish (RA)**	
mm/T	**Inch/T**	**um**	**uinch**
0.076	.003	12.5	500
0.102	.004	6.3	250
0.127	.005	3.2	125
0.152	.006	1.6	63
0.178	.007	0.8	32
0.203	.008	0.4	16
0.229	.009		
0.254	.010		
0.279	.011		
0.305	.012		

Multiply	**By**	**To Obtain**
meters/seconds	3.281	SFM (feet/minute)
inches	25.4	millimeters
millimeters	.03937	inches

Formulas	
Surface feet per minute	**sfm** = .262 x rpm x D
revolutions per minute	**rpm** = 3.82 x sfm ÷ D
inch per revolution	**ipr** = ipm ÷ rpm
(feed rate) inch per minute	**ipm** = lpt x nt x rpm
inch per tooth (chip load)	**ipt** = ipm ÷ (nt x rpm)
metal removal rate	**mrr** = doc x woc x ipm
	= cu. inches/min.
horse power at cutter	**HPc** = mrr÷ k
horse power at motor	**HPm** = hpc ÷ e

Legend

doc = axial depth of cut **woc** = radial width of cut
e = spindle efficiency (varies 75% to 90%)
k = a power factor that represents the number of cubic inches of metal per minutes that can be removed by one horsepower.
nt = number of effective teeth or inserts in a cutter body
D = cutter diameter

Example

5" cutter diameter	
8 teeth in cutter	rpm = 3.82 x 550 ÷ 5 = 420
550 sfm	ipm = .008 x 8 x 420 = 26.9
.008 ipt	ipr = 26.9 ÷ 420 = .064

Hardness Comparison Chart

Tensible strength Rm N/mm²	Vickers hardness HV	Brinell hardness HB	Rockwell hardness HRC
255	80	76	
270	85	80.7	
285	90	85.5	
305	95	90.2	
320	100	95	
335	105	99.8	
350	110	105	
370	115	109	
385	120	114	
400	125	119	
415	130	124	
430	135	128	
450	140	133	
465	145	138	
480	150	143	
495	155	147	
510	160	152	
530	165	156	
545	170	162	
560	175	166	
575	180	171	
595	185	176	
610	190	181	
625	195	185	
640	200	190	
660	205	195	
675	210	199	
690	215	204	
705	220	209	
720	225	214	
740	230	219	
755	235	223	
770	240	228	20.3
785	245	233	21.3
800	250	238	22.2
820	255	242	23.1
835	260	247	24
850	265	252	24.8
865	270	257	25.6
880	275	261	26.4
900	280	266	27.1
915	285	271	27.8
930	290	276	28.5
950	295	280	29.2
965	300	285	29.8
995	310	295	31
1030	320	304	32.2
1060	330	314	33.3
1095	340	323	34.4

Tensible strength Rm N/mm²	Vickers hardness HV	Brinell hardness HB	Rockwell hardness HRC
1125	350	333	35.5
1155	360	342	36.6
1190	370	352	37.7
1220	380	361	38.8
1155	390	371	39.8
1290	400	380	40.8
1320	410	390	41.8
1350	420	399	42.7
1385	430	409	43.6
1420	440	418	44.5
1455	450	428	45.3
1485	460	437	46.1
1520	470	447	46.9
1555	480	(456)	47.7
1595	490	(466)	48.4
1630	500	(475)	49.1
1665	510	(485)	49.8
1700	520	(494)	50.5
1740	530	(504)	51.1
1775	540	(513)	51.7
1810	550	(523)	52.3
1845	560	(532)	53.0
1880	570	(542)	53.6
1920	580	(551)	54.1
1955	590	(561)	54.7
1995	600	(570)	55.2
2030	610	(580)	55.7
2070	620	(589)	56.3
2105	630	(599)	56.8
2145	640	(608)	57.3
2180	650	(618)	57.8
	660		58.3
	670		58.8
	680		59.2
	690		59.7
	700		60.1
	720		61
	740		61.8
	760		62.5
	780		63.3
	800		64
	820		64.7
	840		65.3
	860		65.9
	880		66.4
	900		67
	920		67.5
	940		68

Tensible strength	Rm	N/mm²
Vickers hardness	HV	Diamond pyramid 136°, Test force F = 98 N
Brinell hardness Calculated from: HB = 0.95 x HV	HB	0.102 x F/D2 = 30 N/mm² F = Test force in N, D = Ball diameter in mm
Hardness Rockwell C	HRC	Diamond cone 120°, Total test force 1471 ± 9 N

	Material	Examples	Rockwell C	Feed per Tooth (f_z) / SFM					
				0.003 - 0.006		0.006 - 0.014		0.014 - 0.020	
				💧💧	☀	💧💧	☀	💧💧	☀
P	Plain Carbon steel	1018, 1025	< 20	520	790	490	720	390	520
	Free Machining steel	1212, 12L13	< 20	520	790	490	720	390	520
	Structural alloy steel	1040, 4130	< 30	520	790	490	720	390	520
	Heat-treatment steel,	4140, 6150	< 30	490	620	430	520	360	460
	medium strength	4340, 8740		490	620	430	520	360	460
	Cast Steel	52100, 8620	< 30	490	620	430	520	360	460
	Caste hardening steel	410, 430F, 440	< 30	-	-	-	-	-	-
	Stainless steel,	4140, 8740	< 30	520	720	430	590	330	460
	ferritic			430	590	330	460	260	360
	martensitic			390	520	300	430	230	330
	Heat treatment steel, High strength	A355	28 - 44	-	-	-	-	-	-
	Nitriding Steel	H13, D2	28 - 44	390	520	300	430	230	330
	Tool Steel	1018, 1025,	28 - 44	390	520	300	430	230	330
M	Stainless steel, austenitic Maraging steel	304, 316	< 30	390	590	-	-	-	-
K	Grey cast iron	A319, J431 No. 25B, No. 50B	< 27	-	-	-	-	-	-
	Alloyed grey cast iron	A434, A436-72	< 22	-	-	-	-	-	-
	Nodular cast iron	A536 (80-55-06), J434	< 34	490	620	410	540	340	460
	Malleable cast iron	A220, 50005 A47, 32510	< 29	-	-	-	-	-	-
N	Pure metals, soft	Pure Iron, Lead	< 20	-	-	-	-	-	-
	Aluminum alloys, long chipping	6061, 7050	< 20	-	-	-	-	-	-
	Aluminum alloys, short chipping	A356, 4218	< 20	-	-	-	-	-	-
	Copper alloys, long chipping	C27200, B-148-52	< 20	-	-	-	-	-	-
	Copper alloy, short chipping		< 20	-	-	-	-	-	-
	Magnesium alloys	B94, M11910		-	-	-	-	-	-
	Thermoplastics	PVC, Acrylic glass		-	-	-	-	-	-
	Duroplastics	Durolite, Ampal		-	-	-	-	-	-
	Graphite			-	-	-	-	-	-
S	Titanium alloys, medium strength	F67, B265	< 29	-	-	-	-	-	-
	Titanium alloys, high strength Alloy	Ti-6Al-4V	27 - 44	-	-	-	-	-	-
	Nickel based alloys medium strength	20Cb3	< 29	-	-	-	-	-	-
	Heat resistant nickel based alloys high strength	Inconel 718	27 - 44	-	-	-	-	-	-
H	Chilled cast iron	Ampco 25	< 20	-	-	-	-	-	-
	Hardened steel		45 - 52	-	-	-	-	-	-
			53 - 59						
			60 - 65						

💧💧 Wet machining ☀ Dry machining

	Material	Examples	Rockwell C	Feed per Tooth (f_z) / SFM					
				0.003 - 0.006		0.006 - 0.014		0.014 - 0.020	
				💧💧	☀	💧💧	☀	💧💧	☀
P	Plain Carbon steel	1018, 1025,	< 20	690	870	540	720	430	570
	Free Machining steel	1212, 12L13	< 20	690	870	540	720	430	570
	Structural alloy steel	1040, 4130	< 30	690	870	540	720	430	570
	Heat-treatment steel, medium strength	4140, 6150	< 30	560	710	440	590	360	480
	Cast Steel	4340, 8740	< 30	560	710	440	590	360	480
	Caste hardening steel	52100, 8620	< 30	560	710	440	590	360	480
	Stainless steel, ferritic martensitic	410, 430F, 440	< 30	560	710	440	590	360	480
	Heat treatment steel, High strength	4140, 8740	28 - 44	490	620	390	520	310	430
	Nitriding Steel	A355	28 - 44	490	620	390	520	310	430
	Tool Steel	H13, D2	28 - 44	490	620	390	520	310	430
M	Stainless steel austentic	304, 316	< 30	750	950	590	790	480	620
	Maraging steel			750	950	590	790	480	620
K	Grey cast iron	A319, J431 No. 25B, No. 50B	< 27	690	870	540	720	430	570
	Alloyed grey cast iron	A434, A436-72	< 22	560	710	440	590	360	480
	Nodular cast iron	A536 (80-55-06), J434	< 34	490	620	390	520	310	430
	Malleable cast iron	A220, 50005 A47,32510	< 29	490	620	390	520	310	430
N	Pure metals, soft	Pure Iron, Lead	< 20						
	Aluminum alloys, long chipping	6061, 7050	< 20						
	Aluminum alloys, short chipping	A356, 4218	< 20						
	Copper alloys, long chipping	C27200, B-148-52	< 20						
	Copper alloy, Short chipping		< 20						
	Magnesium alloys	B94, M11910							
	Thermoplastics	PVC, Acrylic glass							
	Duroplastics	Durolite, Ampal							
	Graphite								
S	Titanium alloys, medium strength	F67, B265	< 29						
	Titanium alloys high strength Alloy	Ti-6Al-4V	27 - 44						
	Nickel based alloys medium strength	20Cb3	< 29				230		
	Heat resistant nickel based alloys high strength	Inconel 718	27 - 44				160		
H	Chilled cast iron	Ampco 25	< 20				160		
	Hardened steel		45 - 52				160		
			53 - 59						
			60 - 65						

💧💧 Wet machining ☀ Dry machining

Recommended *maximum* feed per tooth (f_Z) for inserts

Cutter Type	FCZ FCZ R10 FCZ R12 FCZ R16			FCT FCT45 FCT45XX			ECZ ECZR07 ECZ R08 ECZ R10 ECZ R12				FMT45 FMT45 S09 FMT45 S12	
												
Ø inch cutter	1.625-3.00			1.625-5.00			.500-1.50				1.00-6.00	
Insert ISO-Code	RDKT RDHW RDHX			RCKX RCKT OCKX			RDKT RDHW				SNKT SNKX RDHX	
Insert Size mm	10	12	16	10	12	16	7	8	10	12	9.52	12.7
Insert Size inch	.394	.472	.630	.394	.472	.630	.276	.315	.394	.472	.375	.500
Max a_p	.098	.118	.197	.098	.118	.197	.059	.098	.098	.118	.197	.276
P	.010	.016	.018	.010	.016	.018	.012	.010	.010	.016	.016	.020
M	.005	.006	.008	.005	.006	.008	.004	.004	.005	.006	.006	.006
K	.016	.016	.016	.012	.016	.016	.010	.012	.014	.016	.020	.024
H	.012	.012	.012	.010	.012	.012	.006	.008	.010	.012	.010	.012

Cutting Data Recommendations for Copying-Cutters for Roughing with LC280TT

	Material	Examples	SFM
P	Unalloyed tool steel	1045, W1	900
	Heat – treatable die steels	1212, 12L13	820
	Case hardening steels	1040, 4130	900
	Full hardening tool steels	O2, D2, D3, H13, H11	650
	Nitriding steels	H13, 6150, A355 Cl C	575
M	Stainless steel, austenitic	316L 304	820
	Maraging steel		
K	Grey cast iron and Alloyed grey cast iron	No. 35B	750
	Nodular cast iron and Alloyed nodular cast iron	60-40-18	650
H	Chilled cast iron		590
	Hardened steel	45-52 Rc	450

LC430T, LC440T
Cutting Data Recommendations

	Material	Examples	Rockwell C	Feed per Tooth (f_z) / SFM	
				0.003 - 0.006	0.006 - 0.014
M	Austenitic	303, 304, 304L, 316, 316L, 321, 347	< 20	820 - 1050	660 - 920
	Austenitic hardened	309, 310S, 630, J775(SAE)	< 20	660 - 920	-
	Duplex (Austentic / ferritic)	329	< 20	660 - 920	-

Dry machining

For ferritic and martensitic stainless steels we recommend grade LC230F (preferably dry machining)

LC444W
Cutting Data Recommendations

	Material	Examples	Rockwell C	Feed per Tooth (f_z) / SFM	
				0.003 - 0.008	0.009 - 0.016
M	Austenitic	303, 304, 304L, 316, 316L	< 20	260 - 525	229 - 460
		316Ti, 318, 321, 347, 348	< 20	230 - 410	165 - 395
	Austenitic hardened	309, 310S, 630, J775 (SAE)		230 - 330	
	Duplex (austenitic/ferritic)	329		230 - 395	
S	Heat resistant alloys				
	Ni- or Co-basis	Inconel 718, Incoloy 925	32 - 38	130 - 230	95 - 195
	Titanium alloys:				
	Alpha- + Beta-alloys	Ti -6Al-4V	< 32	150 - 195	130 - 180

Wet machining

For ferritic and martensitic stainless steels we recommend grade LC230F (preferably dry machining)

	Material	Examples	Hardness Material No.	Feed per tooth (f_z) Cutting speed (v_c)							
				Roughing				Finishing			
				v_c	d_4 = .188" to .3125"	d_4 = .375" to .500"	d_4 = > .625"		d_4 = .188" to .3125"	d_4 = .375" to .500"	d_4 = > .625"
					f_z				f_z		
P	Plain carbon steel	1018, 1025									
	Heat-treatable die steels	4140, 6150									
	Case hardening steels	5115, 8620									
	Full hardening tools steels	4140, 8740, 4340									
	Nitriding steels	A355, H13, D2									
M	Stainless steel, austenitic	304, 316									
K	Grey cast iron and alloyed grey cast iron	A159, J431, G3500, A436-725									
	Nodular cast iron and alloyed nodular cast iron	A220, F2000, 5005									
H	Hardened steel		45-52HRC	525	.0059	.0078	.0098	787	.004	.0078	.0098
			53-59HRC	394	.004	.0059	.0078	689	.004	.0078	.0098
			60-65HRC	–				590	.004	.0078	.0098

	Material		R_m/UTS (N/mm²)	Cutting speed v_c SFM for feed/tooth					
				.003 - .006		.014 - .020		.006 - .014	
				💧💧	☀	💧💧	☀	💧💧	☀
P	Plain carbon steel		- 700						
	Free cutting steel		- 700						
	Structural alloy steel		500 - 950						
	Heat-treatment steel, medium strength		500 - 950						
	Cast steel		- 950						
	Case hardening steel		- 950						
	Stainless steel, ferritic, martensitic		500 - 950						
	Heat-treatment steel, high strength		950 - 1400						
	Nitriding steel		950 - 1400						
	Tool steel		950 - 1400						
M	Stainless steel, austenitic		500 - 950						
	Maraging steel		–						
K	Grey cast iron		100 - 400 (120 - 260 HB)						
	Alloyed grey cast iron		150 - 250 (160 - 230 HB)						
	Nodular cast iron		400 - 800 (120 - 310 HB)						
	Malleable cast iron		350 - 700 (150 - 280 HB)						
N	Pure metals, soft		- 500						
	Aluminium alloys, long chipping		- 550						
	Aluminium alloys, short chipping		- 400						
	Copper alloys, long chipping		300 - 700						
	Copper alloys, short chipping		- 500						
	Magnesium alloys		160 - 300						
	Thermoplastics	PVC, Acrylic Glass	400 - 600	–	1804	–	1640	–	–
	Duroplastics	Durolite, Ampal	400 - 600	–	1804	–	1640	–	–
	Graphite		400 - 600	–	1968	–	1640	–	1476
S	Titanium alloys, medium strength		- 950						
	Titanium alloys, hight strength		900 - 1400						
	Nickel based alloys, medium strength		- 950						
	Heat resistant nickel based alloys, high strength		900 - 1400						
H	Chilled cast iron		300 - 600 HB						
	Hardened steel		45 - 52 HRC 53 - 59 HRC 60 - 65 HRC						

💧💧 Wet machining ☀ Dry machining

	Material	Examples	Rockwell C	Feed per Tooth (f_z) / SFM					
				0.003 - 0.006		0.006 - 0.014		0.014 - 0.020	
				💧💧	☀	💧💧	☀	💧💧	☀
P	Plain Carbon steel	1018, 1025,	< 20	940	1180	740	980	590	790
	Free Machining steel	1212, 12L13	< 20	940	1180	740	980	590	790
	Structural alloy steel	1040, 4130	< 30	940	1180	740	980	590	790
	Heat-treatment steel, medium strength	4140, 6150	< 30	940	1180	740	980	590	790
	Cast Steel	4340, 8740	< 30	770	980	740	820	490	660
	Caste hardening steel	52100, 8620	< 30	770	980	740	820	490	660
	Stainless steel, ferritic martensitic	410, 430F, 440	< 30	770	980	740	820	490	660
	Heat treatment steel, High strength	4140, 8740	28 -44	620	790	490	660	390	520
	Nitriding Steel	A355	28 - 44	620	790	490	660	390	520
	Tool Steel	H13, D2	28 -44	620	790	490	660	390	520
M	Stainless steel, austenitic	304, 316	< 30	-	-	-	-	-	-
	Maraging steel			-	-	-	-	-	-
K	Grey cast iron	A319, J431 No. 25B, No. 50B	< 27	940	1180	740	980	590	790
	Alloyed grey cast iron	A434, A436-72	< 22	720	910	560	750	460	610
	Nodular cast iron	A536 (80-55-06), J434	< 34	660	820	520	690	410	560
	Malleable cast iron	A220, 50005 A47,32510	< 29	660	820	520	690	410	560
N	Pure metals, soft	Pure Iron, Lead	< 20	2180	2760	1720	2300	1380	1840
	Aluminum alloys, long chipping	6061, 7050	< 20	3120	3280	2460	3280	1970	2620
	Aluminum alloys, short chipping	A356, 4218	< 20	1250	1570	980	1310	790	1050
	Copper alloys, long chipping	C27200, B-148-52	< 20	3120	3280	2460	3280	1970	2620
	Copper alloy, short chipping		< 20	1250	1570	980	1310	790	1050
	Magnesium alloys	B94, M11910		-	1970	-	1640	-	1310
	Thermoplastics	PVC, Acrylic glass		-	1970	-	1640	-	1310
	Duroplastics	Durolite, Ampal		-	1970	-	1640	-	1310
	Graphite			-	1970	-	1640	-	1310
S	Titanium alloys, medium strength	F67, B265	< 29						
	Titanium alloys, high strength Alloy	Ti-6Al-4V	27 - 44						
	Nickel based alloys medium strength	20Cb3	< 29	260	300				
	Heat resistant nickel based alloys high strength	Inconel 718	27 - 44	200	230				
H	Chilled cast iron	Ampco 25	< 20	200	230				
	Hardened steel		45 - 52	260	300				
			53 - 59	200	230				
			60 - 65	130	160				

💧💧 Wet machining ☀ Dry machining

	Material	Examples	Rockwell C	Feed per Tooth (f_z) / SFM					
				0.003 - 0.006		0.006 - 0.014		0.014 - 0.020	
				💧💧	☀	💧💧	☀	💧💧	☀
P	Plain Carbon steel	1018, 1025,	< 20	940	1180	740	980	590	790
	Free Machining steel	1212, 12L13	< 20	940	1180	740	980	590	790
	Structural alloy steel	1040, 4130	< 30	940	1180	740	980	590	790
	Heat-treatment steel, medium strength	4140, 6150	< 30	940	1180	740	980	590	790
	Cast Steel	4340, 8740	< 30	770	980	740	820	490	660
	Caste hardening steel	52100, 8620	< 30	770	980	740	820	490	660
	Stainless steel, ferritic martensitic	410, 430F, 440	< 30	770	980	740	820	490	660
	Heat treatment steel, High strength	4140, 8740	28 -44	620	790	490	660	390	520
	Nitriding Steel	A355	28 - 44	620	790	490	660	390	520
	Tool Steel	H13, D2	28 -44	620	790	490	660	390	520
M	Stainless steel, austenitic	304, 316	< 30	-	-	-	-	-	-
	Maraging steel			-	-	-	-	-	-
K	Grey cast iron	A319, J431 No. 25B, No. 50B	< 27	940	1180	740	980	590	790
	Alloyed grey cast iron	A434, A436-72	< 22	720	910	560	750	460	610
	Nodular cast iron	A536 (80-55-06), J434	< 34	660	820	520	690	410	560
	Malleable cast iron	A220, 50005 A47,32510	< 29	660	820	520	690	410	560
N	Pure metals, soft	Pure Iron, Lead	< 20	2180	2760	1720	2300	1380	1840
	Aluminum alloys, long chipping	6061, 7050	< 20	3120	3280	2460	3280	1970	2620
	Aluminum alloys, short chipping	A356, 4218	< 20	1250	1570	980	1310	790	1050
	Copper alloys, long chipping	C27200, B-148-52	< 20	3120	3280	2460	3280	1970	2620
	Copper alloy, short chipping		< 20	1250	1570	980	1310	790	1050
	Magnesium alloys	B94, M11910		-	1970	-	1640	-	1310
	Thermoplastics	PVC, Acrylic glass		-	1970	-	1640	-	1310
	Duroplastics	Durolite, Ampal		-	1970	-	1640	-	1310
	Graphite			-	1970	-	1640	-	1310
S	Titanium alloys, medium strength	F67, B265	< 29						
	Titanium alloys, high strength Alloy	Ti-6Al-4V	27 - 44						
	Nickel based alloys medium strength	20Cb3	< 29	260	300				
	Heat resistant nickel based alloys high strength	Inconel 718	27 - 44	200	230				
H	Chilled cast iron	Ampco 25	< 20	200	230				
	Hardened steel		45 - 52	260	300				
			53 - 59	200	230				
			60 - 65	130	160				

💧💧 Wet machining ☀ Dry machining

MultiEdge Double 4 Feed
Cutting Data Recommendations

	Material	Material No.	DIN Description	HBN	Cutting speed vc SFM	Recommended Feed Per Tooth (FPT)
P	**Plain carbon steel** 1018, 1025	1.0037 1.0044 1.0038	St 37 St 44 R St 37-2	90-150	650-800	.030-.065
		1.0052 1.0710	St 52 St 70	152-210		.030-.055
	Free Cutting Steel 1212, 1243	1.0711 1.0715	9 S 20 9 SMn 28	105-165		
		1.0727 1.0728	45 s 20 60 s 20	180-240		
	Structural Alloy Steel 1040, 4130	1.1191 1.1221	C 45 E C 60 E	152-280		
	Heat treatable steel Medium strength 4140,6150	1.7219 1.7225 1.2241	26 CrMo 4 50 CrV 4	152-280	450-600	.030 -.055
	Cast steel 4340,8740	1.0416 1.7220	GS 40 GS 34 CrMo 4	200-280		.030-.055
	Case hardening steel 8620	1.2162 1.2764 1.7131	21 mNcR5 X 19NiCrMo 4 16 MnCr5	210-250		
	Nitriding steel A 355	1.8504 1.8550 1.8519	34 CrAl 6 34 CrAlNi7 31 CrMoV9	230-300	325-450	.030-.045
	Tool Steel D2, H13	1.2080 1.2312 1.2379	X 310 Cr12 40 CrMnMoS 8.6 X 155 CrVMo 12 1	240-350		
M	**Stainless Steel** 400 Series, Ph Series	1.4003 1.4105	X 2CrNi 12 X 4CrMoS 18	240-380	500-700	.030-.050
K	**Grey Cast Iron** A 319, J 431	EN-JL-1040 (0.6025)	EN-GJL-250 (GG 25)	120-260	650-850	.030-.055
	Ductile Cast Iron J 434, A536	EN-JS-1030 (0.7040)	EN-GJS400 (GGG 60)	135-180	600-750	.030-.055
	Malleable cast iron A 220, A 47	EN-JM-1160	EN-GJMB-550-4	150-280	525-650	.030-.045

	Material	Material No.	DIN Designation	Material values	Recommended max. feed per tooth f_z with $a_e = 0.75 \times d_1$ (d_1 = Cutter diameter)													
					Cutting speed / v_c (m/min)													
					LC280QN							LC610T / LC610Q / LC 630Q						
					v_c	XCNT07 SN-TR XCNW07 SN	XCNT09 SN-TR XCNW09 SN	XCNT12 SN-TR XCNW12 SN	XCNT07 EN-TR	XCNT09 EN-TR	XCNT12 EN-TR	v_c	XCNT07 SN-TR XCNW07 SN	XCNT09 SN-TR XCNW09 SN	XCNT12 SN-TR XCNW12 SN	XCNT07 EN-TR	XCNT09 EN-TR	XCNT12 EN-TR
P	Plain carbon steel	1.1730	C45W	190 – 200 HB	650 – 850	.078	.098	.118	.055	.067	.078	800 – 980	.063	.078	.094	.043	.055	.063
		1.1545	C105W	190 – 240 HB														
	Heat-treatable die steels	1.2311	40CrMnMo7	280 – 325 HB	450 – 600	.047	.060	.071	.030	.043	.052	600 – 720	.040	.047	.055	.027	.030	.040
		1.2312	40CrMnMoS8.6	280 – 325 HB		.060	.078	.098	.043	.055	.071		.047	.063	.078	.030	.043	.055
		1.2738	40CrMnNiMoS8.6.4	280 – 325 HB														
		1.2711	54NiCrMoV6	280 – 415 HB		.078	.098	.118	.055	.067	.078		.063	.078	.094	.043	.055	.063
	Case hardening steels	1.2162	21MnCr5	215 HB	450 – 720	.078	.098	.118	.055	.067	.078	720 – 920	.063	.078	.094	.043	.055	.063
		1.2764	X19NiCrMo4	255 HB		.071	.087	.098	.052	.060	.071		.055	.071	.078	.040	.047	.055
	Full hardening tools steels	1.2343	X 38 CrMoV 5 1	230 HB	450 – 600	.078	.098	.118	.055	.067	.078	600 – 800	.063	.078	.094	.043	.055	.063
		1.2080	X210Cr12	250 HB		.055	.071	.078	.040	.052	.055		.043	.055	.063	.030	.040	.043
		1.2379	X 155 CrVMo 12 1	250 HB		.078	.098	.118	.055	.067	.078		.063	.078	.094	.043	.055	.063
		1.2767	X 45NiCrMo4	260 HB		.063	.078	.087	.043	.055	.060		.052	.063	.071	.035	.043	.047
	Nitriding steels	1.8550	34CrAlNi7	240 – 300 HB	400 – 450	.055	.063	.071	.040	.043	.052	520 – 650	.043	.052	.055	.030	.035	.040
		1.8519	31CrMoV9	265 – 310 HB														
		1.7735	14CrMoV6.9	265 – 310 HB		.043	.052	.060	.027	.035	.040		.035	.040	.047	0.24	.027	.030
		1.2344	X40CrMoV5.1	280 – 325 HB		.063	.078	.087	.043	.055	.060		.052	.063	.071	.035	.043	.047
M	Stainless steel (dry processing)	1.2083	X42CrMo13	500 – 900 N/mm²	720 – 850	.040	.060	.071	.040	.060	.071							
		1.2316	X36CrMo17															
		1.4301	X5CrNi1810	– 950 N/mm²		.030	.047	.060	.030	.047	.060							
		1.4572	X5CrNiMoTi17-12-3															
K	Cast iron with flake graphite	EN-JL-1040 (0.6025)	EN-GJL 250 (GG 25)	120 – 260 HB	650 – 850	.060	.078	.098	.047	.063	.078	650 – 850	.060	.078	.098	.047	.063	.078
	Cast iron. alloyed	(0.6678)	EN-GJLA-XNiCr35-2 (GGL-NiCr 35-2)	150 – 250 HB	520 – 650							520 – 650						
	Graphite cast iron	EN-JS-1030 (0.7040)	EN-GJS-400 (GGG40)	135 – 180 HB	650 – 800	.060	.078	.098	.040	.055	1.7	650 – 800	.060	.078	.098	.040	.055	.067
		EN-JS-1060 (0.7060)	EN-GJS-600 (GGG60)	190 – 270 HB														
	Malleable cast iron	EN-JL-1160 (0.8155)	EN-GJMB-550-4 (GTS55)	150 – 280 HB	520 – 650	.052	.052	.060	.027	.035	.040	520 – 650	.052	.052	.060	.027	.035	.040
N	Aluminum alloys, long chipping			– 550 N/mm²								1300 – 2600				.071	.078	.087
	Aluminum alloys, short chipping			350 – 700 N/mm²								980 – 1300						
	Copper alloys, long chipping			300 – 750 N/mm²								820 – 1300				.055	.063	.071
	Copper alloys, short chipping			– 750 N/mm²														
S	Titanium alloys, medium strength			– 900 N/mm²								260 – 400				.020	.030	.040
	Titanium alloys, high strength			900 – 1400- N/mm²								130 – 260				.012	.020	.030
	Nickel alloys, medium strength			– 900 N/mm²								260 – 400				.020	.030	.040
	Nickel alloys, high strength			900 – 1400 N/mm²								130 – 260				.012	.020	.030

Feed Correction

$$v_f = n \cdot z \cdot f_z \cdot f_2$$

f_2

a_p	l_{ges} = max. 4 x d_1	l_{ges} = > 4 x d_1
.0197	1.3	1.0
.0394	1.0	0.75
.059	0.7	0.5

v_f = Feed rate (SFM)
n = RPM
z = No. of teeth
f_z = Feed per tooth (in)
l_{ges} = Reach in (in)
a_p = Depth of cut in (in)
f_2 = Correction factor

MultiEdge 2 Feed – Mini High Feed Cutter
Cutting Data Recommendations

	Material	Material No.	DIN Description	HBN	Cutting speed vc SFM	Recommended Feed Per Tooth (FPT)
P	**Plain carbon steel** 1018, 1025	1.0037 1.0044 1.0038	St 37 St 44 R St 37-2	90-150	650-800	.030-.065
		1.0052 1.0710	St 52 St 70	152-210		.030-.055
	Free Cutting Steel 1212, 1243	1.0711 1.0715	9 S 20 9 SMn 28	105-165		
		1.0727 1.0728	45 s 20 60 s 20	180-240		
	Structural Alloy Steel 1040, 4130	1.1191 1.1221	C 45 E C 60 E	152-280		
	Heat treatable steel Medium strength 4140,6150	1.7219 1.7225 1.2241	26 CrMo 4 50 CrV 4	152-280	450-600	.030 -.055
	Cast steel 4340,8740	1.0416 1.7220	GS 40 GS 34 CrMo 4	200-280		.030-.055
	Case hardening steel 8620	1.2162 1.2764 1.7131	21 mNcR5 X 19NiCrMo 4 16 MnCr5	210-250		
	Nitriding steel A 355	1.8504 1.8550 1.8519	34 CrAl 6 34 CrAlNi7 31 CrMoV9	230-300	325-450	.030-.045
	Tool Steel D2, H13	1.2080 1.2312 1.2379	X 310 Cr12 40 CrMnMoS 8.6 X 155 CrVMo 12 1	240-350		
M	**Stainless Steel** 400 Series, Ph Series	1.4003 1.4105	X 2CrNi 12 X 4CrMoS 18	240-380	500-700	.030-.050
	303,304,316,316L	1.2083 1.2316 1.4541 1.4571	X42CrMo13 X36CrMo17 X6CrNiTi18.10 X8CrNiMoTi17.12.2	135-275	500-700	.030-.040
K	**Grey Cast Iron** A 319, J 431	EN-JL-1040 (0.6025)	EN-GJL-250 (GG 25)	120-260	650-850	.030-.055
	Ductile Cast Iron J 434, A536	EN-JS-1030 (0.7040)	EN-GJS400 (GGG 60)	135-180	600-750	.030-.055
	Malleable cast iron A 220, A 47	EN-JM-1160	EN-GJMB-550-4	150-280	525-650	.030-.045
H	Chilled cast iron		Ni-hard, Ampco	300–600	300–600	.025 -.040
	Hardened steel		Sleipner, Toolox Dievar Vandis, Sverker	45–52 53–59 60–65	328 260 225	.040 .025 .015

ACU-JET Double 6 Copy Mill
Cutting Data Recommendations

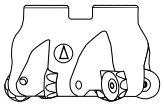
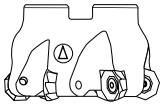
Grade	Roughing			Finishing		
LCKP20M LCPK20M (SFM)	**f_z (FPT)**	**a_p (ADOC)**	**a_e (RDOC)**	**f_z (FPT)**	**a_p (ADOC)**	**a_e (RDOC)**
490-980	0.004 - 0.039	0.039 - 0.118	66%	0.006 - 0.020	0.020 - 0.039	max. 33%
490-980	0.004 - 0.039	0.039 - 0.118		0.006 - 0.020	0.020 - 0.039	
525-820	0.008 - 0.039	0.039 - 0.118	66%	0.008 - 0.016	0.012 - 0.032	max. 33%
525-820	0.008 - 0.039	0.039 - 0.118		0.008 - 0.016	0.012 - 0.032	

	Material	Brinell (BHN)	Recommended Grade	Cutting Speed	
				Face Milling sfm	Copy Milling sfm
P	Low Carbon Steel (1018, 1025)	< 206		525-720	820-980
	Plain Carbon Steel (1212, 12L13)	147-280		525-655	600-850
	Alloy Steel (1040, 4130)	147-280	LC280TT	460-590	600-850
	Cast steel (4340, 8740)	< 280	LC240T	460-590	600-850
	Carburizing steel (52100, 8620)	< 950	LC225S	460-590	600-850
	Stainless, ferritic, martensitic 400-500 series (410, 430F, 440)	147-280		460-560	500-850
	Heat-treatable steel, high-strength (4140)	280-1400	LC280TT	394-492	500-720
	Nitralloy steel, heat-treated (A355)	950-1400	LC240T	394-492	500-720
	Tool steel (H13, D2)	280-412	LC610T	394-492	500-720
M	Stainless, austenitic 200-300 series (303, 304, 316, 316L)	147-280	LC240T	400-630	400-575
K	Gray cast iron (A319, J431, No.25B, No.50B)	< 120	LC610T	425-690	650-984
	Alloyed gray cast iron (No.30B, A436-725)	< 75	LC610T	325-525	500-820
	Spheroidal graphite iron	120-238	LC610T	325-525	524-984
	Malleable cast iron (5005)		LC610T	390-690	524-820
N	Aluminum alloys, short chipping (6061-T6, 7050)	350-700	LW610*	650-980	524-984
	Copper alloys, short chipping (C27200, B-148-52)		LC225S	650-980	524-984
	Magnesium alloys (B94, M11910)	< 119	LW610*	650-1300	524-1300
	Thermosetting plastics (PVC, Acrylic Glass)	< 147			
S	Titanium alloys, medium-strength (F67, B265)	110-275	LW610*	120-250	120-250
	Titanium alloys, high-strength (Ti-6Al-4V)	300-350	LW610*	80-170	80-170
	Nickel-based alloys, medium-strength	< 280	LC225S	90-200	80-200
	Highly refractory Nickel-based alloys (Inconel 718)	266-912	LC225S**	98-165	80-220
K	Chilled cast iron (Ampco 25)	266-412	LC225S*	98-130	80-220

*Uncoated LW610 grade, the sfm specified in the table is for this material.
**Substitute LC280TT grade in cases where there is a risk of the tool breaking.

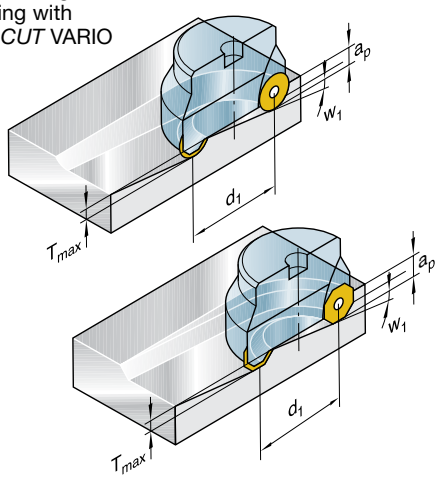
Vario

Face Milling

Catalog No.	Round	Octagonal
		
max.doc.	0.315	0.394
min.doc.	0.079	0.079
ISO-Code	RCKX 1606 MO-TR	OCKX 0606 AD-TR
Recommended Maximum Feed per Tooth (f_z)		
P	0.018	0.014
	0.016	0.012
M	0.008	0.006
K	0.016	0.012
	0.014	0.012
	0.012	0.010

Pocket Milling and Ramp Milling

Max. W_1 angle when ramping with TWIN*CUT* VARIO



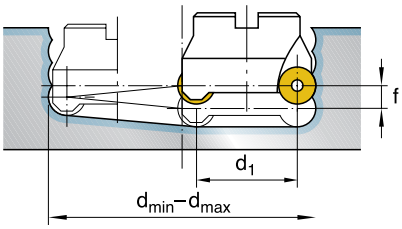
	TWIN*CUT* VARIO with RCKX 1606 MO-TR	TWIN*CUT* VARIO with OCKX 0606 AD-TR
d_1 inch	**W_1°**	**W_1°**
1.50	1.3°	1.1°
2.00	1.8°	1.6°
2.50	2.3°	2.1°
3.00	2.8°	2.6°
4.00	3.8°	3.6°

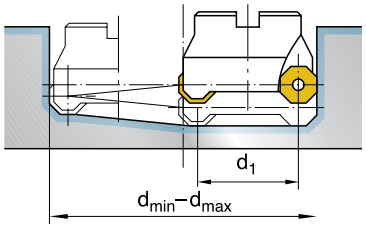
Internal cut depth T_{max} = 0.157"

Ramping

Ramping is always recommended over plunging when entering the workpiece. Ramp milling minimizes the likelihood of the workpiece material work hardening and improves tool life. Climb milling is recommended with workpiece materials that work harden. This method reduces the hear in the workpiece by dissipating it into the chip.

Circular Milling





Diameter Range for Helical Interpolation in One Operation		
d_1	**d_{min}**	**d_{max}**
1.50	3.06	4.54
2.00	4.06	5.54
2.50	5.06	6.54
3.00	6.06	7.54
4.00	8.06	9.54

Face Mills – TWIN*CUT* / ISO
Cutting Data Recommendations

	Material	Hardness		Cutting Speed (SFM) Range			Recommended Grade	Feed Per Tooth (f_z) Range	Starting Speed (SFM)	Starting Feed Per Tooth (f_z)	Wet or Dry
		Brinell (BHN)	Rockwell (HRC)	Uncoated Carbide	Coated Carbide	CBN/PCD					
P	Low Carbon Steels AISI: 1008, 1010, 1018, 1117, 1141	< 220	< 19		350-900 400-1100		LC240T LC225S/T	.004-.020 .004-.014	500 650	.012 .010	D D
P	Plain Carbon, Alloy and Tool Steels AISI: 1045, 4140, 4320, 4340,5120, 8620, P-20	200-300 300-425 425-570	19-32 32-45 45-54		300-700 300-900 175-400 250-650 300-500	 300-800	LC240T LC225S/T LC240T LC225S/T LC610T CBN	.003-.018 .003-.012 .003-.014 .003-.008 .003-.006 .003-.006	400 500 300 450 350 550	.012 .009 .008 .006 .004 .004	D D D D D D
M	Stainless Steels Ferritic-Martensitic 400 to 500 Series PH Stainless Steels Austenitic 200 to 300 Series	< 330 330-450 135-275	< 35 35-45 < 28		200-600 250-650 150-500 150-425 250-550 300-600 300-700		LC240T LC225S/T LC225S LC240T LC240T LC225S/T LC610T	.003-.012 .003-.009 .003-.006 .004-.011 .004-.012 .004-.009 .003-.008	400 .450 425 350 425 450 500	.007 .005 .005 .007 .007 .006 .005	W/D D D W/D D D
N	Aluminum and other Free-Machining Non-Ferrous Materials Aluminum/High-Silicon (12% or higher)	50-150		700-2000 700-1500		 1000-12,000 1000-6000	LW610 PCD LW610 PCD	.004-.015 .004-.012 .003-.014 .003-.012	1000 4000 1000 2000	.008 .006 .009 .007	W/D W/D D D
K	Gray Cast Iron	120-320	< 34		300-900 300-1100		LC610T LC615E	.003-.009 003-.010	700 850	.007 .007	D D
K	Cast Iron Ductile and Malleable	120-320	< 34		300-800 300-1000 250-550		LC610T LC615E LC240T	.003-.008 .003-.009 003-.009	500 575 450	.006 .007 .008	D D D
K	Cast Iron Hardened or Chilled	400-560	43-55		150-600 150-675	 200-900	LC610T LC615E CBN	.004-.008 .004-.008 .003-.008	400 475 600	.006 .006 .006	D D D
S	Nickel-Base Alloys Annealed 600 series Inconel, Hastelloy, & Waspaloy	140-300	< 32		50-220 50-220		LC630T/S LC240T	.002-.006 .002-.008	120 110	.004 .005	D D
S	Nickel-Base, Heat Resistant Alloys Annealed Inconel 700 Series	300-475	31-49		60-200 60-200 60-200		LC630S/T LC225S/T LC240T	.002-.006 .002-.007 .002-.008	95 90 80	004 .004 .005	D D D
S	Iron-Base, Heat Resistant Alloys Wrought: A-286, Incoloy 801, ASTM351 grade HK-30, 40, HT-30	135-320	< 34		80-450 80-350 80-300		LC630S/T LC225S/T LC240T	.003-.007 .003-.008 .003-.009	280 240 210	004 .005 .006	D D D
S	Cobalt Heat Resistant alloys	150-425	< 45		75-400 75-400 75-400		LC630S/T LC225S/T LC240T	.002-.007 .002-.008 .003-.009	120 110 100	.004 .005 .006	D D D
S	Titanium-Alloy Annealed Ti6Al-4V, Ti6Al, Ti98.8, Ti99.9	110-300 300-350 350-440	< 32 32-36 36-46	60-300 60-220 60-180	90-400 90-300 90-200		LC240T/LW610 LC240T/LW610 LC240T/LW610	.003-.008 .003-.007 .003-.006	220 150 130	.004 .004 .004	W W W

When setting initial cutting conditions, consider the following:
Suggested starting conditions are based on a .100" axial depth of cut. Cutting speed should be adjusted for a greater or lesser depth. Using a cutter with the recommended 3:2 cutter diameter-to-workpiece width ratio will provide a negative angle of entry, allowing the insert to make contact with the workpiece at its strongest point on the cutting edge.

Climb Milling is normally recommended in order to allow the insert to enter with a heavier chip load. This reduces edge build up and dissipates the heat in the chip minimizing workhardening.

Use LC280TT in case of tool breakage, or heavy rough milling operations.

For 87° **TWIN*CUT***, reduce roughing and semifinishing chiploads by 40%
For 90° **TWIN*CUT***, and ISO 90° APKT style cutters reduce roughing and semifinishing chiploads by 45%
For Face Milling using ISO 45° insert styles SEAN and SEKN, reduce roughing and finishing chiploads by 30%
For **UNIVEX** data, see pages 171 and 172

	Material	Material No.	DIN Des.	Feed per tooth f_z (inches)			
				Finishing		Roughing	
				(.312"-.625") Ø 8-16	(.750"-1.25") Ø 20-32	(.312"-.625") Ø 8-16	(.750"-1.25") Ø 20-32
P	Unalloyed tool steel (1045, 4130)	1.1730	C45W	0.0059	0.0078-.0098	0.0059-0.0078	0.0078-0.0118
		1.1545	C105W	0.0059	0.0078-.0098	0.0059-0.0078	0.0078-0.0118
	Heat-treatable die steels (4140, 6150)	1.2311	40CrMnMo7	0.0059	0.0078-.0098	0.0059-0.0078	0.0078-0.0118
		1.2312	40CrMnMoS8.6	0.0059	0.0078-.0098	0.0059-0.0078	0.0078-0.0118
		1.2738	40CrMnNiMo8.6.4	0.0059	0.0078-.0098	0.0059-0.0078	0.0078-0.0118
		1.2711	54NiCrMoV6	0.0059	0.0078-.0098	0.0059-0.0078	0.0078-0.0118
	Case hardening steels (52100, 8620)	1.2162	21MnCr5	0.0059	0.0078-.0098	0.0059-0.0078	0.0078-0.0118
		1.2764	X19NiCrMo4	0.0059	0.0078-.0098	0.0059-0.0078	0.0078-0.0118
	Full hardening tool steels (H13, D2)	1.2343	X38CrMoV5.1	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.2344	X40CrMoV5.1	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.2367	X38CrMoV5.3	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.2080	X210Cr12	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.2379	X155CrVMo12.1	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.2767	X45NiCrMo4	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.2842	90MnCrV8	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
	Nitriding steels (A355)	1.8550	34CrAlNi7	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.8519	31CrMoV9	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.7735	14CrMoV6.9	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
		1.2344	X40CrMoV5.1	0.0039	0.0078-.0098	0.0039-0.0059	0.0059-0.0098
M	Stainless steels (303, 304, 316, 316L)	1.2083	X42CrMo13	0.0031	0.0039	0.0039	0.0059
		1.2316	X36CrMo17	0.0031	0.0039	0.0039	0.0059
		1.4541	X6CrNiTi18.10	0.0031	0.0039	0.0039	0.0059
		1.4571	X8CrNiMoTi17.12.2	0.0031	0.0039	0.0039	0.0059
		1.4401	X5CrNiMo17.12.2	0.0031	0.0039	0.0039	0.0059
		1.4521	X1CrMoTi18.2	0.0031	0.0039	0.0039	0.0059
		1.4893	X8CrNiNb11	0.0031	0.0039	0.0039	0.0059
		1.4313	(G-)X4CrNi13.4	0.0031	0.0039	0.0039	0.0059
	Maraging steel	1.2709	X3NiCrMoTi18.9.5	0.0031	0.0039	0.0039	0.0059
K	Grey cast iron and alloyed cast iron (A319, J431, No.25B)	0.6025	GG25	0.0039	0.0059	0.0059	0.0118
			GG25CrMoV	0.0039	0.0059	0.0059	0.0118
	Nodular cast iron and alloyed nodular cast iron (A536 (80-55-06), J434)	0.7040	GGG 40	0.0039	0.0059		
		0.7070	GGG70	0.0031	0.0039	0.0078	0.0098
			GGG70 legiert alloyed	0.0031	0.0039	0.0078	0.0098
N	Aluminium and aluminium alloys (6061-T6), 7050		AlZnMgCu2	0.0059	0.0059	0.0078	0.0098
		32.581	AlSi12	0.0059	0.0059	0.0078	0.0098
	Copper and copper alloys (C27200, B-148-52)		Elektrolyt-Cu Electrolyte copper	0.0039	0.0047	0.0078	0.0098
	Non-metallic materials		Bronze	0.0039	0.0047	0.0078	0.0118
	Duroplastics	PUR	Kunststoff Plastics	0.0059	0.0078	0.0118	0.0157
		Epoxy resin	Plastics	0.0059	0.0078	0.0118	0.0157
			Graphite	0.0039	0.0059	0.0078	0.0018
S	Titanium alpha beta alloys		TiAl6V4	0.0031	0.0039	0.0039	0.0039
	Titanium beta alloys (Inconel 718)		Ti10V2Fe3Al	0.0031	0.0039	0.0039	0.0039
H	Hardened steel	45–52 HRC		0.0031	0.0039	0.0039	0.0078
		53–59 HRC		0.0031	0.0031	0.0039	0.0078
		60–65 HRC		0.0019	0.0031	0.0031	0.0039

The cutting data indicated are starting values and must be adjusted to the prevailing conditions.

	Cutting speed v_c [SFM]						
	Finishing			Roughing			
	LCKP10M (Soft)	LC610T	LCH33M	LC610T	LCKP10M (Hard)	LC240T	LCH33M
	886	755	886	787	738	656	787
	853	722	853	755	705	656	755
	820	689	820	722	673	591	722
	820	689	820	722	673	591	722
	787	656	787	689	640	558	689
	820	689	820	722	673	591	722
	755	623	755	656	607	558	656
	755	623	755	656	607	492	656
	755	623	755	656	607	492	656
	755	623	755	656	607	492	656
	689	558	689	591	541	492	591
	689	558	689	591	541	394	591
	755	623	755	656	607	394	656
	755	623	755	656	607	394	656
	689	558	689	591	541	394	591
	689	558	689	591	541	394	591
	689	558	689	591	541	394	591
	656	525	656	558	509	394	558
	787	656	787			394	
	787	656	787			394	
	787	656	787			361	
	722	591	722			361	
	722	591	722			361	
	787	656	787			361	
	787	656	787			361	
	722	591	722			361	
	722	591	722			361	
	1247	689	1247	1148	1099		1148
	1247	689	1247	1148	1099		1148
	1116	591	1116	1017	968		1017
	1116	591	1116	1017	968		1017
	1116	591	1116	1017	968		1017
	2953	2297	2953	1969	1969		1969
	1312	1148	1312	984	984		984
	1312	1148	1312	984	984		984
	1148	984	1148	820	820		820
	1969		1969	1969			1969
	1641		1641	1641			1641
	1969		1969	1641	1641		1641
	295		295	230	230		230
	295		295	230	230		230
	591		591	459	459		459
	492		492	361	361		361
	295		295	197	197		197

1. Selected diameter of tool to be used.
2. Determine Depth of Cut (DOC) to be used.
3. Refer to Figure and Table to find the Effective Cutting Diameter (ECD).
4. Refer to Feed and Speed chart on pages 196 & 197 to select the surface footage to be used (SFM).
5. Calculate RPM using the ECD and SFM. (SFM x 3.82 / ECD = RPM)
6. Refer to Table to determine Feed Rate Adjustment (FRA).
7. Refer to chart on pages 196 & 197 and select Inches per Teeth (IPT). Calculate Inches per Minute (IPM). (No Teeth x IPT x RPM x FRA = IPM)

Formulas

SFM = .262 x RPM x Diameter of Cutter
RPM = 3.82 x SFM ÷ Diameter of Cutter
IPR = IPM ÷ RPM
IPM = IPT x Number Of Teeth x RPM
IPT = IPM ÷ (Number Of Teeth x RPM)
MRR = Axial DOC x Radial WOC x IPM = in^3/min
HP (Cutter) = MRR ÷ Power Factor (K)
HIFB = (2 x d) – IC

Legend

RPM = Revolutions Per Minute
SFM = Surface Feet Per Minute
IPR = Inches Per Revolution
IPM = Inch Per Minute
IPT = Inches Per Tooth (Chip load)
DOC = Depth Of Cut
MRR = Metal Removal Rate
HP = Horse Power
HIFB = Helical Interpolation to Flat Bottom
ECD = Effective Cutting Data
FRA = Feed Rate Adjustment

Calculated Effective Cutting Diameter for Ball Nose Tooling

Inch	Insert Diameter									
DOC	**0.250**	**0.312**	**0.375**	**0.500**	**0.625**	**0.750**	**1.000**	**1.250**	**1.500**	**2.000**
0.005	0.070	0.078	0.086	0.099	0.111	0.122	0.141	0.158	0.173	0.200
0.010	0.098	0.110	0.121	0.140	0.157	0.172	0.199	0.223	0.244	0.282
0.020	0.136	0.153	0.169	0.196	0.220	0.242	0.280	0.314	0.344	0.398
0.050	0.200	0.229	0.255	0.300	0.339	0.374	0.436	0.490	0.539	0.624
0.075	0.229	0.267	0.300	0.357	0.406	0.450	0.527	0.594	0.654	0.760
0.100	0.245	0.291	0.332	0.400	0.458	0.510	0.600	0.678	0.748	0.872
0.125	0.250	0.306	0.354	0.433	0.500	0.559	0.661	0.750	0.829	0.968
0.156		0.312	0.370	0.463	0.541	0.609	0.726	0.826	0.916	1.073
0.188			0.375	0.484	0.573	0.650	0.781	0.894	0.993	1.167
0.250				0.500	0.612	0.707	0.866	1.000	1.118	1.323
0.312					0.625	0.739	0.927	1.082	1.218	1.451
0.375						0.750	0.968	1.146	1.299	1.561
0.600							1.000	1.225	1.414	1.732
0.625								1.250	1.479	1.854
0.750									1.500	1.936
1.000										2.000

Feed Rate Adjustment (FRA)

Inch	Insert Diameter							
DOC	**0.250**	**0.312**	**0.375**	**0.500**	**0.625**	**0.750**	**1.000**	**1.250**
0.005	3.6	4.0	4.4	5.0	5.6	6.1	7.1	7.9
0.010	2.6	2.8	3.1	3.6	4.0	4.4	5.0	5.6
0.015	2.1	2.3	2.6	2.9	3.3	3.6	4.1	4.6
0.020	1.8	2.0	2.2	2.6	2.8	3.1	3.6	4.0
0.025	1.7	1.8	2.0	2.3	2.6	2.8	3.2	3.6
0.050	1.2	1.4	1.5	1.7	1.8	2.0	2.3	2.6
0.075	1.1	1.2	1.2	1.4	1.5	1.7	1.9	2.1
0.100		1.1	1.1	1.2	1.4	1.5	1.7	1.8
0.125			1.1	1.2	1.3	1.3	1.4	1.5
0.150				1.1	1.2	1.3	1.4	1.5
0.175					1.1	1.2	1.3	1.4
0.200						1.1	1.3	1.4
0.250							1.2	1.2
0.300							1.1	1.2
0.400								1.1

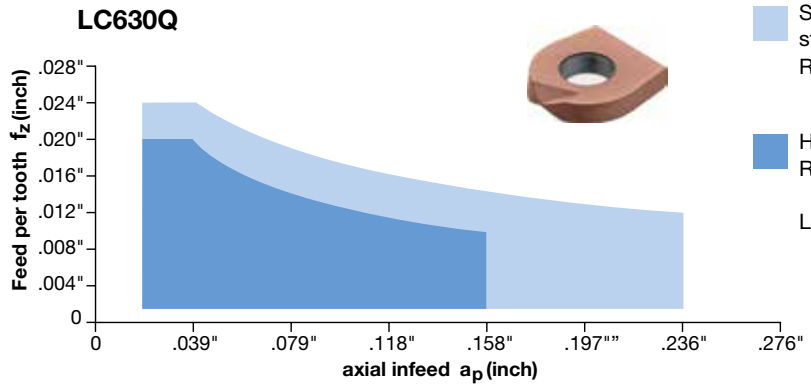
WPR-D – Helical Ball Nose Insert LCKP10M
Cutting Data Recommendations

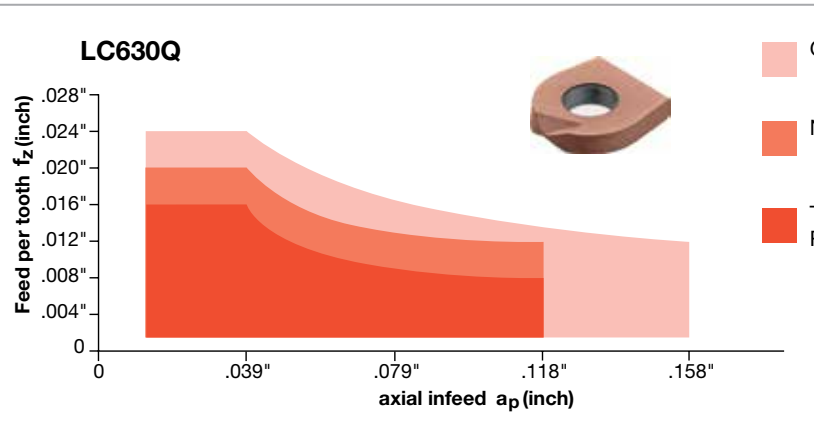
	Material	Material Examples	Rockwell C	Feed IPT / SFM .002" - .012" IPT	
P	Plain Carbon steel	1018, 1025,	< 20	1050	1300
	Free Machining steel	1212, 12L13	< 20	1050	1300
	Structural alloy steel	1040, 4130	< 30	1050	1300
	Heat-treatment steel, medium strength	4140, 6150	< 30	1050	1300
	Cast Steel	4340, 8740	< 30	850	980
	Caste hardening steel	52100, 8680	< 30	850	980
	Stainless steel, ferritic martensitic	410, 430F, 440	< 30	850	980
	Heat treatment steel, high strength	4140, 8740	28 - 44	680	790
	Nitriding Steel	A355	28 - 44	680	790
	Tool Steel	H13, D2	28 - 44	680	790
M	Stainless steel, austenitic	304, 316	< 30	–	–
	Maraging steel			–	–
K	Grey cast iron	A319, J431 No. 25B, No. 50B	< 27	1050	1300
	Alloyed grey cast iron	A434, A436-72	< 22	800	910
	Nodular cast iron	A536 (80-55-06), J434	< 34	725	820
	Malleable cast iron	A220, 50005 A47,32510	< 29	725	820
N	Pure metals, soft	Pure Iron, Lead	< 20	2400	2760
	Aluminum alloys, long chipping	6061, 7050	< 20	3120	3280
	Aluminum alloys, short chipping	A356, 4218	< 20	1250	1570
	Copper alloys, long chipping	C28000, B-148-52	< 20	3120	3280
	Copper alloy, short chipping		< 20	1250	1570
	Magnesium alloys	B94, M11910		–	1570
	Thermoplastics	PVC, Acrylic glass		–	1970
	Duroplastics	Durolite, Ampal		–	1970
	Graphite			–	1970
S	Titanium alloys, medium strength	F67, B265	< 29	–	–
	Titanium alloys, high strength alloy	Ti-6Al-4V	27 - 44	–	–
	Nickel based alloys, medium strength	20Cb3	< 29	260	300
	Heat resistant nickel based alloys, high strength	Inconel 718	27 - 44	200	230
H	Chilled cast iron	Ampco 25	< 20	200	230
	Hardened steel		45 - 52	260	300
			53 - 59	200	230
			60 - 65	130	160

	Material	AISI/SAE (USA Spec) Material Example:	R_m (N/mm^2)	Carbide Grade	Cutting Speed V_c (SFM) LC630Q
P	Plain carbon steel	1018, 1025	-700		590-650
	Free cutting steel	1212, 12L13, 12L14	-700		590-650
	Structural alloy steel	1040, 4130	500-950		650-780
	Heat-treatable die steels	4140, 6150	900-950		650-780
	Cast steel	4340, 8740	-950		650-780
	Case hardening steels	52100, 8620	-950		650-780
	Stainless steel, ferritic, martensitic	410, 430F, 440	500-950		650-780
	Heat-treatable steel, high strength	410, 8740	950-1400		525-590
	Nitriding steel	A355	950-1400		525-590
	Tool steel	H13, D2	950-1400		525-590
K	Grey cast iron	No.20B, No.25B, No.30B, No.35B, No.40B	100-400		525-590
	Alloyed grey cast iron	A434, A436-72	150-250		525-590
	Nodular cast iron	A536 (80-55-06), J434	400-800		525-590
	Malleable cast iron	A220, 50005, A47, 32510			590-650

AR Geometry

Recommended max. feed per tooth in relation to workpiece material and depth of cut





For best performance it is recommended to use a HSS shank not carbide

WPB-FB
Cutting Data Recommendations

	Material	Carbide: LC610Z		CBN: BN081	
		Cutting Speed (sfm)	Feed Per Tooth (fz)	Cutting Speed (sfm)	Feed Per Tooth (fz)
P	Steel, cast steel, stainless steel, ferritic and martensitic	1150-1312	.012"-.016"	–	–
M	Stainless steel and cast steel, Austenitic and austenitic/ferritic	1000-1150	.008"-.016"	–	–
K	Grey cast iron, Nodular cast iron, Malleable cast iron	920-1050	.008"-.016"	1640-2300	.008"-.016"
H	Chilled cast iron, Hardened steel > 60 HRC	–	–	820-1000	.008"

For best results run Flatball in Carbide Shank holder
Increase step over of 50% more than N Geometry possible
Must be programmed using 3D copy milling techniques with a X, Y, X moves simultaneously (45 Degrees on the workpiece)

Application Examples

WPB 16-FB-70 in LC610Z

Cutting Speed:
v_c = 1300 SFM

Feed:
f_z = .015"

Depth of Cut:
a_p = .003"

Step Over:
a_e = .016"

Workpiece:
Clipping tool

Material:
1.2320 / P20

Cutter:
WPB 16-70 in LC610Z
EBG R 16.016 AN140-C-I

Tool Life: 660 Minutes

WPB 16-FB-70 in BN081

Cutting Speed:
v_c = 2000 SFM

Feed:
f_z = .024"

Depth of Cut:
a_p = .010"

Step Over:
a_e = .008"

Workpiece:
Forming die

Material:
Cast steel,
partially hardened to 60 HRC

Cutter:
WPB 16-70 in BN081, CBN
EBG R 16.016 AN140-C-I

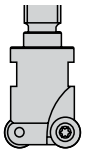
Tool Life: 70 Hours

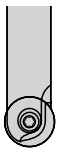
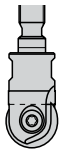
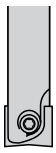
	Material	AISI/SAE (USA Spec) Material Examples	R_m/UTS (N/mm²)	Carbide grade	Cutting speed v_c = SFM			
					Roughing		Finishing	
					with round inserts	with roughing end mills or ball nose cutters		with cermet
P	Plain carbon steel	1018, 1025	- 700	LC240T	984 - 820	721 - 524	984 - 820	1148 - 984
	Free cutting steel	1212, 12L13	- 700	LC610T	984 - 820	721 - 524	984 - 820	1148 - 984
	Structural alloy steel	1040, 4130	500 - 950	(Finishing) LCKP10M	984 - 820	721 - 524	984 - 820	1148 - 984
	Heat-treatable steel, medium strength	4140, 6150	500 - 950		984 - 820	721 - 524	984 - 820	1148 - 984
	Cast steel	4340, 8740	- 950		984 - 820	721 - 524	984 - 820	1148 - 984
	Case hardening steel	52100, 8620	- 950		984 - 820	721 - 524	984 - 820	1148 - 984
	Stainless steel, ferritic, martensitic	410, 430F, 440	500 - 950		984 - 820	721 - 524	984 - 820	1148 - 984
	Heat-treatable steel, high strength	4140, 8740	950 - 1400	LC240T LC610T	721 - 590	492 - 393	721 - 590	820 - 656
	Nitriding steel	A355	950 - 1400	(Finishing)	721 - 590	492 - 393	721 - 590	820 - 656
	Tool steel	H13, D2	950 - 1400	LCKP10M	721 - 590	492 - 393	721 - 590	820 - 656
M	Stainless steel, austenitic	303, 304, 316		500 - 950	LC240T (-262)[3]	820 - 1148	820 - 1148 (-262)[3]	820
	Maraging steel				820 - 984 (-262)[3]		820 - 1148 (-262)[3]	
K	Grey cast iron	A319, J431, No. 25B, No. 50B	100 - 400 (120 - 260 HB)	LC610T	984 - 721	984 - 656	1148 - 820	984 - 820
	Alloyed grey cast iron	A434, A436-72	150 - 250 (100 - 230 HB)	LC610T	984 - 721	984 - 656	1148 - 820	984 - 820
	Nodular cast iron	A536, (80-55-06), J434	400 - 800 (120 -310 HB)	LC610T	984 - 721	984 - 656	1148 - 820	984 - 820
	Malleable cast iron	A220, 50005, A47, 32510	350 - 700 (150 - 280 HB)	LC610T	984 - 721	984 - 656	1148 - 820	984 - 820
N	Pure metals, soft	Pure Iron, Lead	- 500		984 - 3281	984 - 3281	1640 - 4921	
	Aluminium alloys, long chipping	6061-T6, 7050	- 550	LW610[1] LCKP10M	984 - 3281	984 - 3281	1640 - 4921	
	Aluminium alloys, short chipping	A356, 4218	- 400	LW610[1]	984 - 721	984 - 721	1148 - 820	984 - 820
	Copper alloys, long chipping	C27200	300 - 700		984 - 3281	984 - 3281	1640 - 4921	
	Copper alloys, short chipping		- 500		984 - 721	984 - 721	1148 - 820	984 - 820
	Magnesium alloys	B94, M11910	150 - 300	LW610[1]	984 - 3281	984 - 3281	1640 - 4921	
	Thermoplastics	PVC, Acrylic Glass	40 - 70	LW610[1]	984 - 3281	984 - 3281	1640 - 4921	
	Duroplastics	Durolite, Ampal	20 - 40	LW610[1]	984 - 721	984 - 721	1148 - 820	984 - 820
	Graphite		40 - 60	LC610[1]	131 - 262	1312 - 2625	1312 - 2625	
S	Titanium alloys, medium strength	F67, B265	- 950	LW610[1]	131 - 262	131 - 262	131 - 262	
	Titanium alloys, high strength	Ti-6Al-4V	900 - 1400	LW610[1]	131 - 262	131 - 262	131 - 262	
	Nickel based alloys, medium strength	20Cb3	- 950		131 - 262	131 - 262	131 - 262	
	Heat resistant nickel based alloys, high strength	Inconel 718	900 - 1400		131 - 262	131 - 262	131 - 262	
H	Chilled cast iron	Ampco 25	300 - 600 HB	LC240T	131 - 262	131 - 262	131 - 262	

[1] Uncoated grade, value of v_c is valid for this grade
[3] When using liquid coolants.

When using uncoated grades reduce cutting speed by 30%.

Recommended Maximum Feed per Tooth f_z
Feed per tooth and depth of cut tool-dia., indexable insert dia. and unclamped length

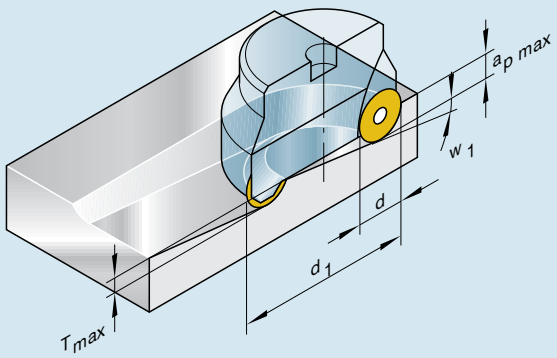
CAT-No.	FCT FCC			ECT				ECP	FCP ECP
									
Cutter Dia.	42 - 125mm / 1.50 - 5.00 in			10 - 40mm / .375 - 1.50 in				16 - 25mm	20 - 100mm
ISO-Code	RCHX RCKT/RCMX			RCHX				1177	XCNT
Insert Dia.	0.394	0.472	0.630	0.197	0.315	0.394	0.472	0.984	1.260
max. ap (DOC)	0.098	0.118	0.197	0.031	0.079	0.118	0.138	.040	.070
P	0.010	.0118-.0157	.0157-.0177	.0098-.0138	.0118-.0138	.0087-.0098	0.012	0.008	0.010
M	0.005	0.006	0.008	0.004	0.005	0.005	0.006	0.003	0.004
K	0.010	0.014	0.014	0.012	0.010	0.012	0.014	0.008	0.010
N	0.012	0.016	0.016	0.014	0.012	0.014	0.016	0.010	0.012
S	0.010	0.012	0.012	0.010	0.008	0.010	0.012	0.007	0.008

CAT-No.	EBG R GWR			EBG R THR	EBG R GWV		
							
Cutter Dia.	6 - 32mm / .250 - 1.25 in				12 - 32mm / .500 - 1.25 in		
ISO-Code	WPR Ball Nose Inserts				WPV/WPB Inserts		
Insert Dia.	0.315	0.394	0.472	0.630	0.787	0.984	1.260
max. ap (DOC)	.039	.039	.039	.059	.079	.0985	.118
P	0.006	0.006	0.006	0.006	0.008	0.008	.0079-.0098
M	0.003	0.003	0.003	0.003	0.004	0.004	0.005
K	0.004	0.004	0.004	0.005	0.006	0.008	0.010
N	0.004	0.004	0.004	0.006	0.008	0.010	0.012
S	0.004	0.004	0.004	0.005	0.006	0.007	0.008

Maximum depth of cut for face milling

	Insert Dia.	5 (.197")	7 (.276")	8 (.315")	10 (.394")	12 (.472")	16 (.630")
$a_{p\ max}$ (DOC)	**Roughing**	.031	.059	.078	.118	.118	.1969
	Finishing	.012	.020	.030	.039	.039	.039

Maximum angle W_1 for ramping

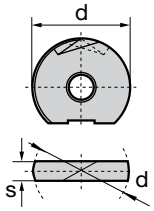


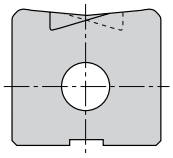
	Copy Insert Diameter					
d_1	5 (.197")	7 (.276")	8 (.315")	10 (.394")	12 (.472")	16 (.630")
0.315	8.9°					
0.394	6.3°					
0.472	4.8°	8.0°				
0.591		5.7°				
0.630	3.3°		6.3°			
0.787	2.5°	3.8°	4.6°	6.3°		
0.945					6.3°	
0.984	2.9°	2.9°	3.4°	4.6°	5.9°	
1.181		2.3°		3.6°		
1.260	2.1°				4.2°	6.3°
1.378		1.9°		3.0°	3.7	
1.575					3.1°	
1.654				2.4°		
1.969					2.3°	3.3°
2.047					2.3°	
2.480					1.7°	2.5°
2.598					1.7°	2.4°
3.150					1.3°	1.9°
3.937						1.5°
4.921						1.1°
T_{max}	.0196	.0295	.0393	.0492	.059	.0787

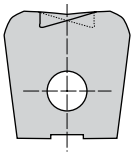
ECT THR

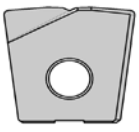
FCC

ECZ

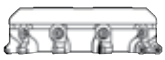
GWR Copying Cutters	Maximum depth of cut a_p max [in]			
	Diameter			
	mm	Inch	Roughing	Finishing
	–	0.250	0.125	0.050
	0.315	0.312	0.157	0.063
	0.394	0.375	0.197	0.079
	0.472	0.500	0.236	0.094
	0.630	0.625	0.315	0.126
	0.787	0.750	0.394	0.157
	0.984	1.000	0.492	0.197
	1.260	1.250	0.630	0.252

GWV Flat Bottom Cutters	Maximum depth of cut a_p max [in]			
	Diameter			
	mm	Inch	Roughing	Finishing
	0.315	0.312	0.079	0.024
	0.394	0.375	0.118	0.079
	0.472	0.500	0.118	0.094
	0.630	0.625	0.157	0.126
	0.787	0.750	0.197	0.157
	0.984	1.000	0.236	0.197
	1.260	1.250	0.315	0.252

GWV Backdraft Cutters	Maximum depth of cut a_p max [in]			
	Diameter			
	mm	Inch	Roughing	Finishing
	0.472	0.500	0.079	0.031
	0.630	0.625	0.118	0.039
	0.787	0.750	0.157	0.039
	0.984	1.000	0.197	0.059

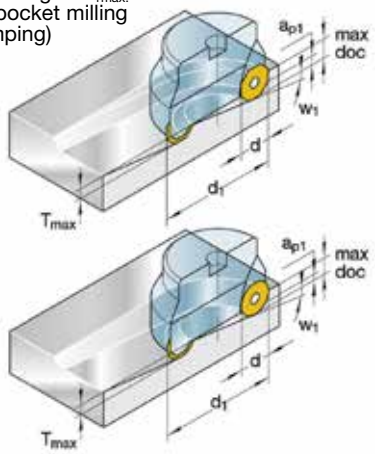
WPB-HF, High feed insert [1]	Maximum depth of cut			
	Diameter			
	mm	Inch	a_p max [in]	R_{theo} [in]
	0.394	0.375	0.020	0.039
	0.472	0.500	0.024	0.039
	0.630	0.625	0.031	0.059
	0.787	0.750	0.039	0.079
	0.984	1.000	0.049	0.098
	1.250	1.250	0.063	0.118

Recommended *maximum* feed per tooth (f_z) when woc = 3:2 (.67 x d_1) d_1 = Cutter dia.

Catalog No.	FCT45	MCT45	FCT 45	MCT45	FCT 45	MCT45
						
ap_1 (doc)	.118 with 8 indexed edges max.		.060 with 12 indexed edges max.		.078 with 8 indexed edges max.	
max.doc.	.394		.380		.315	
ISO-Code	OCKX 0606 AD-TR		XCKX 1606 DD-TR		RCKX 1606 MO-TR	
Recommended Maximum Feed per Tooth (f_z)						
P	.017		.017		.017	
	.015		.015		.015	
M	.008		.008		.008	
N	.015		.015		.015	
K	.014		.014		.014	
S	.012		.012		.012	

Pocket Milling and Ramp Milling

Helix angle $W_{1max.}$ for pocket milling (ramping)



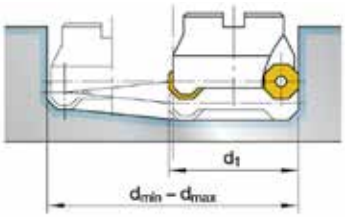
	FCT45 with OCKX 0606 AD-TR	FCT45 with XCKX 0606 AD-TR	FCT45 with RCKX 1606 MO-TR
Insert Dia.	16mm (.630")	16mm (.630")	16mm (.630")
max.doc.	.394	.380	.315
d_1 cutter dia.	**W_{1max} in deg.**		
2.00	8	7	7
2.50	5.4	4.8	4.8
3.00	4	3.6	3.6
4.00	3	2.7	2.7
5.00	2	2	2

Internal cutting depth T_{max} = .158"

Ramping

Ramping is always recommended over plunging when entering the workpiece. Ramp milling minimizes the likelihood of the workpiece material work hardening and improves tool life. Climb milling is recommended with workpiece materials that work harden. This method reduces the heat in the workpiece by dissipating it into the chip.

Circular Milling



Diameter Range for Helical Interpolation in a Recess		
d_1	d_{min}	d_{max}
2.00	2.799	4.00
2.50	3.799	5.00
3.00	4.799	6.00
4.00	6.799	8.00
5.00	8.799	10.00

Helical Interpolation

When possible Helical Interpolation is another preferred method of entry into the workpiece when roughing with button style cutters to full cavity depth. (See chart)

A consistent depth of cut and chip load is maintained without the need to dwell on the Z-axis. Once there is a cavity in the workpiece, the cutter can be used as a conventional facemill and rough the part with normal X and Y axis tool paths.

	Material	(N/mm²)	DIN Des.	Materials	Carbide Grade	Cutting Speed V_c (sfm)	Recommended max. feed per tooth f_z [in] with woc = 0.75 x d_1	
							ONGU0505	ONGU0606
							doc_{max} = 0.12 inch	doc_{max} = 0.16 inch
							inch	inch
P	Plain carbon steel	300-500	St 37, St 44	A36, 1005–1029	LC 225 T LC 240 T	650–800	0.018	0.020
		500-700	St 52, St 70	A570				
		350-500	U- und and R St 37-2	1.0036, 1.0038				
	Free cutting steel	360-550	9 S 20, 9 SMn 28	1213			0.018	0.020
		600-800	45 S 20, 60 S 20	1.0727, 1.0728				
	Structural alloy steel	500-950	Ck 45	1045			0.016	0.018
			26 CrMo 4	4130				
	Heat-treatable steel, medium strength	500-950	42 CrMo 4	4140		590–660	0.014	0.016
			50 CrV 4	1.2241				
	Cast steel	-950	GS 40	1.0416		460–530	0.012	0.014
	Case hardening steel	-950	16 MnCr 5	5115, 8620		460–590	0.012	0.014
	Heat-treatable steel, high strength	950-1400	42 CrMo 4	4140		390–530	0.010	0.012
			30 CrNiMo 8	~8740				
	Nitriding steel	950-1400	34 CrAl 6	~6150		390–460	0.010	0.012
	Tool steel	950-1400	X 38 CrMoV 5 1	H11		390–460	0.008	0.010
			X 155 CrVMo 12 1	D2				
K	Cast iron with flake graphite	100-400 (120-260 HB)	EN-GJL 250 (GG 25)	EN-JL-1040 A159, J431	LC 610 T	660–850	0.018	0.020
	Alloyed cast iron	150-250 (160-230 HB)	EN-GJLA-XNiCr35-2 (GGL-NiCr 35-2)	A436		530–660	0.012	0.014
	Cast iron with nodular graphite	400-800 (120-310 HB)	EN-GJS-600 (GGG60)	EN-JS-1060 (0.7060)		460–590	0.014	0.016
	Malleable cast iron	350-700 (150-280 HB)	EN-GJMB-550-4 (GTS55)	EN-JL-1160 A220		530–660	0.014	0.016

The cutting data indicated are starting values and must be adjusted to the prevailing conditions

The MultiEdge Double 8 was used in replacement of a 45° face milling cutter with inserts having 8 cutting edges, for face milling a guide joint made out of GJS-600. At a speed rate of 590 sfm, tool life could be inreased by 25%. Because of 16-times indexable inserts ONGU0606, the total number of inserts needed was reduced by 50%.

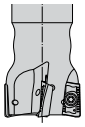
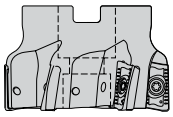
Tool:
FMN45 | Dia. = 3 inches, z = 7 Teeth
MultiEdge Double 8 (ONGU0606) | LC610T

Material:
GGG NiSiCr 3552 GGG60-Nodular Iron

Cutting data:
v_c = 590 sfm
n = 720 rpm
v_f = 71 ipm
woc = 2.4 inch
doc = 0.16 inch

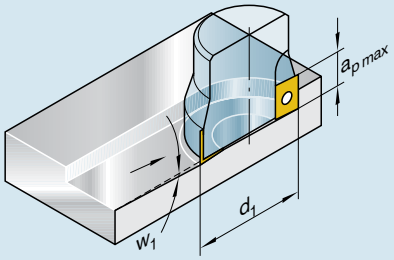
	Material	Material Examples	Rockwell C	Starting Cutting Speed (SFM)		
				LC630T	LC610T	LC240T
P	Plain Carbon Steel	1018, 1025	< 20	660	870	640
	Free Machining Steel	1212, 12L13	< 20	660	870	640
	Structural Alloy Steel	1040, 4130	< 30	590	870	640
	Heat Treatment Steel, medium strength	4140, 6150	< 30	520	870	525
	Cast Steel	4340, 8740	< 30	520	750	525
	Caste Hardening Steel	52100, 8620	< 30	520	750	525
	Stainless Steel, ferritic martensitic	410, 430F, 440	< 30	520	750	525
	Heat Treatment Steel, high strength	4140, 8740	28 - 44	390	575	460
	Nitriding Steel	A355	28 - 44	390	575	460
	Tool Steel	H13, D2	28 - 44	390	575	460
M	Stainless Steel, austenitic	304, 316	< 30	790	–	700
	Maraging Steel			200	–	700
K	Grey Cast Iron	A319, J431, No. 25B, No. 50B	< 27	660	870	640
	Alloyed Grey Cast Iron	A434, A436-72	< 22	490	675	525
	Nodular Cast Iron	A536 (80-55-06), J434	< 34	490	610	460
	Malleable Cast Iron	A220, 50005, A47, 32510	< 29	520	610	460
N	Pure Metals, soft	Pure Iron, Lead	< 20	980	2030	–
	Aluminum Alloys, long chipping	6061, 7050	< 20	3280	2750	–
	Aluminum Alloys, short chipping	A356, 4218	< 20	980	1150	–
	Copper Alloys, long chipping	C27200, B-148-52	< 20	820	2750	–
	Copper Alloys, short chipping		< 20	820	1150	–
	Magnesium Alloys	B94, M11910		1310	1640	–
	Thermoplastics	PVC, Acrylic glass		820	1640	–
	Duroplastics	Durolite, Ampal		660	1640	–
	Graphite			660	1640	–
S	Titanium Alloys, medium strength	F67, B265	< 29	260	–	–
	Titanium Alloys, high strength	Ti-6Al-4V	27 - 44	130	–	–
	Nickel Based Alloys medium strength	20Cb3	< 29	200	280	230
	Heat Resistant Nickel Based Alloys, high strength	Inconel 718	27 - 44	100	215	160
H	Chilled Cast Iron	Ampco 25	< 20	130	215	160
	Hardened Steel		45 - 52	–	280	160
			53 - 59	–	215	–
			60 - 65	–	145	–

Recommended feed per tooth (f_z) when width of cut (a_e) = 0.50 x d_1 (d_1 = Cutter Diameter)

LMT-Code	EMU90		FMU90
			
Ø	.787 - 1.574	.9842 - 1.574	1.574 - 3.937
ISO-Code	ADKX 1204 …	ADKX 1705 …	ADKX 1705 …
P	.0047 - .0059	.0059 - .0098	.0078 - .0118
M	.0047	.0059	.0066
K	.0078	.0118	.0137
N	.0098	.0137	.0157
S	.0039	.0059	.0059

Plunge milling using Univex
EMU90, FMU90

Bevel angle $W_{1\ max}$ for plunge milling “ramping”

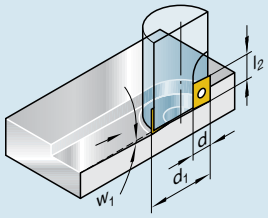


Type	d_1 (mm)	d_1 (inch)	ISO-Code	$a_{p\ max}$	$W_{1\ max}$ Degree
EMU90	20	.750	ADKX	.413	3.3
	25	1.000	1204 …		2.3
	32	1.250			1.6
	40	1.500			1.2
	25	1.000	ADKX	.649	4
	32	1.500	1705 …		2.7
	40	1.500			2
FMU90	40	1.500	ADKX	.649	2
	50	2.000	1705 …		1.5
	63	2.500			1.1
	80	3.000			0.8
	100	4.000			0.6

UNIVEX & UNIVEX Premium Milling Cutters
Feed Rates

Plunge milling using UNIVEX EMU90, FMU90, ERU90, FRU90

Bevel angle $W_{1\ max}$ for plunge milling “ramping”

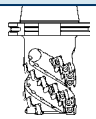
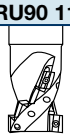
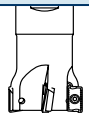
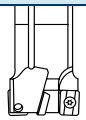


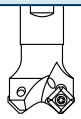
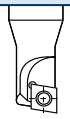
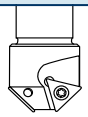
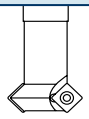
d_1 (mm)	d_1 (inch)	l_2 (Axial DOC)	d (Insert WOC)	$W_{1\ max}$ Degree
12	.472	9	6.35	4.5
14	.500	(.354)	(.250)	3.3
16	.625			2.6
18	.709			2.2
20	.750			1.9
22	.866			1.6
25	1.000	10.5	7.92	1.9
28	1.102	(.413)	(.312)	1.6
30	1.181			1.4
32	1.250			1.3
36	1.417			1.1
40	1.500			1.0

	Material	Hardness		Cutting Speed (SFM) Range		Recommended Grade	Feed Per Tooth (f_z) Range	Starting Speed (SFM)	Starting Feed Per Tooth (f_z)	Starting Chamfering (IPT)	Wet or Dry
		Brinell (BHN)	Rockwell (HRC)	Uncoated Carbide	Coated Carbide						
P	Low Carbon Steels	< 220	< 19		350-800	LC240T	.003-.009	500	.006	.013	D
	AISI: 1008, 1010,				400-1000	LC225T	.003-.008	650	.005	.011	D
	1018, 1117, 1141				300-650	LC630T	.003-.009	450	.006	.012	D
	Plain Carbon, Alloy and Tool Steels	200-300	19-32		300-700	LC240T	.003-.009	450	.006	.013	D
	AISI: 1045, 4140, 4320,				300-900	LC225T	.003-.008	550	.005	.013	D
	4340,5120, 8620, P-20				300-600	LC630T	.003-.009	400	.006		
	Alloy and Tool Steels	300-381	32-41		175-400	LC240T	.003-.008	300	.005	.009	D
	AISI Tool steels: H10, H11,				250-650	LC225S/T	.003-.007	450	.005	.008	D
	H13, alloy steels: 4140, 4150,				200-400	LC630S/T	.003-.008	300	.005	.009	D
	4320, 4340, 5120, 8620, 8640										
M	Stainless Steels										
	Ferritic-Martensitic	< 330	< 35		200-600	LC240T	.003-.008	450	.005	.008	D
	400 to 500 Series				250-650	LC225T	.003-.007	500	.004	.008	D
		330-371	35-40		150-500	LC240T	.003-.007	350	.005	.008	D
					175-550	LC225T	.003-.006	425	.004	.008	D
	PH Stainless Steels 15-5PH, 17-4PH, 17-7PH	150-371	< 40		175-500	LC240T	.003-.007	400	.005	.008	W/D
	Stainless Steels										
	Austenitic 200 to 300 Series	135-275	< 29		250-600	LC240T	.003-.007	400	.005	.008	D
	303, 304, 306, 316, 347				300-800	LC225T	.003-.007	450	.005	.008	D
N	Aluminum and other										
	Free-Machining	50-150			700-2000	LC610T•	.003-.012	1000	.008	.012	W/D
	Nonfererrous Materials				1000-12000	PCD	.003-.010	4000	.006	.010	W/D
	(copper, brass, zinc				900-4000	LC610T•	.003-.010	1500	.008	.012	W/D
	and magnesium)										
	Aluminum/High-Silicon				1000-6000	PCD	.003-.010	4000	.007	.010	W/D
	(12% or Higher)				700-1500	LC610T•	.003-.010	1000	.007	.010	W/D
K	Grey Cast Iron										
	Class: 20, 25, 30, 35, 40, 45, 50	120-320	< 34		300-900	LC610T	.003-.008	700	.006	.012	D
	SAE: grade G1800, G3000,				300-1100	LC615E	.003-.008	850	.006	.012	D
	G3500, G4000										
	Cast Iron										
	Ductile and Malleable	120-320	< 34		275-500	LC240T	.003-.006	325	.004	.008	D
	ASTM A536: 60-40-18,				300-600	LC610T	.003-.006	475	.004	.008	D
	65-45-12, 100-70-06				300-800	LC612E	.003-.006	525	.004	.008	D
	ASTM A47 grades 3000,										
	4000, 5000, 6000										
S	Nickel-Base Alloys										
	Annealed 600 series Inconel	140-300	< 32		50-300	LC610M	.003-.006	130	.004	.008	D
	Hastelloy & Waspaloy-Hastelloy B,				50-250	LC240T	.003-.007	110	.004	.008	D
	C-27, Inconel 601, 617, 625, 718										
	Nickel-Base,										
	Heat Resistant Alloys	300-475	31-49		60-200	LC240T	.002-.005	90	.003	.008	D
	Annealed Inconel 700 Series				60-200	LC225T	.002-.005	95	.003	.008	D
	Inconel 718, Rena 95,										
	MA6000, Hastelloy C										
	Titanium-Alloy	110-300	< 32	60-300	90-400	LC610T LW610	.003-.006	220	.003	.005	W
	Annealed Ti6Al-4V	300-350	32-36	60-220	90-300	LC610T LW610	.002-.006	150	.003	.005	W
	Ti6Al, Ti98.8, Ti99.9	350-440	36-46	60-180	90-200	LC610T LW610	.003-.006	130	.003	.005	W

When using uncoated grades reduce cutting speeds by 25%.
Use grade LC240S/T if tool breakage occurs.

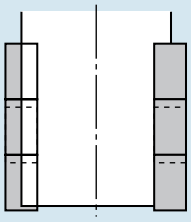
Recommended *maximum* feed per tooth (f_z) when woc = .5 x d_1 (d_1 = Cutter dia.)

Catalog No.	ERT90 11257 FRT90 11259	ERU90 11552 ERU90 11555 ERU90 11335	EMP90 11415 FMP90 11415	EMU90 11473 EMU90 11474
				
Cutter Dia.	2.00-3.00	1.00-2.50	1.00-4.00	0.50-1.50
ISO Code	SNKX	ADMX	APKT	ADHX
Recommended Maximum Feed per Tooth (f_z)				
P	.010	.006	.010	.006*
	.008	.005	.008	.005*
M	–	.004	–	.004*
K	.012	.010	.010	.010*
	.010	.008	.008	.008*
S	–	.004	–	.004*

Catalog No.	EMT45 11253	ESP90 11470	EFZ45/60 1148	EFP45 11483
				
Cutter Dia.	1.56-2.06	.488-1.238	.630-1.26	1.134-1.941
ISO Code	SNKX	CCHX	TCMT	SDM_ and SP__
Recommended Maximum Feed per Tooth (f_z)				
P	.010	.006	.008	.008
	.008	.004	.006	.006
M	.006	–	.004	.004
K	.012	.008	.010	.010
	.010	.006	.008	.008
S	.004	–	.003	.003

*These recommendations represent the average of the size range offered. These figures are not appropriate for smaller cutter diameters.

Calculation of Feed (IPM) When Applying Long Edge Helical Cutters

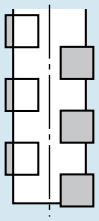


Inserts overlap
(all effective)
$nt_{eff.}$ = number of flutes

rpm = 3.82 x sfm ÷ d

IPM = rpm x $nt_{eff.}$ x f_z x M_f

rpm = spindle speed
f_z = feed per tooth
$nt_{eff.}$ = effective teeth
M_f = multiplication factor



Inserts do not overlap
(half effective)
$nt_{eff.}^{*}$ ÷ 2 = number of flutes

*Inserts are staggered in rows; two rows make one effective flute. Only one row cuts to the end. Each insert in that row is spaced so the next adjacent row of inserts cuts in the gap area with some insert overlap to complete the length of cut and make an effective flute.

	Material	Brinell Hardness (BHN)	Cutting Speed (SFM)	
			LW610 SFM	LC610T* SFM
N	Aluminum Free Machining	HB < 80	3280	4920
		HB > 80	2620	3280
	Copper alloys	long chipping	820	985
	Thermoplastics		985	–
	Aluminum alloys	Si < 12%	2620	328
		Si ≥ 12%**	–	650
	Copper alloys	short chipping	1320	1640
	Magnesium alloys	1320	–	
	Duroplastics		490	650

*LC610T CVD Coated TiAlN

**PCD-tipped inserts upon request.

Recommended Maximum Feed per Tooth (f_z) for V_GT Inserts

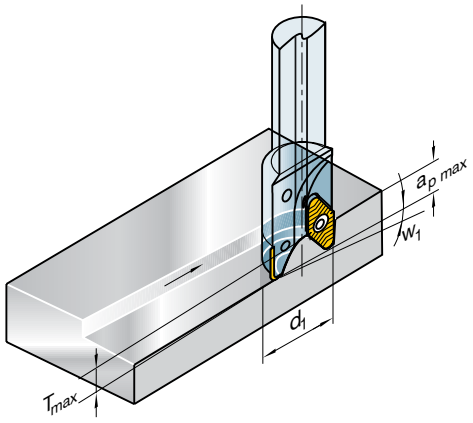
	Maximum Feed Per Tooth (f_z)	
	VPGT1604 . . .	VCGT2205 . . .
N	.014	.020
	.012	.016

EMZ90

EMZ90-THR

FMZ90

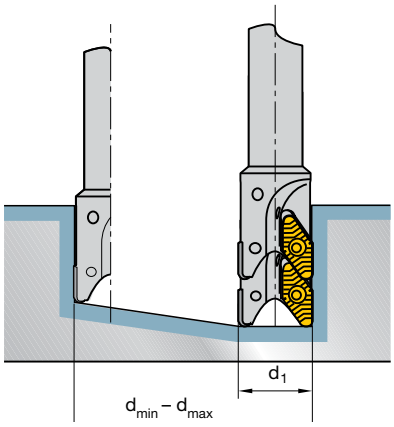
Pocket Milling and Axial Plunging



	VPGT 160412-ALM	VCGT 220530-ALM
$a_{p\ max}$	.531	.590
T_{max}	.31	.350
$W_{1\ max}$ Degree (Ramp Angle)		
1.00	12	
1.25		11
1.50		7.5
2.00		6
2.50		4.5
3.00		3.5
4.00		2.5

Helix angle $W_{1\ max}$ and internal depth of cut T_{max}

Circular Milling



d_1	d_{min}	d_{max}
1.00	1.40	1.91
1.25	1.64	2.26
1.50	2.34	2.75
2.00	3.18	3.76
2.50	4.23	4.76
3.00	5.28	5.76
4.00	7.07	7.75

EMZ90

	Material	Hardness Brinell		SFM	Diameter (Inch) (Chip Load per Tooth)						
					1/16	3/32	1/8	3/16	1/4	3/8	1/2
P	Tool Steels 300M, 4340, 52100, M50, A2, D2 H13 L2 M2, P20, S7 T15 W2	Below 375	Roughing	625	0.0015	0.002	0.003	0.004	0.005	0.008	0.0100
			Finishing	950	0.0017	0.0023	0.0033	0.0043	0.006	0.0088	0.0110
	Tool Steels 300M, 4340, 52100, M50, A2, D2 H13 L2 M2, P20, S7 T15 W2	375 - 500	Roughing	750	0.001	0.0015	0.0025	0.0035	0.0045	0.0075	0.0090
			Finishing	1200	0.0012	0.0018	0.0028	0.0038	0.0055	0.0083	0.0090
	Tool Steels 300M, 4340, 52100, M50, A2, D2 H13 L2 M2, P20, S7 T15 W2	500 - 700	Roughing	750	0.0008	0.0012	0.0022	0.0025	0.003	0.0045	0.0060
			Finishing	1200	0.001	0.0015	0.0025	0.0028	0.0033	0.0048	0.0063

MultiEdge 2 Feed HSC and WPB-HF
Cutting Data Recommendations

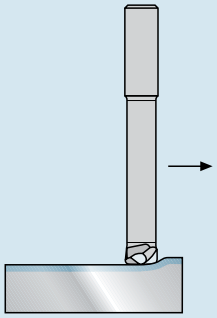
	Material	Material Examples	HRC	LC620ZM	
				Cutting Speed (sfm)	Feed Per Tooth (fz)
P	Unalloyed Carbon Steel	A36, 1005-1029, 1213, 12L14	16 - 30	800 - 1000	.040
	Alloyed Steel, medium strength	4140, 6150, 5115, 8620	< 30	800 - 990	.030
	Heat Treatable Steel, high strength	4340	30 - 44	720 - 790	.030
	Nitriding Steel	H13	30 - 44	490 - 590	.030
	Tool Steel	A2, D2, P20	30 - 44	590 - 720	.030
M	Stainless Steel, austenitic	303, 304, 316, Nitronic	< 30	700 - 800	.030
K	Grey Cast Iron Alloyed Grey Cast Iron	No. 30B A436-725	< 30	750 - 820	.050
	Nodular Cast Iron	5005	< 23	550 - 590	.040
	Alloyed Nodular Cast Iron	5005	< 16	450 - 590	.030
H	Hardened Steel		45 - 52	754	.0195
				656	.016

The cutting data indicated are starting values and must be adjusted to current machining conditions
*We recommend reducing the feed per tooth value with the long length version by 30%.

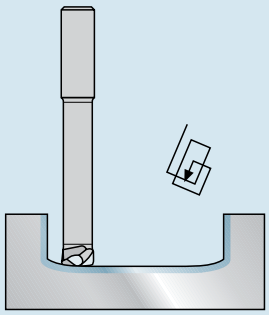
MultiEdge 4 Feed HSC
Cutting Data Recommendations

	Material	Material No.	DIN Des.	Cutting speed v_c = SFM	Feed per tooth f_z = inches						Cutting depth a_p (inch)
					Cutter diameter mm						
					4	5	6	8	10	12	
P	Heat-treatable die steels (4140, 8740)	1.2311	40CrMnMo7	787	0.0118	0.0150	0.0177	0.0236	0.0295	0.0354	0.0020 x d_1 (= a_p max.)
		1.2312	40CrMnMoS8.6								
		1.2738	40CrMnNiMoS8.6.4	722	0.0118	0.0150	0.0177	0.0236	0.0295	0.0354	
		1.2711	54NiCrMoV6	656	0.0094	0.0118	0.0142	0.0189	0.0236	0.0276	
	Full hardening tools steels (H13, D2)	1.2343	X 38 CrMoV 5 1	656	0.0110	0.0138	0.0165	0.0220	0.0276	0.0335	0.0016 x d_1
		1.2080	X210Cr12	591	0.0102	0.0130	0.0154	0.0205	0.0256	0.0315	
		1.2379	X 155 CrVMo 12 1								
		1.2767	X 45NiCrMo4	525	0.0094	0.0118	0.0142	0.0189	0.0236	0.0276	
	Nitriding steels (A355)	1.8550	34CrAlNi7	656	0.0110	0.0138	0.0165	0.0220	0.0276	0.0335	0.0016 x d_1
		1.8519	31CrMoV9	591	0.0102	0.0130	0.0154	0.0205	0.0256	0.0315	
		1.7735	14CrMoV6.9								
		1.2344	X40CrMoV5.1	525	0.0094	0.0118	0.0142	0.0189	0.0236	0.0276	
H	Hardened steel	45–52 HRC		656	0.0063	0.0079	0.0094	0.0126	0.0157	0.0189	0.0016 x d_1
		53–56 HRC		591	0.0047	0.0059	0.0071	0.0094	0.0118	0.0142	0.0012 x d_1
		57–62 HRC		459	0.0031	0.0039	0.0047	0.0063	0.0079	0.0094	0.0008 x d_1
		63–67 HRC		328	0.0024	0.0031	0.0035	0.0047	0.0059	0.0071	0.0004 x d_1

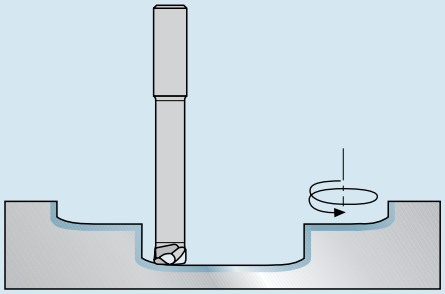
Face Milling



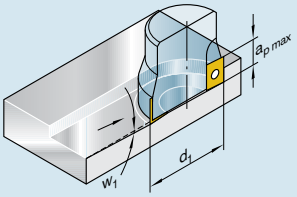
Pocketing



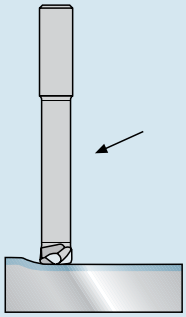
Opening cavity



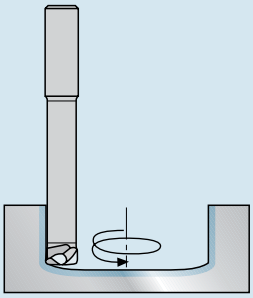
Plunge Milling



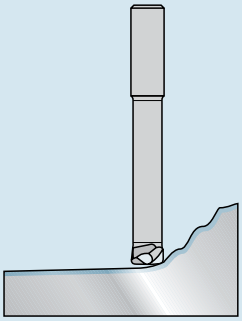
Ramping
Ramp Angle = 1-2°



Circular interpolation



3D rough copy milling



Roughing-Finishing End Mills Type DHC Premium & DHC Premium SLOT
Cutting Data Recommendations

	Material	Rm/UTS (N/mm²)	Example	Material No.	Cutting speed v_c [SFM]	Coolant	Feed per tooth f_z = (inches) Cutter diameter (mm) 4	5	6	8	10	12	14 -16	18 -20
P	Plain carbon steel (1018, 1025)	300-500 500-700 350-500	St 37. St 44 St 52. St 70 U- and R St 37-2	1.0037. 1.0044 1.0052. 1.0070 1.0036. 1.0038	755	☼ 💧	.0016	.0024	.0028	.0035	.0043	.0051	.0071	.0087
	Free cutting steel (1212, 12L13, 12L14)	360-550 600-800	9 S 20. 9 SMn 28 45 S 20. 60 S 20	1.0711. 1.0715 1.0727. 1.0728	755	☼ 💧	.0016	.0024	.0028	.0087	.0043	.0051	.0071	.0087
	Structural alloy steel (1040, 4130)	500-950	Ck 45. 26CrMo4	1.1191 1.7219	656	☼ 💧	.0016	.0020	.0024	.0079	.0039	.0047	.0063	.0079
	Heat-treatable steel, medium strength (4140, 6150)	500-950	42CrMo4. 50CrV4.	1.7225 1.2241	525	☼ 💧	.0016	.0020	.0024	.0079	.0039	.0047	.0063	.0079
	Cast steel (4340, 8740)	-950	GS40	1.0416	427	☼ 💧	.0012	.0016	.0020	.0067	.0035	.0039	.0055	.0067
	Case hardening steel (52100, 8620)	-950	16MnCr5	1.7131	525	☼ 💧	.0016	.0020	.0024	.0079	.0039	.0047	.0063	.0079
	Heat-treatable steel, high strength (4140, 8740)	950-1400	42CrMo4 30CrNiMo8	1.7225 1.6580	394	☼ 💧	.0012	.0016	.0020	.0059	.0031	.0035	.0047	.0059
	Nitriding steel (A355)	950-1400	34CrAl6	1.8504	361	☼ 💧	.0012	.0016	.0020	.0059	.0031	.0035	.0047	.0059
	Tool steel (H13,D2)	950-1400	X38CrMoV5-1 X155 CrVMo12-1	1.2343 1.2379	328	☼ 💧	.0012	.0016	.0016	.0055	.0028	.0031	.0043	.0055
M[1)]	Stainless steel, austenitic (303, 304, 316, 316L)	500-950	X5CrNi18-10 X2CrNiMo17-12-2 X6CrNiMoTi17-12	1.4301 1.4404 1.4571	328	💧	.0008	.0012	.0012	.0039	.0020	.0024	.0031	.0039
	Stainless steel, ferritic, martensitic (431)	500-950	X15Cr13 X17CrNi16-2 X35CrMo17	1.4024 1.4057 1.4122	328	💧	.0012	.0016	.0020	.0059	.0031	.0035	.0047	.0059
	Stainless steel, martensitic steel (403, 420, 430)	800-1000	X3NiCoMoTi18-9-5 X5CrNrCuNb16-4 X7CrNiAl17-7	1.2709 1.4542 1.4568	394	💧	.0012	.0012	.0016	.0051	.0028	.0031	.0039	.0051
K	Grey cast iron (No.20B, No.25B, No.30B, No.35B,No.40B, No.45B)	100-400 (120-260 HB)	EN-GJL-250 (GG25)	EN-JL-1040 (0.6025)	591	☼ 💧	.0024	.0028	.0031	.0110	.0055	.0067	.0087	.0110
	Alloyed grey cast iron	150-250 (160-230 HB)	EN-GJLA-XNiCr35-2 (GGL-NiCr35-2)	(0.6678)	525	☼ 💧	.0020	.0024	.0028	.0094	.0047	.0055	.0075	.0094
	Nodular cast iron (60-40-18, 80-55-06)	400-800 (120-310 HB)	EN-GJS-600 (GGG60)	EN-JS-1060 (0.7060)	492	☼ 💧	.0016	.0024	.0028	.0087	.0043	.0051	.0071	.0087
	Malleable cast iron (32510, 40010, 50005)	350-700 (150-280 HB)	EN-GJMB-550-4 (GTS55)	EN-JM-1160 (0.8155)	394	☼ 💧	.0016	.0024	.0028	.0087	.0043	.0051	.0071	.0087
N	Aluminium alloys, short chipping (6061-T6, 7050)	-400	G-AlSi12	3.2581	984	💧	.0020	.0024	.0031	.0098	.0051	.0059	.0079	.0098
	Aluminium alloys, short chipping	-500	MS58	2.0402	820	💧	.0016	.0020	.0024	.0079	.0039	.0047	.0063	.0079
S[1)]	Titanium alloys, medium strength (Ti6Al V4)	-950	TiAl5Sn2-5 TiAl6V4	3.7115 3.7165	262	💧	.0012	.0012	.0016	.0051	.0028	.0031	.0039	.0051
	Titanium alloys, hight strength	900-1400	TiAl6Sn2	3.7174	197	💧	.0008	.0012	.0012	.0039	.0020	.0024	.0031	.0039
	Nickel based alloys, medium strength (Inconel 718, Hastelloy C, Monel 400)	-950	NiCr12Al6MoNb	2.4670	131	💧	.0012	.0012	.0016	.0051	.0028	.0031	.0039	.0051
	Heat resis. nickel based all., high stren.	900-1400	NiCr19Fe19NbMo	Inconel 718	98	💧	.0008	.0012	.0118	.0039	.0020	.0024	.0031	.0039

☼ Dry machining, air-blast cooling is advantageous

💧 Wet machining, sufficient emulsion volume required

Feed correction factor f_1

$v_f = n \cdot z \cdot f_z \cdot f_1$

WOC a_e	DOC a_p	DHC long f_1	DHC short f_1	
.0039 · d_1	.039 x d_1	.071	.079	The cutting speed v_c must be increased by 30%
	.059 x d_1	.067	–	
	.079 x d_1*)	.063	–	
.0098 · d_1	.039 x d_1	.055	.079	
	.059 x d_1	.051	–	
	.079 x d_1*)	.047	–	
.020 · d_1	.039 x d_1	.043	.051	
	.059 x d_1	.039	–	
	.079 x d_1*)	.0314	–	
.0295 · d_1	.039 x d_1	.0314	.039	
	.059 x d_1	.0275	–	
	.079 x d_1*)	.0236	–	
.039 · d_1	.0196 x d_1	.0314	.0354	Reduce the cutting speed v_c by 20%
	.039 x d_1	.0275	.0314	
	.059 x d_1	.0236	–	

*) .071 x d_1 for diameter 14, 18, 20

a_e = Width of cut in (in)
a_p = Depth of cut in (in)
d_1 = Cutter diameter in (in)
f_1 = Correction factor for v_f
f_z = Feed per tooth in (in)
n = Speed in min^{-1}
Q = Chip volume in cm^3/min
v_c = Cutting speed in (RPM)
v_f = Feed rate in (in/min)
z = No. of teeth

[1)] For that materials do not use DHC, please take the DHC INOX

Roughing-Finishing End Mills Type DHC INOX
Cutting Data Recommendations

	Material	Rm/UTS (N/mm²)	Example	Material No.	Cutting speed v_c [SFM]	Coolant	Feed per tooth f_z = (inches) Cutter diameter (mm) 4	5	6	8	10	12	14 -16	18 -20
M	Stainless steel, austenitic (303, 304, 316Ti, 316L)	500-950	X5CrNi18-10 X2CrNiMo17-12-2 X6CrNiMoTi17-12-2	1.4301 1.4404 1.4571	328	💧	.0008	.0012	.0012	.0016	.0020	.0024	.0031	.0039
	Stainless steel, ferritic, martensitic (431)	500-950	X15Cr13 X17CrNi16-2 X35CrMo17	1.4024 1.4057 1.4122	328	💧	.0012	.0016	.0020	.0059	.0031	.0035	.0047	.0059
	Stainless steel, martensitic steel (403, 420, 430)	800-1000	X3NiCoMoTi18-9-5 X5CrNrCuNb16-4 X7CrNiAl17-7	1.2709 1.4542 1.4568	394	💧	.0012	.0012	.0016	.0051	.0028	.0031	.0039	.0051
N	Aluminium alloys, short chipping (6061-T6, 7050, A413.1)	-400	G-AlSi12	3.2581	984	💧	.0020	.0024	.0031	.0098	.0051	.0059	.0079	.0098
	Aluminium alloys, short chipping	-500	MS58	2.0402	820	💧	.0016	.0020	.0024	.0079	.0039	.0047	.0063	.0079
S	Titanium alloys, medium strength (Ti6Al V4)	-950	TiAl5Sn2-5 TiAl6V4	3.7115 3.7165	262	💧	.0012	.0012	.0016	.0051	.0028	.0031	.0039	.0051
	Titanium alloys, hight strength	900-1400	TiAl6Sn2	3.7174	197	💧	.0008	.0012	.0012	.0039	.0020	.0024	.0031	.0039
	Nickel based alloys, medium strength	-950	NiCr12Al6MoNb	2.4670	131	💧	.0012	.0016	.0016	.0051	.0028	.0031	.0039	.0051
	Heat resistant nickel based alloys, high strength (Inconel 718, Hastelloy C, Monel 400)	900-1400	NiCr19Fe19NbMo	Inconel 718	98	💧	.0008	.0012	.0012	.0039	.0020	.0024	.0031	.0039

☼ Dry machining, air-blast cooling is advantageous

💧 Wet machining, sufficient emulsion volume required

Feed correction factor f_1

$v_f = n \cdot z \cdot f_z \cdot f_1$

WOC a_e	DOC a_p	DHC long f_1	DHC short f_1	
.0039 · d_1	.039 x d_1	.071	.079	The cutting speed v_c must be increased by 30%
	.059 x d_1	.067	–	
	.079 x d_1*)	.063	–	
.0098 · d_1	.039 x d_1	.055	.079	
	.059 x d_1	.051	–	
	.079 x d_1*)	.047	–	
.020 · d_1	.039 x d_1	.043	.051	
	.059 x d_1	.039	–	
	.079 x d_1*)	.0314	–	
.0295 · d_1	.039 x d_1	.0314	.039	
	.059 x d_1	.0275	–	
	.079 x d_1*)	.0236	–	
.039 · d_1	.0196 x d_1	.0314	.0354	Reduce the cutting speed v_c by 20%
	.039 x d_1	.0275	.0314	
	.059 x d_1	.0236	–	

*) .071 x d_1 for diameter 14, 18, 20

1) For that materials do not use DHC, please take the DHC INOX

a_e = Width of cut in (in)
a_p = Depth of cut in (in)
d_1 = Cutter diameter in (in)
f_1 = Correction factor for v_f
f_z = Feed per tooth in (in)
n = Speed in min^{-1}
Q = Chip volume in cm^3/min
v_c = Cutting speed in (RPM)
v_f = Feed rate in (in/min)
z = No. of teeth

Max Q End Mills – 4 Flutes
Cutting Data Recommendations

	Material / Grade	SFM Hardness < 32Rc	SFM Hardness > 32Rc	Machinability Rating	Application	Diameter (Inch) (Chip Load per Tooth) 1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1	1-1/4
P	**Carbon Steel** 10XX, 11XX 10XX, 11XX, 13XX, 15XX	400 - 600	150 - 250	50 to 100%	Slotting	.0011	.0014	.0020	.0024	.0030	.0040	.0050	.0060	.0080	.0099
		400 - 600	150 - 250		Heavy Profile 33%	.0017	.0021	.0030	.0036	.0044	.0060	.0075	.0091	.0120	.0149
		1000 - 1300	500 - 600		Semi Finishing 10%	.0025	.0030	.0044	.0053	.0065	.0088	.0110	.0133	.0176	.0218
		1000 - 1300	500 - 600		Finishing	.0034	.0041	.0060	.0072	.0089	.0120	.0150	.0181	.0239	.0298
	Alloy Steel 4140, 4340, 200, 250, 300	400 - 600	100 - 200	45 to 65%	Slotting	.0011	.0014	.0020	.0024	.0030	.0040	.0050	.0060	.0080	.0099
		250 - 400	100 - 200		Heavy Profile 33%	.0017	.0021	.0030	.0036	.0044	.0060	.0075	.0091	.0120	.0149
		990 - 1200	450 - 560		Semi Finishing 10%	.0025	.0030	.0044	.0053	.0065	.0088	.0110	.0133	.0176	.0218
		990 - 1200	450 - 560		Finishing	.0034	.0041	.0060	.0072	.0089	.0120	.0150	.0181	.0239	.0298
	Mold & Die Steel A2, D2 O1, H-13, P-20, S7	150 - 250	70 - 150	35 - 65%	Slotting	.0011	.0014	.0020	.0024	.0030	.0040	.0050	.0060	.0080	.0099
		150 - 250	70 - 150		Heavy Profile 33%	.0017	.0015	.0022	.0027	.0033	.0045	.0056	.0068	.0090	.0112
		720 - 880	330 - 400		Semi Finishing 10%	.0025	.0023	.0033	.0040	.0049	.0066	.0083	.0100	.0132	.0164
		720 - 880	330 - 400		Finishing	.0034	.0031	.0045	.0054	.0067	.0090	.0113	.0136	.0180	.0223
	Tool Steel A2, D2, H11, M1, O-1, S-7	250 - 300	200 - 280	35 - 65%	Slotting	.0004	.0007	.0010	.0013	.0016	.0021	.0026	.0031	.0040	.0052
		250 - 300	200 - 280		Heavy Profile 33%	.0005	.0009	.0013	.0017	.0020	.0026	.0033	.0039	.0050	.0065
		800 - 1000	700 - 900		Semi Finishing 10%	.0007	.0012	.0017	.0022	.0027	.0035	.0045	.0053	.0067	.0088
		800 - 1000	700 - 900		Finishing	.0005	.0009	.0012	.0016	.0019	.0025	.0032	.0037	.0048	.0062
K	**Cast Iron Grey** No20B, No25B, No30B, No35B, No40B, No45B	200 - 500	130 - 300	35 to 70%	Slotting	.0009	.0011	.0016	.0019	.0023	.0032	.0040	.0048	.0063	.0078
		200 - 500	130 - 300		Heavy Profile 33%	.0010	.0012	.0018	.0021	.0026	.0035	.0045	.0054	.0071	.0088
		1000 - 1300	500 - 600		Semi Finishing 10%	.0015	.0018	.0026	.0031	.0039	.0052	.0065	.0079	.0104	.0129
		1000 - 1300	500 - 600		Finishing	.0020	.0024	.0035	.0043	.0053	.0071	.0089	.0107	.0142	.0176
	Cast Ductile / Nodular Alloyed Grey Cast, 32501, 40010, 50009	120 - 350	80 - 140	35 to 60%	Slotting	.0009	.0010	.0015	.0018	.0022	.0030	.0037	.0045	.0060	.0074
		120 - 350	80 - 140		Heavy Profile 33%	.0010	.0011	.0017	.0020	.0025	.0033	.0042	.0051	.0067	.0083
		800 - 990	370 - 450		Semi Finishing 10%	.0014	.0017	.0025	.0029	.0036	.0049	.0062	.0074	.0098	.0122
		800 - 990	370 - 450		Finishing	.0019	.0023	.0033	.0040	.0050	.0067	.0084	.0101	.0134	.0166
M	**Austenitic Stainless** 304, 310, 314, 316L, Invar, Kovar, 302, 304L	150 - 350	80 - 200	40 to 65%	Slotting	.0009	.0011	.0016	.0020	.0024	.0033	.0041	.0049	.0065	.0081
		150 - 350	80 - 200		Heavy Profile 33%	.0010	.0013	.0018	.0022	.0027	.0037	.0046	.0055	.0073	.0091
		600 - 800	300 - 380		Semi Finishing 10%	.0015	.0018	.0027	.0032	.0040	.0054	.0068	.0081	.0107	.0134
		600 - 800	300 - 380		Finishing	.0021	.0025	.0037	.0044	.0054	.0073	.0092	.0111	.0146	.0182
	Martensitic Stainless 420, 430F, 440, 403, 410, 416	200 - 450	100 - 250	25 to 75%	Slotting	.0009	.0011	.0016	.0019	.0023	.0032	.0040	.0048	.0063	.0078
		200 - 450	100 - 250		Heavy Profile 33%	.0010	.0012	.0018	.0021	.0026	.0035	.0045	.0054	.0071	.0088
		600 - 800	300 - 380		Semi Finishing 10%	.0015	.0018	.0026	.0031	.0039	.0052	.0065	.0079	.0104	.0129
		600 - 800	300 - 380		Finishing	.0020	.0024	.0035	.0043	.0053	.0071	.0089	.0107	.0142	.0176
	Preciptattion Stainless 13-8, 15-5, 17-4PH	80 - 250	90 - 125	30 to 45%	Slotting	.0009	.0011	.0016	.0019	.0023	.0032	.0040	.0048	.0063	.0078
		80 - 250	90 - 125		Heavy Profile 33%	.0010	.0012	.0018	.0021	.0026	.0035	.0045	.0054	.0071	.0088
		600 - 800	300 - 380		Semi Finishing 10%	.0015	.0018	.0026	.0031	.0039	.0052	.0065	.0079	.0104	.0129
		600 - 800	300 - 380		Finishing	.0020	.0024	.0035	.0043	.0053	.0071	.0089	.0107	.0142	.0176
S	**Cobalt Base** Haynes 21/26, NASA CO-W-RE, Stellite	150 - 350	80 - 200	5 to 30%	Slotting	.0007	.0008	.0012	.0015	.0018	.0025	.0031	.0037	.0049	.0061
		150 - 350	80 - 200		Heavy Profile 33%	.0008	.0009	.0014	.0017	.0020	.0028	.0035	.0042	.0055	.0069
		600 - 800	300 - 380		Semi Finishing 10%	.0012	.0014	.0020	.0024	.0030	.0040	.0051	.0061	.0081	.0100
		600 - 800	300 - 380		Finishing	.0016	.0019	.0028	.0033	.0041	.0055	.0069	.0083	.0110	.0137
	Iron Base A-286, Discoly, Incoly, Mulitmet, Timken 16-25-6	60 - 90	40 - 70	9 to 45%	Slotting	.0009	.0010	.0015	.0018	.0022	.0030	.0037	.0045	.0060	.0074
		60 - 90	40 - 70		Heavy Profile 33%	.0010	.0011	.0017	.0020	.0025	.0033	.0042	.0051	.0067	.0083
		160 - 200	60 - 80		Semi Finishing 10%	.0014	.0017	.0025	.0029	.0036	.0049	.0062	.0074	.0098	.0122
		160 - 200	60 - 80		Finishing	.0019	.0023	.0033	.0040	.0050	.0067	.0084	.0101	.0134	.0166
	Nickel Base Hastalloy, Waspalloy, Udimet, Rene 41, 77, 95, Nimonic, Inconel 625, 718	70 - 100	40 - 90	9 to 45%	Slotting	.0007	.0009	.0012	.0015	.0019	.0025	.0031	.0038	.0050	.0062
		70 - 120	40 - 90		Heavy Profile 33%	.0008	.0010	.0014	.0017	.0021	.0028	.0035	.0043	.0056	.0070
		170 - 210	80 - 100		Semi Finishing 10%	.0012	.0014	.0021	.0025	.0031	.0041	.0052	.0062	.0082	.0102
		170 - 210	80 - 100		Finishing	.0016	.0019	.0028	.0034	.0042	.0056	.0071	.0085	.0112	.0140
	Titanium Beta-21, Titanium Aluminide, 6Al-4V, Ti 10-23, Com Pure, 5553	120 - 160	80 - 140	5 to 30%	Slotting	.0009	.0010	.0015	.0018	.0022	.0030	.0037	.0045	.0060	.0074
		300 - 550	160 - 200		Heavy Profile 33%	.0010	.0011	.0017	.0020	.0025	.0033	.0042	.0051	.0067	.0083
		550 - 750	180 - 220		Semi Finishing 10%	.0014	.0017	.0025	.0029	.0036	.0049	.0062	.0074	.0098	.0122
		550 - 750	180 - 220		Finishing	.0019	.0023	.0033	.0040	.0050	.0067	.0084	.0101	.0134	.0166

RULES OF THUMB

Standard endmill with up to 2x Ø projecting from the toolholder

Slotting: ADoC 0.5 x Endmill Ø
Heavy Profiling Milling: RDoC 33% of the Endmill Ø, ADoC up to 1.5 x Endmill Ø
Semi Finishing Profile Milling: RDoC 10% of the Endmill Ø, ADoC up to 2 x Endmill Ø
Finishing: RDoC 5% of the Endmill Ø, ADoC up to 2.5 x Endmill Ø

	Projection Length	Reduce Speeds & Feeds
Reduce feed rate when endmill is projecting from the toolholder	2.5 X Ø	15%
	3 X Ø	20%
	4 X Ø	55%
	5 X Ø	65%
	6 X Ø	75%

Necked Endmill Series

Slotting: ADoC 0.25 x Endmill Ø
Heavy Profiling Milling: RDoC 33% of the Endmill Ø, ADoC up to 0.5 x Endmill Ø
Semi Finishing Profile Milling: RDoC 10% of the Endmill Ø, ADoC up to 0.75 x Endmill Ø
Finishing: RDoC 5% of the Endmill Ø, ADoC up to 1 x Endmill Ø

Ramping Angle For Helical Interpolation	1°–2°

Max Q End Mills – 5 Flutes
Cutting Data Recommendations

	Material / Grade	SFM Hardness < 32Rc	SFM Hardness > 32Rc	Machinability Rating	Application	Diameter (Inch) (Chip Load per Tooth) 1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1	1-1/4
P	**Carbon Steel** 10XX, 11XX 10XX, 11XX, 13XX, 15XX	400 - 600	150 - 250	50 to 100%	Slotting	.0007	.0009	.0012	.0015	.0019	.0025	.0031	.0038	.0050	.0062
		400 - 600	150 - 250		Heavy Profile 33%	.0011	.0013	.0019	.0022	.0028	.0037	.0047	.0057	.0075	.0093
		1000 - 1300	500 - 600		Semi Finishing 10%	.0016	.0019	.0027	.0033	.0041	.0055	.0069	.0083	.0110	.0137
		1000 - 1300	500 - 600		Finishing	.0021	.0026	.0037	.0045	.0056	.0075	.0094	.0114	.0150	.0186
	Alloy Steel 4140, 4340, 200, 250, 300	400 - 600	100 - 200	45 to 65%	Slotting	.0007	.0009	.0012	.0015	.0019	.0025	.0031	.0038	.0050	.0062
		250 - 400	100 - 200		Heavy Profile 33%	.0011	.0013	.0019	.0022	.0028	.0037	.0047	.0057	.0075	.0093
		990 - 1200	450 - 560		Semi Finishing 10%	.0016	.0019	.0027	.0033	.0041	.0055	.0069	.0083	.0110	.0137
		990 - 1200	450 - 560		Finishing	.0021	.0026	.0037	.0045	.0056	.0075	.0094	.0114	.0150	.0186
	Mold & Die Steel A2, D2 O1, H-13, P-20, S7	150 - 250	70 - 150	35 - 65%	Slotting	.0007	.0009	.0012	.0015	.0019	.0025	.0031	.0038	.0050	.0062
		150 - 250	70 - 150		Heavy Profile 33%	.0011	.0010	.0014	.0017	.0021	.0028	.0035	.0043	.0056	.0070
		720 - 880	330 - 400		Semi Finishing 10%	.0016	.0014	.0021	.0025	.0031	.0041	.0052	.0062	.0082	.0102
		720 - 880	330 - 400		Finishing	.0021	.0019	.0028	.0034	.0042	.0056	.0071	.0085	.0112	.0140
	Tool Steel A2, D2, H11, M1, O-1, S-7	250 - 300	200 - 280	35 - 65%	Slotting	.0004	.0007	.0010	.0013	.0016	.0021	.0026	.0031	.0040	.0052
		250 - 300	200 - 280		Heavy Profile 33%	.0005	.0009	.0013	.0017	.0020	.0026	.0033	.0039	.0050	.0065
		800 - 1000	700 - 900		Semi Finishing 10%	.0007	.0012	.0017	.0022	.0027	.0035	.0045	.0053	.0067	.0088
		800 - 1000	700 - 900		Finishing	.0005	.0009	.0012	.0016	.0019	.0025	.0032	.0037	.0048	.0062
K	**Cast Iron Grey** No20B, No25B, No30B, No35B, No40B, No45B	200 - 500	130 - 300	35 to 70%	Slotting	.0009	.0011	.0016	.0019	.0023	.0032	.0040	.0048	.0063	.0078
		200 - 500	130 - 300		Heavy Profile 33%	.0010	.0012	.0018	.0021	.0026	.0035	.0045	.0054	.0071	.0088
		1000 - 1300	500 - 600		Semi Finishing 10%	.0015	.0018	.0026	.0031	.0039	.0052	.0065	.0079	.0104	.0129
		1000 - 1300	500 - 600		Finishing	.0020	.0024	.0035	.0043	.0053	.0071	.0089	.0107	.0142	.0176
	Cast Ductile / Nodular Alloyed Grey Cast, 32501, 40010, 50009	120 - 350	80 - 140	35 to 60%	Slotting	.0009	.0010	.0015	.0018	.0022	.0030	.0037	.0045	.0060	.0074
		120 - 350	80 - 140		Heavy Profile 33%	.0010	.0011	.0017	.0020	.0025	.0033	.0042	.0051	.0067	.0083
		800 - 990	370 - 450		Semi Finishing 10%	.0014	.0017	.0025	.0029	.0036	.0049	.0062	.0074	.0098	.0122
		800 - 990	370 - 450		Finishing	.0019	.0023	.0033	.0040	.0050	.0067	.0084	.0101	.0134	.0166
M	**Austenitic Stainless** 304, 310, 314, 316L, Invar, Kovar, 302, 304L	150 - 350	80 - 200	40 to 65%	Slotting	.0009	.0011	.0016	.0020	.0024	.0033	.0041	.0049	.0065	.0081
		150 - 350	80 - 200		Heavy Profile 33%	.0010	.0013	.0018	.0022	.0027	.0037	.0046	.0055	.0073	.0091
		600 - 800	300 - 380		Semi Finishing 10%	.0015	.0018	.0027	.0032	.0040	.0054	.0068	.0081	.0107	.0134
		600 - 800	300 - 380		Finishing	.0021	.0025	.0037	.0044	.0054	.0073	.0092	.0111	.0146	.0182
	Martensitic Stainless 420, 430F, 440, 403, 410, 416	200 - 450	100 - 250	25 to 75%	Slotting	.0009	.0011	.0016	.0019	.0023	.0032	.0040	.0048	.0063	.0078
		200 - 450	100 - 250		Heavy Profile 33%	.0010	.0012	.0018	.0021	.0026	.0035	.0045	.0054	.0071	.0088
		600 - 800	300 - 380		Semi Finishing 10%	.0015	.0018	.0026	.0031	.0039	.0052	.0065	.0079	.0104	.0129
		600 - 800	300 - 380		Finishing	.0020	.0024	.0035	.0043	.0053	.0071	.0089	.0107	.0142	.0176
	Preciptattion Stainless 13-8, 15-5, 17-4PH	80 - 250	90 - 125	30 to 45%	Slotting	.0009	.0011	.0016	.0019	.0023	.0032	.0040	.0048	.0063	.0078
		80 - 250	90 - 125		Heavy Profile 33%	.0010	.0012	.0018	.0021	.0026	.0035	.0045	.0054	.0071	.0088
		600 - 800	300 - 380		Semi Finishing 10%	.0015	.0018	.0026	.0031	.0039	.0052	.0065	.0079	.0104	.0129
		600 - 800	300 - 380		Finishing	.0020	.0024	.0035	.0043	.0053	.0071	.0089	.0107	.0142	.0176
S	**Cobalt Base** Haynes 21/26, NASA CO-W-RE, Stellite	150 - 350	80 - 200	5 to 30%	Slotting	.0007	.0008	.0012	.0015	.0018	.0025	.0031	.0037	.0049	.0061
		150 - 350	80 - 200		Heavy Profile 33%	.0008	.0009	.0014	.0017	.0020	.0028	.0035	.0042	.0055	.0069
		600 - 800	300 - 380		Semi Finishing 10%	.0012	.0014	.0020	.0024	.0030	.0040	.0051	.0061	.0081	.0100
		600 - 800	300 - 380		Finishing	.0016	.0019	.0028	.0033	.0041	.0055	.0069	.0083	.0110	.0137
	Iron Base A-286, Discoly, Incoly, Mulitmet, Timken 16-25-6	60 - 90	40 - 70	9 to 45%	Slotting	.0009	.0010	.0015	.0018	.0022	.0030	.0037	.0045	.0060	.0074
		60 - 90	40 - 70		Heavy Profile 33%	.0010	.0011	.0017	.0020	.0025	.0033	.0042	.0051	.0067	.0083
		160 - 200	60 - 80		Semi Finishing 10%	.0014	.0017	.0025	.0029	.0036	.0049	.0062	.0074	.0098	.0122
		160 - 200	60 - 80		Finishing	.0019	.0023	.0033	.0040	.0050	.0067	.0084	.0101	.0134	.0166
	Nickel Base Hastalloy, Waspalloy, Udimet, Rene 41, 77, 95, Nimonic, Inconel 625, 718	70 - 100	40 - 90	9 to 45%	Slotting	.0006	.0008	.0011	.0013	.0017	.0022	.0028	.0034	.0045	.0056
		70 - 120	40 - 90		Heavy Profile 33%	.0007	.0009	.0013	.0015	.0019	.0025	.0032	.0038	.0051	.0063
		170 - 210	80 - 100		Semi Finishing 10%	.0011	.0013	.0019	.0022	.0028	.0037	.0047	.0056	.0074	.0092
		170 - 210	80 - 100		Finishing	.0014	.0017	.0025	.0030	.0038	.0051	.0064	.0077	.0101	.0126
	Titanium Beta-21, Titanium Aluminide, 6Al-4V, Ti 10-23, Com Pure, 5553	120 - 160	80 - 140	5 to 30%	Slotting	.0009	.0010	.0015	.0018	.0022	.0030	.0037	.0045	.0060	.0074
		300 - 550	160 - 200		Heavy Profile 33%	.0010	.0011	.0017	.0020	.0025	.0033	.0042	.0051	.0067	.0083
		550 - 750	180 - 220		Semi Finishing 10%	.0014	.0017	.0025	.0029	.0036	.0049	.0062	.0074	.0098	.0122
		550 - 750	180 - 220		Finishing	.0019	.0023	.0033	.0040	.0050	.0067	.0084	.0101	.0134	.0166

RULES OF THUMB

Standard endmill with up to 2x Ø projecting from the toolholder

Slotting: ADoC 0.5 x Endmill Ø
Heavy Profiling Milling: RDoC 33% of the Endmill Ø, ADoC up to 1.5 x Endmill Ø
Semi Finishing Profile Milling: RDoC 10% of the Endmill Ø, ADoC up to 2 x Endmill Ø
Finishing: RDoC 5% of the Endmill Ø, ADoC up to 2.5 x Endmill Ø

	Projection Length	Reduce Speeds & Feeds
Reduce feed rate when endmill is projecting from the toolholder	2.5 X Ø	15%
	3 X Ø	20%
	4 X Ø	55%
	5 X Ø	65%
	6 X Ø	75%

Necked Endmill Series

Slotting: ADoC 0.25 x Endmill Ø
Heavy Profiling Milling: RDoC 33% of the Endmill Ø, ADoC up to 0.5 x Endmill Ø
Semi Finishing Profile Milling: RDoC 10% of the Endmill Ø, ADoC up to 0.75 x Endmill Ø
Finishing: RDoC 5% of the Endmill Ø, ADoC up to 1 x Endmill Ø

Ramping Angle For Helical Interpolation	1°–2°

ONSRUD TVS-4 / TVM-4 – EMC for Exotic Materials and Stainless Steel
ONSRUD TVS-5 / TVM-5 – EMC for Exotic Materials and Stainless Steel
Cutting Data Recommendations

	Material		SFM	Diameter (Inch) (Chip Load per Tooth)					
				1/4	3/8	1/2	5/8	3/4	1
P	Mold & Die Steel A2, D2, 01, H-13, S7	Slotting	150 / 250	0.0014	0.0021	0.0028	0.0035	0.0042	0.0056
		Profiling 33% RDoC		0.0018	0.0027	0.0036	0.0044	0.0053	0.0072
	Alloy Steels 4140, 4340, 200, 250, 300	Slotting	250/450	0.0014	0.0021	0.0028	0.0035	0.0042	0.0056
		Profiling 33% RDoC		0.0018	0.0027	0.0036	0.0044	0.0053	0.0072
	Carbon Steels 10XX, 11XX, 13XX, 15XX	Slotting	400 / 600	0.0014	0.0021	0.0028	0.0035	0.0042	0.0056
		Profiling 33% RDoC		0.0018	0.0027	0.0036	0.0044	0.0053	0.0072
M	Martensitic Stainless 420, 430F, 440 , 403, 410, 416	Slotting	100 - 250	0.0014	0.0021	0.0028	0.0035	0.0042	0.0056
		Profiling 33% RDoC		0.0018	0.0027	0.0036	0.0044	0.0053	0.0072
	Precipitation Stainless 13-8PH, 15-5PH, 17-4PH	Slotting	90 - 250	0.0014	0.0021	0.0028	0.0035	0.0042	0.0056
		Profiling 33% RDoC		0.0018	0.0027	0.0036	0.0044	0.0053	0.0072
	Austenic Stainless 304, 310, 314, 316L, 302, 304L	Slotting	100 - 350	0.0013	0.0021	0.0028	0.0035	0.0042	0.0056
		Profiling 33% RDoC		0.0017	0.0027	0.0036	0.0044	0.0053	0.0072
S	Nickel Base Hastalloy, Waspalloy, Rene 41-95, Monel, Inconel 625, 718	Slotting	40 - 100	0.001	0.0014	0.002	0.0026	0.0031	0.004
		Profiling 33% RDoC		0.0012	0.0018	0.0026	0.0031	0.0038	0.005
	Iron Base A-286, Discoly , Incoly, Multimet	Slotting	50 -100	0.0012	0.0021	0.0025	0.0031	0.0038	0.0050
		Profiling 33% RDoC		0.0014	0.0025	0.0030	0.0038	0.0045	0.0060
	Cobalt Base Haynes 21/26 , NASA CO-W-RE	Slotting	40 - 100	0.0010	0.0014	0.0020	0.0026	0.0031	0.0040
		Profiling 33% RDoC		0.0012	0.0018	0.0026	0.0031	0.0038	0.0050
	Titanium 5553, 6Al-4V	Slotting	60 - 220	0.0014	0.0021	0.0028	0.0035	0.0042	0.0056
		Profiling 33% RDoC		0.0018	0.0027	0.0036	0.0044	0.0053	0.0072

ONSRUD TVS-7 / TVM-7 – EMC for Exotic Materials and Stainless Steel
Cutting Data Recommendations

	Material	SFM	Diameter (Inch) (Chip Load per Tooth)			
			1/2	5/8	3/4	1
M	Martensitic Stainless 420, 430F, 440 , 403, 410, 416	90 - 250	0.0014	0.0017	0.0021	0.0028
		100 - 250	0.0014	0.0017	0.0021	0.0028
	Precipitation Stainless 13-8PH, 15-5PH, 17-4PH	90 - 250	0.0014	0.0017	0.0021	0.0028
		100 - 350	0.0014	0.0017	0.0021	0.0028
	Austenic Stainless 304, 310, 314, 316L, 302, 304L	100 - 250	0.0014	0.0017	0.0021	0.0028
		100 - 350	0.0014	0.0017	0.0021	0.0028
S	Nickel Base Hastalloy, Waspalloy, Rene 41-95, Monel, Inconel 625, 718	40 - 60	0.0020	0.0025	0.0030	0.0040
		45 - 100	0.0020	0.0025	0.0030	0.0040
	Iron Base A-286, Discoly , Incoly, Multimet	50 - 80	0.0020	0.0025	0.0030	0.0040
		80 - 100	0.0020	0.0025	0.0030	0.0040
	Cobalt Base Haynes 21/26 , NASA CO-W-RE	40 - 80	0.0014	0.0017	0.0021	0.0029
		60 - 100	0.0014	0.0017	0.0021	0.0029
	Titanium 5553, 6Al-4V	180	0.0020	0.0023	0.0028	0.0030
		400	0.0020	0.0023	0.0028	0.0030

ONSRUD AF-2 / AF-3 – for Aluminum
Cutting Data Recommendations

	Material		SFM	Diameter (Inch) (Chip Load per Tooth)						
				1/4	5/16	3/8	1/2	5/8	3/4	1
N	Aluminum 6061 / 7075	Slotting	500 / 1500	0.0034	0.0040	0.0051	0.0068	0.0085	0.0102	0.0136
		Profiling 33% RDoC		0.0042	0.0050	0.0063	0.0084	0.0104	0.0125	0.0167
	Brass / Bronze	Slotting	500 / 900	0.0028	0.0030	0.0042	0.0057	0.0071	0.0086	0.0115
		Profiling 33% RDoC		0.0034	0.0045	0.0052	0.0070	0.0087	0.0105	0.0141
	Copper Alloys	Slotting	700 / 1000	0.0028	0.0030	0.0042	0.0057	0.0071	0.0086	0.0115
		Profiling 33% RDoC		0.0034	0.0045	0.0052	0.0070	0.0087	0.0105	0.0141
	Magnesium	Slotting	500 / 900	0.0028	0.0030	0.0042	0.0057	0.0071	0.0086	0.0115
		Profiling 33% RDoC		0.0034	0.0045	0.0052	0.0070	0.0087	0.0105	0.0141

ONSRUD AFC-2 / AFC-3 – for Aluminum
Cutting Data Recommendations

	Material		SFM	Diameter (Inch) (Chip Load per Tooth)					
				1/4	3/8	1/2	5/8	3/4	1
N	Aluminum 6061 / 7075	Slotting	500 / 1500	0.0041	0.0061	0.0081	0.0101	0.0121	0.0162
		Profiling 33% RDoC		0.0049	0.0073	0.0097	0.0120	0.0144	0.0193
	Brass / Bronze	Slotting	500 / 900	0.0034	0.0051	0.0068	0.0085	0.0102	0.0136
		Profiling 33% RDoC		0.0040	0.0061	0.0081	0.0101	0.0121	0.0162
	Copper Alloys	Slotting	700 / 1000	0.0034	0.0051	0.0068	0.0085	0.0102	0.0136
		Profiling 33% RDoC		0.0040	0.0061	0.0081	0.0101	0.0121	0.0162
	Magnesium	Slotting	500 / 900	0.0034	0.0051	0.0068	0.0085	0.0102	0.0136
		Profiling 33% RDoC		0.0040	0.0061	0.0081	0.0101	0.0121	0.0162

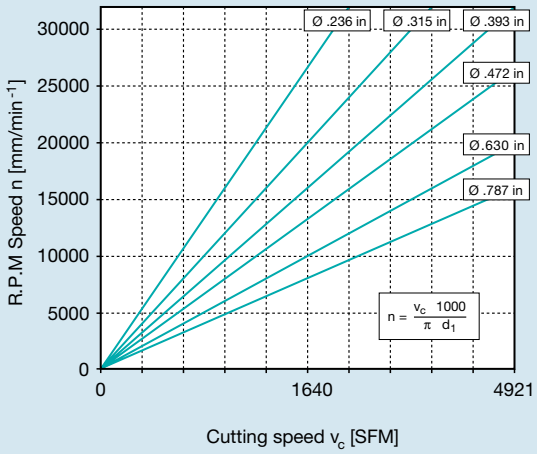
Programming Tip
Standard Length Tools Select SFM on High End of Recommendation
Medium Length Tools (2.5 X D) Reduce SFM by 25% from Top Speed
Long Length Tools (3 X D) Reduce SFM by 40-60% from Top Speed
Extra Long Tools (4 X D) Reduce SFM by 80-85% from Top Speed

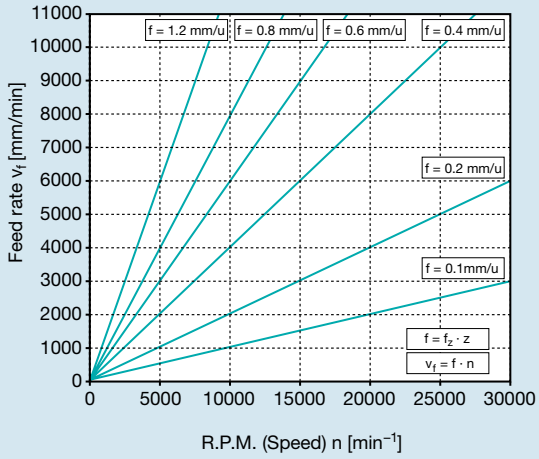
Necessary Formulas
RPM = (3.82 x SFM)/tool dia.
SFM = 3.14 x Diameter x RPM / 12
Feed Rate (I.P.M) = F/T x # of Flutes x RPM
Feed / Tooth = I.P.M / (RPM x # of Flutes)
In^3 / Minute = I.P.M x ADoC x RDoC
Horse Power Required = (In^3 / Min) / Power Factor
Horse Power = 1.341 x kW

Depths of Cut
Profile Milling ADoC = 1 to 1.5 x Endmill Diameter RDoC = .2 to .5 x Endmill Diameter
Slotting ADoC = .5 to 1 x Endmill Diameter

Troubleshooting Cause & Effect	
Excessive Wear	Increase Feed Rate
	Decrease RPM
	Increase DoC
Chipping	Increase Feed Rate
	Decrease RPM
	Increase DoC
Build Up on Cutting Edge	Double Check Speeds & Feeds
	Adjust RPM
	Increase Feed Rate
	Increase DoC
Poor Finish / Chatter	Reduce Gauge Length
	Ensure Rigidly of Tool Holder
	Check Tool Run Out
	Check for Tool Wear
Tool Breakage @ Shank	Decrease DoC
	Decrease Feed Rate
	Shorten Gauge Length

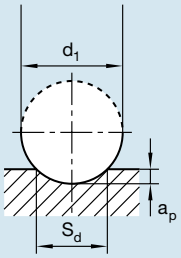
Diagram
for ap ≥ 0,5 · d_4 respectively
otherwise
see formula below





d_1 = Milling Cutter diameter Ø [in]
d_4 = 2 · Corner radius [in]

Ball Nose Copying Milling Cutter



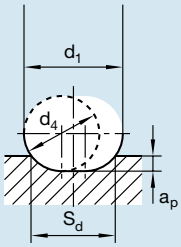
Ball nose copying milling cutter with depth of cut
$a_p < 0.5 \cdot d_1$

$$n = \frac{v_c \cdot 1000}{2 \cdot \pi \sqrt{d_1 \cdot ap - ap^2}} \quad [min^{-1}]$$

a_p = Depth of cut [in]
S_d = Cutting circle dia. [in]
d_1 = Milling Cutter diameter [in]

$$S_d = 2 \cdot \sqrt{d_1 \cdot a_p - a_p^2}$$

Milling Cutter with corner radius



Cutter with depth of cut
$a_p < 0.5 \cdot d_4$

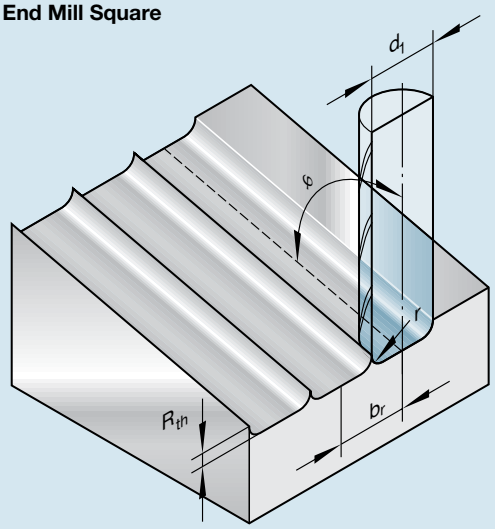
$$n = \frac{v_c \cdot 1000}{(d_1 - d_4 + 2 \cdot \sqrt{d_4 \cdot a_p - a_p^2}) \cdot \pi} \quad [min^{-1}]$$

$d_4 = 2 \cdot$ Corner radius [in]

$$Sd = d_1 - d_4 + 2 \cdot \sqrt{d_4 \cdot a_p - a_p^2}$$

z = No. of teeth
f_z = Feed/Tooth [in]
f = Feed/Revolution
[in/u]

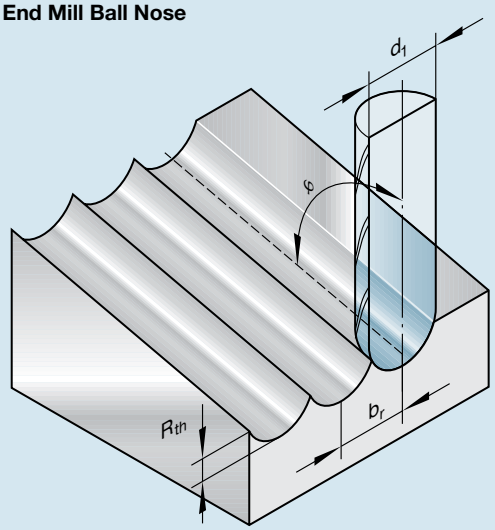
HSC End Mill Square



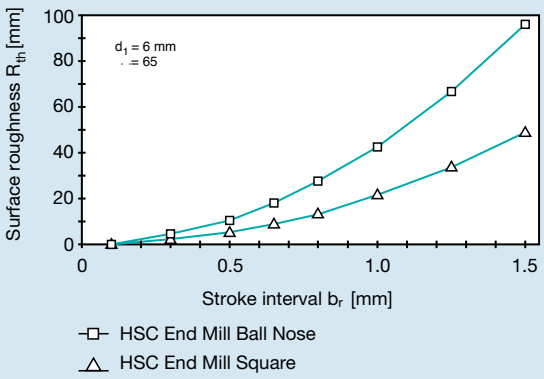
$$R_{th} = a \cdot \sin\varphi \cdot \left(1 - \sqrt{1 - \frac{b_r^2}{4 \cdot a^2}}\right)$$

$$a = \frac{1}{2} d_1 - r + r \cdot \sin\varphi$$

HSC End Mill Ball Nose

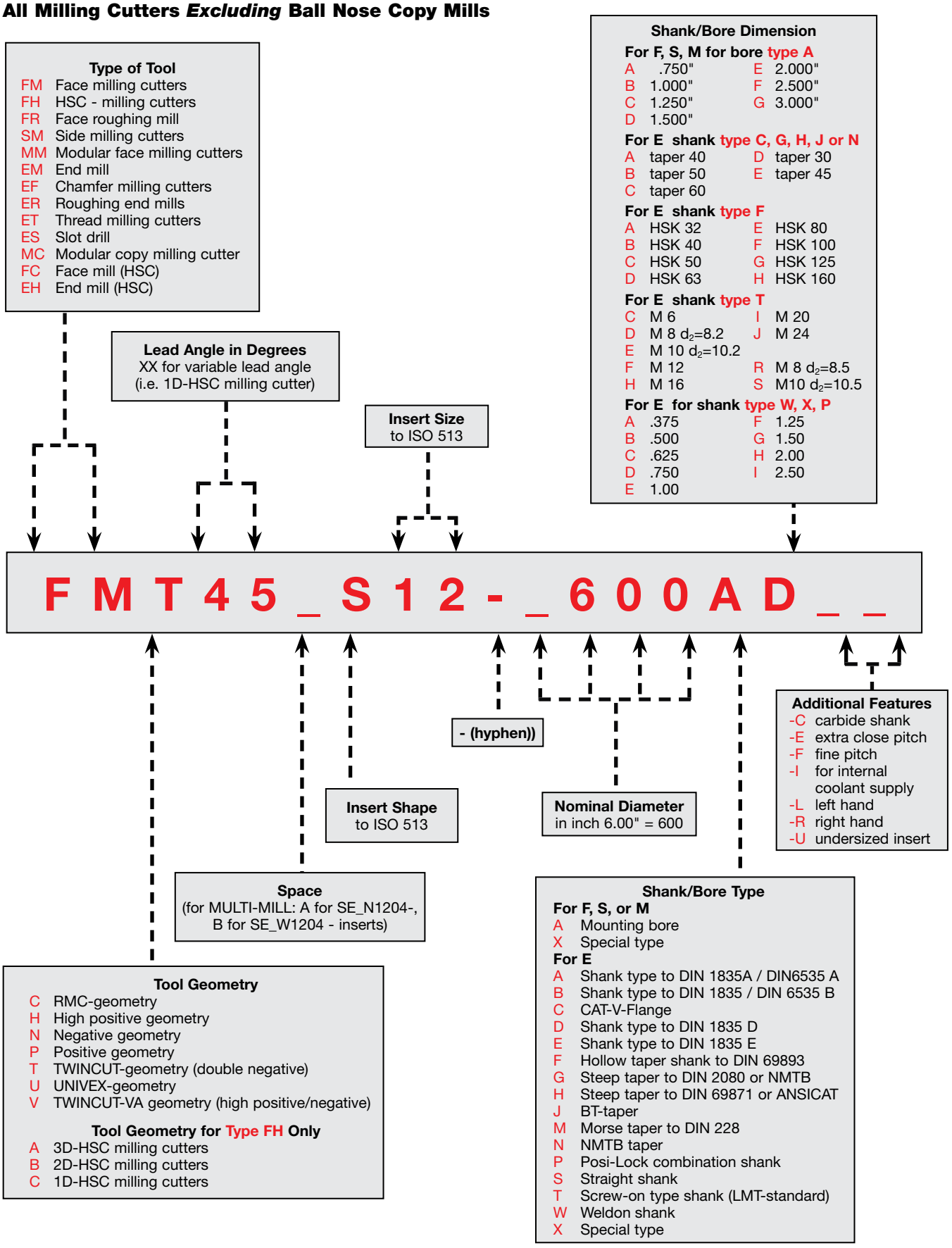


$$R_{th} = \frac{d_1}{2} - \sqrt{\frac{d_1^2 - b_r^2}{4}}$$

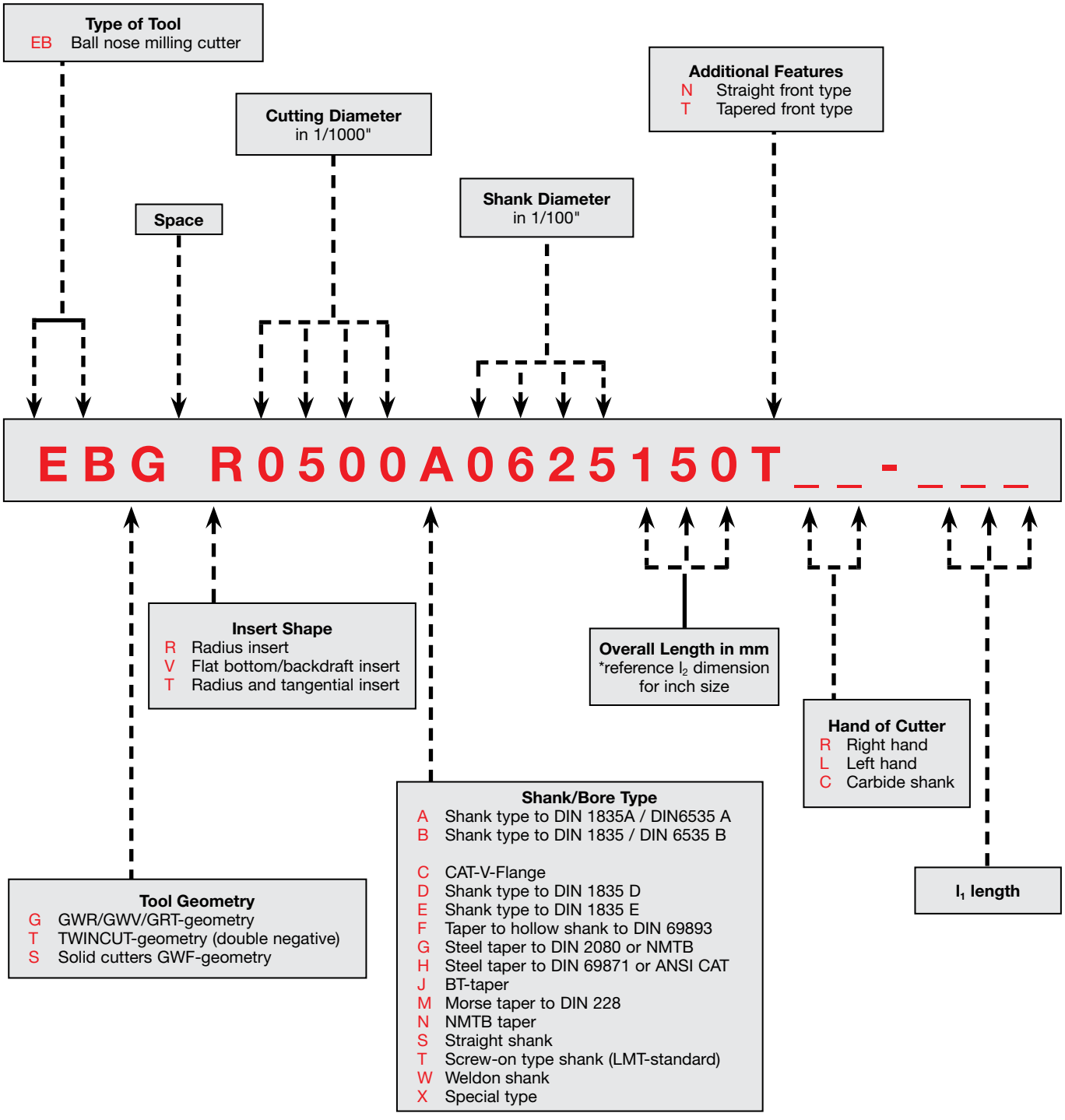


r = Corner radius
d_1 = Milling Cutter diameter
φ = Milling Cutter setting angle

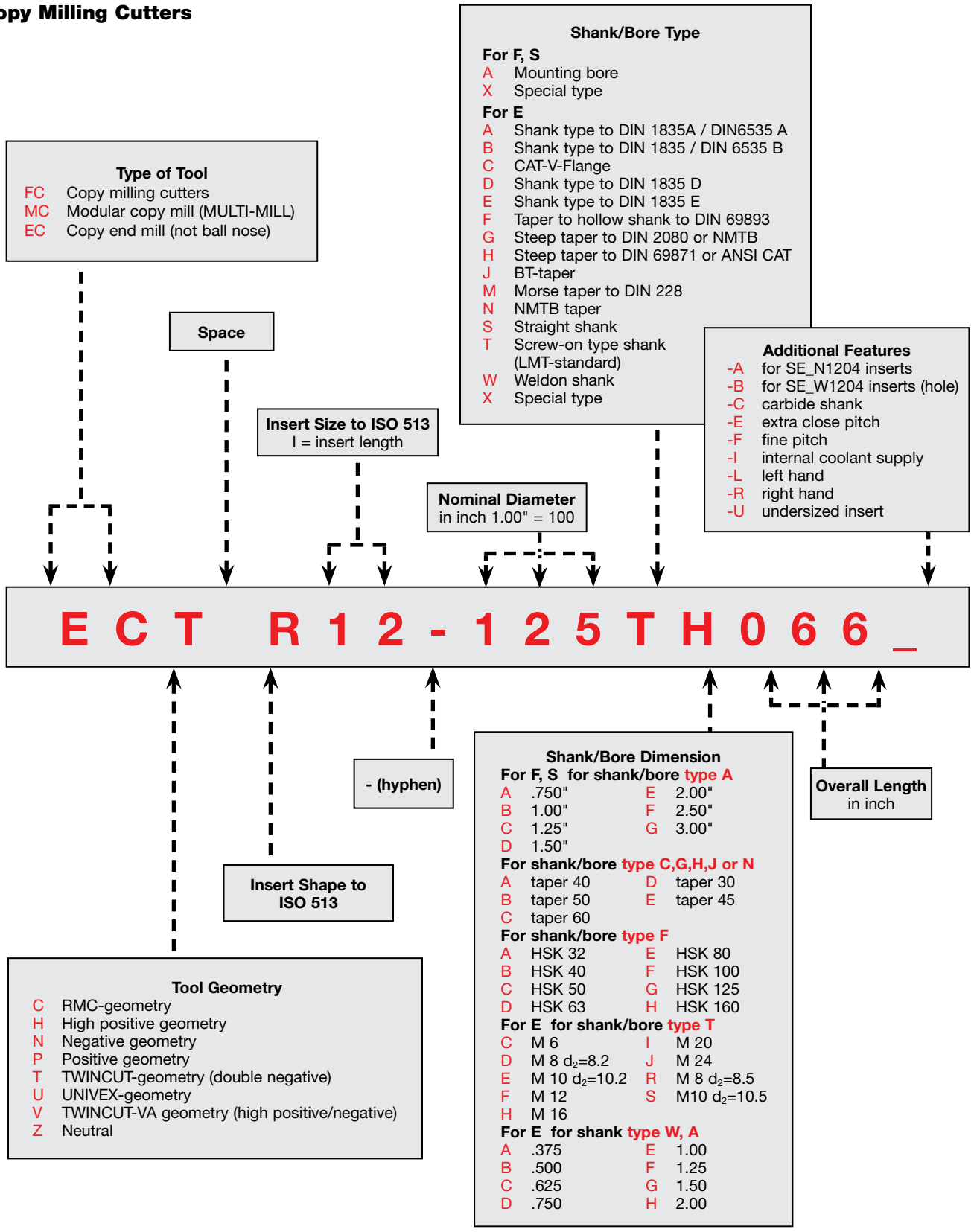
All Milling Cutters *Excluding* Ball Nose Copy Mills



Ball Nose Milling Cutters



Copy Milling Cutters



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