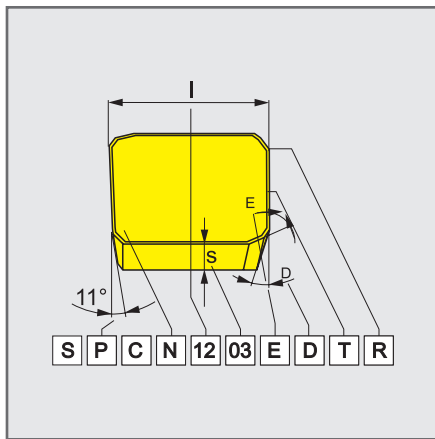


1 Insert Shape			
H	O	P	R
S	T	C	D
E	M	V	W
L	A	B	K

2 Side Clearance	
A	B
C	D
E	F
G	N
	Special
P	X

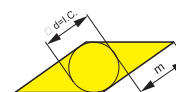
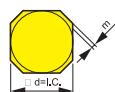
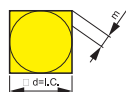
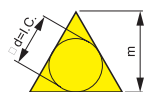
4 Insert Style	
N	R
F	A
M	G
B	T
	Special
C	X



	ISO	1	2	3	4
		S	P	G	N
		S	P	K	N
ANSI		1	2	3	4
		S	P	G	
		S	P	K	N

3 Tolerances

SYMBOL	Tolerances [mm]			Tolerances [Inch]		
	m(±)	s(±)	d = I.C	m	s	d = I.C. (±)
A	0.005	0.025	0.025	0.0002	0.001	0.0010
F	0.005	0.025	0.013	0.0002	0.001	0.0005
C	0.013	0.025	0.025	0.0005	0.001	0.0010
H	0.013	0.025	0.013	0.0005	0.001	0.0005
E	0.0125	0.025	0.025	0.0010	0.001	0.0010
G	0.025	0.130	0.025	0.0010	0.005	0.0010
J	0.005	0.025	0.05/0.13	0.0002	0.001	0.002/0.005
K	0.013	0.025	0.05/0.13	0.0005	0.001	0.002/0.005
L	0.025	0.025	0.05/0.13	0.0010	0.001	0.002/0.005
M	0.08/0.18	0.130	0.05/0.13	0.003/0.007	0.005	0.002/0.005
N	0.08/0.18	0.025	0.05/0.13	0.003/0.007	0.001	0.002/0.005
U	0.05/0.38	0.130	0.08/0.25	0.005/0.015	0.005	0.003/0.010



d=I.C		Cutting Edge Length						
mm	Inch	R	S	T	C	D	V	W
3,97	5/32"			06				
5,00	-	05						
5,56	7/32"			09				03
6,00	-	06						
6,35	1/4"			11	06	07		04
8,00	-	08						
9,525	3/8"	09	09	16	09	11	16	06
10,0	-	10						
12,0	-	12						
12,7	1/2"	12	12	22	12	15		08
15,875	5/8"	15	15	27	16			
16,0	-	16						
19,05	3/4"	19	19	33	19			
20,0	-	20						
25,0	-	25						
25,4	1"	25	25		25			
31,75	1 1/4"	31						
32,0	-	32						

6 Thickness		
Symbol	s	
	mm	Inch
01	1,59	1/16"
T1	1,98	5/64"
02	2,38	3/32"
03	3,18	1/8"
T3	3,97	5/32"
04	4,76	3/16"
05	5,56	7/32"
06	6,35	1/4"
07	7,94	5/16"
09	9,52	3/8"

7 Cutting Edge Angle		Clearance Angle	
A	45	A	3
D	60	B	5
E	75	C	7
F	85	D	15
P	90	E	20
Z	Spec./ Espec.	F	25
		G	30
		N	0
		P	11
		Z	Spec./ Espec.
ZZ- Spec./ Espec.			

5	6	7	8	9
12	03	08		
12	03	ED	S	R
5A	6A	7A	8	9
4	2	2		
4	2	ED	S	R

ANSI

Inscribed Circle 5A		
Symbol	d=I.C	
	mm	Inch/Pal.
1	3,175	1/8"
(1.2)	3,969	5/32"
(1.5)	4,763	5/16"
(1.8)	5,556	7/32"
2	6,350	1/4"
(2.5)	7,938	5/16"
3	9,525	3/8"
4	12,700	1/2"
5	15,875	5/8"
6	19,050	3/4"
7	22,225	7/8"
8	25,400	1"
10	31,750	1-1/4"

Thickness 6A		
Symbol	s	
	mm	Inch/Pal.
1	1,588	1/16"
(1.2)	1,984	5/64"
(1.5)	2,381	3/32"
2	3,175	1/8"
(2.5)	3,969	5/32"
3	4,763	3/16"
(3.5)	5,556	7/32"
4	6,350	1/4"
5	7,938	5/16"
6	9,525	3/8"
7	11,113	7/16"
8	12,700	1/2"
9	14,288	9/16"
10	15,875	5/8"

Nose Radius 7A		
Symbol	r	
	mm	Inch/Pal.
0	0,050	1/512"
(0.2)	0,099	1/256"
(0.5)	0,198	1/128"
1	0,397	1/64"
2	0,794	1/32"
3	1,191	3/64"
4	1,588	1/16"
5	1,984	5/64"
6	2,381	3/32"
7	2,778	7/64"
8	3,175	1/8"
10	3,969	5/32"
12	4,763	3/16"
14	5,556	7/32"
16	6,350	1/4"
x	other/resto	

8 Cutting Edge Condition			
	F Sharp Edges		E Rounded Edges
	T Edges with Facet		S Rounded Edges with Facet
	K Edges with Double Facet		P Rounded Edge with Double Facet

9 Feed Direction	
R	
L	
N	

Coated Grades			05	10	15	20	25	30	35	40	45	50	
TK15MC	K15-K30 An extremely hard carbide substrate with a MT-CVD multilayer coating ideal for dry machining of all cast-irons.	P											
		M											
		K											
		N											
		S											
		H											
RK15MC	K15-K25, H10-H20 A cutting material grade specifically for cast iron milling. Finest grade carbide coated with TeraSpeed (AlTiN) for high-performance cast iron machining, high cutting speeds and dry machining.	P											
		M											
		K											
		N											
		S											
		H											
RP35AP	P15-P35, M15-M35 AlCrN PVD coating with a strong substrate for light roughing to finishing at med to high cutting speeds for materials in steel and stainless classification	P											
		M											
		K											
		N											
		S											
		H											
RP35MP	P20-P35, M20-M40 A tough grade with TiAlN supernitride PVD coating used in roughing of steel and stainless when good wear resistance is required.	P											
		M											
		K											
		N											
		S											
		H											
RP40AP	P25-P40, M25-M40, S35-S45 AlCrN coating and extra-strong substrate combine for a first class grade used in the machining of austenitic stainless steel and hi-temp alloys such as Inconel and Hastalloy and titanium.	P											
		M											
		K											
		N											
		S											
		H											
RP40MP	P30-P40, M30-M40, S30-S40 Very tough strong grade with TiAlN supernitride coating. Used in roughing applications in steel but also machining 300 series stainless steel and difficult to cut aerospace alloys.	P											
		M											
		K											
		N											
		S											
		H											
TM30MP	M20-M35, S20-S35 Grade with premium AlCrN coating delivers exceptional performance in all steels at high SFM. Fine grain substrate is tough enough to handle roughing cuts and is excellent in semi-finishing to finishing applications.	P											
		M											
		K											
		N											
		S											
		H											
TM45MP	M30-M45, S30-S40 Extremely tough, relatively fine-grained carbide substrate with thin, smooth and tough PVD-multilayer coating. Ideal grade for milling austenitic stainless steels at low to medium cutting speeds and wet machining.	P											
		M											
		K											
		N											
		S											
		H											
TK10MP	M10-M20, K10-K30, N05-N20, H10-H20 The ideal grade for working aluminum materials and other non-ferrous metals. Thanks to a very thin micro pulse plasma CVD TiAlN coating it is also excellent for finish machining of stainless steels and grey cast iron. As well as hardened steels.	P											
		M											
		K											
		N											
		S											
		H											

Coated Grades			05	10	15	20	25	30	35	40	45	50	
TP30MP	P25-P35 TiAlN super nitride coating over a high quality carbide substrate is an excellent performer in all steel applications as well as 400 series stainless steel. Post coating process smooths out the cutting edge to help improve tool life and part finishes.	P											
		M											
		K											
		N											
		S											
		H											
TP30MC	P25-P40 The very tough carbide substrate guarantees this universal steel milling grade's high machining security for a wide range of steel material. A modern MT-CVD multilayer Al ₂ O ₃ – coating ensures successful dry machining.	P											
		M											
		K											
		N											
		S											
		H											
TP25MP	P15-P30, M20-M30 Highly wear resistant PVD coated grade with high toughness for wet and dry milling of steel, cast steel and stainless steel with high cutting speeds and low to medium depths of cut and chip loads..	P											
		M											
		K											
		N											
		S											
		H											
TP30AP	P20-P35, M25-M35 Grade with premium AlCrN coating delivers exceptional performance in all steels at high SFM. Fine grain substrate is tough enough to handle roughing cuts and is excellent in semi-finishing to finishing applications.	P											
		M											
		K											
		N											
		S											
		H											
TP35MC	P25-P40, M25-M40, K25-K40 TiN-MT TiCN-Al ₂ O ₃ by CVD. Coating thickness 4-7 microns. For use on steel, alloyed steel and cast iron. With its aluminum oxide coating, the grade TP35MC is recommended every time wear characteristics are more important than toughness.	P											
		M											
		K											
		N											
		S											
		H											
TP35MP	P20-P40, M20-M40 Very tough Nanotop PVD AlTiN gradient coating carbide grade especially for milling tool steels. Ideal for dry milling at low to medium cutting speeds for roughing.	P											
		M											
		K											
		N											
		S											
		H											

Uncoated Grades			05	10	15	20	25	30	35	40	45	50	
TK10M	K15-K25, N05-N15 Uncoated milling grade with high wear resistance for machining grey cast iron, aluminum and non-ferrous metals with medium to high cutting speeds.	P											
		M											
		K											
		N											
		S											
		H											
TP25M	P25-P35, K20-K30 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 with low to medium depths of cut and low to medium chip loads.	P											
		M											
		K											
		N											
		S											
		H											

Designation	l	d	s	d ¹	r	APHT-...-RAL	
						TK10MP	TK10M
APHT-1003PDFR-RAL	.431	.260	.138	.110	.020	●	●
APHT-1604PDFR-RAL	.681	3/8	.207	.177	1/32	●	●

-RAL inserts designed specifically for aluminum

Designation	l	d	s	d ¹	r	APKT-...-TMK	
						TM40MP	TM45MP
APKT-1003PDSR-TMK	.431	.260	.138	.110	.020	●	●
APKT-1604PDSR-TMK	.681	3/8	.207	.177	1/32	●	●

Designation	l	d	s	d ¹	r	APKT-...-SR					
						TP25MP	TP30MC	TP35MP	TP25M	RK15MC	TK15MC
APKT-1003PDSR-SR	.431	.260	.138	.110	.020	●	●	●	●	●	●
APKT-1604PDSR-SR					1/32	●	●	●	●	●	●
APKT-160416PDSR-SR					1/16	●	●	●	●	●	●
APKT-160424PDSR-SR	.681	3/8	.207	.177	3/32	●	●	●	●	●	●
APKT-160432PDSR-SR					1/8	●	●	●	●	●	●

Designation	l	d	s	d ¹	r	HNGX-...	
						RK15MC	TK15MC
HNGX-090520ZZN					.079	●	●
HNGX-090530ZZN	.371	.643	.221	.127	.119	●	●

Designation	l	d	s	d ¹	r	ODHT-...			
						TP25MP	TP30MC	TP35MP	TP25M
ODHT-060508ZZ	.261	5/8	.221	.218	1/32	●	●	●	●

Designation	l	d	s	d ¹	r	ODMW-...				
						TP25MP	TP30MC	TP35MP	TP25M	RK15MC
ODMW-060508SN	.261	5/8	.221	.218	1/32	●	●	●	●	●

Designation	l	d	s	d ¹	r	OFER-...	
						TP30MC	TP35MP
OFER-070405-SN	.294	.719	.187	--	--	●	●
OFER-070405-SN-SR					--	●	●

Designation	l	d	s	d ¹	r	RCMT-...-MOT			
						TP30AP	TP30MP	TM30MP	TP35MC
RCMT-1606MOT-X*	--	.630	1/4	.217	--	●	●	●	●

*Inserts have integrated anti-rotation lock

Designation	l	d	s	d ¹	r	RDGT-...-AL			
						TK10M	TK10MP	TK15M	TK15MP
RDGT-0802MO-AL	--	.315	3/32	.134	--	●	●	●	●
RDGT-0803MO-AL	--	.315	1/8	.134	--	●	●	●	●
RDGT-1003MO-AL	--	.394	1/8	.173	--	●	●	●	●

-AL inserts designed specifically for aluminum

Designation	l	d	s	d ¹	r	RDMT-...-MOT			
						TP30AP	TP30MP	TM30MP	TP35MC
RDMT-0802MOT	--	.315	3/32	.134	--	●	●	●	●
RDMT-1003MOT	--	.394	1/8	.173	--	●	●	●	●
RDMT-1204MOT-X*	--	.472	3/16	.173	--	●	●	●	●
RDMT-1605MOT-X*	--	.630	7/32	.217	--	●	●	●	●


*Inserts have integrated anti-rotation lock

Designation	l	d	s	d ¹	r	RDMW-...-MOT			
						TP30AP	TP30MP	TM30MP	TP35MC
RDMW-0802MOT	--	.315	3/32	.134	--	●	●	●	●
RDMW-1003MOT	--	.394	1/8	.173	--	●	●	●	●
RDMW-1204MOT-X*	--	.472	3/16	.173	--	●	●	●	●
RDMW-1605MOT-X*	--	.630	7/32	.217	--	●	●	●	●
RDMW-2006MOT-X*	--	.787	.250	.259	--	●	●	●	●

*Inserts have integrated anti-rotation lock


Designation	l	d	s	d ¹	r	SCKT-...-ACTN			
						TP25MP	TP30MC	TP35MP	TP25M
SCKT-1205-ACTN	.500	1/2	.221	.218	--	●	●	●	●

Designation	l	d	s	d ¹	r	SDHT-...			
						TP25MP	TP30MC	TP35MP	TP25M
SDHT-43AESN	.500	1/2	.187	.218	--	●	●	●	●
SDHT-53AESN	.625	5/8	.187	.218	--	●	●	●	●




Designation	l	d	s	d ¹	r	SDHT-...-RAL	
						TK10MP	TK10M
SDHT-43AEFN-RAL	.500	1/2	.187	.218	--	●	●
SDHT-53AEFN-RAL	.625	5/8	.187	.218	--	●	


-RAL inserts designed specifically for aluminum




Designation	l	d	s	d ¹	r	SDHW-...					
						TP25MP	TP30MC	TP35MP	TP25M	RK15MC	TK15MC
SDHW-43AEEN	.500	1/2	.187	.218	--					●	●
SDHW-43AESN						●	●				



Designation	l	d	s	d ¹	r	SDMT-...			
						TP25MP	TP30MC	TP35MP	TP25M
SDMT-322	.375	3/8	.125	.159	1/32	●		●	
SDMT-432-SN	.500	1/2	.187	.218	1/32		●	●	




Designation	l	d	s	d ¹	r	SDMT-...			
						TP25MP	TP30MC	TP35MP	TP25M
SDMT-43.5PDSR-SR	.500	1/2	.199	.175	1/32	●	●	●	




Designation	l	d	s	d ¹	r	SEHT-...-RAL	
						TK10MP	TK10M
SEHT-43AFFN-RAL	.500	1/2	.187	.218	--	●	●


-RAL inserts designed specifically for aluminum




Designation	l	d	s	d ¹	r	SEHT-...-TMK	
						TM40MP	TM45MP
SEHT-43AFSN-TMK	.500	1/2	.187	.218	--	●	




Designation	l	d	s	d ¹	r	SEKN-...				
						TP25MP	TP30MC	TP35MP	TP25M	TM45MP
SEKN-42AFEN	.500	1/2	.125	--	.056				●	●
SEKN-42AFSN					.056	●	●	●	●	
SEKN-43AFSN	.500	1/2	.187	--	.056	●	●			
SEKN-53AFEN	.625	5/8	.187	--	.056				●	
SEKN-53AFSN					.056	●	●			




Designation	l	d	s	d ¹	r	SEKR-...				
						TP25MP	TP30MC	TP35MP	TP25M	TM45MP
SEKR-42AFSN	.500	1/2	.125	--	.056	●	●	●		
SEKR-43AFSN	.500	1/2	.187	--	.056	●	●			




Designation	l	d	s	d ¹	r	SEKR-...-TMK				
						TP25MP	TP30MC	TP35MP	TP25M	TM45MP
SEKR-42AFSN-TMK	.500	1/2	.125	--	.056					●
SEKR-43AFSN-TMK	.500	1/2	.187	--	.056					●




Designation	l	d	s	d ¹	r	SEKT-...				
						TP25MP	TP30MC	TP35MP	TP25M	TM45MP
SEKT-43AFSN	.500	1/2	.187	.218	--		●	●	●	




Designation	l	d	s	d ¹	r	SEKW-...				
						TP25MP	TP30MC	TP35MP	TP25M	TM45MP
SEKW-43AFEN	.500	1/2	.187	.218	--		●	●	●	
SEKW-43AFSN	.500	1/2	.187	.218	--	●	●	●	●	●



Designation	l	d	s	d ¹	r	SPKN-...				
						TP25MP	TP30MC	TP35MP	TP25M	TM45MP
SPKN-42EDSR	.500	1/2	.125	--	--	●	●		●	●
SPKN-43EDSR	.500	1/2	.187	--	--					●
SPKN-53EDSR	.625	5/8	.187	--	--	●	●		●	●



Designation	l	d	s	d ¹	r	SPKR-...				
						TP25MP	TP30MC	TP35MP	TP25M	TM45MP
SPKR-42EDSR	.500	1/2	.125	--	--		●			



Designation	l	d	s	d ¹	r	SPMT-...				
						TP25MP	TP30MC	TP35MP	TP25M	TM45MP
SPMT-43AFEN	.500	1/2	.187	.218	--		●			
SPMT-43AFSN	.500	1/2	.187	.218	--	●	●			

SPMT-...						
Designation	l	d	s	d ¹	r	
SPMT-432-SN-P	.500	1/2	.187	.205	1/32	●

XPET-160412						
Designation	l	d	s	d ¹	r	
XPET-160412	.635	3/8	.187	.173	3/64	● ● ● ● ●

SPMW-...						
Designation	l	d	s	d ¹	r	
SPMW-432	.500	1/2	.187	.205	1/32	● ●

XPHT-1604..						
Designation	l	d	s	d ¹	r	
XPHT-160408					1/32	● ●
XPHT-160412	.635	3/8	.187	.173	3/64	● ● ● ●
XPHT-160416					1/16	● ● ● ● ●
XPHT-160432					1/8	● ● ● ● ●

TPKN-...						
Designation	l	d	s	d ¹	r	
TPKN-32PDER	.650	3/8	.125	--	--	● ●
TPKN-32PDSR						● ● ● ● ●
TPKN-43PDER	.866	1/2	.187	--	--	● ● ● ● ●
TPKN-43PDSR						● ● ● ● ●

XPHT-1604.. -AL						
Designation	l	d	s	d ¹	r	
XPHT-160408-AL					1/32	● ●
XPHT-160412-AL	.635	3/8	.187	.173	3/64	● ● ● ● ●
XPHT-160416-AL					1/16	● ● ● ● ●
XPHT-160420-AL					5/64	● ● ● ● ●
XPHT-160424-AL					3/32	● ● ● ● ●
XPHT-160432-AL					1/8	● ● ● ● ●

-AL inserts designed specifically for aluminum

VCGT-...						
Designation	l	d	s	d ¹	r	
VCGT-43.58-ALM	.870	1/2	.219	.216	1/8	● ●

VPGT-...						
Designation	l	d	s	d ¹	r	
VPGT-221-ALM	.437	1/4	.125	.110	1/64	● ●
VPGT-333-ALM	.654	3/8	.187	.173	3/64	● ● ● ● ●
VPGT-33PPFR-ALM						● ● ● ● ●

XPNT-160412						
Designation	l	d	s	d ¹	r	
XPNT-160412	.635	3/8	.187	.173	3/64	● ● ● ● ●

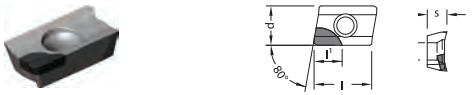
XDET-090308						
Designation	l	d	s	d ¹	r	
XDET-090308	.381	1/4	1/8	.110	1/32	● ● ● ● ●

XPNT-160412 -SR						
Designation	l	d	s	d ¹	r	
XPNT-160412-SR	.635	3/8	.187	.173	3/64	● ● ● ● ●


XDHT-...						
Designation	l	d	s	d ¹	r	
XDHT-090302-AL					.008	● ● ● ● ●
XDHT-090304-AL					1/64	● ● ● ● ●
XDHT-090308-AL	.381	1/4	1/8	.110	1/32	● ● ● ● ●
XDHT-090316-AL					1/16	● ● ● ● ●

XPNX-160412						
Designation	l	d	s	d ¹	r	
XPNX-160412	.635	3/8	.187	.173	3/64	● ● ● ● ●


-AL inserts designed specifically for aluminum




Designation	l	d	s	l'	d'	r	PCD				
							TFC	PDC	PDC-S	PDC-CU-S	
APKW-100302PDR						.008			●		
APKW-100304PDR	.431	1/4	.138	.150	.110	.016			●		
APKW-100308PDR						.032			●		
APKW-160404PDR						.016			●		
APKW-160408PDR	.681	3/8	.207	.150	.177	.031			●		



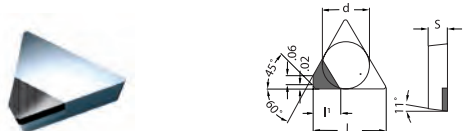
Designation	l	d	s	l'	d'	r	PCD				
							TFC	PDC	PDC-S	PDC-CU-S	
RDHX-0501MO	-	.197	.059	-	.079	-			●		
RDHX-0702MO	-	.276	.094	-	.106	-			●		
RDHX-1003MO	-	.394	.125	-	.150	-			●		
RDHX-12T3MO	-	.472	.156	-	.150	-			●		



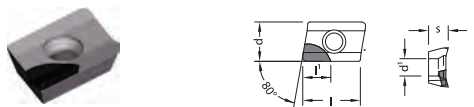
Designation	l	d	s	l'	d'	r	PCD				
							TFC	PDC	PDC-S	PDC-CU-S	
SEHW-43AFN-4		1/2	.187	.157	.217	-			●		
SEHW-43AFN-6				.236					●		



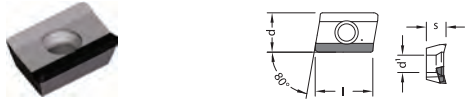
Designation	l	d	s	l'	d'	r	PCD				
							TFC	PDC	PDC-S	PDC-CU-S	
SEKN-42AFN-4		1/2	.125	.157	-	-			●		
SEKN-42AFN-6				.236					●		




Designation	l	d	s	l'	d'	r	PCD				
							TFC	PDC	PDC-S	PDC-CU-S	
TPKN-32PDR-4	.650	3/8	.125	.157	-	-			●		




Designation	l	d	s	l'	d'	r	PCD				
							TFC	PDC	PDC-S	PDC-CU-S	
XDHW-090308	.381	1/4	.125	.150	.110	.031	●		●		
XPHW-160408	.635	3/8	.187		.173		●		●		




Designation	l	d	s	l'	d'	r	PCD				
							TFC	PDC	PDC-S	PDC-CU-S	
XDHW-090308-GS	.381	1/4	.125	.381	.110	.031			●		
XPHW-160412-GS	.635	3/8	.187	.635	.173	.047			●		




Designation	l	d	s	l'	d'	r	CBN				
							PBC-10	PBC-15	PBC-25	PBC-40	
APKW-100302PDR						.008	●		●		
APKW-100304PDR	.431	1/4	.138	.150	.110	.016	●		●		



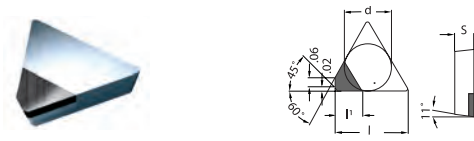
Designation	l	d	s	l'	d'	r	CBN				
							PBC-10	PBC-15	PBC-25	PBC-40	
RDHX-0702MOT-VM	-	.276	.094	-	.106	-	●	●	●		
RDHX-1003MOT-VM	-	.394	.125	-	.150	-	●	●	●		
RDHX-12T3MOT-VM	-	.472	.156	-	.150	-	●	●	●		




Designation	l	d	s	l'	d'	r	CBN				
							PBC-10	PBC-15	PBC-25	PBC-40	
RNGN-090300-E-SE	-	3/8	.125	-	-	-	●			●	
RNGN-090300-F-SE	-			-	-	-		●	●		
RNGN-120400-E-SE	-	1/2	.187	-	-	-	●			●	
RNGN-120400-F-SE	-			-	-	-		●	●		



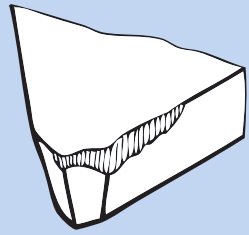
Designation	l	d	s	l'	d'	r	CBN				
							PBC-10	PBC-15	PBC-25	PBC-40	
SPKN-42EDRT-MW	.500	1/2	.125	.157	-	-	●		●		



Designation	l	d	s	l'	d'	r	CBN				
							PBC-10	PBC-15	PBC-25	PBC-40	
TPKN-32PDRT-MW	.650	3/8	.125	.157	-	-	●		●		



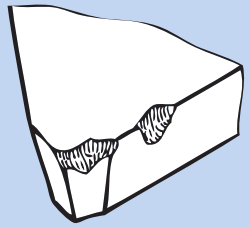
Designation	l	d	s	l'	d'	r	CBN				
							PBC-10	PBC-15	PBC-25	PBC-40	
XDHW-090308	.381	1/4	.125	.150	.110	.031		●		●	
XPHW-160408	.635	3/8	.187		.173		●		●		



Flank Wear

General criteria for end of tool life, characterized by an admissible amount of flank wear

- Remedy:**
- select more wear resistant grade
 - reduce cutting speed



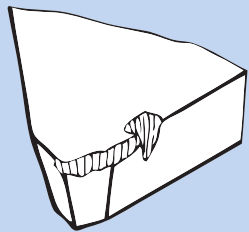
Edge Chipping

Minor chipping along the cutting edge, usually accompanied by flank wear and therefore not always identifiable. Danger of breakage! Edge chipping outside the cutting area is the result of chip impact due to unfavorable chip removal.

- Remedy:**
- select tougher grade
 - use insert with stronger cutting edge geometry
 - reduce feed when starting the cut

Damage caused by chip impact:

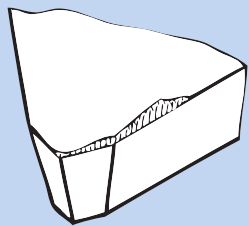
- vary feed
- change chipbreaker geometry
- change cutting edge angle



Notch Wear

Occurs locally in the area of the primary cutting edge where it contacts the workpiece surface. Caused by hard surface layers and work-hardened burrs, especially on austenitic stainless steels. Danger of breakage!

- Remedy:**
- strengthen cutting edge
 - select smaller cutting edge angle (45°)
 - reduce feed

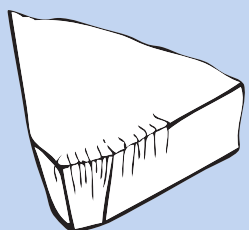


Built-Up Edges

Edge build-up occurs on the rake face as a result of the work material welding together with the cutting material, especially when cutting difficult-to-machine materials.

From time to time the built-up edge will break off and may cause damage to the cutting edge. Built-up edges result in poor surface finish.

- Remedy:**
- increase cutting speed
 - use coated grade
 - select positive cutting edge geometry
 - use cutting fluid



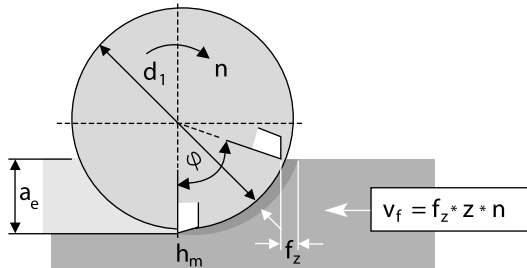
Thermal Cracks

Small cracks running across the cutting edge, caused by thermal shock loads in interrupted cutting operations, particularly in milling. Danger of breakage!

- Remedy:**
- use grade with greater resistance to thermal shock
 - check use of cutting fluid; cutting fluid should not generally be used for milling, except with special grades for wet milling, e.g. TN450, aluminum and titanium alloys, and high-temperature materials
 - use compressed air to remove chips in slot milling

Cutting Ratios and Undeformed Chip Thickness in Milling

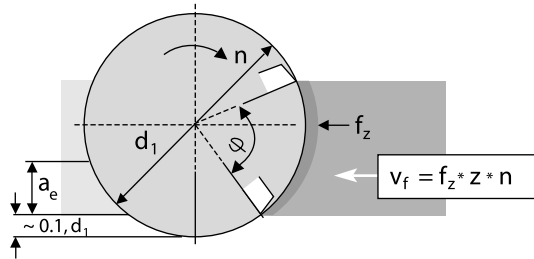
Valid for $a_e < 0.3 d_1$



$$f_z = h_m * \sqrt{\frac{d_1}{a_e}} \quad h_m = f_z * \sqrt{\frac{a_e}{d_1}}$$

At least 2 cutting edges in the working area of the feed motion angle ϕ

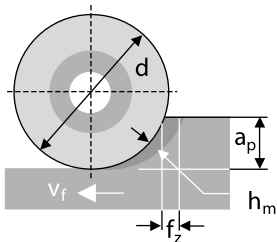
Valid for $a_p < 0.3 d_1$



min. cutter diameter $d_1 \approx 1.25 * a_e$

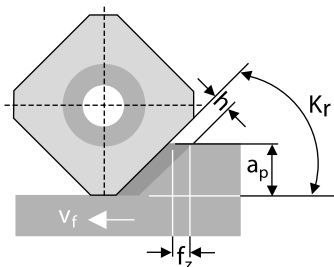
max. width of cut $a_e \approx 0.8 * d_1$

Valid for $a_p < 0.3$



$$f_z = h_m * \sqrt{\frac{d}{a_p}}$$

$$h_m = f_z * \sqrt{\frac{a_p}{d}}$$



$$f_z = h * \sin \chi_r$$

$$h = f_z * \sin \chi_r$$



Cutting Data for TX90/ISO Milling Cutters

ANSI ISO 513	Cutting Data for TA90 / TX90 Milling Cutters				COATED									UNCOATED					
	Cutter	Max ap	Carbide Insert		TP25MP TP30MP TP30MC			TP35MC RP35AP RP35MP			TP35MP RP40AP RP40MP			TP25M					
					feed per tooth *(inch)														
P	TXD90/EMP/FMP	.33	XD..-09/AP..-10		.003	.006	.008	.003	.006	.008	.003	.007	.009				.003	.006	.009
	TXP90/EMP/FMP	.55	XP..-16/AP..-16		.003	.006	.009	.003	.006	.009	.003	.007	.010				.003	.006	.009
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)														
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C annealed	125	1	1080	820	685	915	705	605	620	540	505				555	490	455
		> 0.25% C annealed	190	2	820	635	555	620	490	425	455	375	360				390	325	295
		< 0.55% C heat-treated	250	3	685	520	475	520	390	360	375	325	295				325	260	225
		> 0.55% C annealed	220	4	705	555	475	540	425	360	390	360	325				360	275	260
		heat-treated	300	5	605	425	375	455	325	275	325	275	260				275	225	195
	Low alloy steel and cast steel	annealed	200	6	785	605	490	605	455	375	455	375	360				390	325	295
		heat-treated	275	7	605	475	390	455	360	295	360	295	275				295	260	225
		heat-treated	300	8	520	390	340	390	295	260	295	260	225				260	195	180
		heat-treated	350	9	475	340	295	360	260	225	260	180	210				225	160	130
	High alloy steel, cast steel & tool steel	annealed	200	10	605	475	425	455	360	325	390	340	295				360	275	260
		heat-treated	325	11	390	310	260	295	225	195	260	180	210				225	160	130
	400 series stainless	FE / MA	200	12	770	570	490	590	440	375	425	375	340				375	295	275
MA		240	13.1	670	475	390	505	360	295	360	295	275				325	260	225	
MA / PH		330	13.2	325	225	195	260	180	145	180	145	130				160	130	110	
M	Cutting Data for TA90 / TX90 Milling Cutters				COATED									UNCOATED					
	Cutter	Max ap	Carbide Insert		TP25MP RP35AP			RP35MP TP35MP			RP40AP TM45MP			TP25M					
	feed per tooth *(inch)																		
	TXD90/EMP/FMP	.33	XD..-09/AP..-10		.003	.006	.008	.003	.006	.008	.003	.007	.009				.003	.006	.009
	TXP90/EMP/FMP	.55	XP..-16/AP..-16		.003	.006	.009	.003	.006	.009	.003	.007	.010				.003	.006	.009
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)														
	300 Series	AU	180	14.1	785	655	520	720	590	520	655	555	520				390	260	225
Stainless	DU	230	14.2	620	520	440	590	490	440	520	455	440				295	195	180	
Duplex	S-AU	200	14.3	455	390	325	425	360	325	390	340	325				210	160	130	
Stainless	AU-PH	330	14.4	390	325	260	360	295	260	325	275	260				195	130	110	
K	Cutting Data for TA90 / TX90 Milling Cutters				COATED									UNCOATED					
	Cutter	Max ap	Carbide Insert		RK15MC			TK15MC			TK10M								
	feed per tooth *(inch)																		
	TXD90/EMP/FMP	.33	XD..-09/AP..-10		.003	.005	.007	.003	.005	.007							.008	.005	.002
	TXP90/EMP/FMP	.55	XP..-16/AP..-16		.004	.006	.008	.005	.010	.014							.005	.010	.012
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)														
	Grey cast iron	ferrit./pearl.	180	15	1245	915	785	965	705	605							440	325	275
pearlitic		260	16	950	720	620	735	555	475							325	260	225	
Nodular cast iron	ferritic	160	17	1045	785	655	820	605	490							390	295	245	
	pearlitic	250	18	785	455	325	605	360	260							275	195	130	
Malleable cast iron	ferritic	130	19	1080	655	520	835	490	390							390	245	160	
	pearlitic	230	20	820	520	390	635	410	295							310	195	130	



Cutting Data for TX90/ISO Milling Cutters

ANSI ISO 513	Cutting Data for TA90 / TX90 Milling Cutters				COATED			UNCOATED						
	Cutter	Max ap	Carbide Insert		TK10MP			TK10M						
N					feed per tooth *(inch)									
	TXD90/EMP/FMP	.33	XD..-09/AP..-10		.003	.005	.007				.003	.005	.007	
	TXP90/EMP/FMP	.55	XP..-16/AP..-16		.004	.009	.012				.004	.009	.012	
	Work Material		Condition	Hardness HB	Mat. Gr.	vc*(sfm)								
	Wrought	Non AG		60	21	5425	3115	2620				2785	2000	1670
		AG		100	22	2020	1640	1310				1390	1000	835
	Cast aluminum alloys	Non Ag		75	23	5245	3115	2120				2785	2000	1670
		Si < 12%	AG		90	24	2950	1800	1475			2230	1640	1390
		Si > 12%			130	25	2130	1310	980			1390	900	685
	Copper & Copper alloys	Pb > 1%		110	26	1510	1000	800				1210	820	655
		90	27	1400	855	700				1115	685	555		
		100	28	1000	700	500				835	505	390		
S					COATED									
	Cutter	Max ap	Carbide Insert		TP35MP RP35AP RP35MP			TM45MP RP40AP RP40MP						
					feed per tooth *(inch)									
	TXD90/EMP/FMP	.33	XD..-09/AP..-10		-	.002	.004	-	.002	.004				
	TXP90/EMP/FMP	.55	XP..-16/AP..-16		.003	.005	.006	.003	.005	.006				
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)								
	High Temp	G	200	31	130	95	75	95	75	55				
	Alloy FE	AG	280	32	100	75	65	75	55	45				
	High Temp	G	250	33	80	55	45	55	45	35				
	Alloy	AG	350	34	65	45	35	45	35	30				
Ni / Co	GO	320	35	-	-	-	-	-	-					
Titanium alloys			36	-	-	-	225	145	110					
TiAL6V4	AG		37	-	-	-	180	110	95					

The cutting data given is valid for slot milling with full width of cut $ae = 100\%$ of the cutter diameter.

For peripheral and shoulder milling with the TX90 end mill, the figures in the table should be converted using the following correction factors:

Ratio $ae : d1$	fz factor	SFPM factor
2%	3.5	1.6
5%	3	1.5
10%	2	1.4
20%	1.5	1.3
$\geq 40\%$	1	1.1

ANSI ISO 513	Cutting Data for THA90 / THX90 Milling Cutters				COATED									UNCOATED		
	Cutter		Carbide Insert		TP25MP TP30MP TP30MC			RP35MP TP35MC RP35AP			TP35MP RP40AP RP40MP			TP25M		
					feed per tooth *(inch)											
P	THXD90 ¹⁾		XD..-09..		--	.003	.005	--	.003	.005	--	.003	.005			
	THXP90 ¹⁾		XP..-16..		.005	.010	.013	.005	.010	.013	.005	.010	.014	.003	.006	.009
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C annealed	125	1	1085	820	690	920	720	625	625	555	490	555	490	460
		> 0.25% C annealed	190	2	820	655	555	625	490	425	460	390	360	390	325	295
		< 0.55% C heat-treated	250	3	690	525	490	525	390	360	390	325	295	325	260	230
		> 0.55% C annealed	220	4	720	555	490	540	425	360	425	360	325	360	275	260
		heat-treated	300	5	625	425	390	460	325	275	360	295	260	275	230	195
	Low alloy steel and cast steel	annealed	200	6	785	625	490	605	460	375	460	390	360	390	325	295
		heat-treated	275	7	625	490	390	460	360	295	360	295	260	295	260	230
		heat-treated	300	8	525	390	360	390	295	260	325	260	230	260	195	180
		heat-treated	350	9	490	360	295	360	260	230	260	180	130	230	160	130
	High alloy steel, cast steel & tool steel	annealed	200	10	625	490	425	460	360	325	425	360	295	360	275	260
heat-treated		325	11	390	310	230	295	230	195	260	180	130	230	160	130	
400 series stainless	FE / MA	200	12	785	590	490	590	440	375	425	390	325	375	295	275	
	MA	240	13.1	690	480	390	505	360	295	360	295	260	325	260	230	
	MA / PH	330	13.2	360	245	195	260	180	145	180	145	130	160	130	115	
				COATED									UNCOATED			
M	Cutter		Carbide Insert		TP30MC			RP35MP TP35MP			RP40MP RP40AP TM45MP			TP25M		
					feed per tooth *(inch)											
	THXD90 ¹⁾		XD..-09..		-	.003	.005	-	.003	.005	-	.003	.005	-	-	-
	THXP90 ¹⁾		XP..-16..		.003	.007	.010	.003	.007	.010	.003	.007	.010	.003	.007	.010
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	300 Series	AU	180	14.1	690	425	295	525	325	230	390	230	195	325	195	130
Stainless	DU	230	14.2	555	360	230	425	260	195	310	195	160	260	160	115	
Duplex	S-AU	200	14.3	425	275	195	325	195	160	230	160	130	195	115	80	
Stainless	AU-PH	330	14.4	360	210	160	295	160	130	195	145	115	160	95	65	
				COATED						UNCOATED						
K	Cutter		Carbide Insert		RK15MC			TK15MC			TK10M					
					feed per tooth *(inch)											
	THXD90 ¹⁾		XD..-09..		.003	.006	.007	.003	.006	.008				.004	.007	.009
	THXP90 ¹⁾		XP..-16..		.003	.006	.009	.005	.010	.014				.004	.011	.016
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	Grey cast iron	ferrit./pearl.	180	15	1215	885	720	985	720	590				460	325	260
		pearlitic	260	16	985	690	590	755	555	490				325	260	230
Nodular cast iron	ferritic	160	17	950	720	555	820	625	490				390	295	245	
	pearlitic	250	18	855	490	360	625	360	260				360	275	195	
Malleable cast iron	ferritic	130	19	1015	625	325	820	490	425				490	390	260	
	pearlitic	230	20	785	525	360	655	425	295				425	310	195	



Cutting Data for THX90 Helical Milling Cutters

ANSI ISO 513	Cutting Data for THA90 / THX90 Milling Cutters				COATED						UNCOATED			
	Cutter		Carbide Insert		TK10MP						TK10M			
N	THXD90 ¹⁾		XDH..-09-AL		.003	.005	.007					.004	.007	.009
	THXP90 ¹⁾		XPH..-16-AL		.004	.009	.012					.004	.009	.012
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)									
	Wrought	Non AG	60	21	5425	3115	2620					2950	1965	1640
		AG	100	22	2020	1640	1310					1475	980	820
	Cast alumi- num alloys	Non Ag	75	23	5245	3115	2120					2950	1965	1640
		Si < 12% AG	90	24	2950	1800	1475					2295	1640	1310
		Si > 12%	130	25	2130	1310	980					1475	915	655
	Copper & Cop- per alloys	Pb > 1%	110	26	1510	1000	800					1310	820	655
			90	27	1400	855	700					1115	685	520
		100	28	1000	700	500					820	520	390	

S	Cutting Data for THA90 / THX90 Milling Cutters				COATED								
	Cutter		Carbide Insert		TP35MP RP35AP RP35MP			TM45MP RP40AP RP40MP					
THXD90 ¹⁾		XDH..-09-AL		-	.002	.004	-	.002	.004				
THXP90 ¹⁾		XPH..-16-AL		.003	.005	.006	.003	.005	.006				
Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)									
High Temp	G	200	31	130	95	75	95	75	55				
Alloy FE	AG	280	32	100	75	65	75	55	45				
High Temp	G	250	33	80	55	45	55	45	35				
Alloy	AG	350	34	65	45	35	45	35	30				
Ni / Co	GO	320	35	-	-	-	-	-	-				
Titanium alloys			36	-	-	-	225	145	110				
TiAL6V4	AG		37	-	-	-	180	110	95				

The feeds per tooth (fz) are valid for face milling with width of cut $a_e \geq 0.4 d_1$ and max. depth of cut (ap). For smaller widths and depths of cut, the figures in the table should be converted using correction factors (d = dia. over insert, d_1 = cutter dia.). The axial feed in plunge milling should be reduced by approximately 40%.

E. - Ratio $a_e : d_1$	0.05	0.1	0.2	0.4
fz - Factor	3	2	1.5	1
vc - Factor	1.5	1.4	1.3	1.2

Example:
fz, nom = 0.19 fz, eff = 0.19 x 2 = 0.38 mm / z
vc, nom = 150 vc, eff = 150 x 1.4 = 210 m / min

Example:
fz, nom = .007 fz, eff = .007 x 2 = .014 IPT / z
vc, nom = 492 vc, eff = 492 x 1.4 = 689 SFM



Cutting Data for TS45F Facemills

ANSI ISO 513	Cutting Data for TS45F Facemills				COATED									UNCOATED						
	Cutter		Carbide Insert		TP25MP			TP30MC			TP35MP			TP25M						
P	TS45F		SE..-43..		.006	.013	.018	.006	.013	.018	.006	.013	.018				.006	.013	.018	
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)															
	Carbon steel, Unalloyed	< 0.25% C	annealed	125	1	1345	1065	915	1180	915	785	820	705	655				720	635	590
		> 0.25% C	annealed	190	2	1065	820	705	820	620	450	590	490	455				650	425	390
	steel, cast steel and free cutting steel	< 0.55% C	heat-treated	250	3	900	685	605	685	520	455	490	425	390				425	325	295
		> 0.55% C	annealed	220	4	915	705	605	705	540	455	520	455	425				455	360	325
			heat-treated	300	5	770	555	475	590	425	360	425	360	325				360	295	260
	Low alloy steel and cast steel		annealed	200	6	1030	770	635	785	590	490	590	490	455				520	425	390
			heat-treated	275	7	770	605	520	590	455	390	455	390	360				390	325	295
			heat-treated	300	8	685	520	425	520	390	325	390	325	295				325	260	225
			heat-treated	350	9	605	425	360	455	325	260	325	225	195				295	195	160
	High alloy steel, cast steel & tool steel		annealed	200	10	770	620	555	590	475	425	520	440	390				455	360	325
			heat-treated	325	11	520	390	325	390	295	225	325	225	180				295	195	160
	400 series stainless		FE / MA	200	12	980	915	635	750	570	490	555	490	455				490	390	360
		MA	240	13.1	850	620	520	655	475	390	455	390	360				425	325	295	
		MA / PH	330	13.2	425	310	260	325	245	195	225	195	180				210	160	145	
M	TS45F		SE..-43..		.005	.010	.014	.005	.010	.014	.005	.010	.014				.005	.010	.014	
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)															
	300 Series	AU	180	14.1	850	520	390	655	390	295	490	295	225				390	260	195	
	Stainless	DU	230	14.2	685	455	310	520	310	225	425	225	180				325	245	180	
	Duplex	S-AU	200	14.3	520	360	245	390	225	180	325	180	130				245	180	130	
	Stainless	AU-PH	330	14.4	455	275	210	325	195	145	245	145	110				195	145	110	
	K	TS45F		SE..-43		.007	.010	.020	.004	.009	.012							.001	.010	.018
Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)															
Grey cast iron		ferrit./pearl.	180	15	1570	1145	820	1245	915	770							1100	900	610	
		pearlitic	260	16	1210	915	685	950	705	605							750	610	505	
Nodular cast iron		ferritic	160	17	1375	915	685	1065	770	635							925	570	495	
		pearlitic	250	18	885	655	490	770	475	375							670	450	325	
Malleable cast iron		ferritic	130	19	1115	850	655	1065	635	505							925	570	495	
		pearlitic	230	20	915	685	520	850	520	425							670	450	325	



Cutting Data for TS45F Milling Cutters

ANSI ISO 513	Cutting Data for TS45F Milling Cutters				COATED			UNCOATED							
	Cutter		Carbide Insert		TK10MP			TK10M							
N	TS45F SEHT-43-ALC				.006	.014	.020				.006	.014	.020		
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)									
	Wrought	Non AG		60	21	8200	4920	3935				3280	2460	1965	
		AG		100	22	4100	2460	1965				1640	1180	980	
	Cast aluminum alloys	Non Ag		75	23	8200	4920	3935				3280	2460	1965	
		Si ≤ 12%	AG		90	24	4265	2620	1965				2620	1965	1640
			Si ≥ 12%		130	25	2620	2130	1640				1640	1145	820
	Copper & Copper alloys	Pb > 1%		110	26										
				90	27										
				100	28										
Non Metals				29											
				30											
S	TS45F SE..-43..				.004	.006	.008	.004	.006	.008					
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)									
	High Temp	G		200	31	205	160	145							
	Alloy FE	AG		280	32	160	130	110							
	High Temp	G		250	33	110	80	65							
	Alloy	AG		350	34	80	65	45							
	Ni / Co	GO		320	35	90	70	55							
	Titanium alloys				36				310	195	155				
	TiAL6V4	AG			37				275	180	135				

The feeds per tooth fz are valid for a width of cut $a_e \geq 0.4 d_1$ (cutter dia.).
 In the case of smaller widths of cut the feed fz should be increased, e.g. for $a_e : d_1 = 0.2$ by a factor of 1.5.



Cutting Data for TR360 Milling Cutters

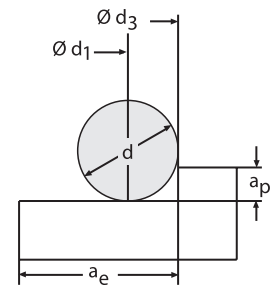
ANSI ISO 513	Cutting Data for TR360 Milling Cutters				COATED													
	Cutter	Max ap	Carbide Insert		TP30AP			TP30MP			TP35MC							
P	TR360 ¹⁾	.157 / .197	RD.. 08/10...		.003	.006	.008	.003	.006	.008	.003	.006	.008					
		.236	RD.. 12...		.004	.009	.012	.004	.009	.012	.004	.009	.012					
		.315	RC / RD.. 16...		.005	.010	.014	.005	.010	.014	.005	.010	.014					
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)												
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	1345	1065	915	1180	915	785	820	705	655				
		> 0.25% C	annealed	190	2	1065	820	705	820	620	540	590	490	455				
		< 0.55% C	heat-treated	250	3	900	685	605	685	520	455	490	425	390				
		> 0.55% C	annealed	220	4	915	705	605	705	540	455	520	455	425				
			heat-treated	300	5	770	555	455	590	425	360	425	360	295				
	Low alloy steel and cast steel		annealed	200	6	1030	770	635	785	590	490	590	490	455				
			heat-treated	275	7	770	605	520	590	455	390	455	390	360				
			heat-treated	300	8	685	520	425	520	390	325	390	325	260				
			heat-treated	350	9	605	425	360	455	325	260	325	225	180				
	High alloy steel, cast steel & tool steel		annealed	200	10	770	620	555	590	475	425	520	440	390				
heat-treated			325	11	520	390	325	390	295	225	325	225	180					
400 series stainless		FE / MA	200	12	980	915	635	750	750	490	555	490	455					
		MA	240	13.1	850	625	520	655	475	390	455	390	360					
		MA / PH	330	13.2	425	310	260	325	245	195	225	195	180					
M	TR360 ¹⁾	.157 / .197	RD.. 08/10...		.003	.006	.008	.003	.006	.008	.003	.006	.008					
		.236	RD.. 12...		.004	.009	.012	.004	.009	.012	.004	.009	.012					
		.315	RC / RD.. 16...		.005	.010	.014	.005	.010	.014	.005	.010	.014					
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)												
	300 Series	AU	180	14.1	850	720	490	785	655	455	685	590	390					
	Stainless	DU	230	14.2	720	590	425	620	605	410	555	490	310					
	Duplex	S-AU	200	14.3	555	455	325	455	440	310	425	360	225					
	Stainless	AU-PH	330	14.4	425	360	245	390	325	225	340	295	195					
	K	TR360 ¹⁾	.157 / .197	RD.. 08/10...					.003	.006	.008							
			.236	RD.. 12...					.004	.009	.012							
			.315	RC / RD.. 16...					.005	.010	.014							
		Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
		Grey cast iron	ferrit/pearl.	180	15				1245	915	770							
				260	16				950	705	605							
Nodular cast iron			ferritic	160	17				1065	770	635							
			pearlitic	250	18				770	475	390							
Malleable cast iron			ferritic	130	19				1065	635	520							
		pearlitic	230	20				850	520	425								

ANSI ISO 513	Cutting Data for TR360 Milling Cutters				UNCOATED					
	Cutter	Max ap	Carbide Insert		TK10M					
N	TR360 ¹⁾	.157 / .197	RD.. 08/10...		.003	.006	.008	feed per tooth *(inch)		
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)					
	Wrought	Non AG	60	21	3280	2460	1965			
		AG	100	22	1640	1180	980			
	Cast aluminum alloys	Non Ag	75	23	3280	2460	1965			
		AG	90	24	2620	1965	1640			
		Si < 12%	130	25	1640	1145	820			
	Copper & Copper alloys	Pb > 1%	110	26	1475	1310	980			
			90	27	1310	820	655			
			100	28	980	655	455			
Non Metals			29	1965	1475	980				
			30	1965	1475	980				
				COATED						
S	Cutter	Max ap	Carbide Insert		TP30AP		TP30MP			
	TR360 ¹⁾	.157 / .197	RD.. 08/10...		.003	.005	.006	.003	.005	.006
		.236	RD.. 12...		.004	.006	.007	.004	.006	.007
		.315	RC / RD.. 16...		.005	.007	.009	.005	.007	.009
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)					
	High Temp	G	200	31	205	160	145	120	95	80
	Alloy FE	AG	280	32	160	130	110	95	75	65
	High Temp	G	250	33	110	80	65	75	60	50
	Alloy	AG	350	34	80	65	45	65	45	40
	Ni / Co	GO	320	35	90	70	55	65	45	40
Titanium alloys			36	-	-	-	260	160	130	
TiAL6V4	AG		37	-	-	-	225	150	110	

fz-factor for ratio ae:d ¹				
ap	0.05	0.1	0.2	0.4
5% of d	9	6.3	4.3	3.2
10% of d	6.3	4.3	3.2	2.2
20% of d	4.3	3.2	2.2	1.6
40% of d	3.2	4.2	1.6	1.1

SFPM Factors for various fz factors	
fz factor	SFPM factor
9	1.6
6.3	1.5
4.3	1.4
3.2	1.3
2.2	1.2
1.6	1.1
1.1	1

1) The feeds per tooth fz are valid for face milling with width of cut $ae \geq 0.4 d_1$ and max. depth of cut ap. For smaller widths and depths of cut, the figures in the table should be converted using correction factors ($d = \text{dia. of insert}$, $d_1 = \text{cutter dia.}$). The axial feed in plunge milling should be reduced by approximately 40%.



Legend

- ae - width of cut
- ap - depth of cut
- d - insert diameter
- $\varnothing d^1$ - effective cutter diameter
- $\varnothing d^3$ - nominal cutter diameter



Cutting Data for TV90

ANSI ISO 513	Cutting Data for TV90 Milling Cutters			COATED			UNCOATED			
	Cutter	Max ap	Carbide Insert	TK10MP			TK10M			
N	feed per tooth *(inch)									
	TV90 Face Mill	.50	VCGT / VPGT	.008	.010	.012	.008	.010	.012	
	TV90 End Mill	.38	VCGT / VPGT	.006	.008	.010	.006	.008	.010	
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)					
	Wrought	Non AG	60	21	4920	3600	2900	3200	2400	1900
		AG	100	22	2600	2000	1400	1600	1200	1000
	Cast aluminum alloys	Non Ag	75	23	4000	3500	3000	3500	2500	2000
		Si ≤ 12% AG	90	24	3100	2800	2000	2600	2000	1500
		Si ≥ 12%	130	25	-	-	-	-	-	-
	Copper & Copper alloys	Pb > 1%	110	26	-	-	-	-	-	-
		90	27	1900	1640	1400	1500	1250	900	
		100	28	1180	980	--	800	600	--	

TPC Plunge Mills

ANSI ISO 513	Material	TPC Plunge Mills					
		DRILLING	SFPM		MILLING	SFPM	
		Feed	Coated	Uncoated	Feed 1)	Coated	Uncoated
P	Steel, unalloyed low carbon	.003 - .008	299 - 673	260 - 585	.003 - .012	325 - 731	260 - 585
	Steel, unalloyed or low-alloy	.003 - .008	262 - 598	228 - 520	.003 - .012	284 - 650	228 - 520
	Steel alloy and tool steels	.003 - .008	224 - 523	195 - 455	.003 - .012	244 - 569	195 - 455
	High tensile steels	.003 - .008	224 - 448	195 - 390	.003 - .012	244 - 488	195 - 390
M	Corrosion-resistant steel	.002 - .006	187 - 523	163 - 455	.003 - .010	203 - 569	163 - 455
	Cast steel, medium strength	.002 - .006	224 - 448	195 - 390	.003 - .010	244 - 488	195 - 390
K	Grey cast iron, medium hardness	.003 - .013	262 - 448	228 - 390	.003 - .015	284 - 488	228 - 390
N	Brass	.003 - .008	374 - 673	325 - 585	.004 - .010	406 - 731	325 - 585
	Mg-alloyed	.003 - .005	1121 - 2990	975 - 2600	.004 - .006	1219 - 3250	975 - 2600
	Si-alloyed	.002 - .005	934 - 2243	813 - 1950	.002 - .006	1016 - 2438	813 - 1950
	Al-alloyed, hypo-eutectic	.003 - .006	1121 - 3737	975 - 3250	.004 - .008	1219 - 4063	975 - 3250
	Al-alloyed, hypo-eutectic Si>12%	.003 - .006	1121 - 1869	975 - 1625	.004 - .008	1219 - 2031	975 - 1625

1) The feeds per tooth fz are valid for a width of cut ae > 40% of the cutter diameter. In the case of smaller widths of cut, the feed fz should be increased as per the following table:

Ratio ae : d1	fz Factor
5%	3
10%	2
20%	1.5
> 40%	1

Legend:
 ae = width of cut
 d1 = cutter diameter
 Feed = fz in inches per tooth
 SFPM = Cutting speeds in SFPM (Surface feet per minute)

Cutting Data for TCP90/ECO Milling Cutters

Materials	Conditions of Chip Removal	Application Range - Cutting Speed N01 - N40		
		N01 - N20 (HSC)	N20 - N30 (HSC)	N25 - N40 (HSC)
N Nonferrous metals Aluminum alloys without silicon	High-Speed Milling	100 μin - 200 μin	100 μin - 200 μin	100 μin - 200 μin
	unstable (varied depth)	PDC-CU-S / TFC 2600-14625	PDC-CU-S / TFC 2600-13000	PDC-CU-S / TFC 2600-8125
	continuous	PDC-CU-S / TFC 2600-14625	PDC-CU-S / TFC 2600-13000	PDC-CU-S / TFC 2600-8125
	heavily + slightly interrupted	PDC-CU-S / TFC 2600-14625	PDC-CU-S / TFC 2600-13000	PDC-CU-S / TFC 2600-8125
N Nonferrous metals Aluminum alloys with less than 12% silicon	unstable (varied depth)	PDC-CU-S / TFC 2600-13000	PDC-CU-S / TFC 2600-11375	PDC-CU-S / TFC 2600-8775
	continuous	PDC-CU-S / TFC 2600-13000	PDC-CU-S / TFC 2600-11375	PDC-CU-S / TFC 2600-8775
	heavily + slightly interrupted	PDC-CU-S / TFC 2600-13000	PDC-CU-S / TFC 2600-11375	PDC-CU-S / TFC 2600-8775
N Nonferrous metals Aluminum alloys with greater than 12% silicon	unstable (varied depth)	PDC-CU-S / TFC 2600-9750	PDC-CU-S / TFC 2275-8125	PDC-CU-S / TFC 1950-4875
	continuous	PDC-CU-S / TFC 2600-9750	PDC-CU-S / TFC 2275-8125	PDC-CU-S / TFC 1950-4875
	heavily + slightly interrupted	PDC-CU-S / TFC 2600-9750	PDC-CU-S / TFC 2275-8125	PDC-CU-S / TFC 1950-4875
N Nonferrous metals Copper and copper alloys brass, bronze, precious metals	unstable (varied depth)	PDC-CU-S / TFC 2600-9750	PDC-CU-S / TFC 2600-8125	PDC-CU-S / TFC 2275-7150
	continuous	PDC-CU-S / TFC 2600-9750	PDC-CU-S / TFC 2600-8125	PDC-CU-S / TFC 2275-7150
	heavily + slightly interrupted	PDC-CU-S / TFC 2600-9750	PDC-CU-S / TFC 2600-8125	PDC-CU-S / TFC 2275-7150
Coolant: Flood or through coolant				

