

RP15TC (P10-P25, K10-K25)

Grade for highest cutting speeds for fine to medium turning, $V_c = 590 - 980$ sfm. Due to the special K coating this grade is extremely wear resistant. For continuous cut. As alternative, also applicable with cast iron.

RP25K (P15-P35, M15-M35)

(Universal Turning Grade.) Main grade for machining steel materials and easily machinable stainless steels at medium cutting speeds. $V_c = 490 - 720$ sfm, for light interrupted cut. This general purpose grade is characterized by the properties of high durability and excellent toughness across a wide range of applications.

RP40K (P25-P40, M25-M40)

A combination of an extremely tough carbide with the new "Nanolock MT-CVD layer". Guarantees maximum performance in heavy interrupted cutting. $V_c =$ up to 490 sfm.

RM35D (M25-M35)

Main grade for turning of austenitic stainless steels at medium to high cutting speeds, $V_c =$ up to 490 sfm. Applicable also for super alloys.

RK10 (K05-K20)

Cast iron turning grade for the area K10. Optimal for machining GG and GGG materials. Possible cutting speeds for GG up to V_c 1200 sfm. Perfectly suitable for dry machining.

RK20 (K10-K25)

Cast iron turning grade for the area K15. Optimal for machining GG and GGG materials. Possible cutting speeds for GG up to V_c 1200 sfm. Perfectly suitable for dry machining.

AS15 (S05-S20)

Special submicron grade for machining super alloys such as Inconel, titanium, etc., particularly suitable for interrupted cut. Also suitable for austenitic stainless steel.

AS15F (S05-S20)

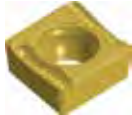
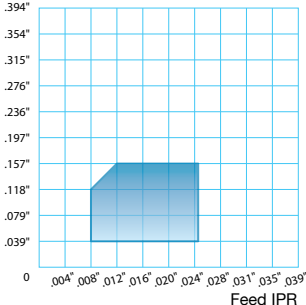
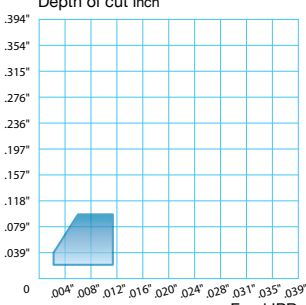
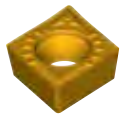
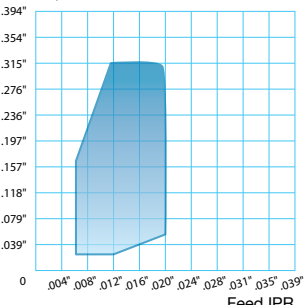
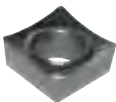
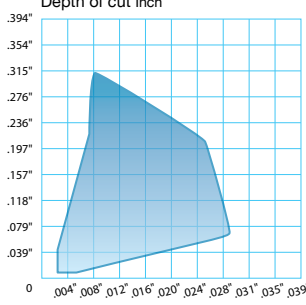
A submicron grade with thin PVD-coating and special cutting edges guarantee high performance on small components.

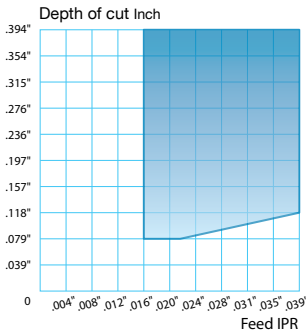
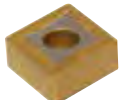
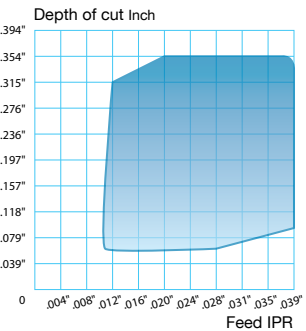
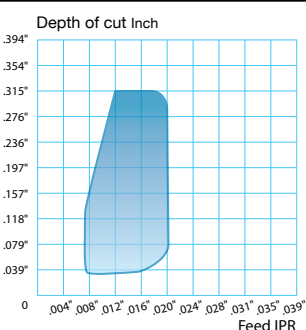
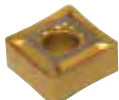
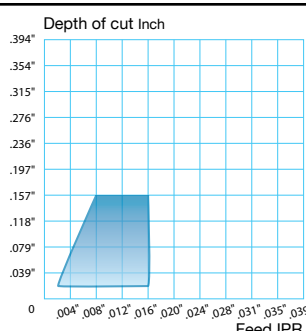
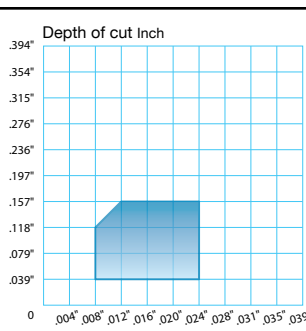
TK10MP (N05-N20, S05-S10)

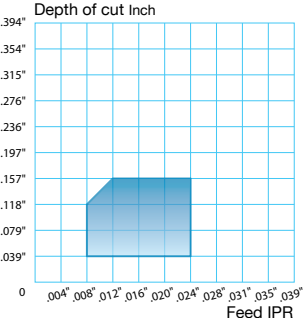
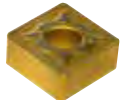
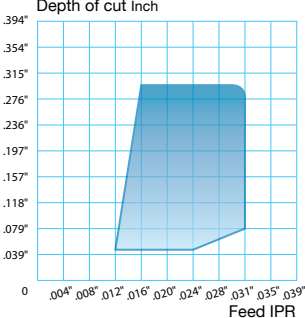
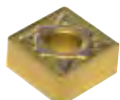
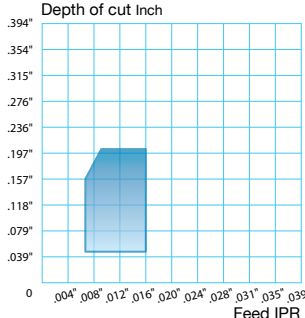
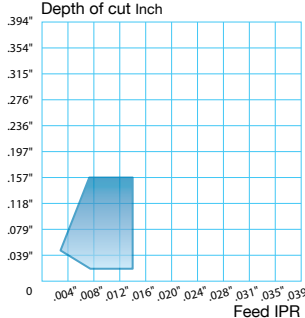
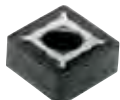
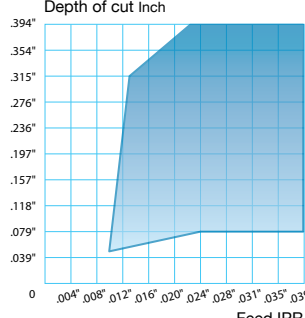
The ideal grade for working aluminum materials and other non-ferrous metals. Thanks to a very thin micropulse plasma CVD TiAlN coating is also excellent for finish machining of stainless steels and grey cast iron.

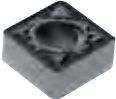
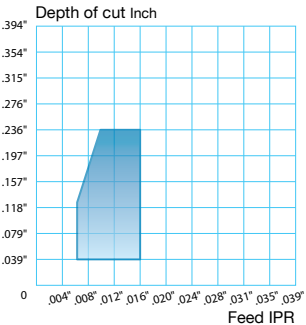
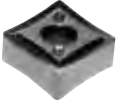
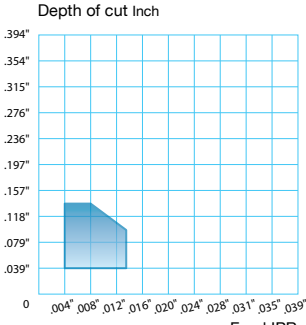
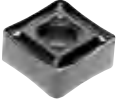
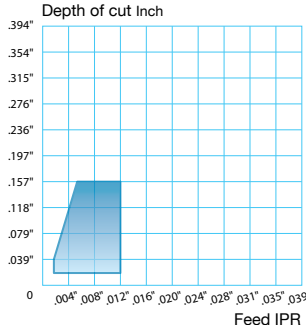
RTK20 (N05-N15)

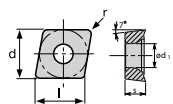
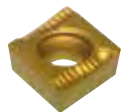
Classic micro-grain uncoated hard metal grade for machining aluminum materials and other Non Ferrous metals as well as grey cast iron at medium to high cutting speeds, even under unfavourable machining conditions.

Positive Geometry	Parameters	Applications	Description
 SCT	P M DOC 0.040" - 0.157" FPR 0.008" - 0.025"	Depth of cut Inch  Feed IPR	SCT – Copy turning and general machining for tool and die steel as well as stainless. Free cutting geometry allows for higher feed rates, especially suitable for swiss style machines.
 TMF	P M DOC 0.010" - 0.085" FPR 0.002" - 0.011"	Depth of cut Inch  Feed IPR	TMF – Finishing geometry for steel and stainless in the ISO positive style inserts. Produces excellent finishes at light depth of cut and feeds.
 TMU	P M DOC 0.030" - 0.315" FPR 0.006" - 0.020"	Depth of cut Inch  Feed IPR	TMU – General purpose machining in the ISO positive style insert geometries. Excellent all around performance in all steel and stainless steel materials.
 RAL	M N S DOC 0.012" - 0.315" FPR 0.003" - 0.029"	Depth of cut Inch  Feed IPR	RAL – Main chipbreaker for aluminum, brass, copper etc. Up-sharp polished edges delivers high shearing action and reduces built up edge. May also be used for light finishing in stainless steel and titanium alloys.

Negative Geometry		Parameters	Applications	Description
 HR	P	DOC 0.079" - 0.472"		HR – Single sided insert for extreme roughing in steel and stainless. Extra strong design for high feeds and depths of cut.
		FPR 0.016" - 0.063"		
 GR	P	DOC 0.050" - 0.354"		GR – Double sided roughing geometry for all steels. Stable cutting edge can take interruptions at elevated feed rates and depths of cut.
		FPR 0.010" - 0.039"		
 TMU	P	DOC 0.030" - 0.315"		TMU – Universal geometry for turning steel. Available in ANSI negative and ISO positive style inserts. The "go-to" edge for most applications.
	K	FPR 0.006" - 0.020"		
 MFM	P	DOC 0.020" - 0.157"		MFM – Finishing geometry for ANSI negative inserts. Produces excellent results at low depth of cut and low feed rates. May be used in steel and stainless steel.
		FPR 0.003" - 0.016"		
 STU	P	DOC 0.040" - 0.157"		STU – Like the SCT edge except chipgroove is on both sides of the radius thereby eliminating the need for right and left hand inserts. May be used for internal and external machining as well as facing. Free cutting design delivers great performance at high feed rates. Available in grades to machine steel, stainless and high temperature alloys.
	M S	FPR 0.008" - 0.025"		

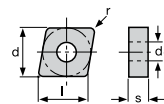
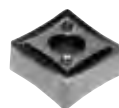
Negative Geometry		Parameters	Applications	Description
 SCT	P M	DOC 0.040" - 0.157" FPR 0.008" - 0.025"		SCT – Copy turning and general machining of tool and die steel as well as stainless. Free cutting geometry allows for higher feed rates, especially suitable for swiss style machines.
 MMR	M	DOC 0.050" - 0.300" FPR 0.012" - 0.031"		MMR – Stainless steel roughing in the negative ANSI insert series. Edge prep is perfect for use in gummy materials and is strong enough to withstand interrupted cuts. May be used in high temperature alloys.
 MM	M	DOC 0.050" - 0.197" FPR 0.006" - 0.016"		MM – Medium machining for stainless steel and high temperature alloys. Freer cutting than the MMR edge, produces excellent surface finishes.
 MMF	M	DOC 0.030" - 0.157" FPR 0.003" - 0.014"		MMF – Finish machining of stainless steel at low depth of cut and low feed rates.
 GRK	K	DOC 0.050" - 0.394" FPR 0.010" - 0.040"		GRK – Medium to rough machining in cast iron materials. The strong cutting edge holds up well in interrupted cuts and provides for the best surface finishes.

Negative Geometry		Parameters	Applications	Description
 HTR	M	DOC 0.039" - 0.236"		HTR – Our first choice for roughing high temperature alloys, titanium and stainless steel. Excellent chip control and cutting performance handles interrupted cuts at higher feed rates.
	S	FPR 0.006" - 0.016"		
 HTM	M	DOC 0.040" - 0.130"		HTM – The best edge for general machining of high temperature alloys, titanium and stainless steel. Positive edge style is very free cutting and produces excellent surface finishes. The best choice for materials such as Inconel, Waspaloy etc.
	S	FPR 0.004" - 0.014"		
 HTF	M	DOC 0.020" - 0.157"		HTF – The finishing edge for the high temperature alloy series. May be used in titanium and stainless steel in light depth of cut and light feed applications.
	S	FPR 0.003" - 0.012"		



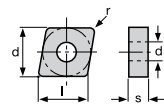
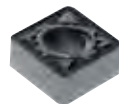
CCGT-...-SCT

Designation	l	d	s	d ¹	r	RP15K	RP25K	RP40K	RM35D		
CCGT-21.51L-SCT	.252	1/4	.094	.110	1/64	●	●	●	●		
CCGT-21.51R-SCT						●	●	●	●		
CCGT-21.52L-SCT					1/32	●	●	●	●		
CCGT-21.52R-SCT						●	●	●	●		
CCGT-32.51L-SCT	.381	3/8	.156	.173	1/64	●	●	●	●		
CCGT-32.51R-SCT						●	●	●	●		
CCGT-32.52L-SCT					1/32	●	●	●	●		
CCGT-32.52R-SCT						●	●	●	●		
CCGT-432L-SCT	.504	1/2	.187	.217	1/32	●	●	●	●		
CCGT-432R-SCT						●	●	●	●		
CCGT-433L-SCT					3/64	●	●	●	●		
CCGT-433R-SCT						●	●	●	●		



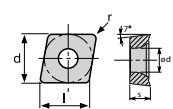
CNGG-...-HTM

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K	AS15		
CNGG-431-HTM	.504	1/2	.187	.203	1/64				●		
CNGG-432-HTM					1/32				●		
CNGG-433-HTM					3/64				●		



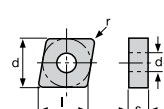
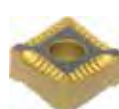
CNGG-...-HTR

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CNGG-433-HTR					3/64				●		



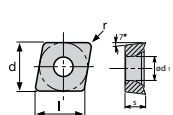
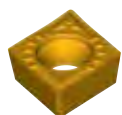
CCMT-...-TMF

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K	RM35D		
CCMT-21.51-TMF	.252	1/4	.094	.110	1/64	●	●				
CCMT-21.52-TMF					1/32	●	●				
CCMT-32.51-TMF	.381	3/8	.156	.173	1/64	●	●				
CCMT-32.52-TMF					1/32	●	●				
CCMT-431-TMF	.504	1/2	.187	.217	1/64	●	●				



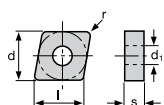
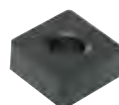
CNGG-...-STU

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K	AS15		
CNGG-432-STU	.504	1/2	.187	.203	1/32	●	●	●	●		



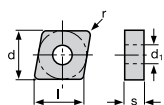
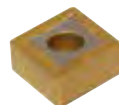
CCMT-...-TMU

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K	RM35D		
CCMT-21.50.5-TMU	.252	1/4	.094	.110	.008	●	●				
CCMT-21.51-TMU					1/64	●	●				
CCMT-21.52-TMU					1/32	●	●				
CCMT-32.51-TMU					1/64	●	●				
CCMT-32.52-TMU	.381	3/8	.156	.173	1/32	●	●				
CCMT-431-TMU					1/64	●	●				
CCMT-432-TMU	.504	1/2	.187	.217	1/32	●	●				



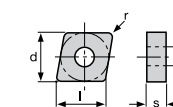
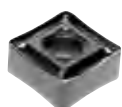
CNMA- ...

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K	RK10	RK20
CNMA-432	.504	1/2	.187	.203	1/32				●	●
CNMA-433					3/64				●	●
CNMA-644	.760	3/4	.250	.312	1/16					●



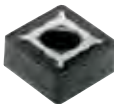
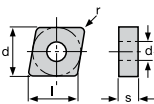
CNMG-...-GR

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K	RK10	RK20
CNMG-432-GR	.504	1/2	.187	.203	1/32	●	●	●	●	●
CNMG-433-GR					3/64	●	●	●		
CNMG-434-GR					1/16	●	●	●		
CNMG-542-GR	.634	5/8	.250	.250	1/32	●	●	●		
CNMG-543-GR					3/64	●	●	●		
CNMG-544-GR					1/16	●	●	●		
CNMG-643-GR	.760	3/4	.250	.312	3/64		●	●		
CNMG-644-GR					1/16		●	●		
CNMG-646-GR					3/32	●	●	●		

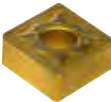
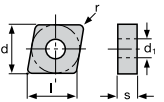


CNGG-...-HTF

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K	AS15		
CNGG-431-HTF	.504	1/2	.187	.203	1/64				●		
CNGG-432-HTF					1/32				●		
CNGG-433-HTF					3/64				●		

Designation	l	d	s	d'	r	CNMG-...-GRK					
										RK10	RK20
CNMG-432-GRK					1/32					●	●
CNMG-433-GRK	.504	1/2	.187	.203	3/64					●	●
CNMG-434-GRK					1/16					●	●
CNMG-543-GRK	.634	5/8	.250	.250	3/64					●	●
CNMG-544-GRK					1/16					●	●

Designation	l	d	s	d'	r	CNMG-...-MMR					
						RP15TC	RP25K	RP40K	RM35D		
CNMG-432-MMR					1/32				●		
CNMG-433-MMR	.504	1/2	.187	.203	3/64				●		
CNMG-543-MMR	.634	5/8	.250	.250	3/64				●		
CNMG-643-MMR	.760	3/4	.250	.312	3/64				●		

CNMG-...-HTM

Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	AS15		
CNMG-431-HTM					1/64		●		●		
CNMG-432-HTM	.504	1/2	.187	.203	1/32		●		●		
CNMG-433-HTM					3/64		●		●		

						CNMG-...-SCT				
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	RM35D	
CNMG-431L-SCT					1/64		●	●	●	
CNMG-431R-SCT							●	●	●	
CNMG-432L-SCT	.504	1/2	.187	.203	1/32		●	●	●	
CNMG-432R-SCT							●	●	●	
CNMG-433L-SCT					3/64		●	●	●	
CNMG-433R-SCT							●	●	●	

CNMG-...-MFM					
Designation	l	d	s	d'	r
CNMG-431-MFM	.504	1/2	.187	.203	1/64
CNMG-432-MFM					1/32

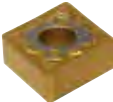
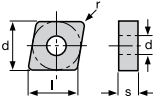
RP15TC	RP25K	RP40K		RK10	RK20
●	●	●		●	●
●	●	●			

CNMG-...-TMF					
Designation	l	d	s	d1	r
CNMG-431-TMF	.504	1/2	.187	.203	1/64
CNMG-432-TMF					1/32

RP15TC	RP25K	RP40K	RM35D		
●	●				
●	●				

CNMG-...-MM

Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	RM35D		
CNMG-432-MM	.504	1/2	.187	.203	1/32				●		
CNMG-433-MM					3/64				●		
CNMG-543-MM	.634	5/8	.250	.250	3/64				●		

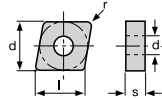
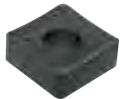
Designation	l	d	s	d'	r	CNMG-...-TMU				
						RP15TC	RP25K	RP40K		
CNMG-322-TMU	.382	3/8	.125	.150	1/32		●	●		
CNMG-432-TMU					1/32	●	●	●		
CNMG-433-TMU	.504	1/2	.187	.203	3/64	●	●	●		
CNMG-434-TMU					1/16	●	●	●		
CNMG-542-TMU					1/32	●	●	●		
CNMG-543-TMU	.634	5/8	.250	.250	3/64	●	●	●		
CNMG-544-TMU					1/16	●	●	●		
CNMG-643-TMU	.760	3/4	.250	.312	3/64	●	●	●		
CNMG-644-TMU					1/16	●	●	●		

CNMG-...-MMF

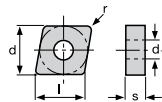
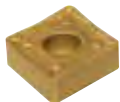
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	RM35D	
CNMG-321-MMF	.382	3/8	.125	.150	1/64				●	
CNMG-431-MMF					1/64				●	
CNMG-432-MMF	.504	1/2	.187	.203	1/32				●	
CNMG-433-MMF					3/64				●	

CNMG-...-WIP

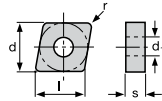
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K		
CNMG-432-WIP	.504	1/2	.187	.203	1/32	●	●			
CNMG-433-WIP					3/64	●	●			



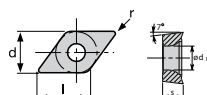
CNMM-....HDR					
Designation	l	d	s	d ¹	r
CNMM-856-HDR	1.015	1.0	.312	.359	3/32
CNMM-866-HDR	1.015	1.0	.375	.359	3/32



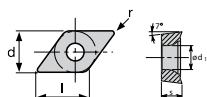
CNMM-....HR					
Designation	l	d	s	d ¹	r
CNMM-432-HR	.504	1/2	.187	.203	1/32
CNMM-433-HR					3/64
CNMM-543-HR	.634	5/8	.250	.250	3/64
CNMM-544-HR					1/16
CNMM-643-HR					3/64
CNMM-644-HR	.760	3/4	.250	.312	1/16
CNMM-646-HR					3/32



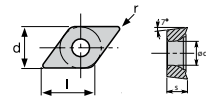
CNMM-....SR					
Designation	l	d	s	d ¹	r
CNMM-644-SR	.760	3/4	.250	.312	1/16
CNMM-646-SR					3/32



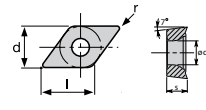
DCGT-....					
Designation	l	d	s	d ¹	r
DCGT-21.50.2	.305	1/4	.094	.148	.003
DCGT-21.50.6					.006
DCGT-32.50.6	.457	3/8	.156	.173	.006
DCGT-32.50.9					.014



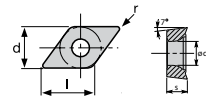
DCGT-....SCT					
Designation	l	d	s	d ¹	r
DCGT-21.51L-SCT	.305	1/4	.094	.148	1/64
DCGT-21.51R-SCT					
DCGT-32.51L-SCT					1/64
DCGT-32.51R-SCT					
DCGT-32.52L-SCT	.457	3/8	.156	.173	
DCGT-32.52R-SCT					1/32



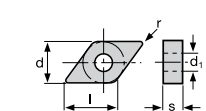
DCGT-....SCT					
Designation	l	d	s	d ¹	r
DCGT-21.50.2FL-SCT					.003
DCGT-21.50.2FR-SCT					.003
DCGT-21.50.6FL-SCT	.305	1/4	.094	.148	.006
DCGT-21.50.6FR-SCT					.006
DCGT-32.50.6FL-SCT					.006
DCGT-32.50.6FR-SCT	.457	3/8	.156	.173	.006
DCGT-32.50.9FL-SCT					.014
DCGT-32.50.9FR-SCT					.014



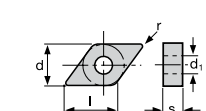
DCMT-....TMF					
Designation	l	d	s	d ¹	r
DCMT-21.51-TMF	.305	1/4	.094	.148	1/64
DCMT-32.51-TMF	.457	3/8	.156	.173	1/64



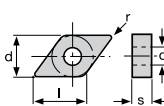
DCMT-....TMU					
Designation	l	d	s	d ¹	r
DCMT-21.51-TMU	.305	1/4	.094	.148	1/64
DCMT-32.51-TMU	.457	3/8	.156	.173	1/64
DCMT-32.52-TMU					1/32



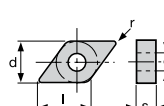
DNCG-....HTF					
Designation	l	d	s	d ¹	r
DNCG-431-HTF					1/64
DNCG-432-HTF	.610	1/2	.187	.203	1/32
DNCG-433-HTF					3/64
DNCG-441-HTF					1/64
DNCG-442-HTF	.610	1/2	.250	.203	1/32
DNCG-443-HTF					3/64



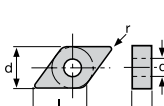
DNMA- ...					
Designation	l	d	s	d ¹	r
DNMA-432	.610	1/2	.250	.203	1/32
DNMA-433					3/64

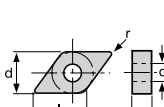
Designation	l	d	s	d'	r	DNMG-...-GR			
						RP15TC	RP25K	RP40K	
DNMG-432-GR	.610	1/2	.187	.203	1/32	●	●	●	
DNMG-433-GR	.610	1/2	.187	.203	3/64	●	●	●	
DNMG-442-GR	.610	1/2	.250	.203	1/32	●	●	●	
DNMG-443-GR	.610	1/2	.250	.203	3/64	●	●	●	
DNMG-444-GR	.610	1/2	.250	.203	1/16	●	●	●	

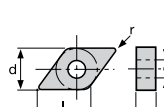
Designation	l	d	s	d'	r	DNMG-...-GRK			
						RP15TC	RP25K	RP40K	RK10 RK20
DNMG-432-GRK	.610	1/2	.187	.203	1/32				●
DNMG-433-GRK	.610	1/2	.187	.203	3/64				●
DNMG-442-GRK	.610	1/2	.250	.203	1/32				●
DNMG-443-GRK	.610	1/2	.250	.203	3/64				●

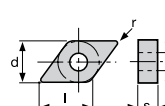
Designation	l	d	s	d'	r	DNMG-...-HTM			
						RP15TC	RP25K	RP40K	AS15
DNMG-431-HTM	.610	1/2	.187	.203	1/64				●
DNMG-432-HTM	.610	1/2	.187	.203	1/32				●
DNMG-433-HTM	.610	1/2	.187	.203	3/64				●
DNMG-441-HTM	.610	1/2	.250	.203	1/64				●
DNMG-442-HTM	.610	1/2	.250	.203	1/32				●
DNMG-443-HTM	.610	1/2	.250	.203	3/64				●

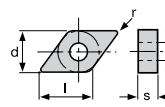
Designation	l	d	s	d'	r	DNMG-...-MFM			
						RP15TC	RP25K	RP40K	RK10 RK20
DNMG-331-MFM	.457	3/8	.187	.156	1/64	●	●		●
DNMG-332-MFM	.457	3/8	.187	.156	1/32	●	●		●
DNMG-432-MFM	.610	1/2	.187	.203	1/32		●		
DNMG-441-MFM	.610	1/2	.250	.203	1/64	●	●	●	
DNMG-442-MFM	.610	1/2	.250	.203	1/32	●	●	●	

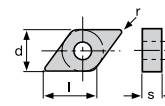
Designation	l	d	s	d'	r	DNMG-...-MM			
						RP15TC	RP25K	RP40K	RM35D
DNMG-332-MM	.457	3/8	.187	.156	1/32				●
DNMG-432-MM	.610	1/2	.187	.203	1/32				●
DNMG-442-MM	.610	1/2	.250	.203	1/32				●
DNMG-443-MM	.610	1/2	.250	.203	3/64				●

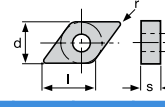
Designation	l	d	s	d'	r	DNMG-...-MMF			
						RP15TC	RP25K	RP40K	RM35D
DNMG-331-MMF	.457	3/8	.187	.156	1/64				●
DNMG-441-MMF	.610	1/2	.250	.203	1/64				●
DNMG-442-MMF	.610	1/2	.250	.203	1/32				●

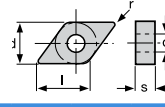
Designation	l	d	s	d'	r	DNMG-...-MMR			
						RP15TC	RP25K	RP40K	RM35D
DNMG-442-MMR	.610	1/2	.250	.203	1/32				●
DNMG-443-MMR	.610	1/2	.250	.203	3/64				●

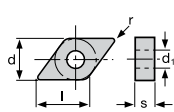
Designation	l	d	s	d'	r	DNMG-...-SCT			
						RP15TC	RP25K	RP40K	RM35D
DNMG-331L-SCT	.457	3/8	.187	.156	1/64	●	●	●	
DNMG-331R-SCT	.457	3/8	.187	.156	1/64	●	●	●	
DNMG-332L-SCT	.457	3/8	.187	.156	1/32	●	●	●	
DNMG-332R-SCT	.457	3/8	.187	.156	1/32	●	●	●	
DNMG-431L-SCT	.610	1/2	.187	.203	1/64		●	●	●
DNMG-431R-SCT	.610	1/2	.187	.203	1/64		●	●	●
DNMG-432L-SCT	.610	1/2	.187	.203	1/32		●	●	●
DNMG-432R-SCT	.610	1/2	.187	.203	1/32		●	●	●
DNMG-441L-SCT	.610	1/2	.250	.203	1/64	●	●	●	●
DNMG-441R-SCT	.610	1/2	.250	.203	1/64	●	●	●	●
DNMG-442L-SCT	.610	1/2	.250	.203	1/32	●	●	●	●
DNMG-442R-SCT	.610	1/2	.250	.203	1/32	●	●	●	●

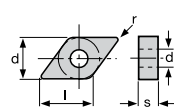
Designation	l	d	s	d'	r	DNMG-...-TMF			
						RP15TC	RP25K	RP40K	RM35D
DNMG-331-TMF	.457	3/8	.187	.156	1/64	●	●		
DNMG-332-TMF	.457	3/8	.187	.156	1/32	●	●		
DNMG-431-TMF	.610	1/2	.187	.203	1/64	●	●		
DNMG-432-TMF	.610	1/2	.187	.203	1/32	●	●		
DNMG-441-TMF	.610	1/2	.250	.203	1/64	●	●		
DNMG-442-TMF	.610	1/2	.250	.203	1/32	●	●		

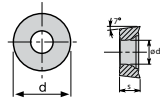
Designation	l	d	s	d'	r	DNMG-...-TMU			
						RP15TC	RP25K	RP40K	RM35D
DNMG-332-TMU	.457	3/8	.187	.156	1/32	●	●	●	
DNMG-432-TMU	.610	1/2	.187	.203	1/32	●	●	●	
DNMG-433-TMU	.610	1/2	.187	.203	3/64	●	●	●	
DNMG-442-TMU	.610	1/2	.250	.203	1/32	●	●	●	
DNMG-443-TMU	.610	1/2	.250	.203	3/64	●	●	●	
DNMG-444-TMU	.610	1/2	.250	.203	1/16	●	●	●	



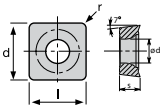
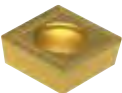
DNMG-...-WIP					
Designation	l	d	s	d ¹	r
DNMG-443-WIP	.610	1/2	.250	.203	3/64



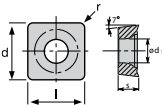
DNMM-...-HR					
Designation	l	d	s	d ¹	r
DNMM-442-HR					1/32
DNMM-443-HR	.610	1/2	.250	.203	3/64
DNMM-444-HR					1/16



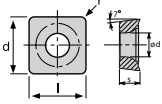
RCMX- ...					
Designation	l	d	s	d ¹	r
RCMX-1003MO	--	.394	.125	.150	--
RCMX-1204MO	--	.472	.187	.165	--
RCMX-1606MO	--	.630	.250	.205	--
RCMX-2006MO	--	.787	.250	.256	--
RCMX-2507MO	--	.984	.311	.283	--
RCMX-3209MO	--	1.260	.375	.374	--



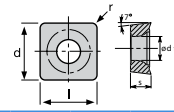
SCMT- ...					
Designation	l	d	s	d ¹	r
SCMT-431	.500	1/2	.187	.217	1/64



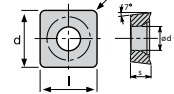
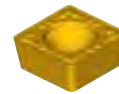
SCMT- ...-BSR					
Designation	l	d	s	d ¹	r
SCMT-864-BSR	1.000	1.0	.375	.339	1/16
SCMT-866-BSR					3/32



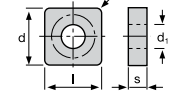
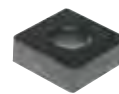
SCMT- ...-CPR					
Designation	l	d	s	d ¹	r
SCMT-866-CPR	1.000	1.0	.375	.339	3/32



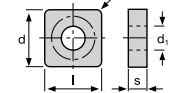
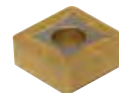
SCMT-...-TMF					
Designation	l	d	s	d ¹	r
SCMT-32.51-TMF	.375	3/8	.156	.173	1/64
SCMT-32.52-TMF					1/32



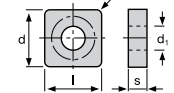
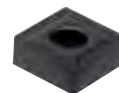
SCMT-...-TMU					
Designation	l	d	s	d ¹	r
SCMT-32.52-TMU	.375	3/8	.156	.173	1/32
SCMT-432-TMU					1/32
SCMT-433-TMU	.500	1/2	.187	.217	3/64



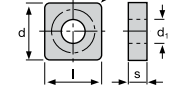
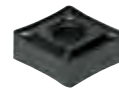
SNMA- ...					
Designation	l	d	s	d ¹	r
SNMA-432					1/32
SNMA-433	.500	1/2	.187	.203	3/64
SNMA-434					1/16
SNMA-644	.750	3/4	.250	.312	1/16
SNMA-856	1.000	1.0	.313	.359	3/32



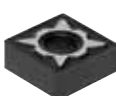
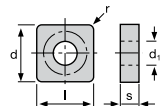
SNMG-...-GR					
Designation	l	d	s	d ¹	r
SNMG-432-GR					1/32
SNMG-433-GR	.500	1/2	.187	.203	3/64
SNMG-643-GR	.750	3/4	.250	.312	3/64
SNMG-644-GR					1/16



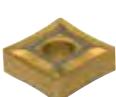
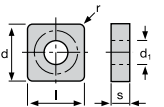
SNMG-...-GRK					
Designation	l	d	s	d ¹	r
SNMG-432-GRK					1/32
SNMG-433-GRK	.500	1/2	.187	.203	3/64
SNMG-643-GRK	.750	3/4	.250	.312	3/64
SNMG-644-GRK					1/16
SNMG-866-GRK	1.000	1.0	.375	.359	3/32



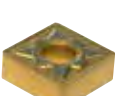
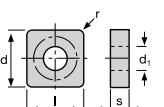
SNMG-...-HTF					
Designation	l	d	s	d ¹	r
SNMG-432-HTF	.500	1/2	.187	.203	1/32
SNMG-433-HTF					3/64

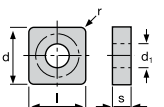
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	AS15
SNMG-432-HTR	.500	1/2	.187	.203	1/32				●
SNMG-433-HTR					3/64				●

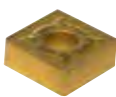
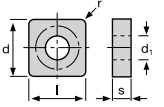
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
SNMG-321-MFM	.375	3/8	.125	.150	1/64	●	●	

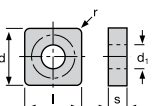
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	RM35D
SNMG-432-MM	.500	1/2	.187	.203	1/32				●
SNMG-433-MM					3/64				●

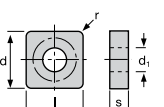
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	RM35D
SNMG-321-MMF	.375	3/8	.125	.150	1/64				●

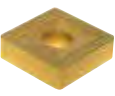
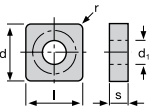
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	RM35D
SNMG-432-MMR	.500	1/2	.187	.203	1/32				●
SNMG-433-MMR					3/64				●
SNMG-643-MMR	.750	3/4	.250	.312	3/64				●

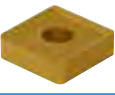
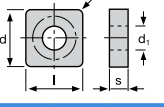
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
SNMG-431-TMF	.500	1/2	.187	.203	1/64	●	●	

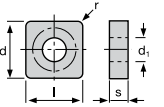
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
SNMG-432-TMU	.500	1/2	.187	.203	1/32	●	●	●
SNMG-433-TMU					3/64	●	●	●
SNMG-542-TMU	.625	5/8	.250	.250	1/32	●	●	●
SNMG-643-TMU	.750	3/4	.250	.312	3/64	●	●	●

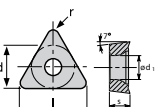
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
SNMM-854	1.000	1.0	.313	.359	1/16			●
SNMM-856					3/32	●	●	

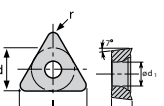
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
SNMM-644-HDR	.750	3/4	.250	.312	1/16			●
SNMM-646-HDR					3/32	●	●	

Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
SNMM-432-HR	.500	1/2	.187	.203	1/32	●	●	●
SNMM-433-HR					3/64	●	●	●
SNMM-543-HR	.625	5/8	.250	.250	3/64	●	●	●
SNMM-544-HR					1/16	●	●	●
SNMM-643-HR					3/64	●	●	●
SNMM-644-HR	.750	3/4	.250	.312	1/16	●	●	●
SNMM-646-HR					3/32	●	●	●
SNMM-648-HR					1/8	●	●	●

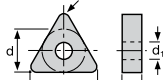
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	RM35D
TCGT-21.51L-SCT	.433	1/4	.094	.110	1/64		●	●	●
TCGT-21.51R-SCT							●	●	●
TCGT-32.51L-SCT					1/64		●	●	●
TCGT-32.51R-SCT							●	●	●
TCGT-32.52L-SCT	.650	3/8	.156	.173			●	●	●
TCGT-32.52R-SCT					1/32		●	●	●

Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
TCMT-21.50.5-TMF	.433	1/4	.094	.110	.008	●	●	
TCMT-21.51-TMF					1/64	●	●	

TCMT....-TMU

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K		
TCMT-21.51-TMU	.433	1/4	.094	.110	1/64	●	●			
TCMT-21.52-TMU					1/32	●	●			
TCMT-32.51-TMU	.650	3/8	.156	.173	1/64	●	●			
TCMT-32.52-TMU					1/32	●	●			

						TNMA- ...				
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K		RK10 RK20
TNMA-332	.650	3/8	.187	.150	1/32					● ●
TNMA-333					3/64					● ●
TNMA-432	.866	1/2	.187	.203	1/16					● ●

TNMG...-MFM

Designation

l

d

s

d'

r

RP15TC

RP25K

RP40K

TNMG-331-MFM

1/64

TNMG-332-MFM

.650

3/8

.187

.150

1/32

TNMG-333-MFM

3/64

TNMG....-MM

Designation	l	d	s	d ¹	r	RP15TC	RP25K	RP40K	RM35D	
TNMG-332-MM	.650	3/8	.187	.150	1/32				●	
TNMG-333-MM					3/64				●	
TNMG-432-MM	.866	1/2	.187	.203	1/32				●	
TNMG-433-MM					3/64				●	

TNMG-...-MMF					
Designation	l	d	s	d ¹	r
TNMG-331-MMF	.650	3/8	.187	.150	1/64
TNMG-332-MMF					1/32

RP15TC	RP25K	RP40K	RM35D		
			●		
			●		

TNMG....-SCT

Designation

l

d

s

d'

r

TNMG-331L-SCT

TNMG-331R-SCT

TNMG-332L-SCT

TNMG-332R-SCT

.650

3/8

.187

.150

1/64

1/32

●

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TNMG....-TMF

RP15TC

RP25K

RP40K

Designation

l

d

s

d¹

r

TNMG-331-TMF

.650

3/8

.187

.150

1/64

●

●

TNMG-332-TMF

.650

3/8

.187

.150

1/32

●

●

TNMG....-TMU

RP15TC	RP25K	RP40K			
●	●	●			
●	●	●			
●	●	●			
●	●	●			
●	●				

Designation

l

d

s

d¹

r

TNMG-332-TMU

1/32

TNMG-333-TMU

.650

3/8

.187

.150

3/64

TNMG-334-TMU

1/16

TNMG-432-TMU

.866

1/2

.187

.203

1/32

TNMG-433-TMU

3/64

TNMM....-HR

RP15TC
RP25K
RP40K

Designation

l

d

s

d¹

r

TNMM-332-HR

.650

3/8

.187

.150

1/32

●

●

TNMM-432-HR

.866

1/2

.187

.203

1/32

●

●

TNMM-433-HR

.866

1/2

.187

.203

3/64

●

●

TPMR...-TMP

Designation

l

d

s

d'

r

RP15TC

RP25K

RP40K

TPMR-221-TMP

.433

1/4

.125

--

1/64

●

●

●

TPMR-222-TMP

1/32

●

●

●

TPMR-321-TMP

.650

3/8

.125

--

1/64

●

●

●

TPMR-322-TMP

1/32

●

●

●

VBMT

Designation

l

d

s

d¹

r

RP15TC

RP25K

RP40K

VBMT-331

1/64

VBMT-332

.653

3/8

.187

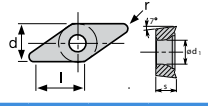
.173

1/32

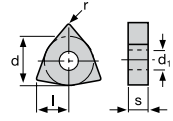
VBMT-333

3/64

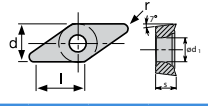
VCGT									
Designation	l	d	s	d'	r	AS15F			
VCGT-220.2	.437	1/4	.125	.110	.003	●			
VCGT-220.6					.006	●			

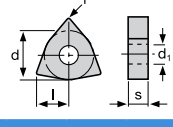
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
VCMT-221-TMF	.437	1/4	.125	.110	1/64	●	●	
VCMT-331-TMF	.653	3/8	.187	.173	1/64	●	●	
VCMT-332-TMF					1/32	●	●	

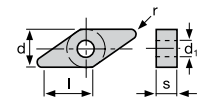
Designation	l	d	s	d'	r	AS15
WNGG-332-HTF	.256	3/8	.187	.150	1/32	●
WNGG-431-HTF					1/64	●
WNGG-432-HTF	.339	1/2	.187	.203	1/32	●
WNGG-433-HTF					3/64	●

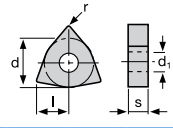
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
VCMT-331-TMU	.653	3/8	.187	.173	1/64	●	●	
VCMT-332-TMU					1/32	●	●	

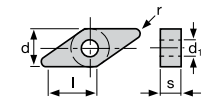
Designation	l	d	s	d'	r	AS15
WNGG-431-HTM					1/64	●
WNGG-432-HTM	.339	1/2	.187	.203	1/32	●
WNGG-433-HTM					3/64	●

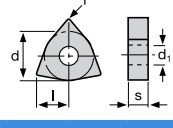
Designation	l	d	s	d'	r	AS15
VNMG-331-HTF	.653	3/8	.187	.150	1/64	●
VNMG-332-HTF					1/32	●

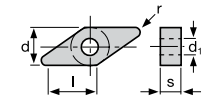
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K	RK10	RK20
WNMA-432	.339	1/2	.187	.203	1/32				●	●
WNMA-433					3/64				●	●

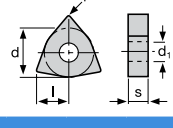
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
VNMG-332-MFM	.653	3/8	.187	.150	1/32	●	●	

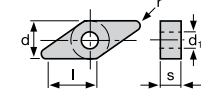
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
WNMG-432-GR					1/32	●	●	
WNMG-433-GR	.339	1/2	.187	.203	3/64	●	●	
WNMG-434-GR					1/16	●	●	

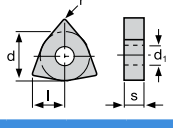
Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
VNMG-331-TMF	.653	3/8	.187	.150	1/64	●	●	
VNMG-332-TMF					1/32	●	●	

Designation	l	d	s	d'	r	RK10	RK20
WNMG-432-GRK	.339	1/2	.187	.203	1/32	●	●
WNMG-433-GRK					3/64	●	●

Designation	l	d	s	d'	r	RP15TC	RP25K	RP40K
VNMG-332-TMU	.653	3/8	.187	.150	1/32	●	●	
VNMG-333-TMU					3/64	●	●	

Designation	l	d	s	d'	r	RP25K	AS15
WNMG-431-HTM					1/64	●	●
WNMG-432-HTM	.339	1/2	.187	.203	1/32	●	●
WNMG-433-HTM					3/64	●	●

WNMG-...-MFM

RP15TC
RP25K
RP40K
RM35D

Designation

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d'

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WNMG-331-MFM

.256

3/8

.187

.150

1/64

●

●

●

●

WNMG-332-MFM

1/32

●

●

●

WNMG-431-MFM

1/64

●

●

●

●

WNMG-432-MFM

.339

1/2

.187

.203

1/32

●

●

●

WNMG-433-MFM

3/64

●

WNMG-...-TMU

RP15TC

RP25K

RP40K

Designation

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WNMG-332-TMU

.256

3/8

.187

.150

1/32

●

●

●

WNMG-432-TMU

.256

3/8

.187

.150

1/32

●

●

●

WNMG-433-TMU

.339

1/2

.187

.203

3/64

●

●

●

WNMG-434-TMU

.339

1/2

.187

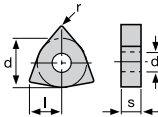
.203

1/16

●

●

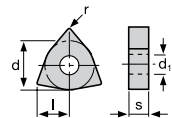
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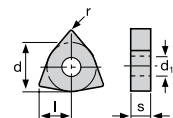
Designation	l	d	s	d'	r	WNMG-...-MM				
						RP15TC	RP25K	RP40K	RM35D	
WNMG-332-MM	.256	3/8	.187	.150	1/32			●		
WNMG-432-MM	.339	1/2	.187	.203	1/32			●		
WNMG-433-MM					3/64		●			
WNMG-434-MM					1/16		●			

WNMG-...-WIP				
RP15TC	RP25K	RP40K		

Designation	l	d	s	d'	r				
WNMG-432-WIP	.339	1/2	.187	.203	1/32	●	●	●	
WNMG-433-WIP					3/64	●	●	●	

Designation	l	d	s	d'	r	WNMG-...-MMF			
						RP15TC	RP25K	RP40K	RM35D
WNMG-432-MMF	.339	1/2	.187	.203	1/32			●	

Designation	l	d	s	d'	r	WNMG-...-MMR			
						RP15TC	RP25K	RP40K	RM35D
WNMG-432-MMR	.339	1/2	.187	.203	1/32			●	
WNMG-433-MMR					3/64		●		

WNMG-...-SCT

RP15TC

RP25K

RP40K

RM35D

Designation

l

d

s

d'

r

WNMG-431L-SCT

WNMG-431R-SCT

WNMG-432L-SCT

WNMG-432R-SCT

WNMG-433L-SCT

WNMG-433R-SCT

.339

1/2

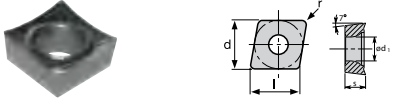
.187

.203

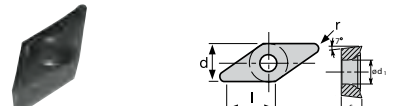
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1/32

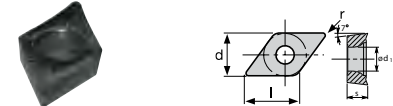
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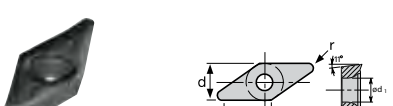
CCGT-...-RAL									
Designation	l	d	s	d'	r	RTK20	TK10MP		
CCGT-21.50.5-RAL	.252	1/4	.094	.110	.008	●	●		
CCGT-21.51-RAL					1/64	●	●		
CCGT-32.50.5-RAL					.008	●	●		
CCGT-32.51-RAL	.382	3/8	.156	.173	1/64	●	●		
CCGT-32.52-RAL					1/32	●	●		
CCGT-431-RAL	.504	1/2	.187	.217	1/64	●	●		
CCGT-432-RAL					1/32	●	●		



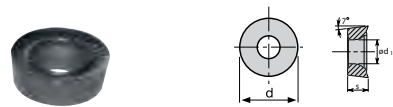
VCGT-...-RAL									
Designation	l	d	s	d'	r	RTK20	TK10MP		
VCGT-220.5-RAL	.437	1/4	.125	.110	.008	●	●		
VCGT-221-RAL					1/64	●	●		
VCGT-330.5-RAL					.008	●	●		
VCGT-331-RAL	.654	3/8	.187	.173	1/64	●	●		
VCGT-332-RAL					1/32	●	●		
VCGT-333-RAL					3/64	●	●		
VCGT-43.58-RAL	.870	1/2	.219	.217	.118	●	●		



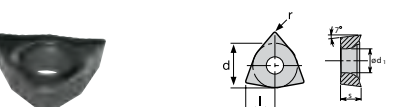
DCGT-...-RAL									
Designation	l	d	s	d'	r	RTK20	TK10MP		
DCGT-21.50.5-RAL	.305	1/4	.094	.148	.008	●	●		
DCGT-21.51-RAL					1/64	●	●		
DCGT-32.50.5-RAL					.008	●	●		
DCGT-32.51-RAL	.457	3/8	.156	.173	1/64	●	●		
DCGT-32.52-RAL					1/32	●	●		



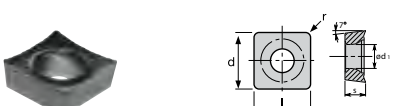
VPGT-...-RAL									
Designation	l	d	s	d'	r	RTK20	TK10MP		
VPGT-43.54-RAL	.870	1/2	.219	.217	1/16	●	●		



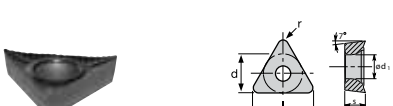
RCGT-...-RAL									
Designation	l	d	s	d'	r	RTK20	TK10MP		
RCGT-0602MO-RAL	--	6mm	.094	.110	--	●	●		
RCGT-0803MO-RAL	--	8mm	.125	.134	--	●	●		
RCGT-1003MO-RAL	--	10mm	.125	.157	--	●	●		



WCGT-...-RAL									
Designation	l	d	s	d'	r	RTK20	TK10MP		
WCGT-32.50.5-RAL					.008	●	●		
WCGT-32.51-RAL	.256	3/8	.156	.173	1/64	●	●		
WCGT-32.52-RAL					1/32	●	●		
WCGT-431-RAL	.339	1/2	.187	.217	1/64	●	●		
WCGT-432-RAL					1/32	●	●		



SCGT-...-RAL									
Designation	l	d	s	d'	r	RTK20	TK10MP		
SCGT-432-RAL	.500	1/2	.187	.217	1/32	●	●		



TCGT-...-RAL									
Designation	l	d	s	d'	r	RTK20	TK10MP		
TCGT-21.51-RAL	.433	1/4	.094	.110	1/64	●	●		
TCGT-32.51-RAL	.650	3/8	.156	.173	1/64	●	●		

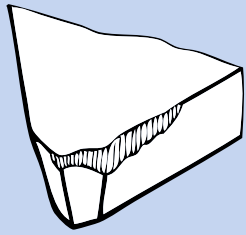
P	Work MaterialCondition			Hardness HB	Grade	RP15TC		RP25K		RP40K		
					FEED (in ipr)	.004"	.008"	.008"	.016"	.008"	.016"	
					Material Grp.	Cutting Speeds vc ft/min (vc for T = 15 minutes)						
	Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	1599	1300	1177	956	670	550	
≥ 0.25% C		annealed	190	2	1563	1219	1050	816	570	467		
< 0.55% C		heat-treated	250	3	1362	1047	952	731	570	420		
≥ 0.55% C		annealed	220	4	1203	894	809	601	420	350		
heat-treated		300	5	920	663	605	436	305	250			
Low alloy steel and cast steel	annealed	200	6	1258	952	868	657	460	375			
	heat-treated	275	7	1203	894	809	601	420	350			
	heat-treated	300	8	1056	774	702	514	360	295			
	heat-treated	350	9	920	663	605	436	305	250			
High alloy steel, cast steel & tool steel	annealed	200	10	1258	952	868	657	460	375			
	heat-treated	325	11	920	663	605	436	305	250			

M	Work MaterialCondition			Hardness HB	Grade	RP25K		RM35D		AS15		
					FEED (in ipr)		.006	.012	.008	.016	.004	.008
					Material Grp.	Cutting Speeds vc ft/min (vc for T = 15 minutes)						
	400 Series Stainless steel and cast steel	ferritic / martensitic	180	12		585	488	360	295			
martensitic		230	13		471	390	360	295				
300 Series Stainless steel	austenitic	200	14				450	370	820	590		

K	Work MaterialCondition			Hardness HB	Grade	RK10			RK20			
					FEED (in ipr)	.004	.008	.016	.004	.008	.016	
					Material Grp.	Cutting Speeds vc ft/min (vc for T = 15 minutes)						
	Grey cast iron	ferritic/pearlitic	180	15	1105	884	709	1000	804	631		
pearlitic		260	16	744	575	445	675	510	405			
Nodular cast iron	ferritic	160	17	1183	975	803	1020	875	720			
	pearlitic	250	18	637	504	397	580	450	360			
Malleable cast iron	ferritic	130	19	1580	1329	1118	1375	1175	1080			
	pearlitic	230	20	1105	884	709	1000	804	631			

N	Work MaterialCondition			Hardness HB	Grade	TK10MP			RTK20	
					FEED (in ipr)		.006	.012	.006	.012
					Material Grp.	Cutting Speeds vc ft/min (vc for T = 15 minutes)				
	Aluminum alloys wrought			60-100	21-22		1600	1300	1300	1100
Cast aluminum alloys			75-130	23-25		2000	1500	1800	1400	
Copper & copper alloys			90-110	26-28		1800	1600	1625	1450	
Non metallic materials				29-30		1200	900	975	870	

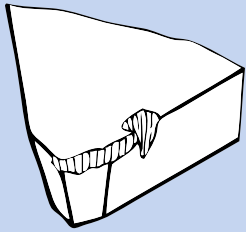
S	Work MaterialCondition			Hardness HB	Grade	RM35D		AS15		TK10MP	
					FEED (in ipr)	.004	.008	.002	.006	.002	.004
					Material Grp.	Cutting Speeds vc ft/min (vc for T = 15 minutes)					
	High-temperature alloys, super alloys	Fe - based	annealed	180	31	150	90	250	130		
age hardened			280	32	100	70	220	95			
Ni - or Co - based		annealed	250	33	120	90	250	150			
		age hardened	350	34	70	40	95	65			
		cast	320	35	100	70	160	195			
Titanium, Ti alloys	pure titanium	annealed		36			300	150	120	100	
	alpha+beta	alloys age hardened		37			250	130	115	100	



Flank Wear

General criteria for end of tool life, characterized by an admissible amount of flank wear. Figures usually relate to a tool life of $T = 15$ min.

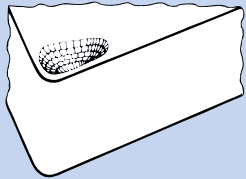
- Remedy:**
- select more wear resistant grade
 - reduce cutting speed



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!

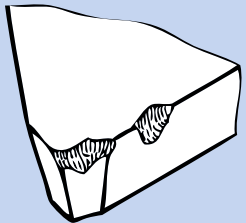
- Remedy:**
- strengthen cutting edge
 - select smaller approach angle (45°)
 - reduce feed



Crater Wear

Wear on the rake face, primarily characterized by crater depth. Not a tool-life criterion with modern coated carbide Inserts and positive chipbreaker geometries.

- Remedy:**
- use coated carbide grades
 - select positive Insert geometries
 - reduce cutting speed

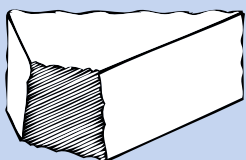


Edge Chipping

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

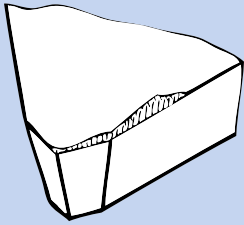
- Damage Caused by Chip Impact:**
- varying feed
 - change chipbreaker geometry
 - change approach angle



Insert breakage

Insert breakage usually means damage to tool and workpiece. Causes are varied and depend on machine and workpiece. Often originates in notches or excessive wear.

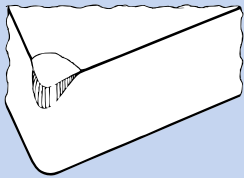
- Remedy:**
- select tougher grade
 - use Insert with stronger cutting edge geometry
 - select chipbreaker geometry for heavier chip sections
 - reduce feed and possibly also depth of cut



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.

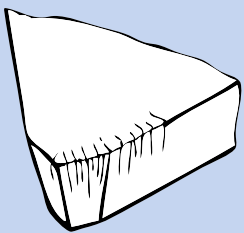
- Remedy:**
- increase cutting speed
 - use coated carbides or cermets
 - select positive cutting edge geometry
 - use cutting fluid



Plastic Deformation

Caused by overloading of the cutting edge combined with high machining temperatures. Danger of breakage!

- Remedy:**
- reduce cutting speed
 - lower feed
 - use a more wear-resistant carbide grade

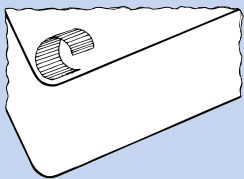


Thermal Cracks

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
 - use compressed air to remove chips in slot milling



Chip Control

Effective chip control is essential for trouble-free operation. Key factors are work material, feed, and depth of cut. Too-short chips result in vibrations and cutting edge overloading. Danger of breakage!

- Remedy:**
- avoid too small depths of cut below 1x radius, except in finishing
 - if chips too long: select chipbreaker geometry for smaller chip sections or increase feed
 - if chips too short: select chipbreaker geometry for larger chip section or reduce feed
 - when form turning shoulders, check sequence of operations

Surface Finish

Surface roughness is a tool-life criteria often applied in finishing operations. It is affected by the configuration and condition of the cutting point, the cutting conditions, and the rigidity of the machining setup.

- Remedy:**
- increase cutting speed
 - reduce feed
 - avoid vibrations
 - increase radius
 - use cutting fluid

Chatter Marks

Chatter marks or surface damage due to unfavorable chip flow call for special measures.

- Remedy:**
- vary feed slightly
 - select different chipbreaker geometry
 - change approach angle
 - check rigidity of tool and holding system

Shape & Dimensional Accuracy

Shape and dimensional accuracy are affected by the condition of the overall machine-part-tool setup.

- Remedy:**
- select grade with adequate wear resistance
 - keep cutting forces low
 - check cutting parameters, including machining allowance
 - avoid unbalance
 - check rigidity of tool and work holding

Vibrations, Instability

Vibrations in the workpiece usually occur with thin-walled parts and non-rigid setups. Unbalance and excessive cutting forces also cause problems.

- Remedy:**
- select larger approach angle for the tool
 - change turning frequency (rpm)
 - use positive geometries
 - reduce chip cross section
 - use smaller radii

Burring

Burring cannot always be avoided when cutting steel workpieces. Chamfering operations should therefore be planned where possible.

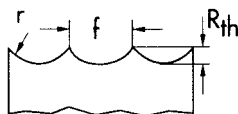
- Remedy:**
- select Inserts with positive geometry
 - reduce approach angle
 - use sharpest possible cutting edges, e.g., cermets
 - check sequence of operations

Finishing

In finish turning exacting demands are placed on surface finish and part accuracy.

To determine approximately the surface finish to be expected in turning with feeds > .004", the following formula for theoretical roughness height R_{th} can be used:

$$R_{th} \approx \frac{125000 \times f^2}{r} \text{ [} \mu\text{in] }$$



Radius	Theoretical roughness height R_{th} for feed f :					
	.004	.005	.006	.008	.010	.013
.016	125	200	300	500	800	---
.031	63	100	150	250	400	700
.047	---	63	100	175	250	450
.063	---	---	75	125	200	350

If the theoretical roughness height R_{th} is assumed to be roughly equal to R_z , the ten-point height (ISO), the roughness average R_a can be inferred, which however does not show a fixed relationship to R_z . A conversion ratio of $R_z : R_a \sim 4 : 1$ is generally appropriate.

Approximate reference values for the ratio R_z to R_a

$R_z \mu\text{in}$	63	100	160	250	400	640	1000
$R_a \mu\text{in}$	16	24	40	63	100	160	250

Note:

Good surfaces are achieved with:

- higher cutting speeds
- Inserts with sharp cutting edges
- positive rake angles and chipbreaker geometries
- use of cermets
- rigid machining setups
- use of easily machinable work materials
- use of cutting fluid

Surface characteristics in the inch system (μin)

AA - arithmetic average $\triangleq R_a$

CLA - centerline average $\triangleq R_a$

RMS - root mean square $\triangleq 1.1 \times AA$

1 $\mu\text{in} = 0.025 \mu\text{m}$

1 $\mu\text{m} = 40 \mu\text{in}$