

Tungaloy

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Keeping the Customer First

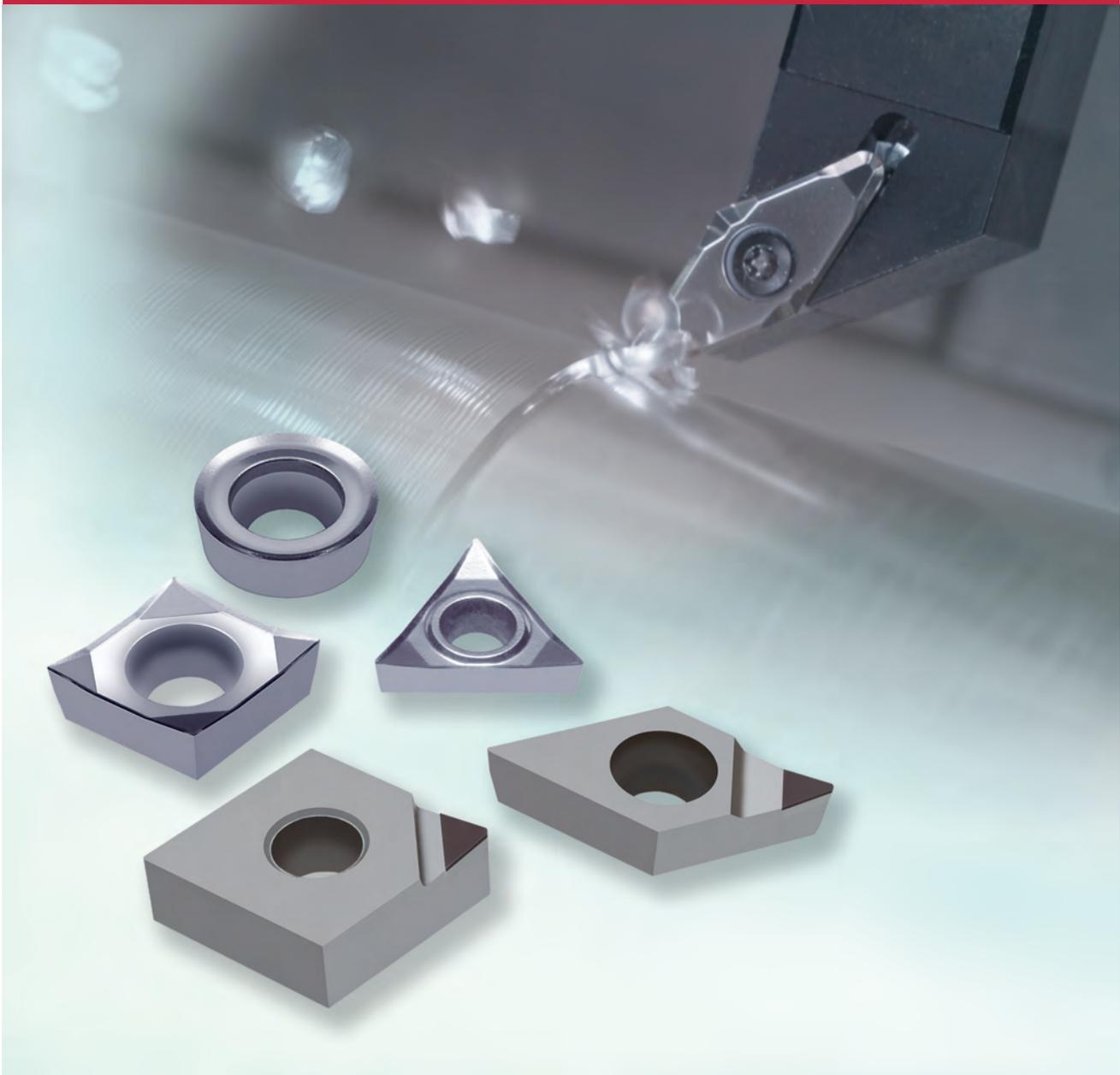
Tungaloy Report No.002-USA

May 2006
Revised: April 2009

TAC Inserts for Aluminum

AL Chipbreaker, T-DIA

Ultimate Solution for Machining Aluminum



Tungaloy America, Inc.

AL Chipbreaker for Aluminum

Chipbreaker for Aluminum Alloy and Non-Ferrous Metals



● Features



Polishing - *Reduce built up edge*

Improve built up edge resistance while cutting aluminum by polishing on entire rake face of inserts

● Machining Time: 5 minutes

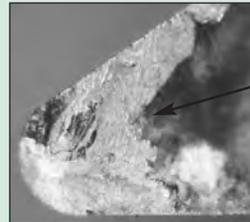
● Example (Built up edge)

AL Type Chipbreaker

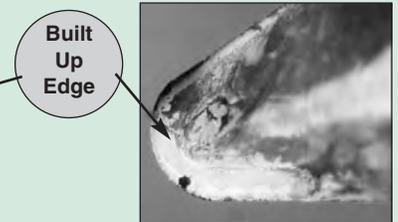
Significantly Reduces Built Up Edge

Cutting Conditions

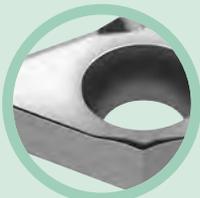
Workpiece	AC4C (Si:6.5~7.5%)
Insert	VCGT160404-□□
Cutting speed	2625 sfm
D.O.C.	.039"
Feed rate	0.006 ipr
Wet or Dry	Wet



Competitor (without polishing)



AL Chipbreaker



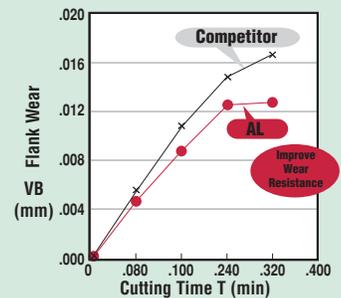
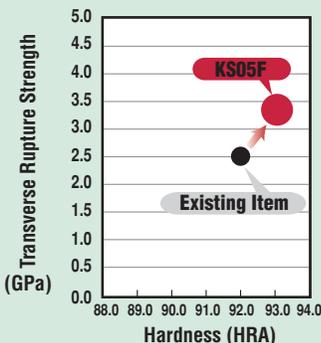
New Grade KS05F - *Improved Wear Resistance*

KS05F super micrograin carbide substrate makes superior wear resistance possible

● Wear Resistance

Cutting Conditions

Workpiece	AC4C (Si:6.5~7.5%)
Insert	RCGT0803M0-□□
Cutting speed	4920 sfm
D.O.C.	.078"
Feed rate	0.015 ipr
Wet or Dry	Wet





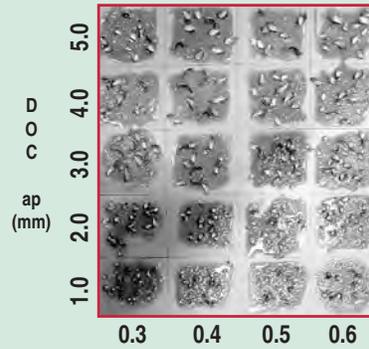
Deep Inclination - *Improve Chip Control*

Prevents chip clogging with deep inclination

- Chip Control (AC4C)
AL Chipbreaker
Prevent Chip Clogging

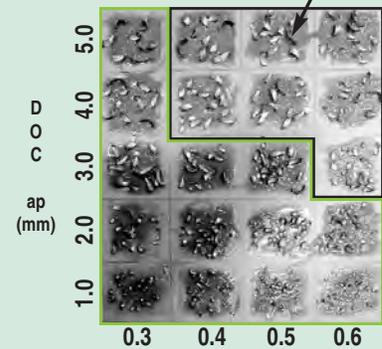
Cutting Conditions

Workpiece	AC4C (Si:6.5~7.5%)
Insert	VCGT 220520-□□
Cutting speed	4920 sfm
Wet or Dry	Wet

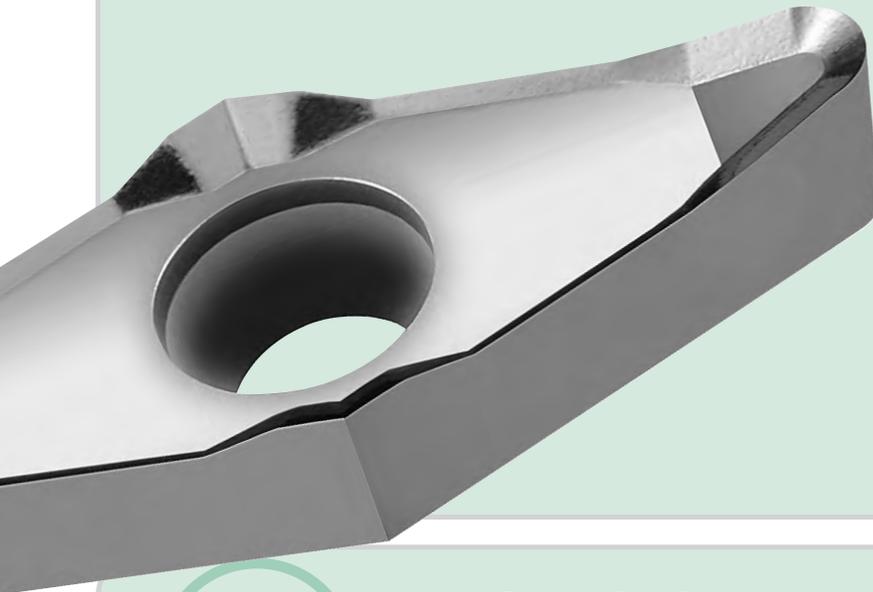


Feed Rate (mm/rev)
AL Chipbreaker

Shows Chip Clogging



Feed Rate (mm/rev)
Competitor (with Chipbreaker)



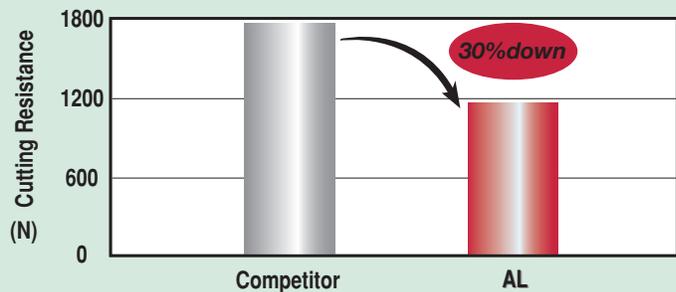
Large Rake Angle - *Reduce Cutting Resistance*

Reduce cutting force with large rake angle and sharp cutting edge

- Comparison of cutting resistance
Lower Cutting Resistance by 30%

Cutting Conditions

Workpiece	AC4C (Si:6.5~7.5%)
Insert	VCGT220520-□□
Cutting speed	2625 sfm
D.O.C.	.160"
Feed rate	0.016 ipr
Wet or Dry	Wet



● Standard Cutting Conditions

Workpiece	Cutting Speed (sfm)	DOC (inch)	Feed Rate (ipr)
Aluminum Alloy (less than 12% Si)	650~4920	.040~.120	.004~.024
Aluminum Alloy (13~17% Si)	650~1640	.020~.060	.004~.016
Copper and Brass	985~2625	.008~.060	.004~.024
Bronze	500~1310		

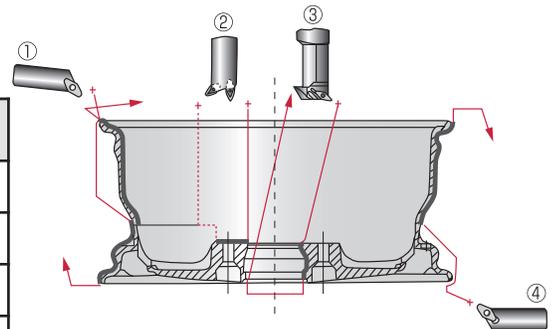
Note: Wet cutting recommended. Use water soluble cutting fluids. Recommended cutting conditions may vary depending on work material, surface treatment, machine condition, cutting speed, and corner radius of inserts.

● Examples - Aluminum Wheel Machining

● Example 1

Revolutions	n=1250 rpm (constant)
DOC	ap=.080"
Cutting Speed	Vc=820~4920 sfm

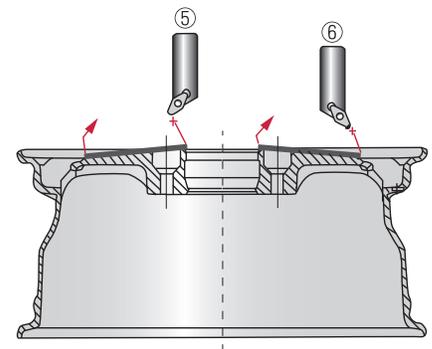
Number	Application	Toolholder Cat. No.	Insert Cat. No.	Feed (in/rev)
1	External Turning	SVHCR2525M22	VCGT220530-AL (KS05F)	.024
2	Facing Internal Turning	Special Toolholder	VCGT220530-AL (KS05F)	.024
3	Internal Turning	Special Toolholder	VCGT220530-AL (KS05F) DCGT11T308-AL (KS05F)	.012
4	Facing External Turning	SVHCL2525M22	VCGT220530-AL (KS05F)	.024



● Example 2

Revolutions	n=1250 rpm (constant)
DOC	ap=.040"
Cutting Speed	Vc=985~4000 sfm

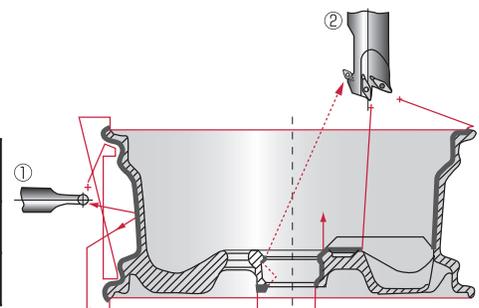
Number	Application	Toolholder Cat. No.	Insert Cat. No.	Feed (in/rev)
1	Facing (Roughing)	SVHCR2525M22	VCGT220530-AL (KS05F)	.024
2	Facing (Finishing)	SVHCR2525M22	VCGW220530-DIA (DX140)	.006



● Example 3

Revolutions	n=1800 rpm (constant)
DOC	ap=.080"
Cutting Speed	Vc=1050~4920 sfm

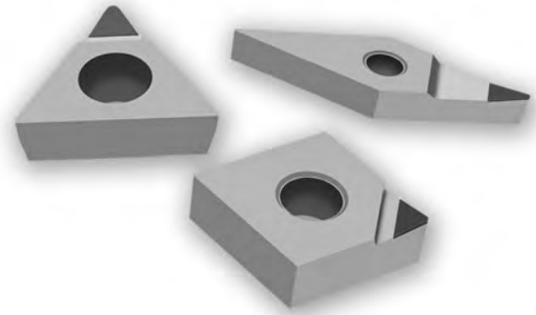
Number	Application	Toolholder Cat. No.	Insert Cat. No.	Feed (in/rev)
1	External turning	SRDCN2525M06	RCGT0602M0-AL	.018
2	Facing Internal turning	Special Toolholder	VCGT160412-AL DCGT070204-AL	.008~.012



● AL - Positive Inserts

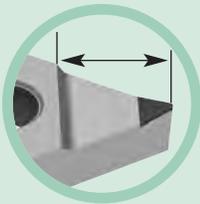
Shape	Inserts	Catalog No. (inch)	Catalog No. (Metric)	Stock KS05F	Dimensions			
					ϕd	s	$\phi d1$	r_c
		CCGT21.50-AL	CCGT060202-AL	●	0.250	0.093	0.110	0.008
		CCGT21.51-AL	CCGT060204-AL	●				0.016
		CCGT32.50-AL	CCGT09T302-AL	●	0.375	0.156	0.173	0.008
		CCGT32.51-AL	CCGT09T304-AL	●				0.016
		CCGT32.52-AL	CCGT09T308-AL	●				0.031
		CCGT430.5-AL	CCGT120402-AL	●	0.500	0.187	0.216	0.008
		CCGT431-AL	CCGT120404-AL	●				0.016
		CCGT432-AL	CCGT120408-AL	●				0.031
		DCGT21.50.5-AL	DCGT070202-AL	●	0.250	0.093	0.110	0.008
		DCGT21.51-AL	DCGT070204-AL	●				0.016
		DCGT32.50.5-AL	DCGT11T302-AL	●	0.375	0.156	0.173	0.008
		DCGT32.51-AL	DCGT11T304-AL	●				0.016
		DCGT32.52-AL	DCGT11T308-AL	●				0.031
			RCGT0602M0-AL	○	0.236	0.125	0.110	-
			RCGT0803M0-AL	●	0.315		0.134	-
			RCGT1003M0-AL	●	0.393		0.157	-
		TCGT21.50.5-AL	TCGT110202-AL	●	0.250	0.093	0.110	0.008
		TCGT21.51-AL	TCGT110204-AL	●				0.016
		TCGT32.50.5-AL	TCGT16T302-AL	●	0.375	0.156	0.173	0.008
		TCGT32.51-AL	TCGT16T304-AL	●				0.016
		TCGT32.52-AL	TCGT16T308-AL	●				0.031
		VCGT331-AL	VCGT160404-AL	●	0.375	0.187	0.173	0.016
		VCGT332-AL	VCGT160408-AL	●				0.031
		VCGT333-AL	VCGT160412-AL	●	0.500	0.218	0.216	0.047
		VCGT43.56-AL	VCGT220520-AL	○				0.078
		VCGT43.58-AL	VCGT220530-AL	○				0.118

T-DIA TAC Inserts



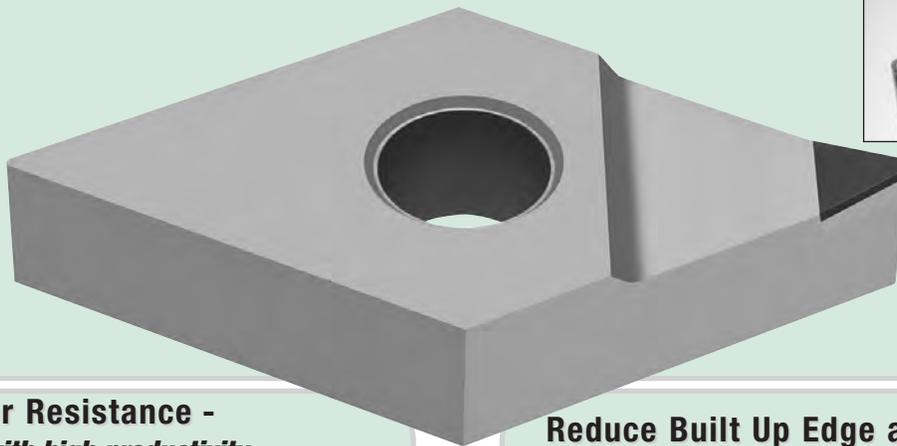
New T-DIA TAC Inserts with Chipbreaker

● Features



Wider Chipbreaker with Sharp Cutting Face - Improved Sharpness

Better chip flow by applying wider chipbreaker for copying



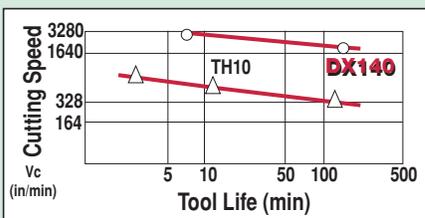
Competitor

Excellent Wear Resistance - Longer tool life with high productivity and cost reduction

● Wear Resistance

Cutting Conditions

Workpiece	Aluminum Alloy (Si: 18%)
Toolholder	CSBPR2525M4
Insert	SPGN120308-DIA
Cutting speed	4920 sfm
D.O.C.	.078"
Feed rate	0.015 IPR
Wet or Dry	Dry



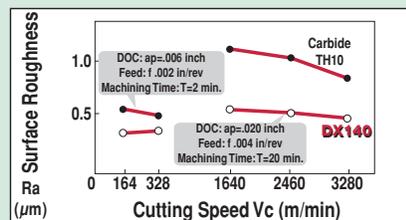
Reduce Built Up Edge and Chattering - Longer tool life and superior quality

● Surface Roughness

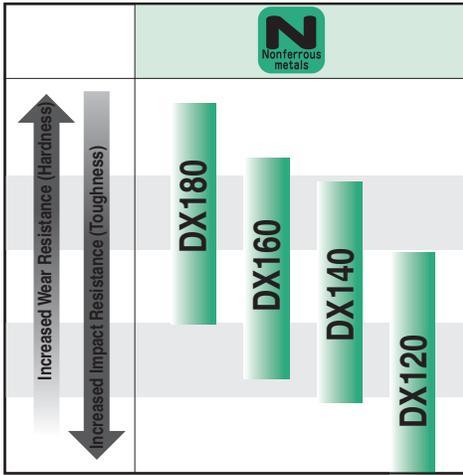
Cutting Conditions

Workpiece	Aluminum Alloy (Si: 10%)
Toolholder	CSBPR2525M4
Insert	SPGN120308-DIA

DX140 produces less built up edge than carbide TH10, which results in a superior surface finish.

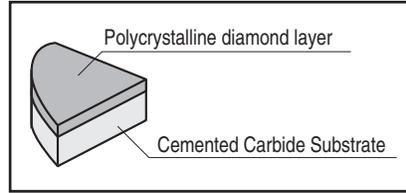


● Features of Grades



This grade is an advanced diamond-based tool material, that is, microcrystals of diamond. They are tightly sintered on cemented carbide alloy base by super high-pressure and temperature process. When compared with the single-crystal diamond, hardness is slightly lower, but PCD is uniform in structure. Additionally, cleavage fracture, stress and wear resistance of single-crystal diamond are the same among different crystal quality and orientation. Therefore, PCD is optimum for cutting of non-ferrous and non-metal materials.

● Structure of T-DIA

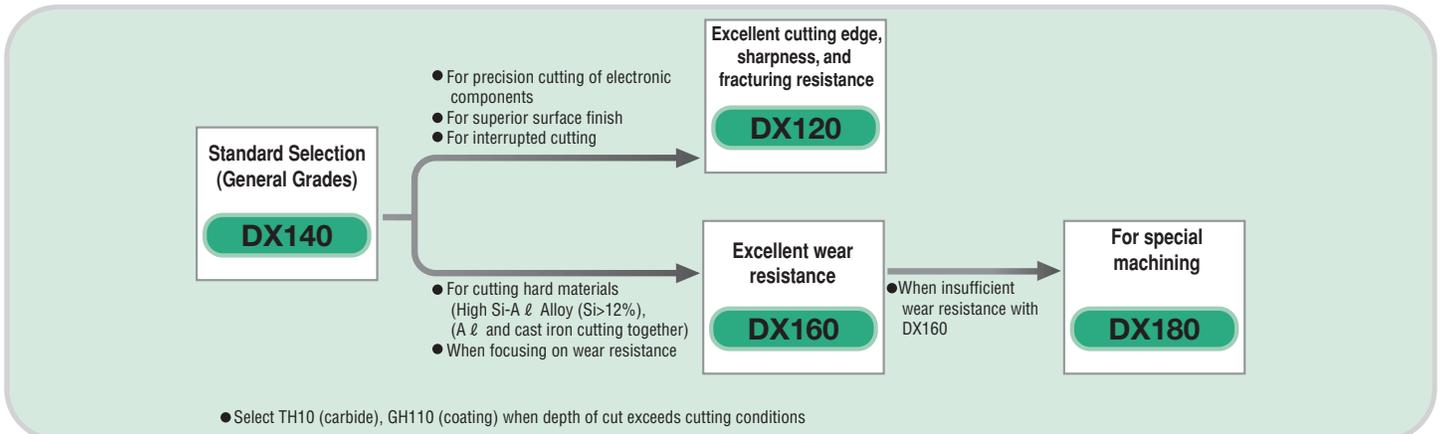


● Comparison of Hardness

Tool Material	Knoop Hardness (HK)
T-DIA	6,000 ~ 9,000
Natural Diamond	8,000 ~ 12,000

Application	Grade	Microstructure	Diamond Content (vol%)	Grain Size (mm)	Hardness (Hv)	Strength Transverse (GPa)	Features
	DX120		88.0	4.5	9,000	1.8	For precision machining of non-ferrous metals and non-metals that require high quality surface finish. Features the finest grain structure among T-DIA series and excels in grindability and cutting edge sharpness.
	DX140		91.0	12.5	10,000	1.7	For machining of non-ferrous metals and non-metals. Composed of medium and fine grained diamond. Provides moderate wear resistance and grindability.
	DX160		94.0	28	11,000	1.6	For machining half-sintered ceramics and cemented carbides, stones, and non-ferrous metals. Mixed sintered compact of coarse and fine-grained diamond. Superior grindability to DX180.
	DX180		96.5	45	12,000	1.5	For turning half-sintered ceramics and cemented carbides. Features the highest purity and large grained PCD with excellent wear resistance.

● Standard of Grade Selection



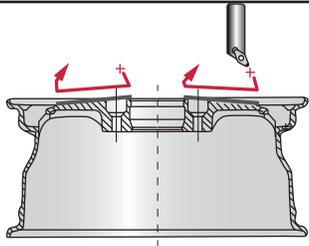
● Standard Cutting Conditions

Work Material	Operation	Cutting Speed	D.O.C. ap (inch)	Feed (ipr)	Grades			
					DX120	DX140	DX160	DX180
Aluminum Alloys (Si<12%)	Finishing	3280~8200	.002~.040	~.008	○	◎		
Aluminum Alloys (Si>13%)		1310~2625				○	◎	○
Copper, Brass		1640~4920				○	◎	
Phosphorous Bronze		980~1640				○	◎	
Carbon		1640~3280	.002~.020	~.004	◎	○		
Fiber, Reinforced Plastic(FRP)								
Plastic, Carbide Alloy, Ceramics					◎	○		
Carbide Alloy		30~60	.002~.008	~.002		○	○	◎
Ceramics (Quenched)		325~500					○	◎

◎: 1st Choice ○: 2nd Choice

● Examples

● Cutting Aluminum Wheel

	Workpiece	Toolholder	SVHCR2525M22	
		Inserts	VCGW220530-DIA (DX140)	
	Cutting Conditions	Workpiece	Al Alloy	
		Cutting Speed	Vc = 980~4000 sfm	
		Feed	f = .006 ipr	
		D.O.C.	ap = .040"	
		Wet/Dry	Wet	
Results: Excellent Surface Finish. Provides High Feed, High Precision Cutting without Chipping				

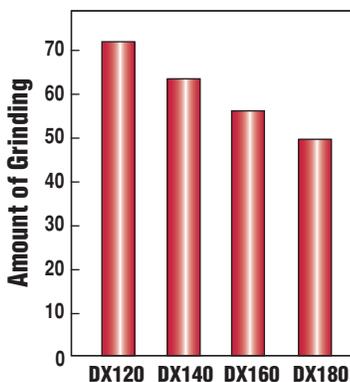
● Regrinding Method

Grade	DX160, DX140, DX120
Grinding Wheel	Diamond
Wheel Bond	Vitrified Bond
Grain Size Concentration	#400~#600 - Roughing
	Finer than #1000 - Finishing
Grinding Conditions	900~1200 m/min.
Grinding Speed	30~60 min ⁻¹

● Notes

- Generally it does not require pre-honing
- Caution for grinding:
 1. Provide sufficient grinding fluid
 2. Keep dressing in order to not clog or scramble
- Pay attention to strength and run out toward the spindle of the grinding machine, while dressing as well as to the grinding wheel, since the cutting edge sharpness has significant influence on surface roughness and tool life.

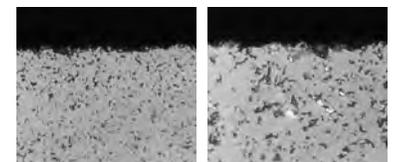
● Comparison of Grindability



The finer grain size provides a better cutting edge for sharpness and grindability. Produces excellent surface finish with less burr.

Grinding Machine	Grinding Machine for Diamond Tool
Grinding Wheel	Vitrified bonded, cup shaped diamond wheel
Work Material	T-DIA, 4 grade, grinding area, 64mm ²
# of Revolutions of Grinding Wheel	1600 minutes ⁻¹
Grinding Time	6 minutes

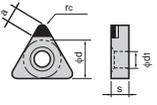
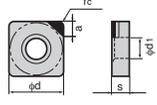
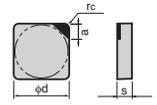
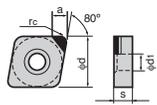
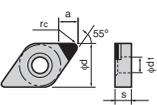
- Comparison of cutting edge sharpness of fine grained and coarse grained grades (Magnified 600 times)



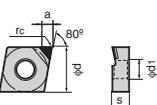
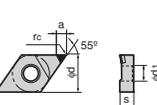
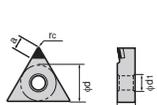
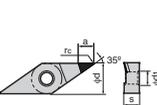
DX120

DX140

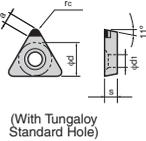
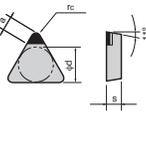
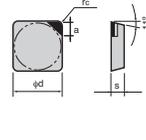
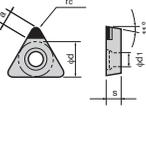
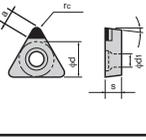
● Negative Inserts - TAC-T-DIA Turning (PCD)

Shape	Catalog No. (inch)	Catalog No. (Metric)	Stock			Dimensions					Applicable Toolholder
			Sharpenability		Wear Resistance	φd	s	φd ₁	r _c	a	
			DX120	DX140	DX160						
	TNGA321-DIA	TNGA160304-DIA				.375	.125	.150	.016	.125	A, D, P, M, E, W
	TNGA322-DIA	TNGA160308-DIA							.031	.115	
	TNGA331-DIA	TNGA160404-DIA	○	○			.187		.016	.125	
	TNGA332-DIA	TNGA160408-DIA	○	○					.031	.115	
	SNGA431-DIA	SNGA120404-DIA		○	○	.500	.187	.203	.016	.142	A, D, P, M, E
	SNGA432-DIA	SNGA120408-DIA		○	○				.031		
	SNGN322-DIA	SNGN090308-DIA				.375	.125	-	.031	.142	C
	SNGN432-DIA	SNGN120408-DIA		○		.500	.187				
	CNGA431-DIA	CNGA120404-DIA		●		.500	.187	.203	.016	.138	A, D, P, M
	CNGA432-DIA	CNGA120408-DIA		●					.031	.134	
	DNGA431-DIA	DNGA150404-DIA		●	○	.500	.187	.203	.016	.122	A, D, P, M
	DNGA432-DIA	DNGA150408-DIA		●					.031	.110	

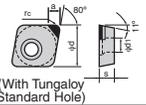
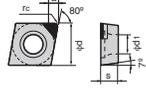
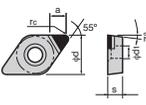
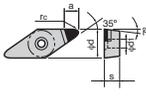
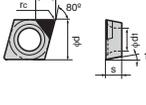
● Negative Inserts - with Chipbreaker

Shape	Catalog No. (inch)	Catalog No. (Metric)	Stock			Dimensions					Applicable Toolholder
			Sharpenability		Wear Resistance	φd	s	φd ₁	r _c	a	
			DX120	DX140	DX160						
	CNMM430.5-DIA	CNMM120402-DIA	○			.500	.187	.203	.008	.138	A, D, P, M
	CNMM431-DIA	CNMM120404-DIA	○						.016		
	DNMM430.5-DIA	DNMM150402-DIA	○			.500	.187	.203	.008	.130	A, D, P, M, E, W
	DNMM431-DIA	DNMM150404-DIA	○						.016	.122	
	TNMM330.5-DIA	TNMM160402-DIA	○			.375	.187	.150	.008	.130	A, D, P, M
	TNMM331-DIA	TNMM160404-DIA	○						.016	.126	
	VNMM330.5-DIA	VNMM160402-DIA	○			.375	.187	.150	.008	.189	M
	VNMM331-DIA	VNMM160404-DIA	○						.016	.173	
	VNMM332-DIA	VNMM160408-DIA	○						.031	.141	

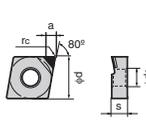
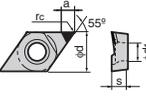
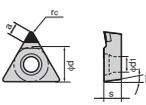
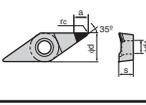
● Positive Inserts

Shape	Catalog No. (inch)	Catalog No. (Metric)	Stock			Dimensions					Applicable Toolholder		
			Sharpenability		Wear Resistance	φd	s	φd ₁	r _c	a			
			DX120	DX140	DX160								
 <p>(With Tungsten Standard Hole)</p>	TPGA730.5-DIA	TPGA090202-DIA		○		.218	.093	.125	.008	.094	-		
	TPGA731-DIA	TPGA090204-DIA		○						.016		.086	
	TPGA21.50.5-DIA	TPGA110202-DIA		○		.250				.008		.094	
	TPGA21.51-DIA	TPGA110204-DIA		○				.016	.086				
	TPGA220.5-DIA	TPGA110302-DIA		○		.250	.125	.118	.008	.094			
	TPGA221-DIA	TPGA110304-DIA		○					.016	.086			
	TPGA222-DIA	TPGA110308-DIA		○					.031	.078			
	TPGA320.5-DIA	TPGA160302-DIA		○		.375	.125	.157	.008	.130			
	TPGA321-DIA	TPGA160304-DIA		○					.016	.125			
	TPGA322-DIA	TPGA160308-DIA		○					.031	.114			
	TPGN731-DIA	TPGN090204-DIA		○		.218	.093	-	.016	.086	C Type Boring Bar		
	TPGN732-DIA	TPGN090208-DIA								.031		.078	
	TPGN220-DIA	TPGN110301-DIA				.250			.125	-		.004	.133
	TPGN220.5-DIA	TPGN110302-DIA					.008	.130					
	TPGN221-DIA	TPGN110304-DIA	○	●			.016	.125					
	TPGN222-DIA	TPGN110308-DIA		●				.031	.114				
	TPGN320-DIA	TPGN160301-DIA				.375	.125	-	.004	.113		C Type Boring Bar	
	TPGN320.5-DIA	TPGN160302-DIA		○					.008	.130			
	TPGN321-DIA	TPGN160304-DIA	○	●	○				.016	.125			
	TPGN322-DIA	TPGN160308-DIA		●				.031	.114				
TPGN323-DIA	TPGN160312-DIA						.047	.102					
	SPGN320.5-DIA	SPGN090302-DIA				.375	.125	-	.008	.141	C Type Boring Bar		
	SPGN321-DIA	SPGN090304-DIA		●	○				.016				
	SPGN322-DIA	SPGN090308-DIA		●					.031				
	SPGN420.5-DIA	SPGN120302-DIA		○		.500	.125	-	.008				
	SPGN421-DIA	SPGN120304-DIA		●	○				.016				
	SPGN422-DIA	SPGN120308-DIA		●	○				.031				
	SPGN423-DIA	SPGN120312-DIA							.047				
		TPGW080202-DIA		○		.187	.093	.090	.008	.094	S Type Boring Bar		
		TPGW080204-DIA		●					.016	.090			
	TPGW730.5-DIA	TPGW090202-DIA	○	○		.218		.098	.098	.008		.094	
	TPGW731-DIA	TPGW090204-DIA		●						.016		.086	
	TPGW21.50.5-DIA	TPGW110202-DIA	○	○		.250		.110	.110	.008		.094	
	TPGW21.51-DIA	TPGW110204-DIA		●						.016		.086	
	TPGW2.520.5-DIA	TPGW130302-DIA	○	○		.312		.125	.133	.008		.130	
	TPGW2.521-DIA	TPGW130304-DIA		○	○					.016		.125	
	TPGW32.50.5-DIA	TPGW16T302-DIA		○		.375		.156	.173	.008		.130	
	TPGW32.51-DIA	TPGW16T304-DIA		●						.016		.125	
TPGW32.52-DIA	TPGW16T308-DIA		●		.031		.114						
	TCGW21.50.5-DIA	TCGW110202-DIA				.250	.093	.110	.008	.094	S Type Boring Bar		
	TCGW21.51-DIA	TCGW110204-DIA							.016	.086			
	TCGW32.50.5-DIA	TCGW16T302-DIA				.375			.156	.173		.008	.130
	TCGW32.51-DIA	TCGW16T304-DIA										.016	.125
	TCGW32.52-DIA	TCGW16T308-DIA										.031	.114

● Positive Inserts

Shape	Catalog No. (inch)	Catalog No. (Metric)	Stock			Dimensions					Applicable Toolholder
			Sharpenability		Wear Resistance	φd	s	φd ₁	r _c	a	
			DX120	DX140							
 (With Tungaloy Standard Hole)		CPGA090202-DIA		○		.375	.093	.110	.008	.094	S Type Boring Bar
		CPGA090204-DIA		○					.016		
	CCGW21.5V-DIA	CCGW060200-DIA		○		.250	.093	.110	.001	.094	S Type Boring Bar
	CCGW21.50.5-DIA	CCGW060202-DIA		○					.008		
	CCGW21.51-DIA	CCGW060204-DIA		●		.016					
	CCGW32.50.5-DIA	CCGW09T302-DIA		○		.008					
	CCGW32.51-DIA	CCGW09T304-DIA		●	○	.016					
	CCGW32.52-DIA	CCGW09T308-DIA		●	○	.031					
	DCGW21.5V-DIA	DCGW070200-DIA		○		.250	.093	.110	.001	.094	S Type Boring Bar
	DCGW21.50.5-DIA	DCGW070202-DIA	○	○					.008	.090	
	DCGW21.51-DIA	DCGW070204-DIA		●		.016	.082				
	DCGW32.50.5-DIA	DCGW11T302-DIA		○		.008	.125				
	DCGW32.51-DIA	DCGW11T304-DIA		●		.016	.118				
	DCGW32.52-DIA	DCGW11T308-DIA		●		.031	.106				
	VCGW330.5-DIA	VCGW160402-DIA		○		.375	.186	.173	.008	.188	S Type Boring Bar
	VCGW331-DIA	VCGW160404-DIA		○					.016	.173	
	VCGW332-DIA	VCGW160408-DIA				.031	.141				
	VCGW333-DIA	VCGW160412-DIA				.047	.106				
	VCGW43.58-DIA	VCGW220530-DIA				.118	.196				
		EPGW040102-DIA		○		.156	.062	.090	.008	.078	S and TAC Type Boring Bar, Round Shank, Top Borer Tools
		EPGW040104-DIA		○					.016	.074	

● Positive Inserts - with Chipbreakers

Shape	Catalog No. (inch)	Catalog No. (Metric)	Stock			Dimensions					Applicable Toolholder
			Sharpenability		Wear Resistance	φd	s	φd ₁	r _c	a	
			DX120	DX140							
	CCMT21.50.5-DIA	CCMT060202-DIA	○			.250	.093	.110	.008	.094	S Type Boring Bar
	CCMT21.51-DIA	CCMT060204-DIA	○						.016		
	CCMT32.50.5-DIA	CCMT09T302-DIA	○			.008					
	CCMT32.51-DIA	CCMT09T304-DIA	○			.016					
	DCMT21.50.5-DIA	DCMT070202-DIA	○			.250	.093	.110	.008	.090	S Type Boring Bar
	DCMT21.51-DIA	DCMT070204-DIA	○						.016	.082	
	DCMT32.50.5-DIA	DCMT11T302-DIA	○			.008	.125				
	DCMT32.51-DIA	DCMT11T304-DIA	○			.016	.118				
	TCMT630.5-DIA	TCMT080202-DIA	○			.187	.093	.090	.008	.086	-
	TCMT631-DIA	TCMT080204-DIA	○						.016	.078	
	TCMT21.50.5-DIA	TCMT110202-DIA	○			.250	.110	.110	.008	.094	
	TCMT21.51-DIA	TCMT110204-DIA	○						.016	.090	
	TCMT220.5-DIA	TCMT110302-DIA	○			.125	.110	.110	.008	.094	
	TCMT221-DIA	TCMT110304-DIA	○						.016	.090	
	VCMT330.5-DIA	VCMT160402-DIA	○			.375	.187	.173	.008	.188	S Type Boring Bar
	VCMT331-DIA	VCMT160404-DIA	○						.016	.173	

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