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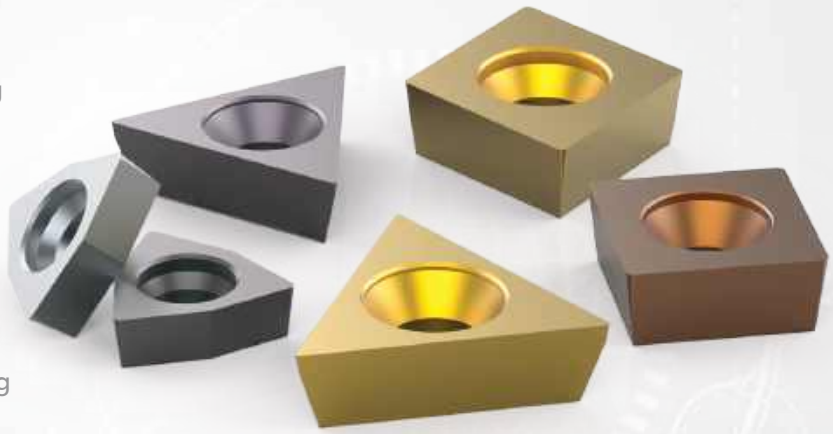


Wohlhaupter®

▶ *BORING*

Inserts

WOHLHAUPTER®

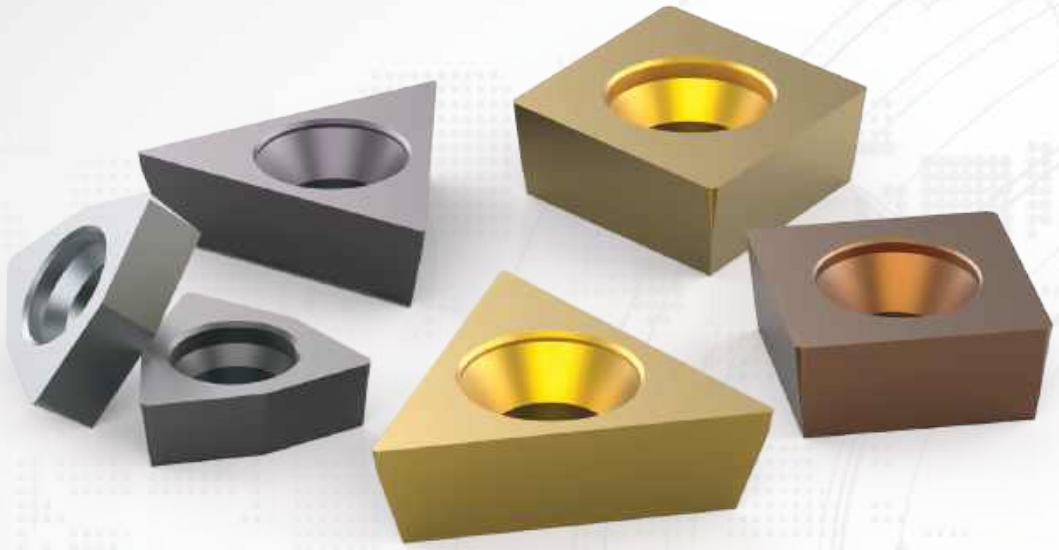
SECTION

B10-H

Inserts

Wohlhaupter® Inserts

Replaceable Boring Inserts



Cutting-Edge Technology

Wohlhaupter has the cutting-edge technology to achieve all of your boring applications. With precision in mind, our inserts are available in multiple insert geometries, coatings, and nose radii. Wohlhaupter inserts are offered in uncoated and coated carbide, cermet, and CBN and PCD materials.

Try our easy-to-use boring insert selector available online or to download from the app store to find the perfect inserts for your boring applications.
www.alliedmachine.com/bis

Applicable Industries

Aerospace | Agriculture | Automotive | Firearms | General Machining | Oil & Gas | Renewable Energy

Your safety and the safety of others is very important. This catalog contains important safety messages. Always read and follow all safety precautions.

This triangle is a safety hazard symbol. It alerts you to potential safety hazards that can cause tool failure and serious injury.

When you see this symbol in the catalog, look for a related safety message that may be near this triangle or referred to in the nearby text.

There are safety signal words also used in the catalog. Safety messages follow these words.

⚠ WARNING

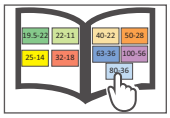
WARNING (shown above) means that failure to follow the precautions in this message could result in tool failure and serious injury.

NOTICE means that failure to follow the precautions in this message could result in damage to the tool or machine but not result in personal injury.

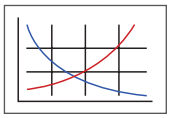
NOTE and **IMPORTANT** are also used. These are important that you read and follow but are not safety-related.

Visit www.alliedmachine.com for the most up-to-date information and procedures.

Reference Icons
The following icons will appear throughout the catalog to help you navigate between products.



MVS Connection Color Guide
Detailed instructions and information regarding the MVS connection(s)



Recommended Cutting Data
Speed and feed recommendations for optimum and safe boring

Wohlhaupter® Inserts Table of Contents

Wohlhaupter Insert Product Nomenclature

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼	Universal - Main Application
▽▽	Universal - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
○	Good - Extended Application
◕	Average - Main Application
◔	Average - Extended Application
✱	Difficult - Main Application
✲	Difficult - Extended Application

Reference Key

Symbol	Wohlhaupter Insert Grades
WHW	Uncoated carbide (HW)
WHC	Coated carbide (HC)
WHT	Uncoated cermet (HT)
WTC	Coated cermet (HC)
WCN	Ceramic cutting material (CN)
WBN	Cubic boron nitride CBN (BN)
WBC	Coated CBN (BC)
PCD	Polycrystalline diamond PCD (DP)

Wohlhaupter Inserts

F101	04	M	N	–	158	W	D
1	2	3	4		5	6	7

1. Wohlhaupter Insert Form

211	**262**
20	**264**
161	**112**
163	**113**
47	**114**
101	**04**
103	**05**
104	**89**
105	**90**
123	**91**
124	**304**
39	**325**
75	

2. Corner Radius

Metric (mm)

005 = 0.05 mm
01 = 0.10 mm
02 = 0.20 mm
03 = 0.30 mm
04 = 0.40 mm
06 = 0.60 mm
08 = 0.80 mm
12 = 1.20 mm
16 = 1.60 mm
20 = 2.00 mm
24 = 2.40 mm

3. Tolerance Group

	Metric (mm)	
G	Length of edge	±0.025
	IC	±0.025
	Thickness	±0.13
M	Length of edge	±0.08-0.15*
	IC	±0.05-0.10*
	Thickness	±0.13
F	Length of edge	±0.013
	IC	±0.005
	Thickness	±0.025
C	Length of edge	±0.13
	IC	±0.025
	Thickness	±0.025

*Varies upon insert size

4. Machining Direction

N = Neutral
L = Left
R = Right

5. Geometry

Carbide	Carbide	Tangential	Ceramic	PCD	CBN
108	**155**	**880**	**711**	**530**	**538**
109	**158**	**811**		**720**	**741**
112	**161**			**730**	**742**
114	**161**			**735**	**745**
117	**174W**				**747**
121	**192**				**748**
122	**199**				**749**
126	**200**				**768**
127	**650**				
128	**711**				
129	**840**				
145	**850**				
	860				

6./7. Optional Information

W = Wiper Geometry
D = Double Tipped
T = Triple Tipped

ISO Insert Nomenclature

DIN ISO 1832

C	C	M	T	09	T3	02
1	2	3	4	5	6	7

1. Basic Insert Form

- **C** = Rhomboid 80°
- **D** = Rhomboid 55°
- **L** = Rectangular
- **R** = Round
- **S** = Square
- **T** = Triangular
- **V** = Rhomboid 35°
- **W** = Trigon

2. Clearance Angle

- **B** = 5°
- **C** = 7°
- **N** = 0°
- **P** = 11°
- **O** = 10°

3. Tolerance Group

	Metric (mm)	
G	Length of edge	±0.025
	IC	±0.025
	Thickness	±0.13
M	Length of edge	±0.08-0.15*
	IC	±0.05-0.10*
	Thickness	±0.13
F	Length of edge	±0.013
	IC	±0.005
	Thickness	±0.025
C	Length of edge	±0.13
	IC	±0.025
	Thickness	±0.025

*Varies upon insert size

4. Mounting Style

T = One-sided countersunk	Cylindrical fixing hole Countersunk 40° - 60°
H = One-sided chipbreaker	Cylindrical fixing hole Countersunk 70° - 90°
W = Without chipbreaker	Cylindrical fixing hole Countersunk 40° - 60°
X = Special design	Special insert design
A = Without chipbreaker	Cylindrical fixing hole Without countersunk

5. Insert Size / Cutting Edge

Metric (mm)	C	D	R	S	T	V	W
3.97 mm					006		02
5.00 mm					F20		
6.00 mm					F21		
6.35 mm	06				11	11	
7.94 mm				07			
9.52 mm	09	11		09	16	16	
10.00 mm		10					
12.00 mm	12	12					
12.70 mm	16	15		12			
15.87 mm			15	15			
16.00 mm			16				
19.05 mm		19		19			
20.00 mm			20				
25.00 mm			25				
25.40 mm				25			

6. Insert Thickness

Metric (mm)

- **01** = 1.59 mm
- **02** = 2.38 mm
- **T2** = 2.78 mm
- **03** = 3.18 mm
- **T3** = 3.97 mm
- **04** = 4.76 mm
- **05** = 5.56 mm
- **06** = 6.35 mm
- **07** = 7.94 mm

7. Corner Radius

Metric (mm)

- **005** = 0.05 mm
- **01** = 0.10 mm
- **02** = 0.20 mm
- **03** = 0.30 mm
- **04** = 0.40 mm
- **06** = 0.60 mm
- **08** = 0.80 mm
- **12** = 1.20 mm
- **16** = 1.60 mm
- **20** = 2.00 mm
- **24** = 2.40 mm

Wohlhaupter Insert Grades

Uncoated Carbides

Uncoated Carbides

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
WHW01 (HW)	• Fine-grain carbide • Finishing and light roughing • Nonferrous metals, cast materials and difficult-to-machine alloys	P								
		M								
		K	■	■	■					
		N	■	■	■					
		S	■	■						
		H								
WHW16 (HW)	• Fine-grain carbide • Finishing and light roughing • Nonferrous metals, cast materials and difficult-to-machine alloys	P								
		M								
		K		■	■					
		N		■	■					
		S		■	■					
		H								
WHW20 (HW)	• Tough fine-grain carbide • Finishing, roughing and grooving • Steel and cast materials, cast steel • Nonferrous materials and difficult-to-machine alloys	P			■	■				
		M								
		K			■	■				
		N			■	■				
		S			■	■				
		H								

Wohlhaupter Insert Grades

Coated Carbides

Coated Carbides

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
WHC05 (HC)	• PVD coating with nano-composite structure • Finishing and roughing • Steels, stainless steels, cast materials, and difficult-to-machine alloys	P		■	■					
		M		■	■					
		K		■	■					
		N								
		S		■	■					
		H								
WHC18 (HC)	• PVD-TiB2 coating • Finishing and light roughing • Nonferrous metals	P								
		M								
		K								
		N		■	■	■				
		S								
		H								
WHC19 (HC)	• Newest generation multilayer PVD coating • Finishing and roughing • Extremely universal and the first choice for poor machining conditions • Excellent in cast steels, stainless steels, and super alloys	P				■	■	■	■	
		M				■	■	■		
		K					■	■	■	
		N								
		S				■	■	■		
		H								
WHC20 (HC)	• Multilayer CVD coating • Finishing • Steels and stainless steels	P		■	■	■				
		M		■	■					
		K								
		N								
		S								
		H								
WHC30 (HC)	• CVD coating • Roughing • Steel and cast steel	P					■	■		
		M				■	■			
		K					■	■		
		N								
		S								
		H								
WHC77 (HC)	• Fine-grained substrate with modified cobalt to increase strength • MT-CVD coating combines advantages of TiCN and Al_2O_3 • Versatile material designed for turning gray and ductile iron • Rough and finish machining • Medium to high cutting speeds • Continuous and light to medium interrupted cuts	P		■	■	■				
		M								
		K		■	■	■				
		N								
		S								
		H		■	■					
WHC79 (HC)	• Multilayer MT CVD coating • Roughing and finishing • Steels, stainless steels and cast materials	P				■	■	■		
		M			■	■	■			
		K			■	■	■			
		N								
		S								
		H								
WHC81 (HC)	• Thick MT CVD coating with adominal AL203 • High cutting speeds possible • Excellent choice for cast materials	P				■	■			
		M								
		K				■	■	■		
		N								
		S								
		H								
WHC88 (HC)	• Multilayer PVD coating • Finishing & roughing • Universal usage	P					■	■	■	
		M					■	■		
		K								
		N								
		S				■	■	■		
		H								

Wohlhaupter Insert Grades

Coated Carbides

Coated Carbides

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
WHC98 (HC)	• PVD TiAlN coating • Roughing & finishing • Steels, stainless steels & difficult-to-machine materials	P				■	■	■		
		M				■	■	■		
		K				■	■	■		
		N								
		S				■	■			
		H								
WHC111 (HC)	• PVD TiAlN coating • Finishing • Machining of steels after heat treating with high Cr content up to 60 HRC • Hard - soft transitions, difficult-to-machine alloys and stainless steels	P	■	■						
		M	■	■						
		K	■	■	■					
		N								
		S	■	■						
		H	■	■						
WHC114 (HC)	• Multilayer PVD coating • Finishing and roughing • Steels, stainless steels, and difficult-to-machine materials	P			■	■	■			
		M			■	■	■			
		K			■	■	■			
		N								
		S			■	■	■			
		H								
WHC136 (HC)	• Stronger PVD coating with improved coating adhesion • High oxidation resistance allows a wide range of applications	P			■	■	■			
		M			■	■	■			
		K				■	■			
		N								
		S			■	■	■			
		H								
WHC164 (HC)	• Thick MT-CVD coating with a dominant Al_2O_3 • Primarily developed for the material groups P, K, and H • Full and discontinuous cut • High cutting speeds and feeds possible	P				■	■	■		
		M								
		K				■	■	■		
		N								
		S								
		H		■	■					
WHC168 (HC)	• Multilayer MT CVD coating • Excellent combination of toughness and reliability • Steels, cast materials and alternatively for stainless steel	P				■	■	■		
		M				■	■			
		K				■	■	■		
		N								
		S								
		H								
WHC170 (HC)	• Multilayer MT CVD coating • Excellent toughness • First choice for strong interruptions • Cast materials and steel	P						■	■	■
		M					■	■	■	
		K						■	■	■
		N								
		S								
		H								
WHC198 (HC)	• Upgraded PVD grade with hard AlTiN coating • Optimized cutting edge stability • General machining of steel, stainless steel, high-temperature resistant alloys, titanium, iron, cast iron, and nonferrous materials	P				■	■	■		
		M				■	■			
		K				■	■	■		
		N				■	■	■	■	
		S				■	■			
		H								

Wohlhaupter Insert Grades

Uncoated Cermet | Coated Cermet

Uncoated Cermet

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
WHT10 (HT)	• Uncoated cermet • Finishing • Steels, stainless steels and cast materials	P								
		M								
		K								
		N								
		S								
		H								
WHT12 (HC)	• Uncoated cermet • Finishing • Steels, cast materials, sintered metals, and nonferrous metals	P								
		M								
		K								
		N								
		S								
		H								
WHT32 (HC)	• Uncoated cermet • Finishing • Steels and cast materials	P								
		M								
		K								
		N								
		S								
		H								

Coated Cermet

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
WTC15 (TC)	• New PVD brilliant coating • Reduce friction coefficient in turning applications • Coated cermet general purpose grade for material group P • Achieves excellent surface finish with excellent wear resistance • Usable in stainless steels	P								
		M								
		K								
		N								
		S								
		H								
WTC121 (TC)	• PVD coated cermet • Finishing of steels and stainless steels	P								
		M								
		K								
		N								
		S								
		H								

Wohlhaupter Insert Grades

Uncoated Cubic Boron Nitride | Coated Cubic Boron Nitride

Uncoated Cubic Boron Nitride

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
WBN150 (BN)	• Uncoated CBN grade • Roughing and finishing smooth and slightly discontinuous cuts • Hardened steels 52 - 64 HRC • Grain size 2 µm • CBN content: 50%	P								
		M								
		K								
		N								
		S								
		H								
WBN200 (BN)	• Uncoated CBN grade • Roughing and finishing highly discontinuous cuts • Hardened steels 52 - 64 HRC • Grain size 3 µm • CBN content: 65%	P								
		M								
		K								
		N								
		S								
		H								
WBN300 (BN)	• Uncoated CBN grade • Roughing and finishing smooth cuts • Hardened steels 52 - 64 HRC • Grain size 0.5 - 1.0 µm • CBN content: approximately 50%	P								
		M								
		K								
		N								
		S								
		H								
WBN450 (BN)	• Uncoated CBN grade • Roughing and finishing smooth and discontinuous cuts • Pearlite grey cast iron and sintered metals • Grain size 2 µm • CBN content: 90%	P								
		M								
		K								
		N								
		S								
		H								
WBN448 (BN)	• Uncoated CBN grade • Roughing & finishing smooth & discontinuous cuts • Pearlite grey cast iron & sintered metals and ductile iron • CBN content: 90%	P								
		M								
		K								
		N								
		S								
		H								

Coated Cubic Boron Nitride

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
WBC300 (BC)	• Coated CBN • Roughing and finishing smooth cuts • Hardened steels 52 - 64 HRC • Grain size 1 µm • CBN content: 50%	P								
		M								
		K								
		N								
		S								
		H								

Wohlhaupter Insert Grades

Polycrystalline Diamond | Ceramic Cutting Material

Polycrystalline Diamond

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
PCD D30 (DP)	• PCD medium grain grade • Finishing • Al alloys and Mg alloys up to 12% Si • Grain size 10 µm	P								
		M								
		K								
		N	■	■	■					
		S								
		H								
PCD D50 (DP)	• PCD mixed-grain grade • Finishing • CFRP, GRP, MMC, Al alloys over 12% Si • Grain size 2 - 30 µm	P								
		M								
		K								
		N	■	■						
		S								
		H								

Ceramic Cutting Material

Cutting Material	Description	Material	ISO Application 05	10	15	20	25	30	35	40
WCN40 (CN)	• Uncoated silicon-nitride ceramic • Roughing • Pearlite grey cast iron	P								
		M								
		K			■	■	■			
		N								
		S								
		H								

Wohlhaupter Insert Geometries

Cermet | Carbide

Cermet | Carbide

Geometry	Description	Application	Available Form
108 	• Sintered chip breaker for higher feeds • Suitable for highly discontinuous cuts	▼▼▼ ▼	F101, F103, F104, F112, F113
109 	• Sintered geometry with V-shaped chip breaker for roughing and finishing • Good chip control even for shallow depth of cut	▼▼▼ ▼	F101, F103, F104
112 	• Sintered chip breaker • Finishing and light roughing	▼▼▼ ▽	F101, F03
121 	• Positive geometry with stable cutting edge • Finishing in different material groups • Good chip control	▼▼▼	F20, F211
122 	• Sintered chip breaker • Good chip control - even with long-chipping materials	▼▼▼	F101, F103, F161
126 	• Sintered version with a wide range of applications	▼	F105
127 	• Highly positive sintered geometry • For nonferrous metals and cast iron	▼▼▼ ▼	F37, F39, F101, F103, F104, F112, F113
128 	• Highly positive sintered geometry • Polished for finishing nonferrous metals, cast iron, and steel	▼▼▼	F20
129 	• Highly positive chip breaking geometry • Polished for nonferrous metals, cast iron, and steel • Ideal for structural steel applications	▼▼▼ ▼	F37, F39, F101, F103
145 	• Geometry for finishing in smooth and discontinuous cut • Good chip control - even with long-chipping materials	▼▼▼ ▼	F101, F103, F112, F113, F161
146 	• Positive geometry with stable cutting edge • Universal usage for roughing, finishing and chamfering	▼▼▼ ▼	F037, F039, F101, F103, F104, F112, F113,

Wohlhaupter Insert Geometries

Cermet | Carbide

Cermet | Carbide

Geometry		Description	Application	Available Form
155		• Positive sintered geometry • Special cutting edge design in combination with the chip breaker design enables exceptional chip control even at shallow cutting depths and light feeds	▼▼▼	F20, F101, F103, F39
158		• Stable sintered geometry for roughing and finishing with and without discontinuous cuts	▼▼▼ ▼	F101, F103, F104, F105, F113, F114, F163
174W		• Wiper geometry for highly productive turning and boring • Can be used with pitch angle 92° - 95° • Good chip breaking properties even at lower feed rates	▼▼▼ ▽	F101, F103
192		• Sintered version for a variety of applications • Low cutting pressure because of sharp cutting edge prep	▼▼▼ ▼	F39, F101, F103, F104, F112, F113, F163, F161, F262, F264
199		• Positive sintered geometry for wide variety of applications • Special chip breaker allows chip control with different radial depth of cut	▼▼▼ ▼	F101, F103, F104, F112, F113
200		• Highly positive sintered geometry • Applicable for various material groups for low cutting pressure	▼▼▼ ▼	F39, F101, F103, F104, F264
650		• Obliquely ground chip breaker reduces cutting forces • Finishing and smooth interrupted cuts	▼▼▼	F20, F211
711		• Negative geometry with 0 rake suitable for fine finishing and semi roughing • Machined materials in groups K and H • Continuous and moderately interrupted cut	▼▼▼ ▼	F101, F103, F104, F113, F163
840		• Parallel ground chip breaker • For finish operations with stable cutting edge	▼▼▼	F20
850		• Parallel ground chip breaker • Good chip control with short to medium feeds	▼▼▼	F161
860		• Parallel ground chip breaker reduces cutting forces • Stable for a wide range of applications	▼▼▼ ▼	F101, F103, F104, F105, F325

Wohlhaupter Insert Geometries

Tangential | Ceramic

Tangential

Geometry	Description	Application	Available Form
880 	• Large parallel ground chip breaker with 10° rake angle for reduced cutting force	▼	F04, F05
811 	• Smooth geometry without additional ground chip breaker • Reinforced cutting edges provide stability • Excellent for cast materials	▼	F05

Ceramic

Geometry	Description	Application	Available Form
711 	• Smooth geometry with 0° rake angle • High cutting edge stability particularly in discontinuous cuts	▼	F75, F103, F104, F123

Wohlhaupter Insert Geometries

PCD | CBN

PCD

Geometry	Description	Application	Available Form
720 	• Smooth geometry in positive version with 7° rake angle for PCD • Sharp cutting edge	▼▼▼	F20, F101, F103
730 	• Smooth geometry with 0° rake angle for PCD • Sharp cutting edge	▼▼▼	F20, F39, F75, F101, F103, F123, F211, F262, F264
735 	• Smooth geometry • Laser-cut chip breaker for PCD • Suitable for long-chipping aluminum wrought alloys	▼▼▼	F20, F39, F101, F103, F211, F262, F264

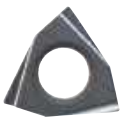
CBN

Geometry	Description	R	Fb	Fw	Application	Available Form
741 	• Smooth geometry with 0° rake angle for CBN • Rounded cutting edge with 30° chamfer	0.015	0.15	30°	▼▼▼	F20, F101, F103
742 	• Smooth geometry with 0° rake angle for CBN • Rounded cutting edge with 15° chamfer	0.015	0.1	15°	▼▼▼	F20, F101, F103
745 	• Smooth geometry with 0° rake angle for CBN • Rounded cutting edge with 30° chamfer	0.015	0.05	30°	▼▼▼	F20, F211
747 	• Smooth geometry with 0° rake angle for CBN • Rounded cutting edge with a small 20° chamfer	0.015	0.1	20°	▼▼▼	F39, F104, F262, F264
748 	• Smooth geometry with 0° rake angle for CBN • Rounded cutting edge • No chamfer	0.015			▼▼▼	F20, F101, F103, F211
749 	• Smooth geometry with 0° rake angle for CBN • Rounded cutting edge with a large 20° chamfer	0.015	0.2	20°	▼▼▼ ▼	F75, F123, F264
768 	• Smooth geometry with 7° rake angle for CBN • Rounded cutting edge	0.015			▼▼▼	F20, F101, F103

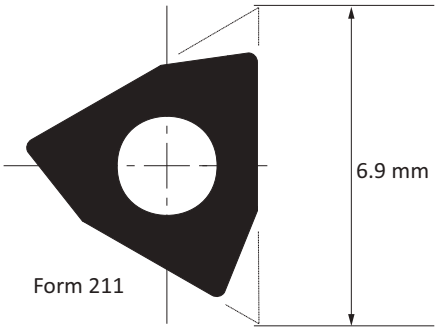
Insert Form 211

Cermet | Carbide

121 Geometry



650 Geometry



		Cermet					Carbide											
		Uncoated			Coated		Uncoated		Coated									
Steel	P	▼▼▼							▼▼▼		▼▼▼			▼▼▼		▼▼▼		
Stainless Steel	M								▽▽▽		▼▼▼			▼▼▼		▼▼▼		
Cast Iron	K	▽▽▽					▽▽▽		▼▼▼		▽▽▽			▼▼▼		▽▽▽		
Nonferrous Materials	N	▽▽▽					▼▼▼			▼▼▼								
Titanium	S	▽▽▽					▽▽▽		▽▽▽		▼▼▼			▼▼▼		▼▼▼		
Hard Materials	H													▼▼▼				

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WHT10	WHT12	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
121	0.004	0.10	F21101GN121	WBGX020101	**397675**										✱			◔			
121	0.008	0.20	F21102GN121	WBGX020102	**397676**										✱			◔			
650	0.004	0.10	F21101GL650	WBGX020101	**097755**		●				●		●	●						◔	
650	0.008	0.20	F21102GL650	WBGX020102	**097454**		●				●		●							◔	

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◔	Average - Main Application
✱	Difficult - Main Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
211	**215377**	M2 x 0.4 x 4	**415507**	**115537**	0.6 Nm	T6

Reference Key

Symbol	Insert Type
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

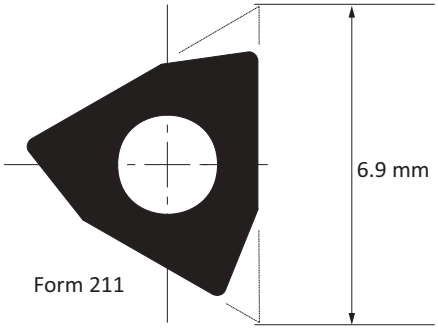
Insert Form 211

CBN | PCD


730 Geometry


735 Geometry


748 Geometry



		Ceramic					CBN								PCD			
		Uncoated			Coated		Uncoated						Coated					
Steel	P																	
Stainless Steel	M																	
Cast Iron	K									▼▼▼								
Nonferrous Materials	N														▼▼▼	▼▼▼		
Titanium	S																	
Hard Materials	H							▼▼▼										
Geometry	Radius in / mm	Description	ISO Code	Part No.			WBN150	WBN200	WBN300	WBN450					PKDD30	PKDD50		
730	0.004 / 0.10	F21101GN730	WBGX020101	**397763**											●			
730	0.008 / 0.20	F21102GN730	WBGX020102	**097557**											●	●		
735	0.008 / 0.20	F21102GN735	WBGX020102	**397237**											●			
748	0.004 / 0.10	F21101GN748	WBGX020101	**097486**				●		●								
748	0.008 / 0.20	F21102GN748	WBGX020102	**097552**				●		●								

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
211	**215377**	M2 x 0.4 x 4	**415507**	**115537**	0.6 Nm	T6

Reference Key

Symbol	Machining Conditions
●	Average - Main Application

Reference Key

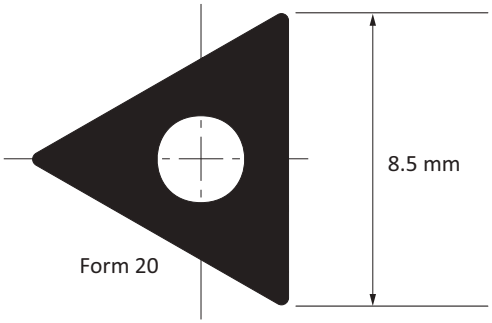
Symbol	Insert Type
▼▼▼	Finishing - Main Application

Insert Form 20

Cermet | Carbide

121 Geometry 128 Geometry

155 Geometry 650 Geometry 840 Geometry



		Cermet					Carbide									
		Uncoated			Coated		Uncoated		Coated							
Steel	P	▼▼▼		▼▼▼	▼▼▼			▼▼▼		▼▼▼			▼▼▼		▼▼▼	
Stainless Steel	M				▽▽▽	▽▽▽			▽▽▽		▼▼▼			▼▼▼		▼▼▼
Cast Iron	K	▽▽▽		▽▽▽			▽▽▽	▽▽▽	▼▼▼		▽▽▽			▼▼▼		▽▽▽
Nonferrous Materials	N	▽▽▽					▼▼▼	▼▼▼		▼▼▼						
Titanium	S						▽▽▽	▽▽▽	▽▽▽		▼▼▼			▼▼▼		▼▼▼
Hard Materials	H													▼▼▼		

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WHT10	WHT12	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136
121	0.004	0.10	F02001GN121	TOGX080201	**397672**										✱			◕		
121	0.008	0.20	F02002GN121	TOGX080202	**397673**										✱			◕		
121	0.016	0.40	F02004GN121	TOGX080204	**397674**										✱			◕		
121W	0.008	0.20	F02002GX121W	TOGX080202	**397916**													◕		
121W	0.016	0.40	F02004GX121W	TOGX080204	**397917**													◕		
128	0.004	0.10	F02001GN128	TOGX080201	**297473**							●	●							
128	0.008	0.20	F02002GN128	TOGX080202	**297541**							●	●	●						
128	0.016	0.40	F02004GN128	TOGX080204	**297542**							●	●	●						
155	0.008	0.20	F02002MN155	TOMX080202	**397688**				◕											
155	0.016	0.40	F02004MN155	TOMX080204	**397689**				◕											
650	0.004	0.10	F02001GL650	TOGX080201	**097153**		●			◕	●		●							◕
650	0.008	0.20	F02002GL650	TOGX080202	**097546**		●			◕	●		●							◕
650	0.012	0.30	F02003GL650	TOGX080203	**097154**						●		●							◕
650	0.016	0.40	F02004GL650	TOGX080204	**097599**		●			◕	●		●							◕
650	0.031	0.80	F02008GL650	TOGX080208	**397764**						●									◕
840	0.008	0.20	F02002GR840	TOGX080202	**097701**		●						●							

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application
✱	Difficult - Main Application

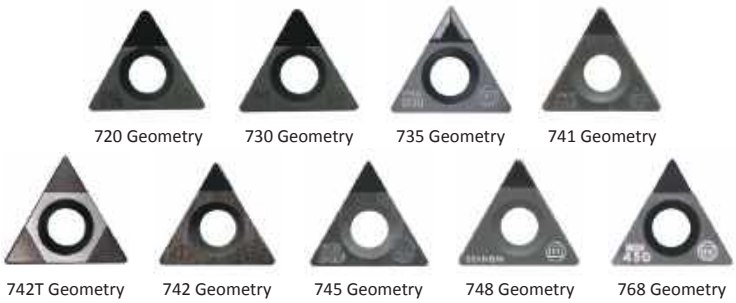
Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
20	**115535**	M2 x 0.4 x 5	**415508**	**115591**	0.9 Nm	T7

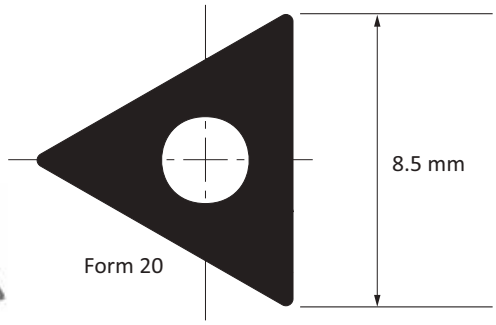
Reference Key

Symbol	Insert Type
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Form 20

CBN | PCD





		CBN								PCD			
		Uncoated						Coated					
Steel	P												
Stainless Steel	M												
Cast Iron	K			▼▼▼	▼▼▼	▼▼▼							
Nonferrous Materials	N									▼▼▼	▼▼▼		
Titanium	S												
Hard Materials	H		▼▼▼	▼▼▼				▼▼▼					

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WBN150	WBN200	WBN300	WBN450	WBN448		WBC300		PKDD30	PKDD50		
720	0.008	0.20	F02002GN720	TOGX080202	**297692**									◕			
720	0.016	0.40	F02004GN720	TOGX080204	**297845**									◕			
730	0.008	0.20	F02002GN730	TOGX080202	**097487**									◕	◕		
730	0.016	0.40	F02004GN730	TOGX080204	**097686**									◕	◕		
730	0.031	0.80	F02008GN730	TOGX080208	**097877**									◕			
735	0.008	0.20	F02002GN735	TOGX080202	**397133**									◕			
735	0.016	0.40	F02004GN735	TOGX080204	**397301**									◕			
741	0.008	0.20	F02002GN741	TOGX080202	**297260**		◕										
741	0.016	0.40	F02004GN741	TOGX080204	**297262**		◕										
742	0.008	0.20	F02002GN742	TOGX080202	**297264**			●									
742	0.016	0.40	F02004GN742	TOGX080204	**397610**			●									
742T	0.008	0.20	F02002GN742T	TOGX080202	**397961**					◕		●					
742T	0.016	0.40	F02004GN742T	TOGX080204	**397551**					◕		●					
745	0.004	0.10	F02001GN745	TOGX080201	**297259**		◕										
748	0.008	0.20	F02002GN748	TOGX080202	**297780**				◕								
748	0.016	0.40	F02004GN748	TOGX080204	**297782**				◕								
768	0.008	0.20	F02002GN768	TOGX080202	**397146**				◕								
768	0.016	0.40	F02004GN768	TOGX080204	**397192**				◕								

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
20	**115535**	M2 x 0.4 x 5	**415508**	**115591**	0.9 Nm	T7

Reference Key

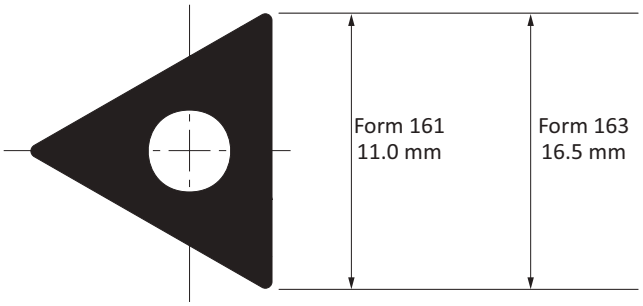
Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application

Reference Key

Symbol	Insert Type
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Forms 161, 163

Cermet | Carbide



		Cermet					Carbide										
		Uncoated			Coated		Uncoated		Coated								
Steel	P	▼▼▼	▼▼▼						▼▼▼	▼▼▼	▼▼▼	▼▼▼	▼▼▼	▼▼▼			▼▼▼
Stainless Steel	M								▽▽▽	▼▼▼	▼▼▼		▽▽▽	▼▼▼			
Cast Iron	K	▽▽▽	▽▽▽					▽▽▽	▼▼▼	▽▽▽		▼▼▼	▼▼▼	▼▼▼			▼▼▼
Nonferrous Materials	N	▽▽▽	▽▽▽					▼▼▼									
Titanium	S							▽▽▽	▽▽▽	▼▼▼	▼▼▼			▼▼▼			
Hard Materials	H											▽▽▽		▼▼▼			▽▽▽

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WHT10	WHT12	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC19	WHC88	WHC77	WHC79	WHC111	WHC114	WHC136	WHC164
122	0.016	0.40	F16104MN122	TCMT110204	**097953**	●															
129	0.008	0.20	F16102GN129	TCGT110202	**397769**							●	●								
129	0.016	0.40	F16104GN129	TCGT110204	**397770**							●	●								
129	0.016	0.40	F16304GN129	TCGT16T304	**397771**							●	●								
145	0.016	0.40	F16104GN145	TCGT110204	**297993**													●			
146	0.016	0.40	F16104MN146	TCMT110204	**397977**										✱						
146	0.031	0.80	F16108MN146	TCMT110208	**397026**										✱						
146	0.016	0.40	F16304MN146	TCMT16T304	**397990**										✱						
146	0.031	0.80	F16308MN146	TCMT16T308	**397974**										✱						
158	0.016	0.40	F16304MN158	TCMT16T304	**297604**												◕				
192	0.016	0.40	F16104MN192	TCMT110204	**397663**									✱		◕					◕
192	0.016	0.40	F16304MN192	TCMT16T304	**397654**									✱							◕
192	0.031	0.80	F16308MN192	TCMT16T308	**397772**									✱							
711	0.016	0.40	F16304MN711	TCMT16T304	**397898**											●					
711	0.031	0.80	F16304MN711	TCMT16T308	**397899**											●					
850	0.008	0.20	F16102GL850	TCGT110202	**097512**		●														

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application
✱	Difficult - Main Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
161	**115676**	M2.5 x 0.45 x 5	**415514**	**115590**	1.2 Nm	T8
163	**115673**	M3.5 x 0.6 x 9	**415510**	**115664**	3.0 Nm	T15

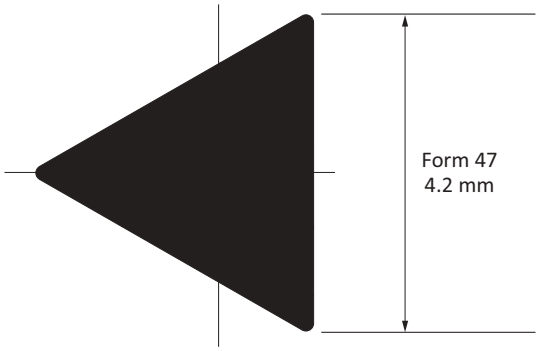
Reference Key

Symbol	Insert Type
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Form 47

Cermet | Carbide

650 Geometry



		Carbide									
		Uncoated		Coated							
Steel	P					▼▼▼					
Stainless Steel	M					▽▽▽					
Cast Iron	K	▽▽▽				▽▽▽					
Nonferrous Materials	N	▼▼▼									
Titanium	S	▽▽▽									
Hard Materials	H										

Geometry	Radius in	Radius mm	ISO Code	Description	Part No.	WHW01	WHW16	WHC05	WHC18	WHC20	WHC79	WHC111	WHC114	WHC136	WHC164
650	0.004	0.10	TOFX040101	F04701FL650	**097832**	●				●					
650	0.008	0.20	TOFX040102	F04702FL650	**097833**	●				●					

Insert Form	Countersunk Screw		Clamping Jaw	Torque Driver	Service Key	Technical Data Torque	Technical Data Key Size
47	**315324**	M1.8 x 0.35 x 4	**315323**	–	**115537**	0.5 Nm	T6

Reference Key

Symbol	Machining Conditions
●	Good - Main Application

Reference Key

Symbol	Insert Type
▼▼▼	Finishing - Main Application

Insert Forms 101, 103, 104, 105

Cermet | Carbide


108 Geometry

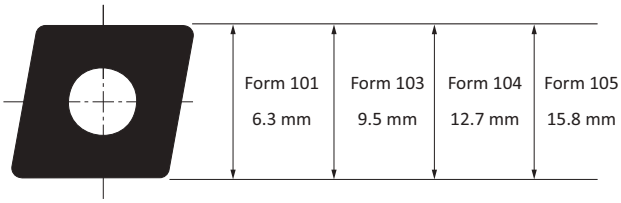

109 Geometry


112 Geometry


122 Geometry


126 Geometry


127 Geometry



		Cermet						Carbide									
		Uncoated				Coated		Uncoated	Coated								
Steel	P	▼▼▼			▼▼▼ ▽								▼▼▼ ▼			▼▼▼ ▼	
Stainless Steel	M												▼▼▼ ▼			▼▼▼ ▽	
Cast Iron	K	▽▽▽			▽▽▽				▽▽▽ ▽				▽▽▽ ▽			▽▽▽ ▽	
Nonferrous Materials	N	▽▽▽			▽▽▽				▼▼▼ ▼		▼▼▼ ▼						
Titanium	S								▽▽▽ ▽							▼▼▼ ▼	
Hard Materials	H																

Geometry	Radius in	Radius mm	Description	ISO Description	Part No.	WHT10	WHT12	WHT16	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
108	0.008	0.20	F10102MN108	CCMT060202	**297833**													●				
108	0.016	0.40	F10104MN108	CCMT060204	**297537**													●				
108	0.016	0.40	F10304MN108	CCMT09T304	**297891**													●				
108	0.031	0.80	F10308MN108	CCMT09T308	**397118**													●				
108	0.016	0.40	F10404MN108	CCMT120404	**297725**													●				
108	0.031	0.80	F10408MN108	CCMT120408	**297724**													●				
109	0.008	0.20	F10102MN109	CCMT060202	**397352**																●	
109	0.016	0.40	F10104MN109	CCMT060204	**397765**																●	
109	0.016	0.40	F10304MN109	CCMT09T304	**397354**																●	
109	0.031	0.80	F10308MN109	CCMT09T308	**397355**																●	
109	0.016	0.40	F10404MN109	CCMT120404	**397356**																●	
109	0.031	0.80	F10408MN109	CCMT120408	**397357**																●	
112	0.008	0.20	F10102GN112	CCGT060202	**297485**				◕													
112	0.016	0.40	F10104MN112	CCMT060204	**297434**				◕													
112	0.008	0.20	F10302GN112	CCGT09T302	**297534**				◕													
112	0.016	0.40	F10304MN112	CCMT09T304	**297387**				◕													
122	0.008	0.20	F10102MN122	CCMT060202	**097899**	●																
122	0.016	0.40	F10104MN122	CCMT060204	**097926**	●																
122	0.008	0.20	F10302MN122	CCMT09T302	**097862**	●																
122	0.016	0.40	F10304MN122	CCMT09T304	**097957**	●																
126	0.031	0.80	F10508MN126	CCMT160508	**297557**																◕	
126	0.047	1.20	F10512MN126	CCMT160512	**297558**																◕	
127	0.008	0.20	F10102GN127	CCGT060202	**097529**								●		●							
127	0.016	0.40	F10104GN127	CCGT060204	**097445**								●		●							
127	0.008	0.20	F10302GN127	CCGT09T302	**297550**								●		●							
127	0.016	0.40	F10304GN127	CCGT09T304	**097497**								●		●							
127	0.016	0.40	F10404GN127	CCGT120404	**097496**								●		●							

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application

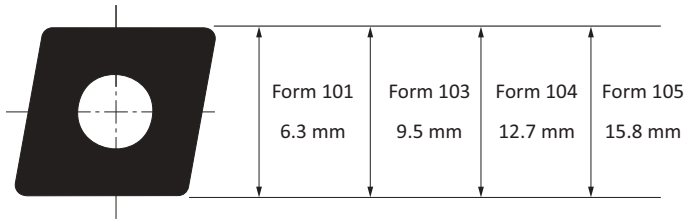
Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
101	**115676**	M2.5 x 0.45 x 5	**415514**	**115590**	1.2 Nm	T8
103	**115672**(<Ø37 mm)	M3.5 x 0.6 x 7.5	**415510**	**115664**	3.0 Nm	T15
103	**115673**(>Ø36 mm)	M3.5 x 0.6 x 9	**415510**	**115664**	3.0 Nm	T15
104	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20
105	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Forms 101, 103, 104, 105

Cermet | Carbide



		Cermet				Carbide															
		Uncoated		Coated		Uncoated	Coated														
Steel	P			▼▼▼			▼▼▼ ▽				▼▼▼ ▼	▼▼▼ ▼		▼▼▼ ▼							
Stainless Steel	M			▽▽▽			▽▽▽					▼▼▼ ▼		▼▼▼ ▼							
Cast Iron	K			▽▽▽		▽▽▽ ▽	▼▼▼ ▼				▼▼▼			▼▼▼ ▼							
Nonferrous Materials	N					▼▼▼ ▼		▼▼▼ ▼													
Titanium	S					▽▽▽ ▽	▽▽▽ ▽					▼▼▼ ▼		▼▼▼ ▼							
Hard Materials	H										▽▽▽ ▽			▼▼▼ ▽							

Geometry	Radius in	Radius mm	Description	ISO Description	Part No.	WHT10	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC81	WHC88	WHC98	WHC111	WHC114	WHC136	WHC164
129	0.002	0.05	F101005GN129	CCGT0602005	**397738**						●	●										
129	0.004	0.10	F10101GN129	CCGT060201	**397737**						●	●										
129	0.008	0.20	F10102GN129	CCGT060202	**297545**						●	●	●									
129	0.016	0.40	F10104GN129	CCGT060204	**297546**						●	●	●									
129	0.008	0.20	F10302GN129	CCGT09T302	**297547**						●	●	●									
129	0.016	0.40	F10304GN129	CCGT09T304	**297548**						●	●	●									
145	0.016	0.40	F10104GN145	CCGT060204	**297980**														●			
145	0.031	0.80	F10108GN145	CCGT060208	**397742**														●			
145	0.016	0.40	F10304GN145	CCGT09T304	**297994**														●			
145	0.031	0.80	F10308GN145	CCGT09T308	**297995**														●			
146	0.016	0.40	F10104MN146	CCMT060204	**397953**											●	⧓					
146	0.016	0.40	F10304MN146	CCMT09T304	**397142**											●	⧓					
146	0.031	0.80	F10308MN146	CCMT09T308	**397946**											●	⧓					
146	0.016	0.40	F10404MN146	CCMT120404	**397469**												⧓					
146	0.031	0.80	F10408MN146	CCMT120408	**397143**											●	⧓					
146	0.047	1.20	F10412MN146	CCMT120412	**397939**												⧓					
155	0.008	0.20	F10102MN155	CCMT060202	**397662**			◕														
155	0.016	0.40	F10104MN155	CCMT060204	**397739**			◕														
155	0.016	0.40	F10304MN155	CCMT09T304	**397740**			◕														

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
101	**115676**	M2.5 x 0.45 x 5	**415514**	**115590**	1.2 Nm	T8
103	**115672**(<Ø37 mm)	M3.5 x 0.6 x 7.5	**415510**	**115664**	3.0 Nm	T15
103	**115673**(>Ø36 mm)	M3.5 x 0.6 x 9	**415510**	**115664**	3.0 Nm	T15
104	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20
105	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

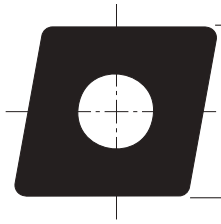
Insert Forms 101, 103, 104, 105

Carbide

158 Geometry

174W Geometry

192 Geometry



		Carbide											
		Uncoated		Coated									
Steel	P			▼▼▼ ▽		▼▼▼ ▼	▼▼▼ ▼		▼▼▼ ▼				▼▼▼ ▼
Stainless Steel	M			▽▽▽		▼▼▼ ▼	▽▽▽ ▽		▼▼▼ ▼				
Cast Iron	K			▼▼▼ ▼		▽▽▽ ▽	▼▼▼ ▼		▼▼▼ ▼				▼▼▼ ▼
Nonferrous Materials	N												
Titanium	S			▽▽▽		▼▼▼ ▼			▼▼▼ ▼				
Hard Materials	H								▼▼▼ ▼				▽▽▽

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
158	0.008	0.20	F10102MN158	CCMT060202	297248						◕		●			
158	0.016	0.40	F10104MN158	CCMT060204	297377						◕		●			
158	0.016	0.40	F10304MN158	CCMT09T304	297239						◕		●			
158	0.031	0.80	F10308MN158	CCMT09T308	297240						◕		●			
158	0.016	0.40	F10404MN158	CCMT120404	297242						◕		●			
158	0.031	0.80	F10408MN158	CCMT120408	297241						◕		●			
158	0.031	0.80	F10508MN158	CCMT160508	297559			●			◕					
158	0.047	1.20	F10512MN158	CCMT160512	297560						◕					
174W	0.016	0.40	F10104MN174W	CCMT060204	397766					✱						◕
174W	0.016	0.40	F10304MN174W	CCMT09T304	397767					✱						◕
174W	0.031	0.80	F10308MN174W	CCMT09T308	397768											◕
192	0.008	0.20	F10102MN192	CCMT060202	297531					✱						◕
192	0.016	0.40	F10104MN192	CCMT060204	297658					✱						◕
192	0.031	0.80	F10108MN192	CCMT060208	297588					✱						◕
192	0.008	0.20	F10302MN192	CCMT09T302	297958					✱						
192	0.016	0.40	F10304MN192	CCMT09T304	297653					✱						◕
192	0.031	0.80	F10308MN192	CCMT09T308	397614					✱						◕
192	0.016	0.40	F10404MN192	CCMT120404	397666					✱						◕
192	0.031	0.80	F10408MN192	CCMT120408	297878					✱						◕
192	0.047	1.20	F10412MN192	CCMT120412	397632											◕

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
101	**115676**	M2.5 x 0.45 x 5	**415514**	**115590**	1.2 Nm	T8
103	**115672**(<Ø37 mm)	M3.5 x 0.6 x 7.5	**415510**	**115664**	3.0 Nm	T15
103	**115673**(>Ø36 mm)	M3.5 x 0.6 x 9	**415510**	**115664**	3.0 Nm	T15
104	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20
105	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application
✱	Difficult - Main Application

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Forms 101, 103, 104, 105

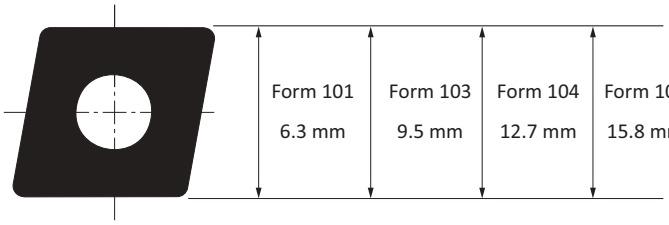
Cermet | Carbide


199 Geometry


200 Geometry


711 Geometry


860 Geometry



		Cermet						Carbide											
		Uncoated				Coated		Uncoated		Coated									
Steel	P						▼▼▼			▼▼▼ ▼			▼▼▼ ▼			▼▼▼ ▼	▼▼▼ ▼	▼▼▼ ▼
Stainless Steel	M						▽▽▽			▽▽▽ ▽			▼▼▼ ▼			▼▼▼ ▼	▼▼▼ ▼	▼▼▼ ▼
Cast Iron	K							▽▽▽ ▽		▼▼▼ ▼			▼▼▼ ▼			▼▼▼ ▼	▽▽▽ ▽	▽▽▽ ▽
Nonferrous Materials	N							▼▼▼ ▼											
Titanium	S									▽▽▽						▼▼▼ ▼	▼▼▼ ▼	▼▼▼ ▼
Hard Materials	H												▽▽▽			▼▼▼ ▽			

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WHT10	WHT12	WHT16	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC77	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
199	0.008	0.20	F10102MN199	CCMT060202	**397164**																●		
199	0.016	0.40	F10104MN199	CCMT060204	**397165**																●		
199	0.008	0.20	F10302MN199	CCMT09T302	**397702**																●		
199	0.016	0.40	F10304MN199	CCMT09T304	**397166**																●		
199	0.031	0.80	F10308MN199	CCMT09T308	**397167**																●		
199	0.016	0.40	F10404MN199	CCMT120404	**397191**																●		
199	0.031	0.80	F10408MN199	CCMT120408	**397168**																●		
200	0.008	0.20	F10102GN200	CCGT060202	**397585**															●			
200	0.016	0.40	F10104GN200	CCGT060204	**397586**															●			
200	0.008	0.20	F10302GN200	CCGT09T302	**397587**															●			
200	0.016	0.40	F10304GN200	CCGT09T304	**397588**															●			
200	0.016	0.40	F10404GN200	CCGT120404	**397589**															●			
711	0.016	0.40	F10104MN711	CCMT060204	**097637**												●						
711	0.016	0.40	F10404MN711	CCMW120404	**097692**												●						
711	0.031	0.80	F10308MN711	CCMT09T308	**297910**												●						
711	0.031	0.80	F10408MN711	CCMT120408	**297911**												●						
860	0.004	0.10	F10101GL860	CCGT060201	**097324**						◕	●		●								●	
860	0.008	0.20	F10102GL860	CCGT060202	**097241**						◕	●		●								●	
860	0.016	0.40	F10104GL860	CCGT060204	**097242**							●		●								●	
860	0.008	0.20	F10302GL860	CCGT09T302	**097245**							●		●								●	
860	0.016	0.40	F10304GL860	CCGT09T304	**097244**							●		●								●	
860	0.016	0.40	F10404GL860	CCGT120404	**097738**							●										●	
860	0.031	0.80	F10408GL860	CCGT120408	**097247**							●		●								●	
860	0.031	0.80	F10508ML860	CCMT160508	**097249**							●		●								●	

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data Torque	Technical Data Key Size
101	**115676**	M2.5 x 0.45 x 5	**415514**	**115590**	1.2 Nm	T8
103	**115672**(<Ø37 mm)	M3.5 x 0.6 x 7.5	**415510**	**115664**	3.0 Nm	T15
103	**115673**(>Ø36 mm)	M3.5 x 0.6 x 9	**415510**	**115664**	3.0 Nm	T15
104	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20
105	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20

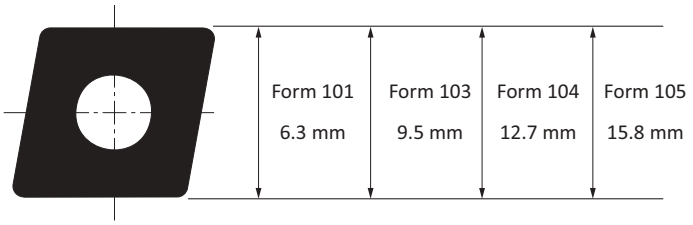
Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Forms 101, 103, 104

Ceramic | CBN | PCD

711 Geometry | 720 Geometry | 730 Geometry | 735 Geometry



		Ceramic					CBN								PCD			
		Uncoated			Coated		Uncoated						Coated					
Steel	P																	
Stainless Steel	M																	
Cast Iron	K	▼								▼▼▼ ▼								
Nonferrous Materials	N														▼▼▼ ▼	▼▼▼ ▼		
Titanium	S																	
Hard Materials	H																	

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WCN40					WBN150	WBN200	WBN300	WBN450					PKDD30	PKDD50		
711	0.016	0.40	F10304GN711	CCGW09T304	**297561**	✱																
711	0.031	0.80	F10308GN711	CCGW09T308	**297192**	✱																
711	0.031	0.80	F10408GN711	CCGW120408	**297249**	✱																
711	0.047	1.20	F10412GN711	CCGW120412	**297234**	✱																
720	0.008	0.20	F10102GN720	CCGT060202	**297501**														●			
720	0.016	0.40	F10104GN720	CCGT060204	**297502**														●			
720	0.008	0.20	F10302GN720	CCGT09T302	**297578**														●			
720	0.016	0.40	F10304GN720	CCGT09T304	**297483**														●			
730	0.008	0.20	F10102GN730	CCGW060202	**097462**														●	●		
730	0.016	0.40	F10104GN730	CCGW060204	**297164**														●	●		
730	0.031	0.80	F10108GN730	CCGW060208	**297165**														●			
730	0.008	0.20	F10302GN730	CCGW09T302	**397251**														●	●		
730	0.016	0.40	F10304GN730	CCGW09T304	**297533**														●	●		
730	0.016	0.40	F10404GN730	CCGW120404	**397257**														●	●		
730	0.031	0.80	F10408GN730	CCGW120408	**297871**														●	●		
735	0.008	0.20	F10102GN735	CCGT060202	**297872**														●			
735	0.016	0.40	F10104GN735	CCGT060204	**397244**														●			
735	0.008	0.20	F10302GN735	CCGT09T302	**397252**														●			
735	0.016	0.40	F10304GN735	CCGT09T304	**297870**														●			

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application
✱	Difficult - Main Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
101	**115676**	M2.5 x 0.45 x 5	**415514**	**115590**	1.2 Nm	T8
103	**115672**(<Ø37 mm)	M3.5 x 0.6 x 7.5	**415510**	**115664**	3.0 Nm	T15
103	**115673**(>Ø36 mm)	M3.5 x 0.6 x 9	**415510**	**115664**	3.0 Nm	T15
104	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Forms 101, 103, 104

CBN


741 Geometry


742 Geometry

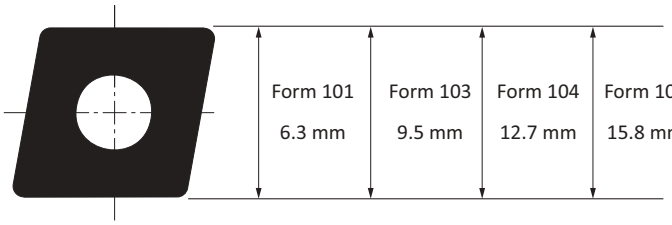

742D Geometry


747 Geometry


748 Geometry


749 Geometry


768 Geometry



		CBN							
		Uncoated						Coated	
Steel	P								
Stainless Steel	M								
Cast Iron	K	▽▽▽ ▽		▼▼▼ ▽	▼▼▼ ▼	▼▼▼ ▼			
Nonferrous Materials	N								
Titanium	S								
Hard Materials	H	▼▼▼ ▽	▼▼▼ ▽	▼▼▼ ▽				▼▼▼ ▽	

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WBN150	WBN200	WBN300	WBN450	WBN448		WBC300	
741	0.008	0.20	F10102GN741	CCGW060202	297290		◕						
741	0.016	0.40	F10104GN741	CCGW060204	297291		◕						
741	0.016	0.40	F10304GN741	CCGW09T304	297303		◕						
742	0.008	0.20	F10102GN742	CCGW060202	297293			●					
742	0.016	0.40	F10104GN742	CCGW060204	297294			●					
742	0.016	0.40	F10304GN742	CCGW09T304	297306			●					
742D	0.008	0.20	F10102GN742D	CCGW060202	397949					◕		●	
742D	0.016	0.40	F10104GN742D	CCGW060204	397999					◕		●	
742D	0.016	0.40	F10304GN742D	CCGW090204	397931					◕		●	
742D	0.031	0.80	F10308GN742D	CCGW090208	397958					◕		●	
747	0.016	0.40	F10404GN747	CCGW120404	397260	◕			◕				
748	0.008	0.20	F10102GN748	CCGW060202	297787				◕				
748	0.016	0.40	F10104GN748	CCGW060204	297788				◕				
748	0.008	0.20	F10302GN748	CCGW09T302	297790				◕				
748	0.016	0.40	F10304GN748	CCGW09T304	297419				◕				
749	0.031	0.80	F10408GN749	CCGW120408	397261	◕			◕				
768	0.008	0.20	F10102GN768	CCGT060202	297486				◕				
768	0.016	0.40	F10104GN768	CCGT060204	297659				◕				
768	0.008	0.20	F10302GN768	CCGT09T302	397439				◕				
768	0.016	0.40	F10304GN768	CCGT09T304	297660								

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
101	**115676**	M2.5 x 0.4 x 5	**415514**	**115590**	1.2 Nm	T8
103	**115672**(<Ø37 mm)	M3.5 x 0.6 x 7.5	**415510**	**115664**	3.0 Nm	T15
103	**115673**(>Ø36 mm)	M3.5 x 0.6 x 9	**415510**	**115664**	3.0 Nm	T15
104	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Form 37, 39

Cermet | Carbide


121 Geometry


127 Geometry

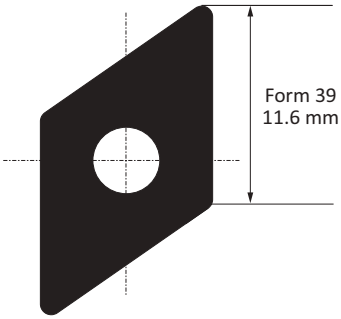

129 Geometry


146 Geometry


155 Geometry


192 Geometry


200 Geometry



		Cermet						Carbide										
		Uncoated				Coated		Uncoated	Coated									
Steel	P					▼▼▼				▼▼▼ ▼	▼▼▼ ▼	▼▼▼ ▼	▼▼▼ ▽		▼▼▼ ▽			▼▼▼ ▼
Stainless Steel	M					▽▽▽				▽▽▽ ▽	▼▼▼ ▼		▼▼▼ ▽		▼▼▼ ▽			
Cast Iron	K					▽▽▽			▽▽▽ ▽	▼▼▼ ▼	▽▽▽ ▽	▼▼▼ ▼			▼▼▼ ▼			▼▼▼ ▼
Nonferrous Materials	N								▼▼▼ ▼									
Titanium	S								▽▽▽	▽▽▽	▼▼▼ ▼		▼▼▼ ▽		▼▼▼ ▽			
Hard Materials	H											▽▽▽			▼▼▼			▽▽▽

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WHT10	WHT12	WHT16	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC19	WHC81	WHC88	WHC98	WHC111	WHC114	WHC136	WHC164
121	0.008	0.20	F03902MN121	DCMT11T302	**397787**										✱							
121	0.016	0.40	F03904MN121	DCMT11T304	**397788**										✱							
127	0.008	0.20	F03702GN127	DCGT070202	**397234**								●									
127	0.016	0.40	F03704GN127	DCGT070204	**097787**								●									
127	0.008	0.20	F03902GN127	DCGT11T302	**397235**								●									
127	0.016	0.40	F03904GN127	DCGT11T304	**097559**								●									
129	0.008	0.20	F03702GN129	DCGT070202	**397708**								●									
129	0.008	0.20	F03902GN129	DCGT11T302	**397816**								●	●								
129	0.016	0.40	F03904GN129	DCGT11T304	**397817**								●	●								
146	0.016	0.40	F03704MN146	DCMT070204	**397968**											●	✱					
146	0.031	0.80	F03708MN146	DCMT070208	**397047**												✱					
146	0.016	0.40	F03904MN146	DCMT11T304	**397591**											●	✱					
146	0.031	0.80	F03908MN146	DCMT11T308	**397598**											●	✱					
155	0.008	0.20	F03902MN155	DCMT11T302	**397809**					◕												
155	0.016	0.40	F03904MN155	DCMT11T304	**397810**					◕												
192	0.008	0.20	F03902MN192	DCMT11T302	**397783**										✱							◕
192	0.016	0.40	F03904MN192	DCMT11T304	**297721**										✱							◕
192	0.031	0.80	F03908MN192	DCMT11T308	**397784**										✱							◕
200	0.008	0.20	F03902GN200	DCGT11T302	**397785**														●			
200	0.016	0.40	F03904GN200	DCGT11T304	**397786**														●			

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application
✱	Difficult - Main Application

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
39	**115673**	M3.5 x 0.6 x 9	**414510**	**115664**	3.0 Nm	T15

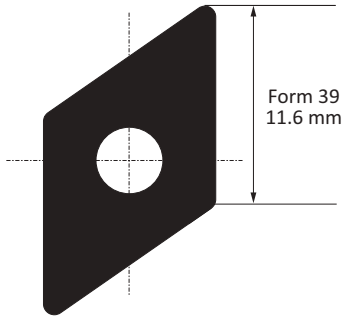
Insert Form 37, 39

CBN | PCD

730 Geometry

735 Geometry

747 Geometry



		CBN								PCD			
		Uncoated						Coated					
Steel	P												
Stainless Steel	M												
Cast Iron	K	▽▽▽			▼▼▼								
Nonferrous Materials	N									▼▼▼			
Titanium	S												
Hard Materials	H	▼▼▼ ▽											

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WBN150	WBN200	WBN300	WBN450	WBN200				PKDD30	PKDD50		
730	0.008	0.20	F03902GN730	DCGW11T302	**397269**									◕			
730	0.016	0.40	F03904GN730	DCGW11T304	**397270**									◕			
735	0.008	0.20	F03902GN735	DCGT11T302	**397271**									●			
735	0.016	0.40	F03904GN735	DCGT11T304	**397272**									●			
747	0.008	0.20	F03902GN747	DCGW11T302	**397273**	◕			◕								
747	0.016	0.40	F03904GN747	DCGW11T304	**397274**	◕			◕								

Reference Key

Symbol	Machining Conditions
◕	Average - Main Application
◕	Difficult - Main Application

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
39	**115673**	M3.5 x 0.6 x 9	**414510**	**115664**	3.0 Nm	T15

Insert Forms 112, 113, 114

Carbide


108 Geometry


127 Geometry

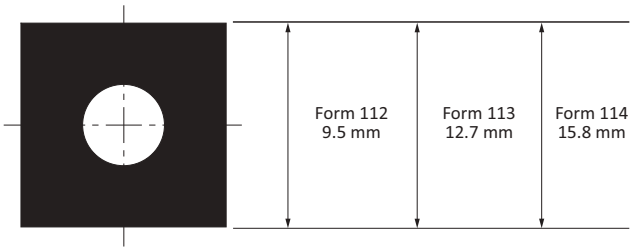

145 Geometry


158 Geometry


192 Geometry


199 Geometry


711 Geometry



		Carbide														
		Uncoated		Coated												
Steel	P				▼	▼	▼	▼	▼	▼	▼	▼	▼			▼
Stainless Steel	M				▼	▼		▽		▼	▼	▼	▼			
Cast Iron	K		▽		▽	▽	▼	▼	▼		▽	▼	▽			▼
Nonferrous Materials	N		▼													
Titanium	S		▽		▼	▼				▼		▼	▼			
Hard Materials	H						▽		▽			▽				▽

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WHW01	WHW16	WHC05	WHC19	WHC30	WHC77	WHC79	WHC81	WHC88	WHC98	WHC111	WHC114	WHC136	WHC164
108	0.016	0.40	F11204MN108	SCMT09T304	**297535**										◕				
108	0.031	0.80	F11308MN108	SCMT120408	**397110**										◕				
127	0.016	0.40	F11204GN127	SCGT09T304	**097539**		●												
127	0.016	0.40	F11304GN127	SCGT120404	**397590**		●												
127	0.031	0.80	F11308GN127	SCGT120408	**097566**		●												
145	0.031	0.80	F11208GN145	SCGT09T308	**297996**											●			
145	0.031	0.80	F11308GN145	SCGT120408	**297997**											●			
146	0.016	0.40	F11204MN146	SCMT09T304	**397940**								●	✱					
146	0.031	0.80	F11208MN146	SCMT09T308	**397992**								●	✱					
146	0.016	0.40	F11304MN146	SCMT12T304	**397049**									✱					
146	0.031	0.80	F11308MN146	SCMT12T308	**397969**								●	✱					
158	0.031	0.80	F11308MN158	SCMT120408	**297497**							◕							
158	0.047	1.20	F11412MN158	SCMT150512	**097252**					✱									
192	0.016	0.40	F11204MN192	SCMT09T304	**397741**				✱										◕
192	0.031	0.80	F11208MN192	SCMT09T308	**397640**				✱										◕
192	0.031	0.80	F11308MN192	SCMT120408	**397709**				✱										◕
192	0.047	1.20	F11312MN192	SCMT120412	**397710**				✱										
199	0.016	0.40	F11204MN199	SCMT09T304	**397703**												◕		
199	0.031	0.80	F11208MN199	SCMT09T308	**397704**												◕		
199	0.031	0.80	F11308MN199	SCMT120408	**397705**												◕		
711	0.031	0.80	F11308MN711	SCMT120408	**297212**						◕								

Reference Key

Symbol	Machining Conditions
●	Good - Main Application
◕	Average - Main Application
✱	Difficult - Main Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
112	**115672**(<Ø37 mm)	M3.5 x 0.6 x 7.5	**415510**	**115664**	3.0 Nm	T15
112	**115673**(>Ø36 mm)	M3.5 x 0.6 x 9	**415510**	**115664**	3.0 Nm	T15
113	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20
114	**215149**	M4.5 x 0.75 x 11.5	**415543**	**215150**	5.0 Nm	T20

Reference Key

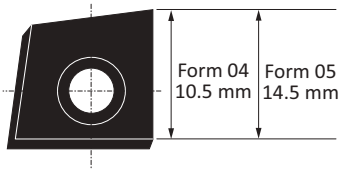
Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application
▽▽▽	Finishing - Extended Application

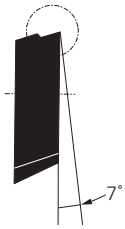
Insert Forms 04, 05

Carbide

880 Geometry

811 Geometry





		Carbide										
		Uncoated		Coated								
Steel	P										▼	▼
Stainless Steel	M										▽	▼
Cast Iron	K										▼	▼
Nonferrous Materials	N											▽
Titanium	S											▽
Hard Materials	H											

Geometry	Radius in	Radius mm	Description	ISO Code	Part No.	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC170	WHC168	WHC198
880	0.016	0.40	F00404ML880	–	**397595**											●
880	0.016	0.40	F00504ML880	–	**397593**										✱	●
880	0.031	0.80	F00508ML880	–	**397594**									✱	✱	●
811	0.031	0.80	F00508ML811	–	**397844**										✱	

Reference Key

Symbol	Machining Conditions
●	Average - Main Application
✱	Difficult - Main Application

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
04	**415977**	M4 x 0.7 x 7.9	**415510**	**115664**	3.0 Nm	T15
05	**415949**	M4 x 0.7 x 11	**415543**	**215150**	5.0 Nm	T20

Reference Key

Symbol	Insert Type
▼	Roughing - Main Application
▽	Roughing - Extended Application

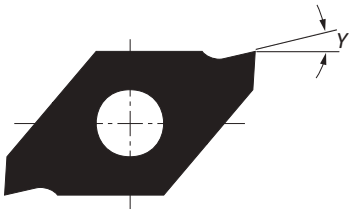
Radial Grooving Insert Forms 89, 90, 91

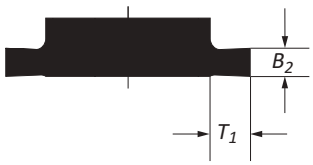
Carbide

Insert Form 89

Insert Form 90

Insert Form 91





							Carbide											
							Uncoated			Coated								
Steel	P															▼▼		
Stainless Steel	M															▽▽		
Cast Iron	K								▽▽							▼▼		
Nonferrous Materials	N								▼▼									
Titanium	S								▽▽							▼▼		
Hard Materials	H																	
	Insert Form	B_2	Y	T_1	Ring Width	Part No.	WHW01	WHW16	WHW20	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
	89	0.048	13°	0.051	0.039	097257			●								●	
	89	0.056	13°	0.051	0.047	097258			●								●	
	89	0.068	13°	0.059	0.059	097259			●								●	
	90	0.078	9°	0.094	0.068	097256			●								●	
	90	0.090	9°	0.094	0.078	097253			●								●	
ⓘ	90	0.109	9°	0.094	0.098	097254			●								●	
	90	0.129	9°	0.094	0.118	097255			●								●	
	91	0.109	9°	0.094	0.098	097260			●								●	
	91	0.129	9°	0.094	0.118	097261			●								●	
	91	0.168	9°	0.129	0.157	097262			●								●	
	91	0.208	9°	0.177	0.196	097294			●								●	
	89	1.24	13°	1.30	1.00	097257			●								●	
	89	1.44	13°	1.30	1.20	097258			●								●	
	89	1.74	13°	1.50	1.50	097259			●								●	
	90	1.99	9°	2.40	1.75	097256			●								●	
	90	2.29	9°	2.40	2.00	097253			●								●	
ⓜ	90	2.79	9°	2.40	2.50	097254			●								●	
	90	3.29	9°	2.40	3.00	097255			●								●	
	91	2.79	9°	2.40	2.50	097260			●								●	
	91	3.29	9°	2.40	3.00	097261			●								●	
	91	4.29	9°	3.30	4.00	097262			●								●	
	91	5.29	9°	4.50	5.00	097294			●								●	

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
89	**115676**	M2.5 x 0.45 x 5	**415514**	**115590**	1.2 Nm	T8
90	**115531**	M3 x 0.5 x 7.5	**415514**	**115590**	1.2 Nm	T8
91	**115802**	M3 x 0.5 x 12	**415514**	**115590**	1.2 Nm	T8

Reference Key

Symbol	Machining Conditions
●	Average - Main Application

Reference Key

Symbol	Insert Type
▼▼	Universal - Main Application
▽▽	Universal - Extended Application

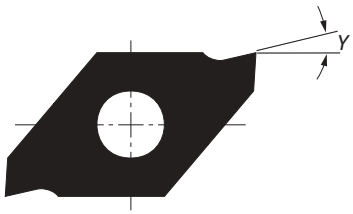
Radial Grooving Insert Forms 89, 90, 91

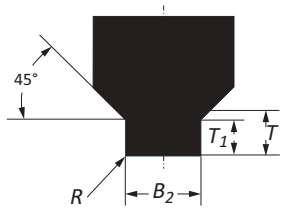
Carbide

Insert Form 89

Insert Form 90

Insert Form 91





										Carbide												
										Uncoated			Coated									
Steel									P												▼▼	
Stainless Steel									M												▽▽	
Cast Iron									K												▼▼	
Nonferrous Materials									N													
Titanium									S												▼▼	
Hard Materials									H													
	Insert Form	Boring Ø	B_2	Y	R	T_1	T	Ring Width	Part No.	WHW01	WHW16	WHW20	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164	
	89	0.944 - 1.023	0.056	13°	0.004	0.021	0.025	0.047	297937											◕		
	89	1.102 - 1.181	0.056	13°	0.004	0.025	0.029	0.047	297938											◕		
	89	1.220 - 1.259	0.056	13°	0.004	0.030	0.035	0.047	297939											◕		
	89	1.338	0.068	13°	0.004	0.030	0.035	0.059	297940											◕		
	89	1.377 - 1.496	0.068	13°	0.004	0.036	0.041	0.059	297941											◕		
ⓘ	90	1.574 - 1.889	0.078	9°	0.006	0.046	0.051	0.068	297942											◕		
	90	1.968 - 2.480	0.090	9°	0.006	0.056	0.062	0.078	297943											◕		
	91	2.559 - 3.070	0.109	9°	0.008	0.056	0.062	0.098	297944											◕		
	91	3.149 - 3.228	0.109	9°	0.008	0.066	0.072	0.098	297945											◕		
	91	3.346 - 3.937	0.129	9°	0.008	0.066	0.072	0.118	297946											◕		
	91	4.015 - 5.708	0.168	9°	0.008	0.076	0.084	0.157	297947											◕		
	89	24.00 - 26.00	1.44	13°	0.10	0.54	0.65	1.20	297937											◕		
	89	28.00 - 30.00	1.44	13°	0.10	0.64	0.75	1.20	297938											◕		
	89	31.00 - 32.00	1.44	13°	0.10	0.78	0.91	1.20	297939											◕		
	89	34.00	1.74	13°	0.10	0.78	0.91	1.50	297940											◕		
	89	35.00 - 38.00	1.74	13°	0.10	0.93	1.06	1.50	297941											◕		
ⓜ	90	40.00 - 48.00	1.99	9°	0.15	1.18	1.31	1.75	297942											◕		
	90	50.00 - 63.00	2.29	9°	0.15	1.43	1.58	2.00	297943											◕		
	91	65.00 - 78.00	2.79	9°	0.20	1.43	1.58	2.50	297944											◕		
	91	80.00 - 82.00	2.79	9°	0.20	1.68	1.84	2.50	297945											◕		
	91	85.00 - 100.00	3.29	9°	0.20	1.68	1.84	3.00	297946											◕		
	91	102.00 - 145.00	4.29	9°	0.20	1.94	2.14	4.00	297947											◕		

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
89	**115676**	M2.5 x 0.45 x 5	**415514**	**115590**	1.2 Nm	T8
90	**115531**	M3 x 0.5 x 7.5	**415514**	**115590**	1.2 Nm	T8
91	**115802**	M3 x 0.5 x 12	**415514**	**115590**	1.2 Nm	T8

Reference Key

Symbol	Machining Conditions
◕	Average - Main Application

Reference Key

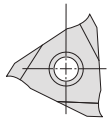
Symbol	Insert Type
▼▼	Universal - Main Application
▽▽	Universal - Extended Application

Axial Grooving Insert Blanks Form 304

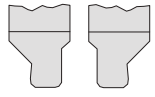
Carbide

		Carbide											
		Uncoated			Coated								
Steel	P												
Stainless Steel	M												
Cast Iron	K			▽▽									
Nonferrous Materials	N			▼▼									
Titanium	S			▽▽									
Hard Materials	H												

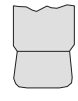
	Geometry	S_1	Part No.	WHW01	WHW16	WHW20	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
i		0.137	297150			◕									
		0.169	297151			◕									
		0.208	297152			◕									
		0.255	297154			◕									
		0.295	297493			◕									
		0.137	397850			◕									
		0.169	397851			◕									
		0.208	397852			◕									
		0.255	397853			◕									
		0.295	397854			◕									
m		3.50	297150			◕									
		4.30	297151			◕									
		5.30	297152			◕									
		6.50	297154			◕									
		7.50	297493			◕									
		3.50	397850			◕									
		4.30	397851			◕									
		5.30	397852			◕									
		6.50	397853			◕									
		7.50	397854			◕									


Other insert types available upon request.


Two-Sided Cutting Form


Single-Sided Cutting Form (Right / Left)


Two-Sided Angle Cutting


With Corner Radius


Full Radius

Reference Key

Symbol	Machining Conditions
◕	Average - Main Application

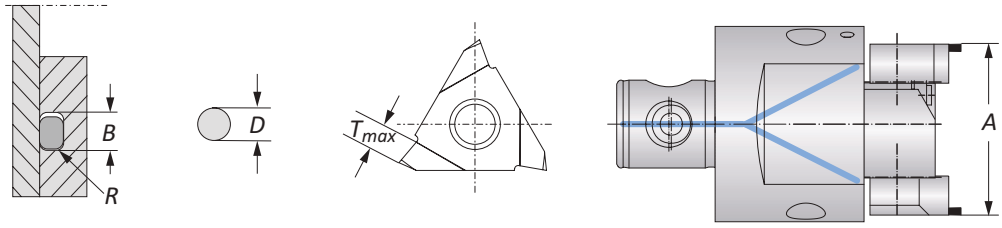
Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
304	215392	M5 x 0.8 x 12.9	415543	215150	5.0 Nm	T20

Reference Key

Symbol	Insert Type
▼▼	Universal - Main Application
▽▽	Universal - Extended Application

Axial Grooving O-Rings for Single Cutter Tools Insert Form 304

Carbide



		Carbide															
		Uncoated			Coated												
Steel	P														▼▼		
Stainless Steel	M														▽▽		
Cast Iron	K														▼▼		
Nonferrous Materials	N																
Titanium	S														▼▼		
Hard Materials	H																

	Geometry	*A* Boring Range	O-Ring Cross Section	*B* + *0.05*	B_{max}	T_{max}	*R* ± *0.05*	Part No.	WHW01	WHW16	WHW20	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
i		0.787 - 2.125	0.039	0.059	0.059	0.064	0.008	**297969**											●	
		0.787 - 2.125	0.059	0.086	0.086	0.092	0.012	**297970**											●	
		0.787 - 2.125	0.078	0.114	0.114	0.124	0.016	**297971**											●	
		0.787 - 2.125	0.098	0.137	0.137	0.151	0.020	**297972**											●	
		0.787 - 2.125	0.118	0.161	0.161	0.175	0.024	**297973**											●	
		0.787 - 2.125	0.157	0.212	0.212	0.194	0.031	**297974**											●	
		0.787 - 2.125	0.196	0.267	0.267	0.194	0.031	**297975**											●	
m		20.00 - 54.00	1.00	1.50	1.50	1.65	0.20	**297969**											●	
		20.00 - 54.00	1.50	2.20	2.20	2.35	0.30	**297970**											●	
		20.00 - 54.00	2.00	2.90	2.90	3.15	0.40	**297971**											●	
		20.00 - 54.00	2.50	3.50	3.50	3.85	0.50	**297972**											●	
		20 00 - 54.00	3.00	4.10	4.10	4.45	0.60	**297973**											●	
		20.00 - 54.00	4.00	5.40	5.40	4.95	0.80	**297974**											●	
		20.00 - 54.00	5.00	6.80	6.80	4.95	0.80	**297975**											●	

Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
304	**215392**	M5 x 0.8 x 12.9	**415543**	**215150**	5.0 Nm	T20

Reference Key

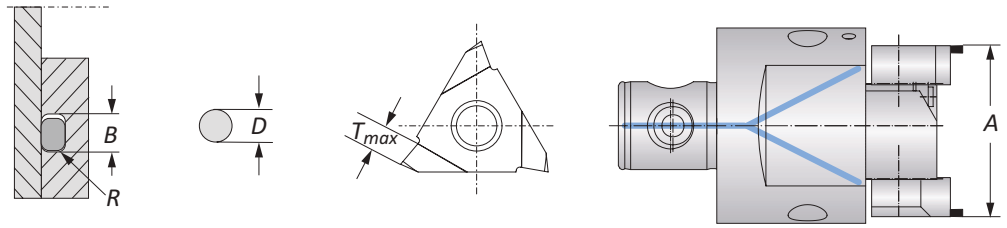
Symbol	Machining Conditions
●	Average - Main Application

Reference Key

Symbol	Insert Type
▼▼	Universal - Main Application
▽▽	Universal - Extended Application

Axial Grooving O-Rings for Twin Cutter Tools Insert Form 304

Carbide



								Carbide												
								Uncoated			Coated									
Steel	P																	▼▼		
Stainless Steel	M																	▽▽		
Cast Iron	K																	▼▼		
Nonferrous Materials	N																			
Titanium	S																	▼▼		
Hard Materials	H																			
	Geometry	*A* Boring Range	O-Ring Cross Section	*B + 0.05*	B_{max}	T_{max}	*R ± 0.05*	Part No.	WHW01	WHW16	WHW20	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
i		2.086 - 39.37	0.039 - 0.059	0.059	0.098	0.064	0.008	**297976**											●	
		2.086 - 39.37	0.039 - 0.059	0.086	0.145	0.092	0.012	**297977**											●	
		2.086 - 39.37	0.039 - 0.059	0.133	0.224	0.143	0.020	**297978**											●	
		2.086 - 39.37	0.039 - 0.059	0.212	0.358	0.194	0.031	**297979**											●	
m		53.00 - 1000.00	1.00 - 1.50	1.50	2.50	1.65	0.20	**297976**											●	
		53.00 - 1000.00	1.50 - 2.40	2.20	3.70	2.35	0.30	**297977**											●	
		53.00 - 1000.00	2.40 - 4.00	3.40	5.70	3.65	0.50	**297978**											●	
		53.00 - 1000.00	4.00 - 5.50	5.40	9.10	4.95	0.80	**297979**											●	

Reference Key

Symbol	Machining Conditions
●	Average - Main Application

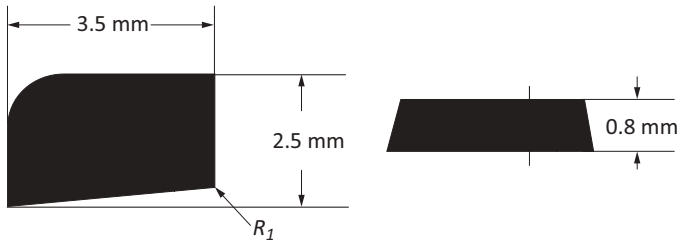
Insert Form	Countersunk Screw		Torque Driver	Service Key	Technical Data: Torque	Technical Data: Key Size
304	**215392**	M5 x 0.8 x 12.9	**415543**	**215150**	5.0 Nm	T20

Reference Key

Symbol	Insert Type
▼▼	Universal - Main Application
▽▽	Universal - Extended Application

Insert Form 325

Carbide



		Carbide												
		Uncoated			Coated									
Steel	P											▼▼▼		
Stainless Steel	M											▼▼▼		
Cast Iron	K			▼▼▼								▽▽▽		
Nonferrous Materials	N			▽▽▽										
Titanium	S											▼▼▼		
Hard Materials	H													

	Geometry	Radius R_1	Description	Part No.	WHW01	WHW16	WHW20	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
ⓘ	860	0.004	**F32501CN860**	**097831**			●								●	
ⓜ	860	0.10	**F32501CN860**	**097831**			●								●	

Insert Form	Countersunk Screw		Clamping Jaw	Torque Driver	Service Key	Technical Data	
						Torque	Key Size
325	**315321**	M1.6 x 0.35 x 3	**315320**	-	**315322**	0.3 Nm	0.5x3

Reference Key

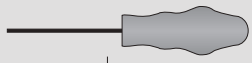
Symbol	Machining Conditions
●	Average - Main Application

Reference Key

Symbol	Insert Type
▼▼▼	Finishing - Main Application
▽▽▽	Finishing - Extended Application

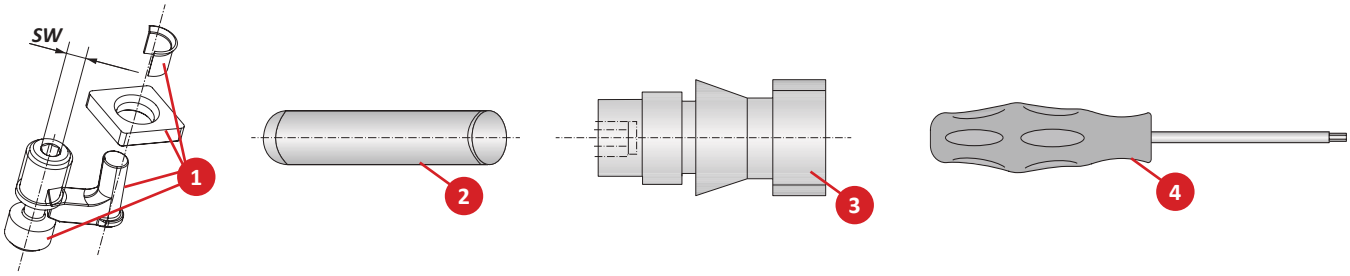
Insert Accessories

Countersunk Screws | Torque Drivers

						Technical Data	
Insert Form	Countersunk Screw		Clamping Jaw	Torque Driver	Service Key	Torque	Key Size
04	**415977**	M4 x 0.7 x 7.9	–	**415510**	**115664**	3.0 Nm	T15
05	**415949**	M4 x 0.7 x 11	–	**415543**	**215150**	5.0 Nm	T20
20	**115535**	M2 x 0.4 x 5	–	**415508**	**115591**	0.9 Nm	T7
39	**115673**	M3.5 x 0.6 x 9	–	**414510**	**115664**	3.0 Nm	T15
47	**315324**	M1.8 x 0.35 x 4	**315323**	**–**	**115537**	0.5 Nm	T6
89	**115676**	M2.5 x 0.45 x 5	–	**415514**	**115590**	1.2 Nm	T8
90	**115531**	M3 x 0.5 x 7.5	–	**415514**	**115590**	1.2 Nm	T8
91	**115802**	M3 x 0.5 x 12	–	**415514**	**115590**	1.2 Nm	T8
101	**115676**	M2.5 x 0.45 x 5	–	**415514**	**115590**	1.2 Nm	T8
103	**115672(<Ø37 mm)**	M3.5 x 0.6 x 7.5	–	**415510**	**115664**	3.0 Nm	T15
103	**115673(>Ø36 mm)**	M3.5 x 0.6 x 9	–	**415510**	**115664**	3.0 Nm	T15
104	**215149**	M4.5 x 0.75 x 11.5	–	**415543**	**215150**	5.0 Nm	T20
105	**215149**	M4.5 x 0.75 x 11.5	–	**415543**	**215150**	5.0 Nm	T20
111	**115531**	M3 x 0.5 x 7.5	–	**415514**	**115590**	1.2 Nm	T8
112	**115672(<Ø37 mm)**	M3.5 x 0.6 x 7.5	–	**415510**	**115664**	3.0 Nm	T15
112	**115673(>Ø36 mm)**	M3.5 x 0.6 x 9	–	**415510**	**115664**	3.0 Nm	T15
113	**215149**	M4.5 x 0.75 x 11.5	–	**415543**	**215150**	5.0 Nm	T20
114	**215149**	M4.5 x 0.75 x 11.5	–	**415543**	**215150**	5.0 Nm	T20
161	**115676**	M2.5 x 0.45 x 5	–	**415514**	**115590**	1.2 Nm	T8
163	**115673**	M3.5 x 0.6 x 9	–	**415510**	**115664**	3.0 Nm	T15
211	**215377**	M2 x 0.4 x 4	–	**415507**	**115537**	0.6 Nm	T6
262	**215987**	M2.5 x 0.45 x 6	–	**415514**	**115590**	1.2 Nm	T8
264	**115673**	M3.5 x 0.6 x 9	–	**415510**	**115664**	3.0 Nm	T15
304	**215392**	M5 x 0.8 x 12.9	–	**415543**	**215150**	5.0 Nm	T20
325	**315321**	M1.6 x 0.35 x 3	**315320**	**–**	**315322**	0.3 Nm	0.5x3
394	**215915**	M2.5 x 0.45 x 7	–	**415514**	**115590**	1.1 Nm	T8
395	**215985**	M3 x 0.5 x 7.5	–	**415514**	**115590**	1.2 Nm	T8
396	**415320**	M3.5 x 0.6 x 11	–	**415510**	**115664**	3.0 Nm	T15
397	**215149**	M4.5 x 0.75 x 11.5	–	**415543**	**215150**	5.0 Nm	T20

Insert Accessories

Countersunk Screws | Torque Drivers



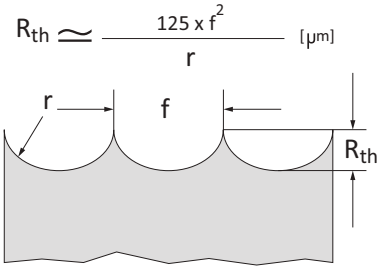
Insert Form	1. Clamping Set		2. Mounting Arbor for Sleeve	3. Clamping Bolt		4. Service Key	
	Part No.	Key Size	Part No.	Part No.	Key Size	Part No.	Key Size
75	**315004**	s3	**415642**	**–**	–	**415578**	s3
123	**315003**	s3	**415642**	**115775**	s2.5	**415578**	s3
						115575	s2.5
124	**315054**	s3	**415644**	**115776**	s3	**415578**	s3
						115630	s3

Technical Information

Surface Finish | General Formulas

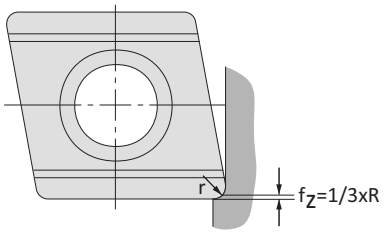
The corner radius of replaceable inserts is very important in finish machining. Large corner radii (0.031" (0.8 mm)) or higher allow for high feed rates with good surface quality.

The expected surface quality can be estimated by using the function of corner radius and feed rate formula.



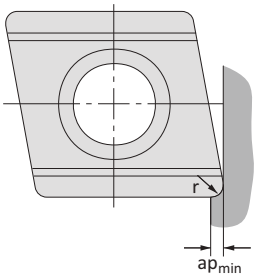
1. The larger the corner radius and the lighter the feed rate is, the better the surface quality.

2. If the feed is approximately 1/3 of the corner radius, the better the machining time and surface finish will be in finish machining applications.



3. A larger corner radius increases radial forces, which can negatively affect dimensional accuracy. Large corner radii also require increased depth of cut.

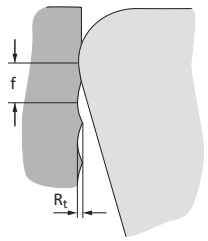
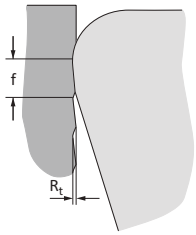
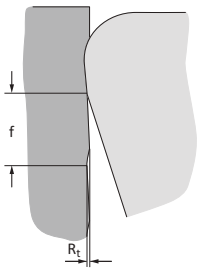
Minimum depth of cut (a_p) should at least match the corner radius. This minimizes the radial forces.



General Formulas		
Cutting Speed	$\frac{Vc = D \times \pi \times n}{1000}$	**(m/min)**
RPM	$\frac{n = Vc \times 1000}{D \times \pi}$	**(min^{-1})**
Feed Speed	$V_f = f \times n$	**(mm/min)**
	D = Machining Ø	**(mm)**
	f= Feed	**(mm/u)**
	V_c= Cutting Speed	**(m/min)**
	n = RPM	**(min^{-1})**

Technical Information

Wiper Geometries

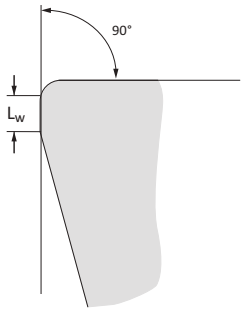
Replaceable Inserts with Wiper Geometry	
Insert with conventional corner radius with feed (f)	
Insert with wiper geometry radius with same feed (f)	
Insert with wiper geometry with increased feed (f)	

Wiper Geometry for 90° Approach Angle

Replaceable inserts produce a right-angled step at the bottom of the hole. When used in a Wohlhaupter standard insert holder that has a 90° approach angle, the secondary wiper cutting edge is nearly parallel with the wall of the hole.

Wiper geometry for 90° approach angle

Lw = length of the wiper secondary cutting edge

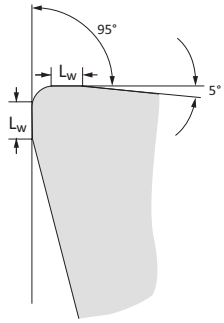


Wiper Geometry for 95° Approach Angle

Wiper inserts can also be used with 95° insert holders, which are included in the Wohlhaupter standard insert range.

Wiper geometry for 95° approach angle (left and right cutting)

Lw = length of the secondary wiper cutting edge



Rough Machining Recommended Cutting Data | Imperial (inch)

ISO	Material	(BHN) Hardness	Grade	*Speed SFM	Recommended Feed (inch / tooth) Nose Radii 0.008"	0.016"	0.032"	0.047"
P	**Free-Machining Steel** 1118, 1215, 12L14, etc.	100 - 250	Carbide	490 - 750	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
			Cermet	490 - 820	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
	Low-Carbon Steel 1010, 1020, 1025, 1522, 1144, etc.	85 - 275	Carbide	460 - 820	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
	Medium-Carbon Steel 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 325	Carbide	460 - 820	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
	Alloy Steel 4140, 5140, 8640, etc.	125 - 375	Carbide	390 - 660	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
	High-Strength Alloy 4340, 4330V, 300M, etc.	225 - 400	Carbide	330 - 590	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
	Structural Steel A36, A285, A516, etc.	100 - 350	Carbide	490 - 850	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
			Cermet	490 - 920	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
	Tool Steel H-13, H-21, A-4, 0-2, S-3, etc.	150 - 250	Carbide	330 - 590	0.004 - 0.006	0.004 - 0.012	0.008 - 0.020	0.004 - 0.031
S	**High-Temp Alloy** Hastelloy B, Inconel 600, etc.	140 - 310	Carbide	70 - 160	0.004 - 0.006	0.004 - 0.008	0.006 - 0.014	0.008 - 0.016
	Titanium Alloy	140 - 310	Carbide	130 - 260	0.004 - 0.006	0.004 - 0.008	0.006 - 0.014	0.008 - 0.016
	Aerospace Alloy S82	185 - 350	Carbide	130 - 260	0.004 - 0.006	0.004 - 0.008	0.006 - 0.014	0.008 - 0.016
M	**Stainless Steel 400 Series** 416, 420, etc.	185 - 350	Carbide	160 - 330	0.004 - 0.006	0.004 - 0.010	0.004 - 0.014	0.008 - 0.024
	Stainless Steel 300 Series 304, 316, 17-4PH, etc.	135 - 275	Carbide	260 - 490	0.004 - 0.006	0.004 - 0.010	0.004 - 0.014	0.008 - 0.024
	Super Duplex Stainless Steel	135 - 275	Carbide	200 - 330	0.004 - 0.006	0.004 - 0.010	0.004 - 0.014	0.008 - 0.024

*Not to exceed max recommended RPM for boring head found in corresponding Wohlhaupter Operation Manual.

Deep Hole Boring Speed Adjustment

⚠ For Dynamic Boring Tool NOVI[TECH®] Length			
Boring Type	**8xD**	**9xD**	**10xD**
Roughing	0.80	0.60	0.40
Finishing	0.90	0.70	0.50

*Not to exceed recommended RPM printed on NOVI[TECH®] module.

Recommended Speed Example

If the recommended speed for a finish boring assembly under 5xD is 120 m/min, then the speed for a 10xD finish boring assembly in the same application would be 60 m/min (120 m/min x 0.50 = 60 m/min).

5xD = 120 m/min	10xD = 60 m/min

IMPORTANT: Max spindle speed refers to maximum possible speed for individual boring head and is not a recommended parameter. Factory technical assistance is available for your specific applications through our Application Engineering department. *ext:* **7611** | *email:* **appeng@alliedmachine.com**

⚠ WARNING **Tool failure can cause serious injury. To prevent:**
-Do not exceed recommended 10xD length-to-diameter ratio or exceed four total components (including shank).
-When using Alu-Line components, do not exceed recommended 5xD length-to-diameter ratio.
-When using tool steel components, do not exceed recommended 6xD length-to-diameter ratio.
-When using heavy metal components, do not exceed recommended 8xD length-to-diameter ratio.
-When using a carbide shank, do not exceed recommended 9xD length-to-diameter ratio.
-When using a NOVI[TECH®] module, do not exceed recommended 10xD length-to-diameter ratio.
Factory technical assistance is available for your specific applications through our Application Engineering department. *ext:* **7611** | *email:* **appeng@alliedmachine.com**

Rough Machining Recommended Cutting Data | Imperial (inch)

ISO	Material	(BHN) Hardness	Grade	*Speed SFM	Recommended Feed (inch / tooth) Nose Radii 0.008"	0.016"	0.032"	0.047"
H	**Wear Plate** Hardox®, AR400, T-1, etc.	400 - 600	Carbide	100 - 160	0.002 - 0.006	0.004 - 0.008	0.004 - 0.008	0.004 - 0.010
			CBN	200 - 460	0.002 - 0.006	0.004 - 0.008	0.004 - 0.008	0.004 - 0.010
	Hardened Steel	300 - 500	Carbide	130 - 200	0.002 - 0.006	0.004 - 0.008	0.004 - 0.008	0.004 - 0.010
			CBN	200 - 460	0.002 - 0.006	0.004 - 0.008	0.004 - 0.008	0.004 - 0.010
K	**SG / Nodular Cast Iron**	120 - 320	Carbide	430 - 820	0.004 - 0.006	0.006 - 0.014	0.008 - 0.020	0.008 - 0.031
			Ceramic	660 - 1310	0.004 - 0.006	0.006 - 0.014	0.008 - 0.020	0.008 - 0.031
	Grey / White Iron	180 - 320	Carbide	490 - 920	0.004 - 0.006	0.006 - 0.014	0.008 - 0.020	0.008 - 0.031
			Ceramic	1310 - 3280	0.004 - 0.006	0.006 - 0.014	0.008 - 0.020	0.008 - 0.031
N	**Cast Aluminum**	30 - 180	Carbide	820 - 2620	0.004 - 0.006	0.006 - 0.014	0.008 - 0.024	0.008 - 0.031
			PCD	1310 - 3940	0.004 - 0.006	0.006 - 0.014	0.008 - 0.024	0.008 - 0.031
	Wrought Aluminum	30 - 180	Carbide	660 - 1640	0.004 - 0.006	0.006 - 0.014	0.006 - 0.020	0.008 - 0.031
	Aluminum Bronze	100 - 250	Carbide	390 - 820	0.004 - 0.006	0.006 - 0.010	0.006 - 0.016	0.008 - 0.024
	Brass	100	Carbide	660 - 1640	0.004 - 0.006	0.006 - 0.010	0.006 - 0.016	0.008 - 0.031
	Copper	60	Carbide	330 - 490	0.004 - 0.006	0.006 - 0.010	0.006 - 0.014	0.008 - 0.016

*Not to exceed max recommended RPM for boring head found in corresponding Wohlhaupter Operation Manual.

Deep Hole Boring Speed Adjustment

⚠ For Dynamic Boring Tool NOVI[TECH®] Length			
Boring Type	**8xD**	**9xD**	**10xD**
Roughing	0.80	0.60	0.40
Finishing	0.90	0.70	0.50

*Not to exceed recommended RPM printed on NOVI[TECH®] module.

Recommended Speed Example

If the recommended speed for a finish boring assembly under 5xD is 120 m/min, then the speed for a 10xD finish boring assembly in the same application would be 60 m/min (120 m/min x 0.50 = 60 m/min).

5xD = 120 m/min	10xD = 60 m/min

IMPORTANT: Max spindle speed refers to maximum possible speed for individual boring head and is not a recommended parameter. Factory technical assistance is available for your specific applications through our Application Engineering department. *ext:* **7611** | *email:* **appeng@alliedmachine.com**

⚠ WARNING **Tool failure can cause serious injury. To prevent:**
-Do not exceed recommended 10xD length-to-diameter ratio or exceed four total components (including shank).
-When using Alu-Line components, do not exceed recommended 5xD length-to-diameter ratio.
-When using tool steel components, do not exceed recommended 6xD length-to-diameter ratio.
-When using heavy metal components, do not exceed recommended 8xD length-to-diameter ratio.
-When using a carbide shank, do not exceed recommended 9xD length-to-diameter ratio.
-When using a NOVI[TECH®] module, do not exceed recommended 10xD length-to-diameter ratio.
Factory technical assistance is available for your specific applications through our Application Engineering department. *ext:* **7611** | *email:* **appeng@alliedmachine.com**

Finish Machining Recommended Cutting Data | Imperial (inch)

ISO	Material	(BHN) Hardness	Grade	*Speed SFM	Recommended Feed (inch / tooth) Nose Radii 0.004"	0.008"	0.016"	0.031"
P	**Free-Machining Steel** 1118, 1215, 12L14, etc.	100 - 250	Carbide	525 - 975	0.001 - 0.003	0.002 - 0.005	0.004 - 0.006	0.006 - 0.009
P	**Low-Carbon Steel** 1010, 1020, 1025, 1522, 1144, etc.	85 - 275	Carbide	475 - 925	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
P	**Medium-Carbon Steel** 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 325	Carbide	475 - 825	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
P	**Alloy Steel** 4140, 5140, 8640, etc.	125 - 375	Carbide	400 - 700	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
P	**High-Strength Alloy** 4340, 4330V, 300M, etc.	225 - 400	Carbide	325 - 600	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
P	**Structural Steel** A36, A285, A516, etc.	100 - 350	Carbide	475 - 925	0001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
P	**Tool Steel** H-13, H-21, A-4, 0-2, S-3, etc.	150 - 250	Carbide	325 - 600	0.001 - 0.002	0.002 - 0.003	0.003 - 0.004	0.004 - 0.006
S	**High-Temp Alloy** Hastelloy B, Inconel 600, etc.	140 - 310	Carbide	100 - 225	0.001 - 0.002	0.002 - 0.003	0.003 - 0.005	0.004 - 0.006
S	**Titanium Alloy**	140 - 310	Carbide	125 - 300	0.001 - 0.002	0.002 - 0.003	0.003 - 0.005	0.004 - 0.006
S	**Aerospace Alloy** S82	185 - 350	Carbide	125 - 300	0.001 - 0.002	0.002 - 0.003	0.003 - 0.005	0.004 - 0.006
M	**Stainless Steel 400 Series** 416, 420, etc.	185 - 350	Carbide	164 - 394	0.001 - 0.002	0.002 - 0.004	0.003 - 0.004	0.004 - 0.006
M	**Stainless Steel 300 Series** 304, 316, 17-4PH, etc.	135 - 275	Carbide	300 - 525	0.001 - 0.002	0.002 - 0.004	0.003 - 0.004	0.004 - 0.006
M	**Super Duplex Stainless Steel**	135 - 275	Carbide	197 - 525	0.001 - 0.002	0.002 - 0.004	0.003 - 0.004	0.004 - 0.006

*Not to exceed max recommended RPM for boring head found in corresponding Wohlhaupter Operation Manual.

Deep Hole Boring Speed Adjustment

⚠ For Dynamic Boring Tool NOVI[TECH®] Length			
Boring Type	**8xD**	**9xD**	**10xD**
Roughing	0.80	0.60	0.40
Finishing	0.90	0.70	0.50

*Not to exceed recommended RPM printed on NOVI[TECH®] module.

Recommended Speed Example

If the recommended speed for a finish boring assembly under 5xD is 120 m/min, then the speed for a 10xD finish boring assembly in the same application would be 60 m/min (120 m/min x 0.50 = 60 m/min).

5xD = 120 m/min	10xD = 60 m/min

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-When using a carbide shank, do not exceed recommended 9xD length-to-diameter ratio.
-When using a NOVI[TECH®] module, do not exceed recommended 10xD length-to-diameter ratio.
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Finish Machining Recommended Cutting Data | Imperial (inch)

ISO	Material	(BHN) Hardness	Grade	*Speed SFM	Recommended Feed (inch / tooth) Nose Radii 0.004"	0.008"	0.016"	0.031"
H	**Wear Plate**	400 - 600	Carbide	100 - 200	0.001 - 0.002	0.002 - 0.003	0.003 - 0.004	0.004 - 0.006
	Hardox®, AR400, T-1, etc.		CBN	225 - 600	0.001 - 0.002	0.002 - 0.003	0.003 - 0.004	0.004 - 0.006
	Hardened Steel	300 - 500	Carbide	125 - 275	0.001 - 0.002	0.002 - 0.003	0.003 - 0.004	0.004 - 0.006
			CBN	225 - 600	0.001 - 0.002	0.002 - 0.003	0.003 - 0.004	0.004 - 0.006
K	**SG / Nodular Cast Iron**	120 - 320	Carbide	475 - 850	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
	Grey / White Iron	180 - 320	Carbide	600 - 1050	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
			CBN	1325 - 3275	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
N	**Cast Aluminum**	30 - 180	Carbide	850 - 2800	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
			PCD	1625 - 6550	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
	Wrought Aluminum	30 - 180	Carbide	675 - 1975	0.001 - 0.003	0.002 - 0.005	0.004 - 0.006	0.006 - 0.009
	Aluminum Bronze	100 - 250	Carbide	475 - 925	0.001 - 0.002	0.002 - 0.004	0.004 - 0.005	0.005 - 0.008
	Brass	100	Carbide	675 - 1975	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
	Copper	60	Carbide	325 - 600	0.001 - 0.002	0.002 - 0.003	0.003 - 0.004	0.004 - 0.005

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Deep Hole Boring Speed Adjustment

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*Not to exceed recommended RPM printed on NOVI[TECH®] module.

Recommended Speed Example

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-When using a carbide shank, do not exceed recommended 9xD length-to-diameter ratio.
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Rough Machining Recommended Cutting Data | Metric (mm)

ISO	Material	(BHN) Hardness	Grade	*Speed M / Min	Recommended Feed (mm / tooth) Nose Radii 0.2 mm	0.4 mm	0.8 mm	1.2 mm
P	**Free-Machining Steel** 1118, 1215, 12L14, etc.	100 - 250	Carbide	150 - 230	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
			Cermet	150 - 250	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
	Low-Carbon Steel 1010, 1020, 1025, 1522, 1144, etc.	85 - 275	Carbide	140 - 250	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
	Medium-Carbon Steel 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 325	Carbide	140 - 250	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
	Alloy Steel 4140, 5140, 8640, etc.	125 - 375	Carbide	120 - 200	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
	High-Strength Alloy 4340, 4330V, 300M, etc.	225 - 400	Carbide	100 - 180	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
	Structural Steel A36, A285, A516, etc.	100 - 350	Carbide	150 - 260	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
			Cermet	150 - 280	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
	Tool Steel H-13, H-21, A-4, 0-2, S-3, etc.	150 - 250	Carbide	100 - 180	0.10 - 0.15	0.10 - 0.30	0.20 - 0.50	0.10 - 0.80
S	**High-Temp Alloy** Hastelloy B, Inconel 600, etc.	140 - 310	Carbide	20 - 50	0.10 - 0.15	0.10 - 0.2	0.15 - 0.35	0.20 - 0.40
	Titanium Alloy	140 - 310	Carbide	40 - 80	0.10 - 0.15	0.10 - 0.2	0.15 - 0.35	0.20 - 0.40
	Aerospace Alloy S82	185 - 350	Carbide	40 - 80	0.10 - 0.15	0.10 - 0.2	0.15 - 0.35	0.20 - 0.40
M	**Stainless Steel 400 Series** 416, 420, etc.	185 - 350	Carbide	50 - 100	0.10 - 0.15	0.10 - 0.25	0.10 - 0.35	0.20 - 0.60
	Stainless Steel 300 Series 304, 316, 17-4PH, etc.	135 - 275	Carbide	80 - 150	0.10 - 0.15	0.10 - 0.25	0.10 - 0.35	0.20 - 0.60
	Super Duplex Stainless Steel	135 - 275	Carbide	60 - 100	0.10 - 0.15	0.10 - 0.25	0.10 - 0.35	0.20 - 0.60

*Not to exceed max recommended RPM for boring head found in corresponding Wohlhaupter Operation Manual.

Deep Hole Boring Speed Adjustment

⚠ For Dynamic Boring Tool NOVI[TECH®] Length			
Boring Type	**8xD**	**9xD**	**10xD**
Roughing	0.80	0.60	0.40
Finishing	0.90	0.70	0.50

*Not to exceed recommended RPM printed on NOVI[TECH®] module.

Recommended Speed Example

If the recommended speed for a finish boring assembly under 5xD is 120 m/min, then the speed for a 10xD finish boring assembly in the same application would be 60 m/min (120 m/min x 0.50 = 60 m/min).

5xD = 120 m/min	10xD = 60 m/min

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-When using a carbide shank, do not exceed recommended 9xD length-to-diameter ratio.
-When using a NOVI[TECH®] module, do not exceed recommended 10xD length-to-diameter ratio.
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Rough Machining Recommended Cutting Data | Metric (mm)

ISO	Material	(BHN) Hardness	Grade	*Speed M / Min	Recommended Feed (mm / tooth) Nose Radii 0.2 mm	0.4 mm	0.8 mm	1.2 mm
H	**Wear Plate** Hardox®, AR400, T-1, etc.	400 - 600	Carbide	30 - 50	0.05 - 0.15	0.10 - 0.20	0.10 - 0.20	0.10 - 0.25
			CBN	60 - 140	0.05 - 0.15	0.10 - 0.20	0.10 - 0.20	0.10 - 0.25
	Hardened Steel	300 - 500	Carbide	40 - 60	0.05 - 0.15	0.10 - 0.20	0.10 - 0.20	0.10 - 0.25
			CBN	60 - 140	0.05 - 0.15	0.10 - 0.20	0.10 - 0.20	0.10 - 0.25
K	**SG / Nodular Cast Iron**	120 - 320	Carbide	130 - 250	0.10 - 0.15	0.15 - 0.35	0.20 - 0.50	0.20 - 0.80
			Ceramic	200 - 400	0.10 - 0.15	0.15 - 0.35	0.20 - 0.50	0.20 - 0.80
	Grey / White Iron	180 - 320	Carbide	150 - 280	0.10 - 0.15	0.15 - 0.35	0.20 - 0.60	0.20 - 0.80
			Ceramic	400 - 1000	0.10 - 0.15	0.15 - 0.35	0.20 - 0.60	0.20 - 0.80
N	**Cast Aluminum**	30 - 180	Carbide	250 - 800	0.10 - 0.15	0.15 - 0.35	0.20 - 0.60	0.20 - 0.80
			PCD	400 - 1200	0.10 - 0.15	0.15 - 0.35	0.20 - 0.60	0.20 - 0.80
	Wrought Aluminum	30 - 180	Carbide	200 - 500	0.10 - 0.15	0.15 - 0.35	0.15 - 0.50	0.20 - 0.80
	Aluminum Bronze	100 - 250	Carbide	120 - 250	0.10 - 0.15	0.15 - 0.25	0.15 - 0.40	0.20 - 0.60
	Brass	100	Carbide	200 - 500	0.10 - 0.15	0.15 - 0.25	0.15 - 0.40	0.20 - 0.80
	Copper	60	Carbide	100 - 150	0.10 - 0.15	0.15 - 0.25	0.15 - 0.35	0.20 - 0.40

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Deep Hole Boring Speed Adjustment

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Boring Type	**8xD**	**9xD**	**10xD**
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Finish Machining Recommended Cutting Data | Metric (mm)

ISO	Material	(BHN) Hardness	Grade	*Speed M / Min	Recommended Feed (mm / tooth) Nose Radii 0.1 mm	0.2 mm	0.4 mm	0.8 mm
P	**Free-Machining Steel** 1118, 1215, 12L14, etc.	100 - 250	Carbide	150 - 300	0.02 - 0.08	0.05 - 0.13	0.10 - 0.15	0.15 - 0.23
P	**Low-Carbon Steel** 1010, 1020, 1025, 1522, 1144, etc.	85 - 275	Carbide	145 - 280	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
P	**Medium-Carbon Steel** 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 325	Carbide	145 - 280	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
P	**Alloy Steel** 4140, 5140, 8640, etc.	125 - 375	Carbide	120 - 215	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
P	**High-Strength Alloy** 4340, 4330V, 300M, etc.	225 - 400	Carbide	100 - 180	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
P	**Structural Steel** A36, A285, A516, etc.	100 - 350	Carbide	145 - 280	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
P	**Tool Steel** H-13, H-21, A-4, 0-2, S-3, etc.	150 - 250	Carbide	100 - 180	0.02 - 0.05	0.05 - 0.08	0.08 - 0.10	0.10 - 0.15
S	**High-Temp Alloy** Hastelloy B, Inconel 600, etc.	140 - 310	Carbide	30 - 70	0.02 - 0.05	0.05 - 0.08	0.08 - 0.13	0.10 - 0.15
S	**Titanium Alloy**	140 - 310	Carbide	40 - 90	0.02 - 0.05	0.05 - 0.08	0.08 - 0.13	0.10 - 0.15
S	**Aerospace Alloy** S82	185 - 350	Carbide	40 - 90	0.02 - 0.05	0.05 - 0.08	0.08 - 0.13	0.10 - 0.15
M	**Stainless Steel 400 Series** 416, 420, etc.	185 - 350	Carbide	50 - 120	0.02 - 0.05	0.05 - 0.10	0.08 - 0.10	0.10 - 0.15
M	**Stainless Steel 300 Series** 304, 316, 17-4PH, etc.	135 - 275	Carbide	90 - 160	0.02 - 0.05	0.05 - 0.10	0.08 - 0.10	0.10 - 0.15
M	**Super Duplex Stainless Steel**	135 - 275	Carbide	60 - 160	0.02 - 0.05	0.05 - 0.10	0.08 - 0.10	0.10 - 0.15

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ISO	Material	(BHN) Hardness	Grade	*Speed M / Min	Recommended Feed (mm / tooth) Nose Radii 0.1 mm	0.2 mm	0.4 mm	0.8 mm
H	**Wear Plate** Hardox®, AR400, T-1, etc.	400 - 600	Carbide	30 - 60	0.02 - 0.05	0.05 - 0.08	0.08 - 0.10	0.10 - 0.15
			CBN	70 - 180	0.02 - 0.05	0.05 - 0.08	0.08 - 0.10	0.10 - 0.15
	Hardened Steel	300 - 500	Carbide	40 - 80	0.02 - 0.05	0.05 - 0.08	0.08 - 0.10	0.10 - 0.15
			CBN	70 - 180	0.02 - 0.05	0.05 - 0.08	0.08 - 0.10	0.10 - 0.15
K	**SG / Nodular Cast Iron**	120 - 320	Carbide	145 - 260	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
	Grey / White Iron	180 - 320	Carbide	180 - 320	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
			CBN	400 - 1000	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
N	**Cast Aluminum**	30 - 180	Carbide	260 - 850	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
			PCD	495 - 1995	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
	Wrought Aluminum	30 - 180	Carbide	205 - 600	0.02 - 0.05	0.05 - 0.13	0.10 - 0.15	0.15 - 0.23
	Aluminum Bronze	100 - 250	Carbide	145 - 280	0.02 - 0.05	0.05 - 0.10	0.10 - 0.13	0.13 - 0.20
	Brass	100	Carbide	205 - 600	0.02 - 0.05	0.05 - 0.10	0.08 - 0.13	0.13 - 0.20
	Copper	60	Carbide	100 - 180	0.02 - 0.05	0.05 - 0.08	0.08 - 0.10	0.10 - 0.13

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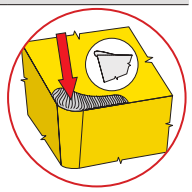
Boring Insert Wear Patterns

Built-up Edge



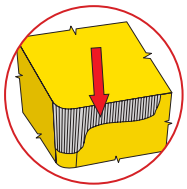
Potential Problem

- Machined material adheres to the cutting edge of insert.
- When it breaks, the edge becomes brittle and cracks.
- This can negatively affect machined surface.

Possible Solution

- Increase temperature by increasing speed or feed.
- Use an insert with higher lubricity coating.
- Choose a freer cutting insert geometry.

Flank Wear



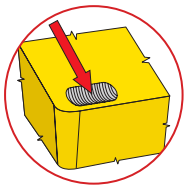
Potential Problem

- Caused by friction between the insert and machined material.
- It cannot be fully eliminated, but it can be reduced.

Possible Solution

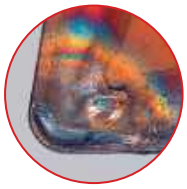
- Use a more wear-resistant grade
- Reduce cutting speed.
- Use coolant or increase coolant flow to the cutting edge.

Cratering



Potential Problem

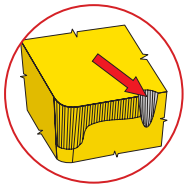
- Appears when the geometry is too neutral or material is too hard for the substrate.



Possible Solution

- Use a more wear-resistant grade.
- Reduce cutting speed or feed.
- Use coolant or increase coolant flow to the cutting edge.

Notch Wear



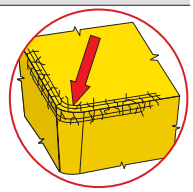
Potential Problem

- Occurs when cutting edge of insert comes in contact with surface of machined material.
- Caused by hardening of surface layer of material and burrs.
- Often appears on stainless austenitic steels and other high-temperature alloy steels.

Possible Solution

- Use a more wear-resistant grade (Al_2O_3).
- Select a tool with a smaller approach angle.
- Vary the radial depth of cut.
- Use coolant or increase coolant flow to the cutting edge.

Comb Cracks



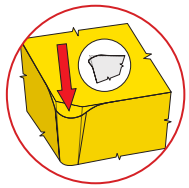
Potential Problem

- Caused by high stress on the cutting edge during interrupted cuts.

Possible Solution

- Switch off coolant or increase coolant flow to obtain an even temperature level.
- Reduce cutting speed.
- Use tougher insert grade.

Plastic Deformation



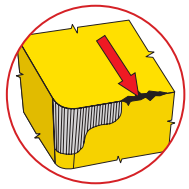
Potential Problem

- Caused by high thermal stress on the cutting edge from excessive feed rate and cutting speed.

Possible Solution

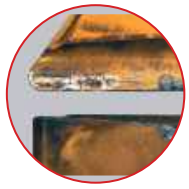
- Use a more wear-resistant grade.
- Reduce cutting speed.
- Reduce feed rate.
- Use coolant or increase coolant flow to the cutting edge.

Chipping of Cutting Edge (Out of Cut)



Potential Problem

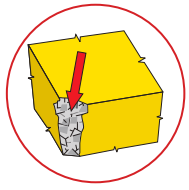
- Caused by poor chip control.
- Can damage the portion of the cutting edge that might not be engaged in the cut.



Possible Solution

- Change feed rate to gain chip control.
- Select a tool with a different approach angle.
- Use an insert with a different geometry.
- Use a tougher grade of carbide.

Insert Fracture



Potential Problem

- Caused by workpiece material, grade, condition, the rigidity of the machine-tool workpiece, extent of wear, and cutting conditions.

Possible Solution

- Use a tougher grade of carbide.
- Reduce the feed and depth of cut.
- Use an insert with a stronger chip breaker.
- Use an insert with a bigger corner radius.

Notes

Guaranteed Test / Demo Application Form

Distributor PO #	

The following must be filled out completely before your test will be considered.

IMPORTANT: For processing, send purchase order to your Allied Field Sales Engineer (FSE). Please clearly mark the paperwork as "Test Order."

Distributor Information

Company Name: _____
Contact: _____
Account Number: _____
Phone: _____
Email: _____

End User Information

Company Name: _____
Contact: _____
Industry: _____
Phone: _____
Email: _____

Current Process

List all tooling, coatings, substrates, speeds and feeds, tool life, and any problems you are experiencing.

_____

_____

Test Objective

List what would make this a successful test (i.e. penetration rate, finish, tool life, hole size, etc.).

_____

_____

Application Information

Hole Diameter: _____ in/mm
Tolerance: _____
Material: _____ (4150, A36, cast iron, etc.)
Preexisting Diameter: _____ in/mm
Depth of Cut: _____ in/mm
Hardness: _____ (BHN, Rc)
Required Finish: _____ RMS
State: _____ (Casting, hot rolled, forging)

Machine Information

Machine Type: _____ (Lathe, screw machine, machine center, etc.)
Builder: _____ (Haas, Mori Seiki, etc.)
Model #: _____
Shank Required: _____ (CAT50, Morse taper, etc.)
Power: _____ HP/KW
Thrust: _____ lbs/N

Rigidity:
- ☐ Excellent
- ☐ Good
- ☐ Poor

Orientation:
- ☐ Vertical
- ☐ Horizontal

Tool Rotating:
- ☐ Yes
- ☐ No

Coolant Information

Coolant Delivery: _____ (Through tool, flood)
Coolant Pressure: _____ PSI / bar
Coolant Type: _____ (Air mist, oil, synthetic, water soluble, etc.)
Coolant Volume: _____ GPM / LPM

Requested Tooling

QTY	Item Number

QTY	Item Number

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Complete information as to operating conditions, machine, setup, and the application of cutting fluid should accompany any product returned for inspection. This warranty shall not apply to any Allied Machine products which have been subjected to misuse, abuse, improper operating conditions, improper machine setup or improper application of cutting fluid or which have been repaired or altered if such repair or alteration, in the judgement of Allied Machine, would adversely affect the performance of the product.

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