



ALLIED MACHINE & ENGINEERING

Holemaking Solutions for Today's Manufacturing



Drilling



Reaming



Burnishing



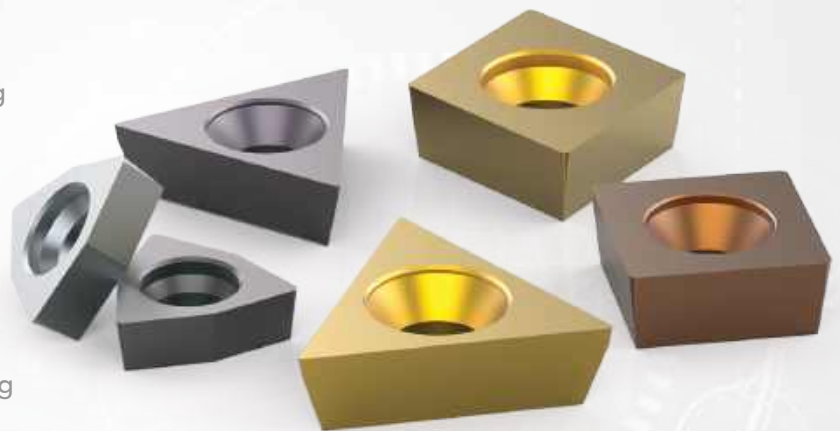
Threading



Wohlhaupter®

► **BORING**

Inserts



Specials

WOHLHAUPTER®

The background of the entire page is a solid red color. Overlaid on this are several concentric circles and a grid of thin, light-red lines. The circles are centered on the left side of the page and expand towards the right. The grid lines are horizontal and vertical, creating a subtle pattern across the entire surface.

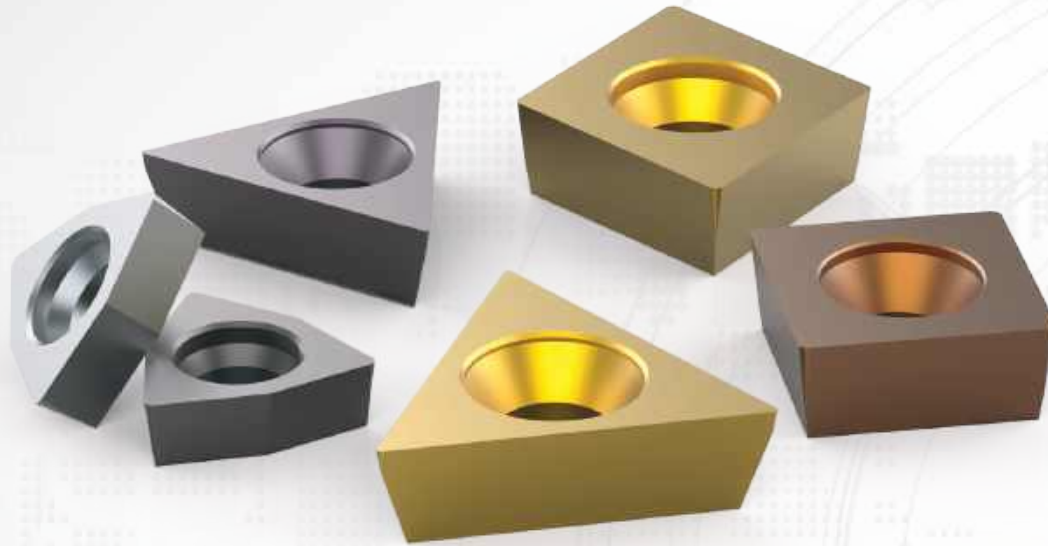
SECTION

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.

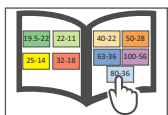
NOTICE means that failure to follow the precautions in this message could result in damage to the tool or machine but not result in personal injury.

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.

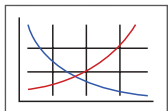
Reference Icons

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

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WOHLHAUPTER®

Boring Insert Selector

Find the best insert for your application.

- Generate the correct boring insert for your job in just six easy steps
- Choose type, shape, substrate, insert form, nose radius, and material
- Order easily by adding the item to your cart

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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	2. Clearance Angle	3. Tolerance Group	4. Mounting Style
C = Rhomboid 80° D = Rhomboid 55° L = Rectangular R = Round S = Square T = Triangular V = Rhomboid 35° W = Trigon	B = 5° C = 7° N = 0° P = 11° O = 10°	Metric (mm) Length of edge ±0.025 G IC ±0.025 Thickness ±0.13 Length of edge ±0.08-0.15* M IC ±0.05-0.10* Thickness ±0.13 Length of edge ±0.013 F IC ±0.005 Thickness ±0.025 Length of edge ±0.13 C IC ±0.025 Thickness ±0.025 *Varies upon insert size	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	6. Insert Thickness	7. Corner Radius
Metric (mm) C D R S T V W 3.97 mm 5.00 mm 6.00 mm 6.35 mm 7.94 mm 9.52 mm 10.00 mm 12.00 mm 12.70 mm 15.87 mm 16.00 mm 19.05 mm 20.00 mm 25.00 mm 25.40 mm	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	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 Al₂O₃ - 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								
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								
WHC114 (HC)	- Multilayer PVD coating - Finishing and roughing - Steels, stainless steels, and difficult-to-machine materials	P								
		M								
		K								
		N								
		S								
WHC136 (HC)	- Stronger PVD coating with improved coating adhesion - High oxidation resistance allows a wide range of applications	P								
		M								
		K								
		N								
		S								
WHC164 (HC)	- Thick MT-CVD coating with a dominant Al₂O₃ - 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								
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								
WHC170 (HC)	- Multilayer MT CVD coating - Excellent toughness - First choice for strong interruptions - Cast materials and steel	P								
		M								
		K								
		N								
		S								
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								

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 - 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								

Wohlhafter 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

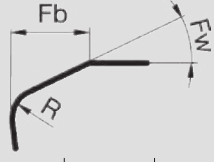
Wohlhaupter Insert Geometries

PCD | CBN

PCD

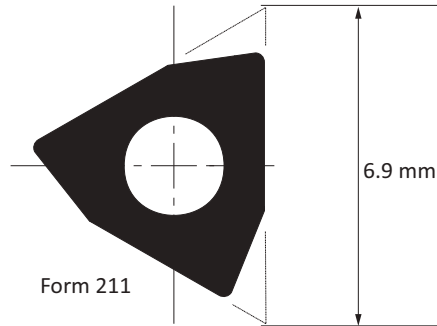
Geometry	Description	Application	Available Form
720 	- Smooth geometry in positive version with 7° rake angle for PCD - Sharp cutting edge	▼▼▼	F20, F101, F103
730 	- Smooth geometry with 0° rake angle for PCD - Sharp cutting edge	▼▼▼	F20, F39, F75, F101, F103, F123, F211, F262, F264
735 	- Smooth geometry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

CBN

Geometry	Description				Application	Available Form
		R	Fb	Fw		
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



						Cermet					Carbide											
						Uncoated			Coated		Uncoated		Coated									
Steel					P		▼▼▼						▼▼▼		▼▼▼			▼▼▼		▼▼▼		
Stainless Steel					M								▼▼▼		▼▼▼			▼▼▼		▼▼▼		
Cast Iron					K		▼▼▼				▼▼▼		▼▼▼		▼▼▼			▼▼▼		▼▼▼		
Nonferrous Materials					N		▼▼▼				▼▼▼			▼▼▼								
Titanium					S						▼▼▼		▼▼▼		▼▼▼			▼▼▼		▼▼▼		
Hard Materials					H													▼▼▼				
Geometry	Radius		Description	ISO Code	Part No.	WHT10	WHT12	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164	
	in	mm																				
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

Reference Key

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

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

Insert Form 211

CBN | PCD



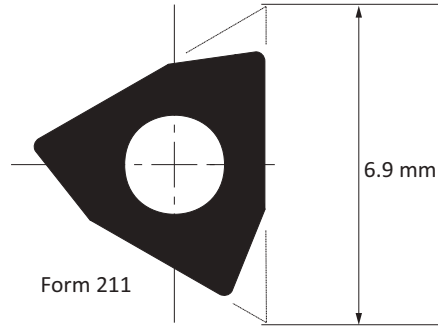
730 Geometry



735 Geometry



748 Geometry



Form 211

						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		Description	ISO Code	Part No.					WBN150	WBN200	WBN300	WBN450				PKDD30	PKDD50			
	in	mm																			
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	
211	215377	M2 x 0.4 x 4	415507	115537	Torque	Key Size
					0.6 Nm	T6

Reference Key

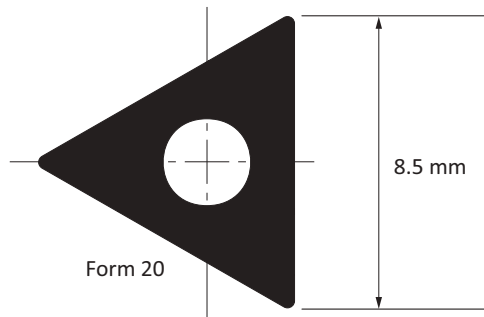
Symbol	Machining Conditions
●	Average - Main Application

Reference Key

Symbol	Insert Type
▼▼▼	Finishing - Main Application

Insert Form 20

Cermet | Carbide



						Cermet					Carbide														
						Uncoated			Coated		Uncoated		Coated												
Steel						P		▼▼		▼▼	▼▼			▼▼		▼▼			▼▼			▼▼		▼▼	
Stainless Steel						M				▼▼	▼▼			▼▼		▼▼			▼▼			▼▼		▼▼	
Cast Iron						K		▼▼		▼▼			▼▼	▼▼	▼▼		▼▼			▼▼			▼▼		▼▼
Nonferrous Materials						N		▼▼					▼▼	▼▼		▼▼									
Titanium						S							▼▼	▼▼	▼▼		▼▼				▼▼		▼▼		
Hard Materials						H							▼▼	▼▼	▼▼		▼▼				▼▼		▼▼		
Geometry	Radius		Description	ISO Code	Part No.	WHT10	WHT12	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136					
	in	mm																							
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

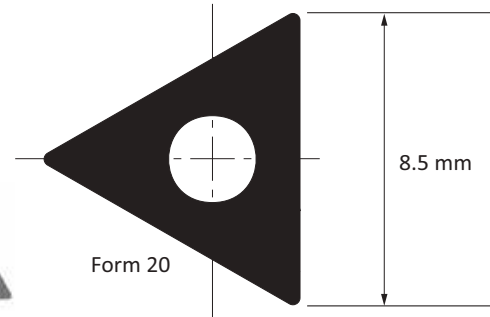
Reference Key

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

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

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		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	
20	115535	M2 x 0.4 x 5	415508	115591	Torque	Key Size
					0.9 Nm	T7

Reference Key

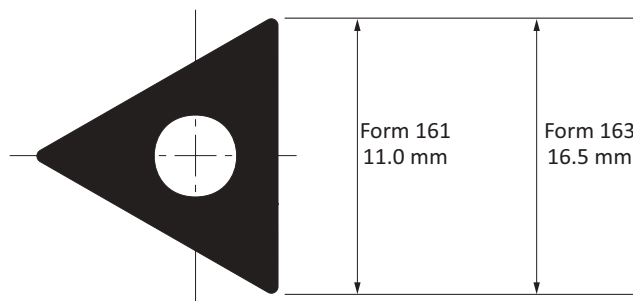
Symbol	Machining Conditions
●	Good - Main Application
◐	Average - Main Application

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		Description	ISO Code	Part No.	WHT10	WHT12	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC19	WHC88	WHC77	WHC79	WHC111	WHC114	WHC136	WHC164	
	in	mm																				
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

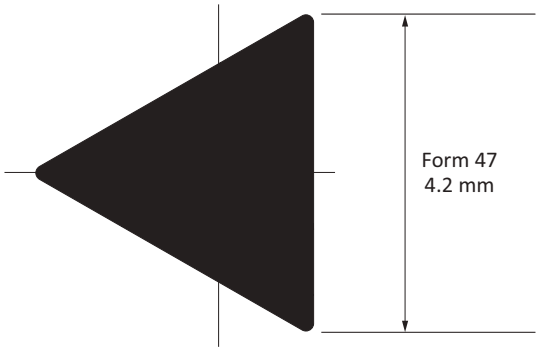
Reference Key

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

Insert Form	Countersunk Screw		Torque Driver		Service Key		Technical Data	
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		

Insert Form 47

Cermet | Carbide



						Carbide									
						Uncoated		Coated							
Steel					P					▼▼▼					
Stainless Steel					M					▽▽▽					
Cast Iron					K	▽▽▽				▽▽▽					
Nonferrous Materials					N	▼▼▼									
Titanium					S	▽▽▽									
Hard Materials						H									
Geometry	Radius		ISO Code	Description	Part No.	WHW01	WHW16	WHC05	WHC18	WHC20	WHC79	WHC111	WHC114	WHC136	WHC164
	in	mm													
650	0.004	0.10	TOFX040101	F04701FL650	097832	●				●					
650	0.008	0.20	TOFX040102	F04702FL650	097833	●				●					

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

Reference Key

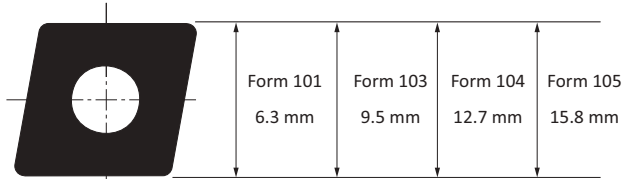
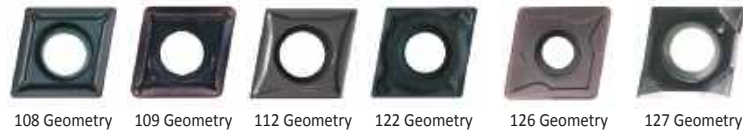
Symbol	Machining Conditions
●	Good - Main Application

Reference Key

Symbol	Insert Type
▽▽▽	Finishing - Main Application

Insert Forms 101, 103, 104, 105

Cermet | Carbide



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

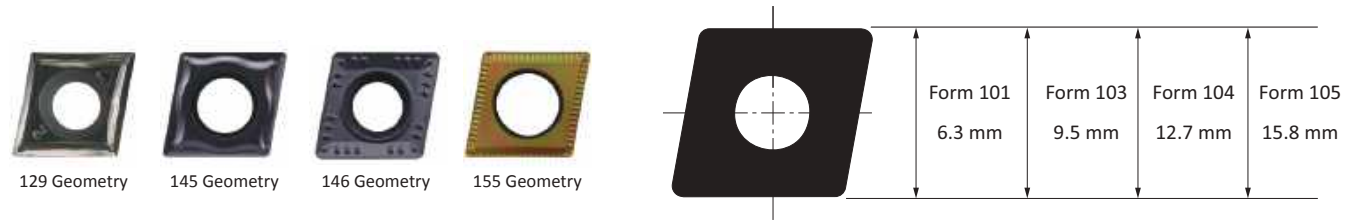
Reference Key

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	
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		

Insert Forms 101, 103, 104, 105

Cermet | Carbide



						Cermet				Carbide													
						Uncoat- ed		Coated		Uncoated		Coated											
Steel						P			▼▼▼			▼				▼▼▼	▼▼▼		▼▼▼				
Stainless Steel						M			▼▼▼			▼▼▼					▼▼▼	▼▼▼		▼▼▼			
Cast Iron						K			▼▼▼			▼▼▼	▼				▼▼▼	▼▼▼		▼▼▼			
Nonferrous Materials						N						▼▼▼	▼		▼▼▼								
Titanium						S						▼▼▼	▼				▼▼▼	▼▼▼		▼▼▼			
Hard Materials						H						▼	▼				▼▼▼	▼		▼▼▼			
Geometry	Radius		Description	ISO Description	Part No.	WHT10	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC81	WHC88	WHC98	WHC111	WHC114	WHC136	WHC164	
	in	mm																					
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	
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



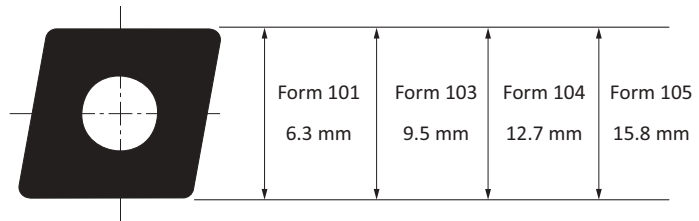
158 Geometry



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		Description	ISO Code	Part No.	WHW01	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164
	in	mm														
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											●

Reference Key

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

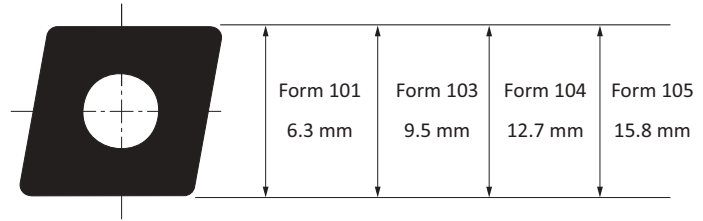
Reference Key

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	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

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		Description	ISO Code	Part No.	WHT10	WHT12	WHT16	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC18	WHC19	WHC77	WHC79	WHC98	WHC111	WHC114	WHC136	WHC164		
	in	mm																							
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							●		●								●			

Insert Form	Countersunk Screw		Torque Driver		Service Key		Technical Data	
							Torque	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

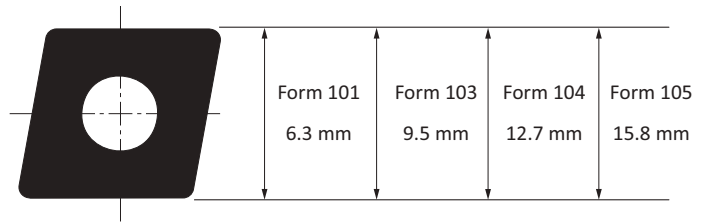
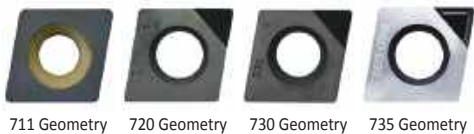
Symbol	Machining Conditions
●	Good - Main Application
◐	Average - Main Application

Reference Key

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

Insert Forms 101, 103, 104

Ceramic | CBN | PCD



						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		Description	ISO Code	Part No.	WCN40				WBN150	WBN200	WBN300	WBN450				PKDD30	PKDD50
	in	mm																
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

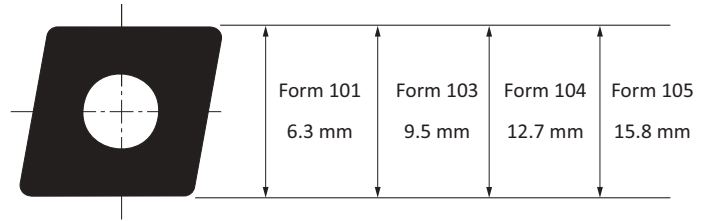
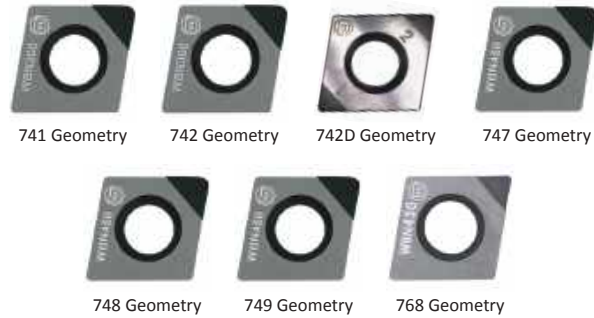
Reference Key

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	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

Insert Forms 101, 103, 104

CBN



						CBN						
						Uncoated					Coated	
Steel						P						
Stainless Steel						M						
Cast Iron						K	▽▽▽	▽	▽▽▽	▽▽▽		
Nonferrous Materials						N						
Titanium						S						
Hard Materials						H	▽▽▽	▽▽▽	▽▽▽		▽▽▽	
Geometry	Radius		Description	ISO Code	Part No.	WBN150	WBN200	WBN300	WBN450	WBN448	WBC300	
	in	mm										
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

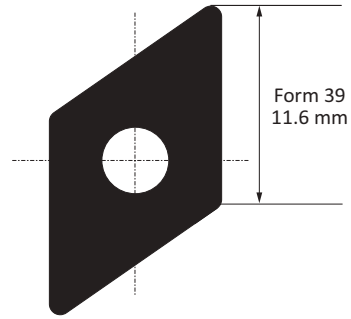
Reference Key

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	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

Insert Form 37, 39

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		Description	ISO Code	Part No.	WHT10	WHT12	WHT16	WHT32	WTC15	WTC121	WHW01	WHW16	WHC05	WHC19	WHC81	WHC88	WHC98	WHC111	WHC114	WHC136	WHC164			
	in	mm																							
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	
39	115673	M3.5 x 0.6 x 9	414510	115664	Torque	Key Size
					3.0 Nm	T15

Insert Form 37, 39

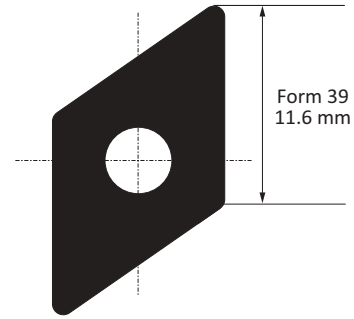
CBN | PCD



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		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

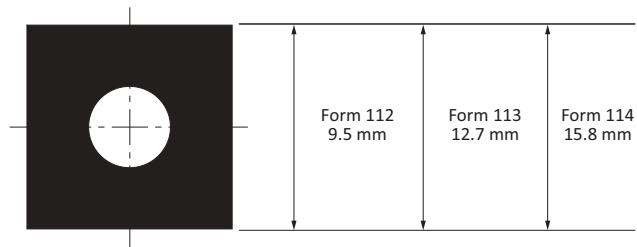
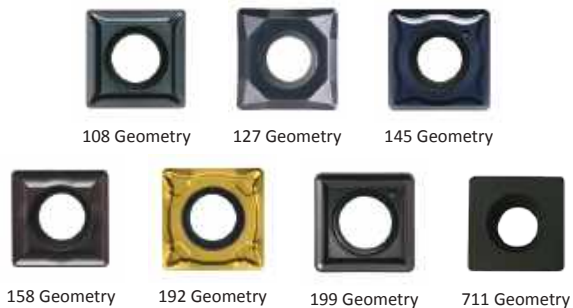
Reference Key

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	
39	115673	M3.5 x 0.6 x 9	414510	115664	Torque	Key Size
					3.0 Nm	T15

Insert Forms 112, 113, 114

Carbide



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

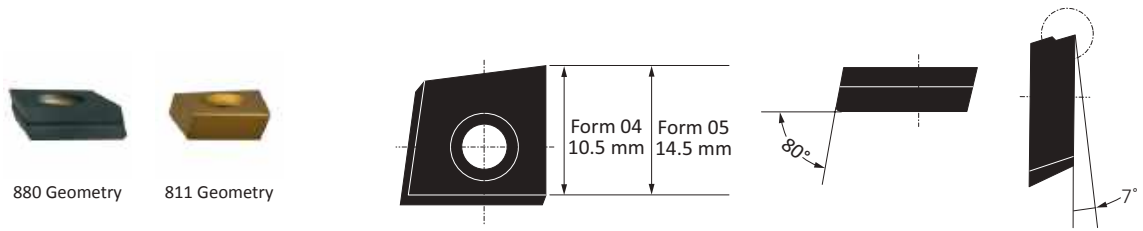
Reference Key

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

Insert Form	Countersunk Screw		Torque Driver		Service Key		Technical Data	
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		

Insert Forms 04, 05

Carbide



						Carbide										
						Uncoated		Coated								
Steel					P										▼	▼
Stainless Steel					M										▽	▼
Cast Iron					K										▼	▼
Nonferrous Materials					N											▽
Titanium					S											▽
Hard Materials					H											
Geometry	Radius		Description	ISO Code	Part No.	WHW16	WHC05	WHC18	WHC19	WHC79	WHC98	WHC111	WHC114	WHC170	WHC168	WHC198
	in	mm														
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										⚙	

Insert Form	Countersunk Screw		Torque Driver		Technical Data	
					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

Reference Key

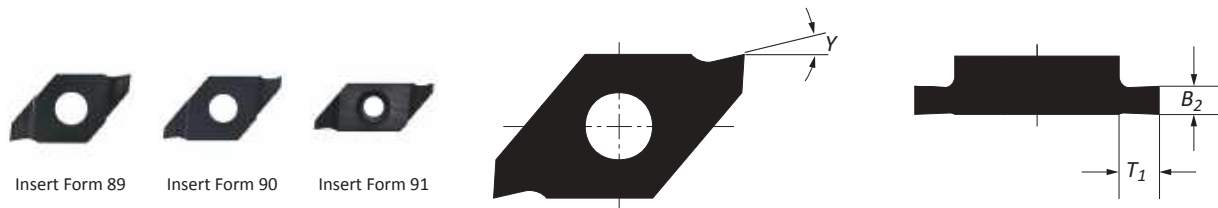
Symbol	Machining Conditions
●	Average - Main Application
●	Difficult - Main Application

Reference Key

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

Radial Grooving Insert Forms 89, 90, 91

Carbide



							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
i	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			●								●		
m	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	
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

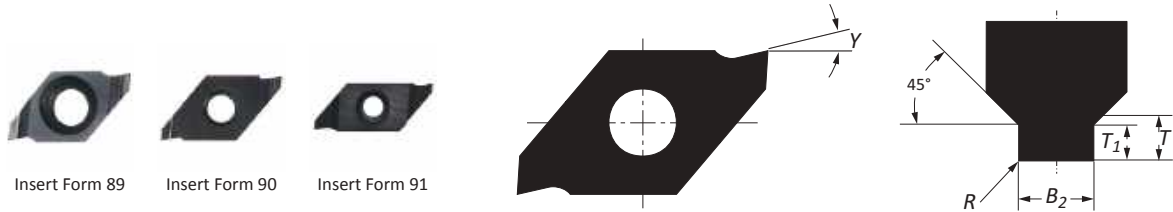
Symbol	Machining Conditions
●	Average - Main Application

Reference Key

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

Radial Grooving Insert Forms 89, 90, 91

Carbide



									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
i	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										●	
m	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	
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

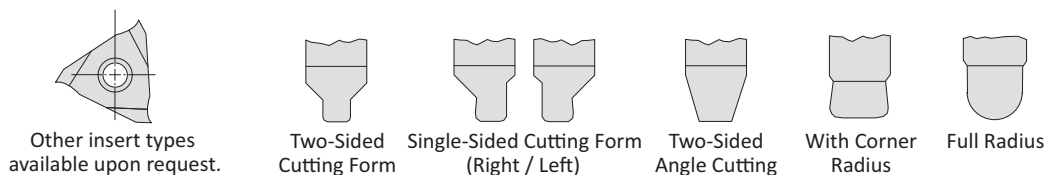
Symbol	Insert Type
▼▼	Universal - Main Application
▽▽	Universal - Extended Application

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 _I	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			●									



Reference Key

Symbol	Machining Conditions
●	Average - Main Application

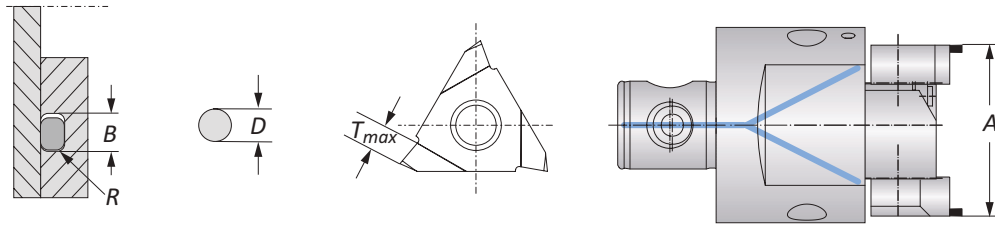
Reference Key

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

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

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

Carbide



									Uncoated		Carbide											
												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	
304	215392	M5 x 0.8 x 12.9	415543	215150			Torque	Key Size
							5.0 Nm	T20

Reference Key

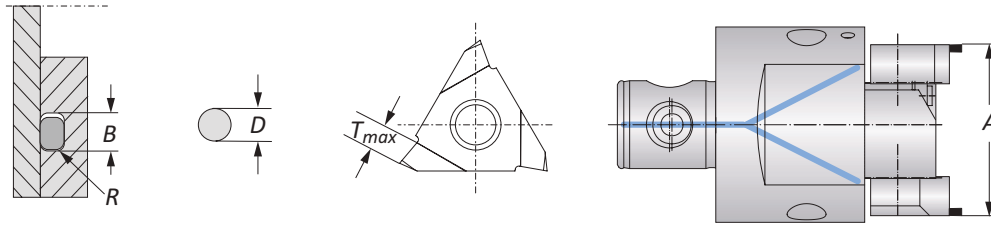
Symbol	Machining Conditions
	Average - Main Application

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

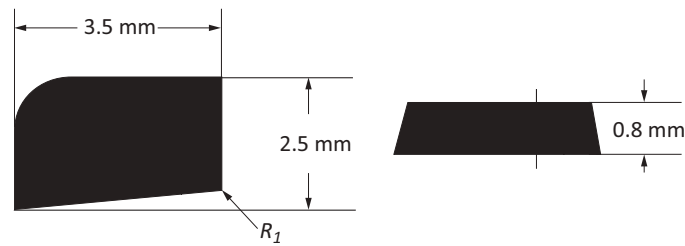
Reference Key

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

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

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			●								●	

				Technical Data			
Insert Form	Countersunk Screw	Clamping Jaw	Torque Driver	Service Key	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

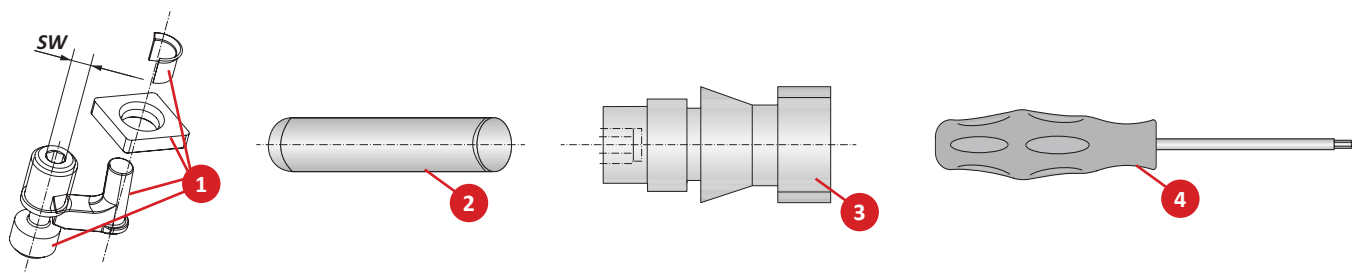
Insert Accessories

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



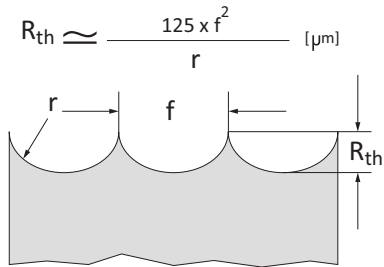
Insert Form	1. Clamping Set		2. Mounting Arbor for Sleeve	3. Clamping Bolt		4. Service Key	
	Part No.	Key Size	Part No.	Part No.	Key Size	Part No.	Key Size
75	315004	s3	415642	—	—	415578	s3
123	315003	s3	415642	115775	s2.5	415578 115575	s3 s2.5
124	315054	s3	415644	115776	s3	415578 115630	s3 s3

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.

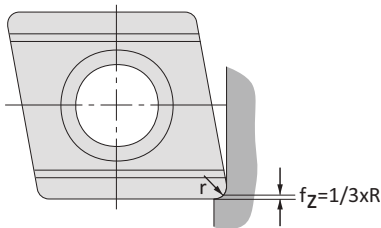
The expected surface quality can be estimated by using the function of corner radius and feed rate formula.



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



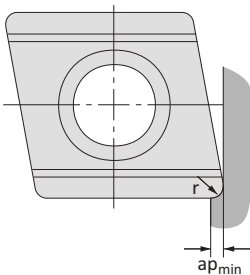
2. If the feed is approximately 1/3 of the corner radius, the better the machining time and surface finish will be in finish machining applications.



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



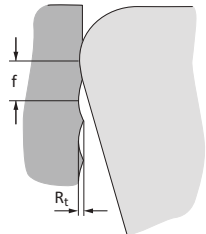
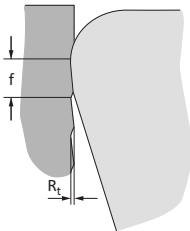
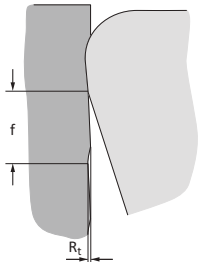
Minimum depth of cut (a_p) should at least match the corner radius. This minimizes the radial forces.

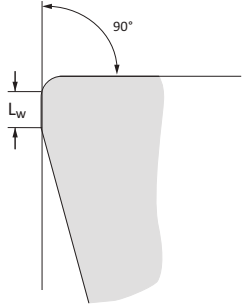


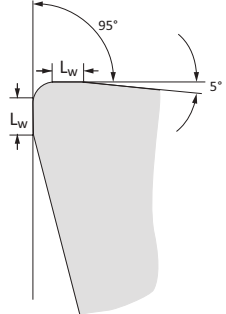
General Formulas		
Cutting Speed	$\frac{V_c = D \times \pi \times n}{1000}$	(m/min)
RPM	$\frac{n = V_c \times 1000}{D \times \pi}$	(min ⁻¹)
Feed Speed	$V_f = f \times n$	(mm/min)
	$D = \text{Machining } \varnothing$	(mm)
	$f = \text{Feed}$	(mm/u)
	$V_c = \text{Cutting Speed}$	(m/min)
	$n = \text{RPM}$	(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 Wohlschlag 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 L_w = 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 Wohlschlag standard insert range. Wiper geometry for 95° approach angle (left and right cutting) L_w = 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
S								
	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, O-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
	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
M	Aerospace Alloy S82	185 - 350	Carbide	130 - 260	0.004 - 0.006	0.004 - 0.008	0.006 - 0.014	0.008 - 0.016
	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
M	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.

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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 Wohlschlag 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 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.

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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"
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
	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
	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
	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
	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
	Structural Steel A36, A285, A516, etc.	100 - 350	Carbide	475 - 925	0.001 - 0.002	0.002 - 0.004	0.003 - 0.005	0.005 - 0.008
	Tool Steel H-13, H-21, A-4, O-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
	Titanium Alloy	140 - 310	Carbide	125 - 300	0.001 - 0.002	0.002 - 0.003	0.003 - 0.005	0.004 - 0.006
	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
	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
	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 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.

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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 Hardox®, AR400, T-1, etc.	400 - 600	Carbide	100 - 200	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
	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

*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 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.

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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
S	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, O-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
M	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
M	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
M								
	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 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.

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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

*Not to exceed max recommended RPM for boring head found in corresponding Wohlschlag 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).
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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
	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
	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
	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
	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
	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
	Tool Steel H-13, H-21, A-4, O-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
	Titanium Alloy	140 - 310	Carbide	40 - 90	0.02 - 0.05	0.05 - 0.08	0.08 - 0.13	0.10 - 0.15
	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
	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
	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

*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
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*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

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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
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

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

Deep Hole Boring Speed Adjustment

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- When using a NOVI^{TECH} module, do not exceed recommended 10xD length-to-diameter ratio.

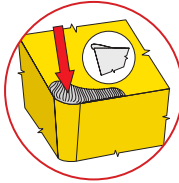
Factory technical assistance is available for your specific applications through our Application Engineering department. ext: 7611 | email: appeng@alliedmachine.com

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

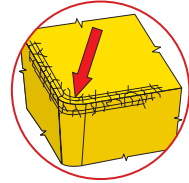
- Increase temperature by increasing speed or feed.
- Use an insert with higher lubricity coating.
- Choose a freer cutting insert geometry.



Comb Cracks

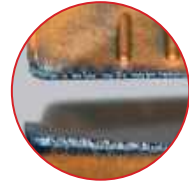
Potential Problem

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



Possible Solution

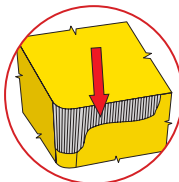
- Switch off coolant or increase coolant flow to obtain an even temperature level.
- Reduce cutting speed.
- Use tougher insert grade.



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

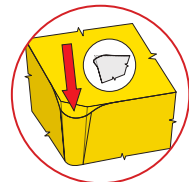
- Use a more wear-resistant grade
- Reduce cutting speed.
- Use coolant or increase coolant flow to the cutting edge.



Plastic Deformation

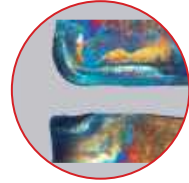
Potential Problem

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



Possible Solution

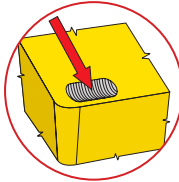
- Use a more wear-resistant grade.
- Reduce cutting speed.
- Reduce feed rate.
- Use coolant or increase coolant flow to the cutting edge.



Cratering

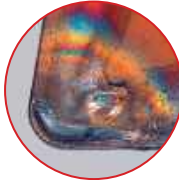
Potential Problem

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



Possible Solution

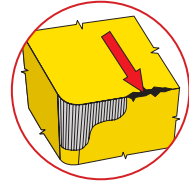
- Use a more wear-resistant grade.
- Reduce cutting speed or feed.
- Use coolant or increase coolant flow to the cutting edge.



Chipping of Cutting Edge (Out of Cut)

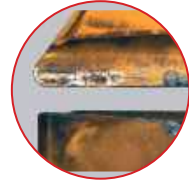
Potential Problem

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



Possible Solution

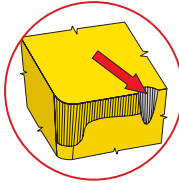
- Change feed rate to gain chip control.
- Select a tool with a different approach angle.
- Use an insert with a different geometry.
- Use a tougher grade of carbide.



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

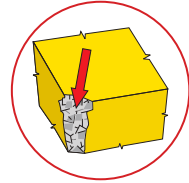
- Use a more wear-resistant grade (Al_2O_3).
- Select a tool with a smaller approach angle.
- Vary the radial depth of cut.
- Use coolant or increase coolant flow to the cutting edge.



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

INDEX

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: _____ Builder: _____ Model #: _____
(Lathe, screw machine, machine center, etc.) (Haas, Mori Seiki, etc.)
Shank Required: _____ Power: _____ HP/KW
(CAT50, Morse taper, etc.)
Rigidity: Orientation: Tool Rotating: Thrust: _____ lbs/N
☐ Excellent ☐ Vertical ☐ Yes
☐ Good ☐ Horizontal ☐ No
☐ Poor

Coolant Information

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

Requested Tooling

QTY	Item Number

QTY	Item Number



**ALLIED MACHINE
& ENGINEERING**

Allied Machine & Engineering
120 Deeds Drive
Dover, OH 44622

Telephone: (330) 343-4283
Toll Free USA & Canada: (800) 321-5537
Email: info@alliedmachine.com

Warranty Information



Allied Machine & Engineering ("Allied Machine") warrants to original equipment manufacturers, distributors, industrial and commercial users of its products for one year from the original date of sale that each new product manufactured or supplied by Allied Machine shall be free from defects in material and workmanship.

Allied Machine's sole and exclusive obligation under this warranty is limited to, at its option, without additional charge, replacing or repairing this product or issuing a credit. For this warranty to be applied, the product must be returned freight prepaid to the plant designated by an Allied Machine representative and which, upon inspection, is determined by Allied Machine to be defective in material and workmanship.

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.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Allied Machine shall have no liability or responsibility for any claim, whether in contract, tort or otherwise, for any loss or damage arising out of, connected with, or resulting from the manufacture, sale, delivery or use of any product sold hereunder, in excess of the cost of replacement or repair as provided herein.

Allied Machine shall not be liable in contract or in tort (including, without limitation, negligence, strict liability or otherwise) for economic losses of any kind or for any special, incidental, indirect, consequential, punitive or exemplary damages arising in any way out of the performance of, or failure to perform this agreement.

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United States

Allied Machine & Engineering
120 Deeds Drive
Dover OH 44622
United States

Phone:
+1.330.343.4283

Toll Free USA and Canada:
800.321.5537

Toll Free USA and Canada:
800.223.5140

Allied Machine & Engineering
485 W Third Street
Dover OH 44622
United States

Phone:
+1.330.343.4283

Toll Free USA and Canada:
800.321.5537

Europe

Allied Machine & Engineering Co. (Europe) Ltd.
93 Vantage Point
Pensnett Estate
Kingswinford
West Midlands
DY6 7FR England

Phone:
+44 (0) 1384 400900

Wohlhaupter® GmbH
Maybachstrasse 4
Postfach 1264
72636 Frickenhausen
Germany

Phone:
+49 (0) 7022 408.0

Asia

Wohlhaupter® India Pvt. Ltd.
B-23, 3rd Floor
B Block Community Centre
Janakpuri, New Delhi - 110058
India

Phone:
+91 (0) 11.41827044

Your local Allied Machine representative:

www.alliedmachine.com

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