CUTTING SOLUTIONS BY CERATIZIT

USER MANUAL

HARD MATERIAL MACHINING WITH PCBN

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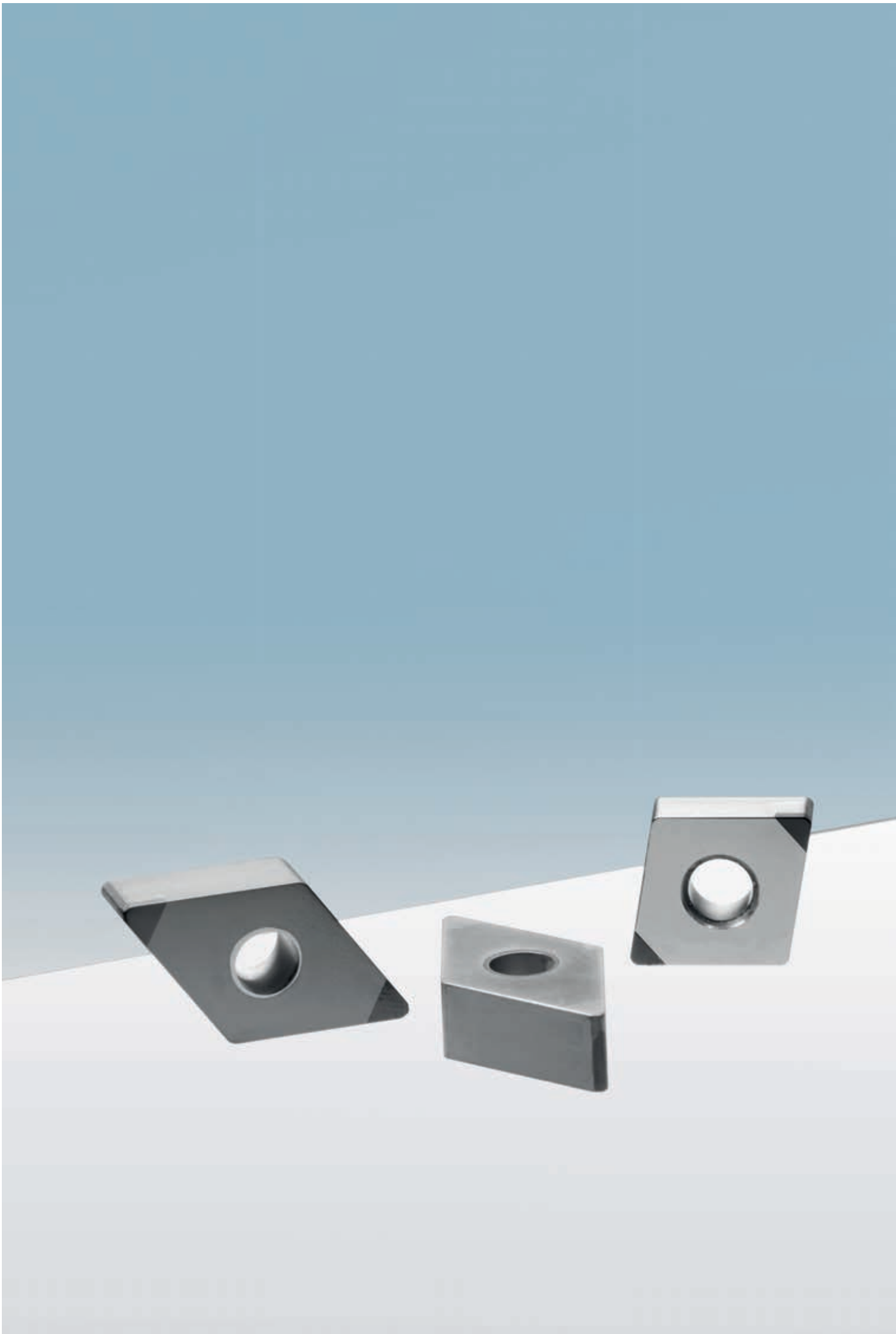
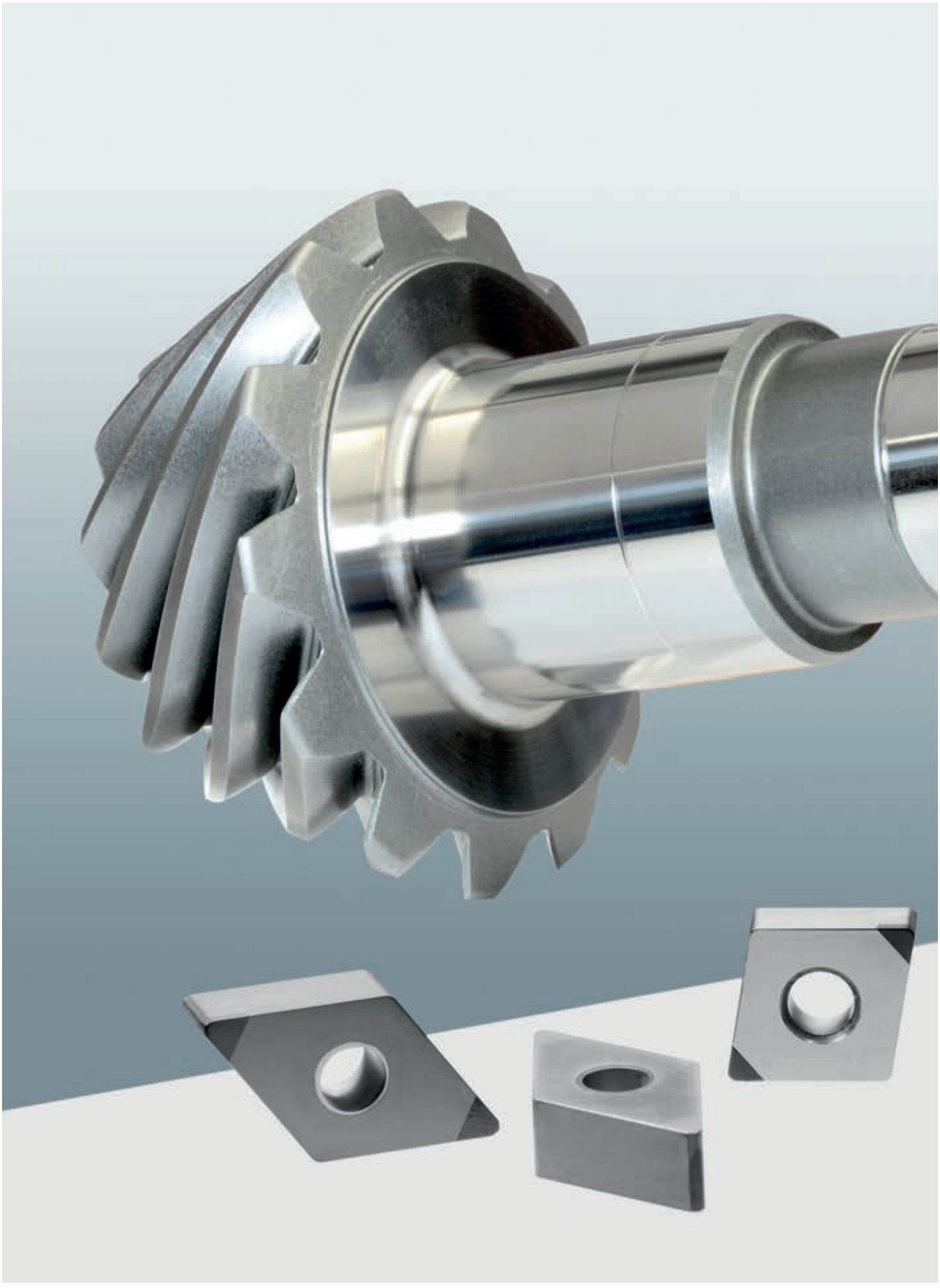


Dear customers,

Ultra-hard cutting materials allow the machining of hardened iron materials (hardness > 57 HRC) with a geometrically defined cutting edge. At the upper end of the material hardness scale you can find polycrystalline diamond as well as cubic boron nitride, which is the first choice in most cases of hard material machining.
As your partner for cutting solutions of the premium performance class, we guarantee both maximum tool life and process reliability, offering you a broad range of PCBN cutting materials.
We suggest that you take a close look at our portfolio of boron nitride inserts. Our PCBN user manual on hard material machining will tell you all you need to know about the CERATIZIT clamping systems which are used in this field. You can benefit from our application recommendations, and the examples cited of successful applications will show how you can optimise your processes with PCBN cutting materials.

Any questions? Our specialists for hard material machining look forward to exchanging ideas and sharing their expertise.

Yours, the CERATIZIT team



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CERATIZIT HIGHLIGHTS – MORE THAN A BRAND

Cutting Solutions by CERATIZIT is a competence brand of the CERATIZIT Group. Our brand promise is based on what we offer as a strong and creative partner who has only one goal: to achieve the best for you by working together!

CUTTING SOLUTIONS BY CERATIZIT

> 90 YEARS OF EXPERIENCE

> 20 PRODUCTION SITES WORLDWIDE

> 100 EMPLOYEES IN R&D

> 5,800 CARBIDE EXPERTS

> 10,000,000,000

SALES OF > 800 million €

> 90,000 ARTICLES IN THE PRODUCT PORTFOLIO

600 PATENTS

Let's talk!

> 65,000 ARTICLES
AVAILABLE IN STOCK

> 3,000 ORDERS PER DAY

3 MIN. FROM THE INCOMING ORDER TO THE READY-FOR-TRANSPORT PACKAGING

ORDER BY 6:30pm WITH GUARANTEED DELIVERY ON THE FOLLOWING DAY

JUST IN TIME

MINIMISATION OF TOLL AND SHIPPING COSTS

THE CERATIZIT HIGHLIGHTS

Best possible quality and top-class customer service are our goal: with CERATIZIT you have a partner who guarantees quality standards and elaborates innovative solutions in dialogue with customers. Benefit from the extensive expertise that CERATIZIT specialists pass on to you in training courses with highly qualified staff, and let us help you find new and even more efficient tooling solutions.
We will be happy to give you our full support!

GUARANTEED QUALITY STANDARD

As your partner manages the entire process chain of carbide production whilst also constantly ensuring precision and performance at the highest level.
Our quality promise to you is a premium-class cutting tools solution with maximum tool life and optimal process security, which guarantees added value both technically and economically.

Vacuum brazing unit

UNIVERSAL EXPERTISE IN SOLUTIONS

As the products we supply will increase the economic efficiency of your production – from standard tools with an attractive price-performance ratio, to industry-specific and individually customised product innovations. As a creative partner, we consult with you and therefore understand what your requirements are.
Accordingly, we develop the right solution for your challenges.

RELIABLE LOGISTICS

As you benefit from a logistics centre which sets standards throughout the world and keeps costs low thanks to harmonised processes. Rely on maximum availability of the products which we deliver you in minimum time and just in time to your desired destination.

TOP CLASS SERVICE

Because we make it possible for you to expand your knowledge of your tools and machining processes at our test and training centres. This results in your production becoming even more efficient and forms the basis for the development of new tooling solutions in partnership with us.

COMPETENT DIALOGUE

As your consultant partners and application engineers, we speak your language and provide support enriched by knowledge, experience and passion. Our expertise in solutions will be evident in our consultation with you: it is always our top priority to understand your requirements in order to find the best solutions in cooperation with you. Just speak to the distribution partner closest to you.

CERATIZIT standard tools and inserts

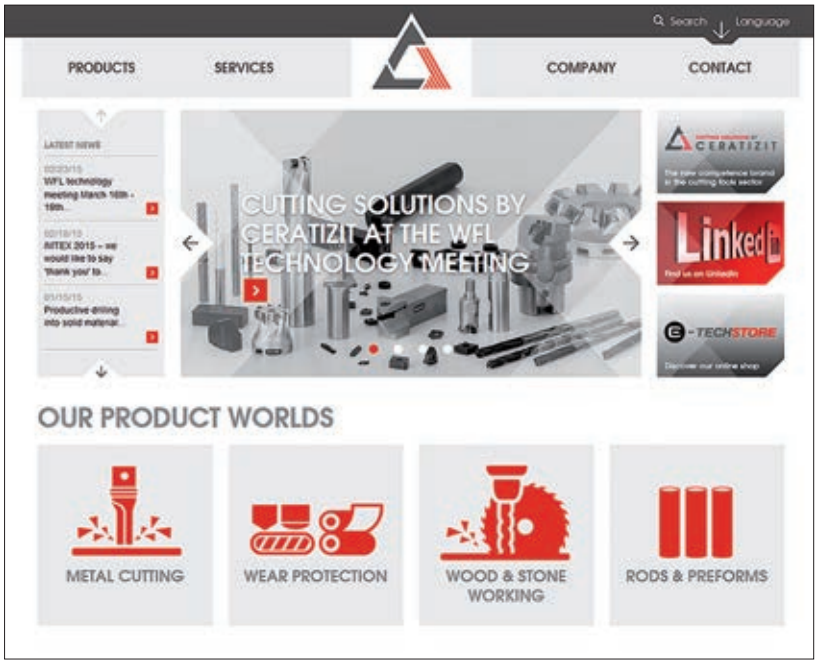
The CERATIZIT Group has the metallurgical expertise to control the entire process chain of carbide production: from raw materials production and powder preparation to forming, sintering and finishing, we can make the right adjustments at any time and adapt the material properties to your individual requirements. Just talk to us about your future projects!

ONLINE SERVICE

Of course we are also available for you online – right around the clock!

On the new CERATIZIT website you will not only find details about our innovative products, but you can also order them right there.

CERATIZIT's website combines a modern design with increased user-friendliness, making it easy and intuitive to use on mobile devices.



ONLINE SHOP – E-TECHSTORE

Our online shop offers more than 25,000 standard and special products: inserts and solid carbide tools for the cutting tools sector as well as products for wood and stone machining, carbide rods, circular saw blanks, the tool and die industry and focusing tubes.

You can order 24/7 and check availability for all products in real time.

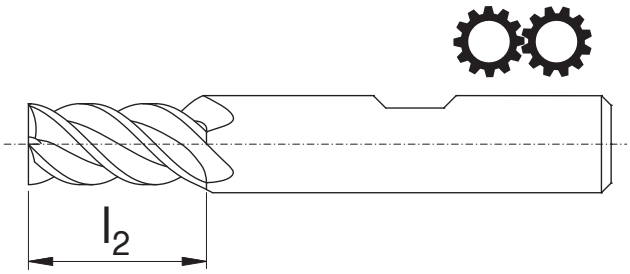
TOOLING ACADEMY

Make use of the fund of knowledge we have amassed at the CERATIZIT cutting tools centre in Reutte. Here we subject tools and new developments to comprehensive endurance tests under realistic conditions. To ensure high-quality and economical production, all components – machine, spindle and tools – must be optimally coordinated. Should there be issues in a particular field, our experts can recommend the best tools for the purpose or develop a specific tool for you. Our application engineers and specialists look forward to sharing their knowledge with you – this is why the Tooling Academy organises customer-specific seminars and workshops regularly.

OEM SERVICES

You will receive not only excellent cutting tools, but also customised complete solutions and tooling packages for optimal machining of entire work pieces on your machine.

Every project is supported by a large team comprising various specialisations and fields of expertise: whether you are talking to a project director, field service or office employees, engineers, designers, workers in production or logistics – you will benefit from the full range of services of an international company with a worldwide service network.



CONFIGURATE SERVICE

Using the online solution CONFIGURATE, it is possible to configure a customised semi-standard tool with only a few mouse clicks. Thanks to this solution we are able to offer simple and easy order processing of customised solid carbide tools. You can configure a customised semi-standard tool with just a few mouse clicks – 24 hours a day, 7 days a week.

RESTORE SERVICE

You can rely on the internationally renowned and consistently high product quality you have come to expect from CERATIZIT. Of course the regrinding of solid carbide tools also forms part of the package we offer. The reground tool has virtually 100 % of the tool life and cutting performance of a new tool.

CERATIZIT – the cemented carbide concept for success

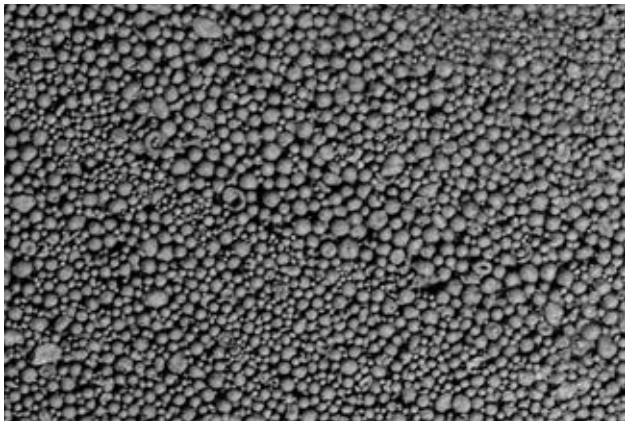
Cemented carbides are used today in numerous industries and production processes, and have become indispensable. Complex products and modern materials make ever higher demands on the tools and materials and call for machining accuracy.

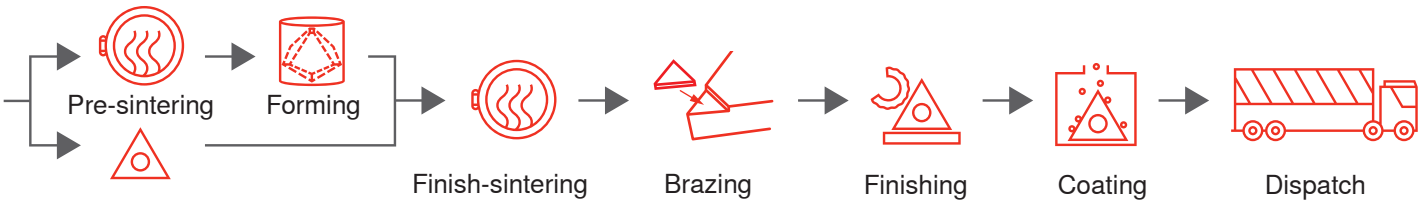
Cemented carbides are composite materials consisting of hard material and a very tough binder metal. They are exceptionally hard, and offer high wear resistance and heat resistance. Cemented carbide is used wherever tools or components are exposed to high wear, as is the case when machining hard materials. CERATIZIT's composite carbides enhance the quality of the tools and parts, guarantee an extended tool life and ensure process reliability.
Cemented carbides from CERATIZIT consist of a particularly hard tungsten carbide and a comparatively soft binder metal, such as cobalt. The two substances are mixed in the form of powder. CERATIZIT offers more than 130 carbide grades with different compositions. We have the ideal solution for every application and industry.
CERATIZIT commands the entire process chain – from powder preparation to forming, sintering, to finishing and surface treatment. The blanks are subjected to grinding, polishing and erosion and are subsequently provided with innovative wear protection coatings to ensure that the product has the required technical characteristics.

To make a ready-to-use carbide blank from the powder mixture, first it has to be pressed into a mould. The resulting green carbide blank can then be machined. But only after the sintering process (involving temperatures between 1,300 and 1,500 degrees Celsius and a pressure of up to 100 bar) does it become a homogeneous and dense cemented carbide.

Cemented carbide - a composite material with valuable properties

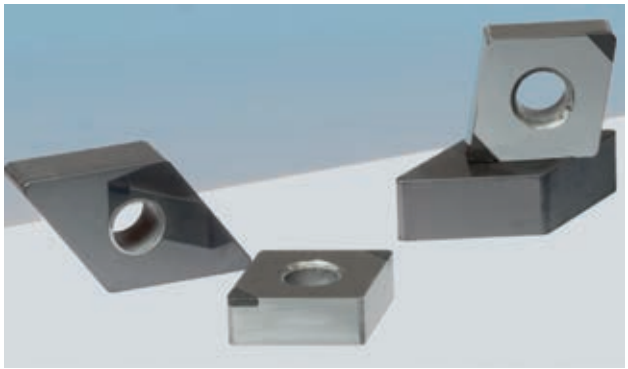
Both the metal binder content and the grain size of the tungsten carbide influence the performance characteristics of the cemented carbide. The specific composition determines the hardness, transverse rupture strength and fracture toughness of the resulting material. The tungsten carbide grains have an average size of 0.5 to 20 micrometres (µm). The softer binder, cobalt, fills the gaps between the carbide grains.





On the one hand, when extremely high toughness is required, the cobalt content can amount to as much as 30%. On the other, the cobalt content is reduced and the grain size decreased to the submicron range (for example 0.3 µm), in order to guarantee maximum wear resistance.

CERATIZIT produces far more than 100 different carbide grades particularly for wear parts and cutting tools, thus offering a customised solution for every one of your applications.



Hard material machining

The materials machined have a hardness of up to HRC 64. Case-hardened steels are subject to soft pre-machining (in non-hardened condition) using carbide inserts. After hardening (minimum hardness of steel: 57 HRC) areas showing hardening distortions and also the running surfaces must be machined after hardening. When finish machining with PCBN, very high surface quality and close tolerances can be achieved. In many cases grinding of the bearing surfaces is not necessary.

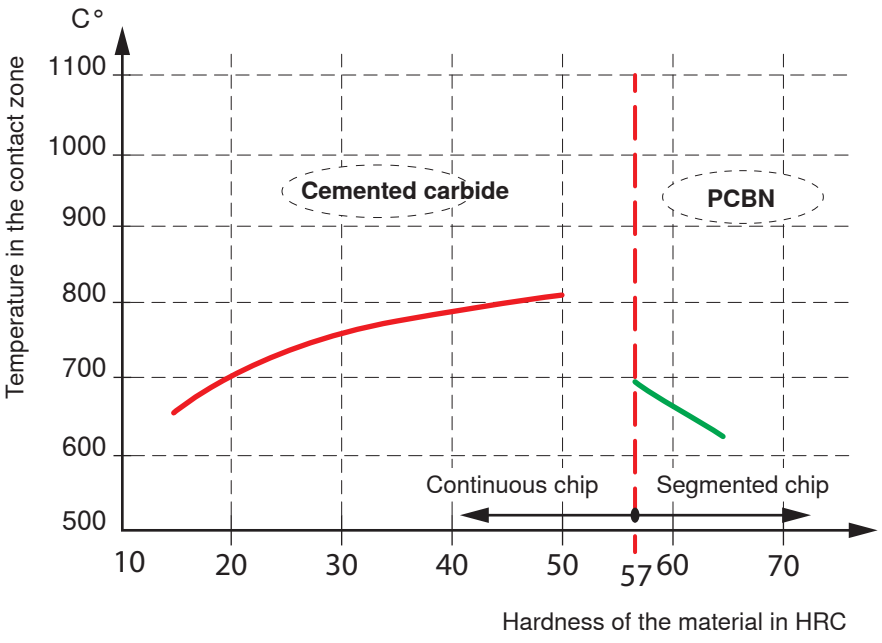
Advantages

- ▲ Turning instead of grinding.
  Change to a grinding machine is not necessary.
- ▲ Several machining operations can be carried out with one tool: longitudinal and face turning, external and internal machining in one set-up
- ▲ Roughing and finishing in one process
- ▲ Coolant replaced by cold compressed air (< 0 °C)

Hard material machining – how it works

Chip formation with hardened steel
Softening of the chip due to high cutting speed represents the basis for hard machining. Due to the cutting energy input (high temperatures) shear swarf can be generated from the hardened steel.

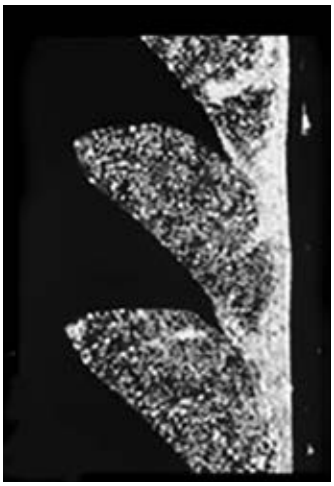
Material:	100Cr6 (1.1645)
Feed rate:	f = 0.1 mm/rev
Cutting speed:	v_c = 120 m/min



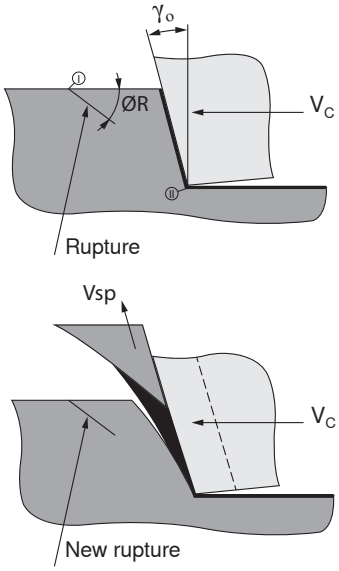
Hard material machining with PCBN From 57 HRC

Up to HRC 50 cemented carbide is used.
From HRC 57 upward PCBN is used.

Segmented chip with chip thickness h_{cu} >0.02 mm



Source: chip formation according to Ackerschott, Berktold



Material: 100Cr6 (60-62 HRC)
Chip thickness: h_{cu} = 0.05 mm

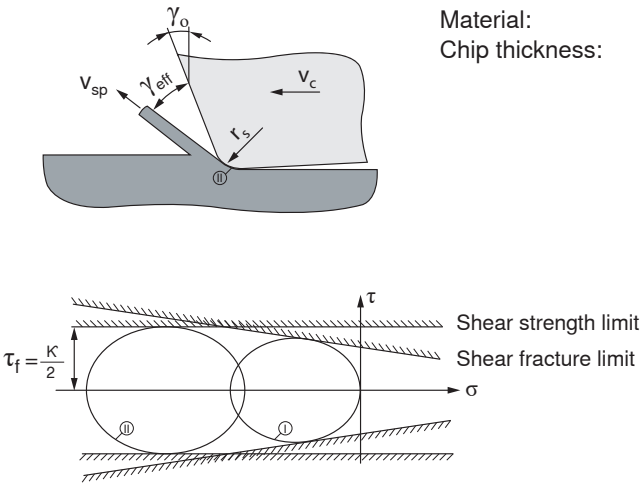
Rupture on the steel surface

Chip segment is cut out, a new rupture is created

Chip segments cohere into one segmented chip

Continuous chip with small chip thickness h_{cu} <0.02 mm

Source: chip formation for small chip thicknesses (according to Kaiser), tension/stress condition according to Siebel, Kloos. Berktold, Kaiser



Material: 100Cr6 (60-62 HRC)
Chip thickness: h_{cu} = 0.005 mm

Application recommendations

▲ The basis for hard material machining is the softening of the swarf as a result of the of high cutting speed: → ideally the swarf is glowing red hot.
This can be recognised by the medium-grey annealing colour on the cooled-down back of the chip.

Under optimal processing conditions the resulting sheared swarf is brittle and can easily be crumbled between the fingers.

▲ Select the largest possible corner radius.
▲ High surface quality is achieved by means of Masterfinish.
▲ Reduce feed rate at tool entry and exit.
▲ With a double-cut strategy choose various cutting depths.
▲ When soft pre-machining, chamfer the sharp edges of the work piece or start with radius programme, dry machining preferred.
▲ Coolant may not be used for interrupted cut.
▲ Avoid vibration.

PCBN – production of discs

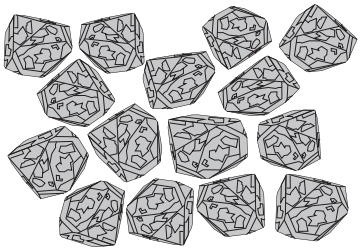
Pyrolysis

of boron-halogen compounds
in a catalytic reaction

Boron nitride with a
hexagonal lattice structure

PCBN – synthesis

Pressure: 5 – 9 GPa
Temperature: 1600 – 2100 °C



Boron nitride grit with a
cubic body and centred
lattice

Hot pressing of

the PCBN grains

Binder
▲ ceramic (TiC, TiN, TiCN, Al_2O_3)
▲ metallic (WC-Co-Ni)

Pressure: approx. 5 GPa
Temperature: >1000 °C

The basic structure is a flat
cylindrical carbide substrate

PCBN discs

Properties of PCBN

▲ Second hardest material after diamond (4,700 N/mm²)
▲ High wear resistance (abrasion)
▲ High oxidation resistance up to 1,250 °C
→ is therefore suitable for the machining of iron alloys

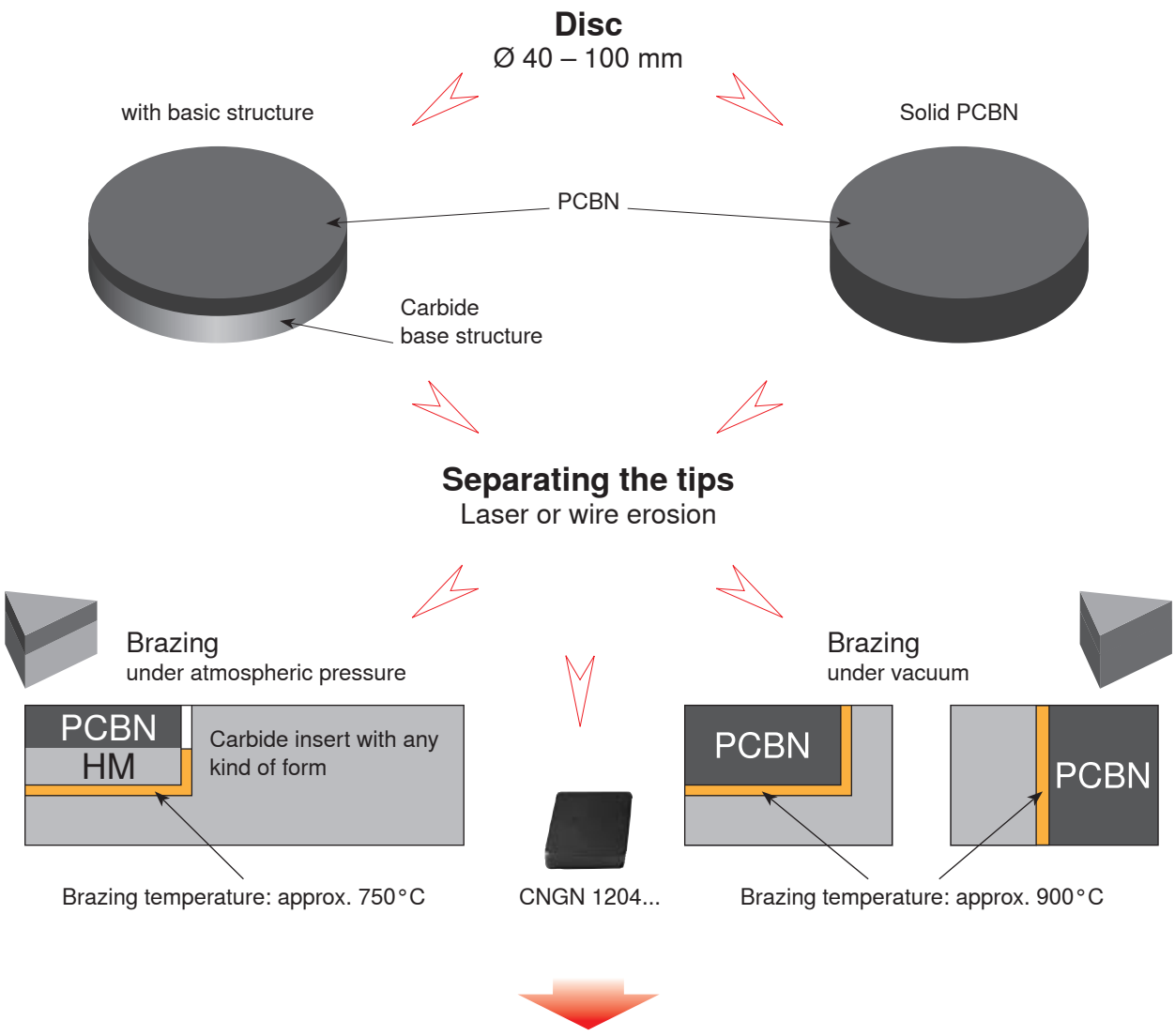
▲ High compressive strength but low tensile strength
▲ Cutting forces must be adapted accordingly
Compression stress, not tensile stress on the cutting edge
▲ Chamfered or chamfered and honed inserts recommended

High heat resistance

▲ Hardness at 800 °C comparable with the hardness of cemented carbide at room temperature

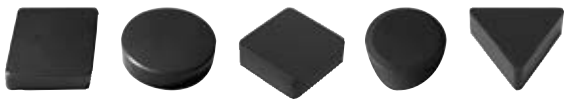
▲ Good thermal conductivity

PCBN – insert production



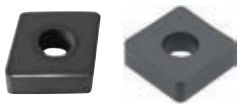
Grinding, chamfering, honing (coating when necessary)

Solid PCBN inserts

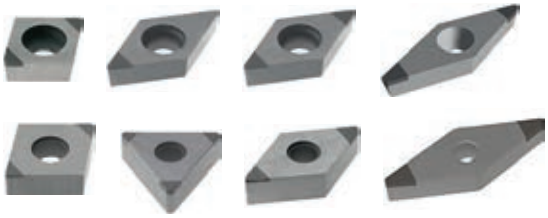


Solid PCBN inserts with C-Clamp clamping dimple

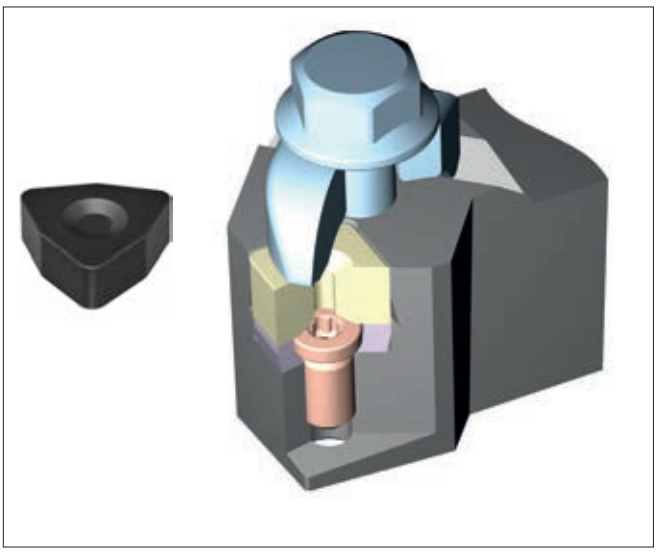
Solid PCBN inserts with hole



PCBN-tipped inserts



C-Clamp



- Clamping element
- Insert
- Shim
- Screw

▲ Both the design and torque moment of 20 Nm guarantee maximum stability
▲ Stable insert position during the entire application is possible even under maximum stress

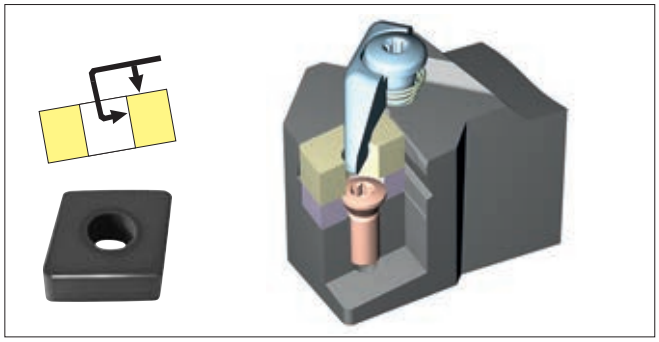
Clamping system advantages

▲ Clamping elements made of cemented carbide, virtually no wear
▲ Claw covers 'dimple' of the insert completely
▲ Optimised distortion lock
▲ High torque moment thanks to M8 screw

Contact face

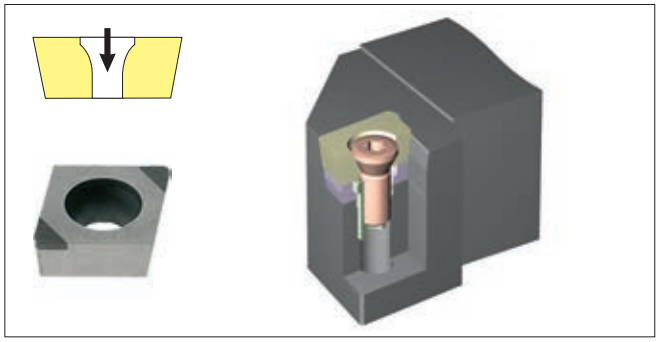
▲ Extensive contact face in the clamping zone of clamping claw and 'dimple'
▲ No wear in the area of the clamping zone

MaxiLock D



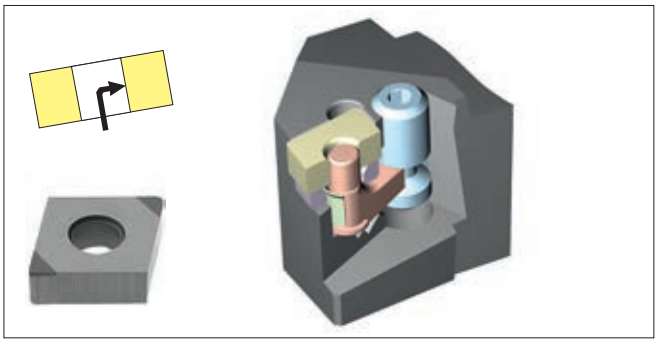
- Clamping element
- Insert
- Shim
- Screw

MaxiLock S
(for PCBN-tipped inserts only)



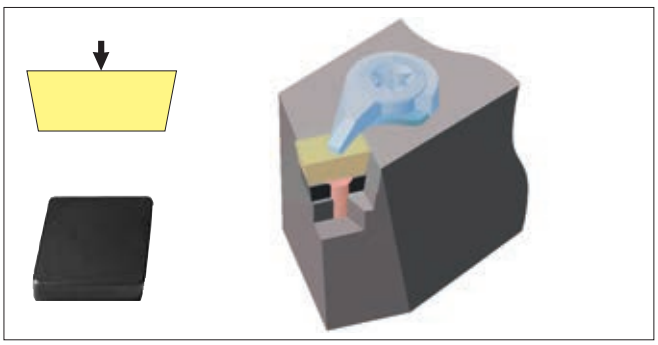
- Clamping screw
- Insert
- Shim
- Threaded shim screw

MaxiLock N
(for PCBN-tipped inserts only)



- Clamping screw
- Insert
- Shim
- Wedge
- Lever

Simplex N / P



- Clamping screw and clamping claw
- Insert
- Shim
- Shim pin

Special tools

Dialogue with our customers enables us to look for innovative solutions. Upon request we elaborate customer-specific solutions together.

Just talk to us – you can count on our solution-finding expertise and our efficient products.

Your advantages

- ▲ Expert contact persons on site and at the CERATIZIT test lab
- ▲ Analysis of your requirements
- ▲ Development of innovative solutions
- ▲ Reduced downtimes and increased productivity thanks to complete solutions from CERATIZIT

Your benefits

- ▲ Individual customised solutions
- ▲ Competitive advantage thanks to innovation
- ▲ Individually produced, efficient tools and suitable inserts
- ▲ Reduced costs thanks to the perfect synergy of all factors

CERATIZIT CUTTING TOOLS complete range

Detailed information on our standard tools and inserts for turning can be found in the up-to-date CUTTING TOOLS complete range.

You can download it from here:
www.ceratizit.com/de/service/downloads/

Machine connections

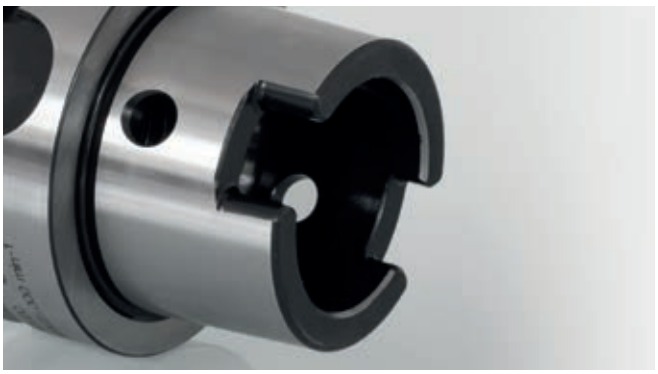
CERATIZIT offers tool holders with all standard connection systems– including for example the polygon shank taper (PSC Capto™), HSK-T, UTS and square shanks.

Polygon adapters (PSC Capto™)

▲ The advantages of the new CERATIZIT polygon adapters (PSC Capto™) lie in the extreme rigidity and transverse rupture strength. This offers maximum precision, a high degree of repeatability and high torque transmission.

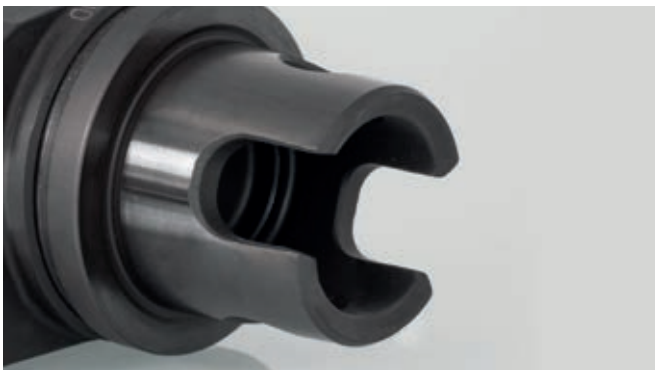
HSK-T

▲ HSK-T turning tools for complete machining are characterised by high radial positioning accuracy and precise tip height. HSK-T tool holders are suitable for use with HSK-T and HSK-A spindles, can be clamped in overhead position and come with an optimised coolant supply.



UTS

▲ Universal tooling systems (UTS) make it possible to keep tool changing times to a minimum, while adhering to the highest quality and safety standards, resulting in greater productivity.

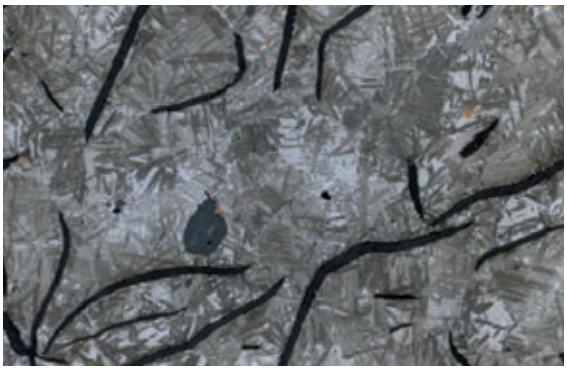


Square shank

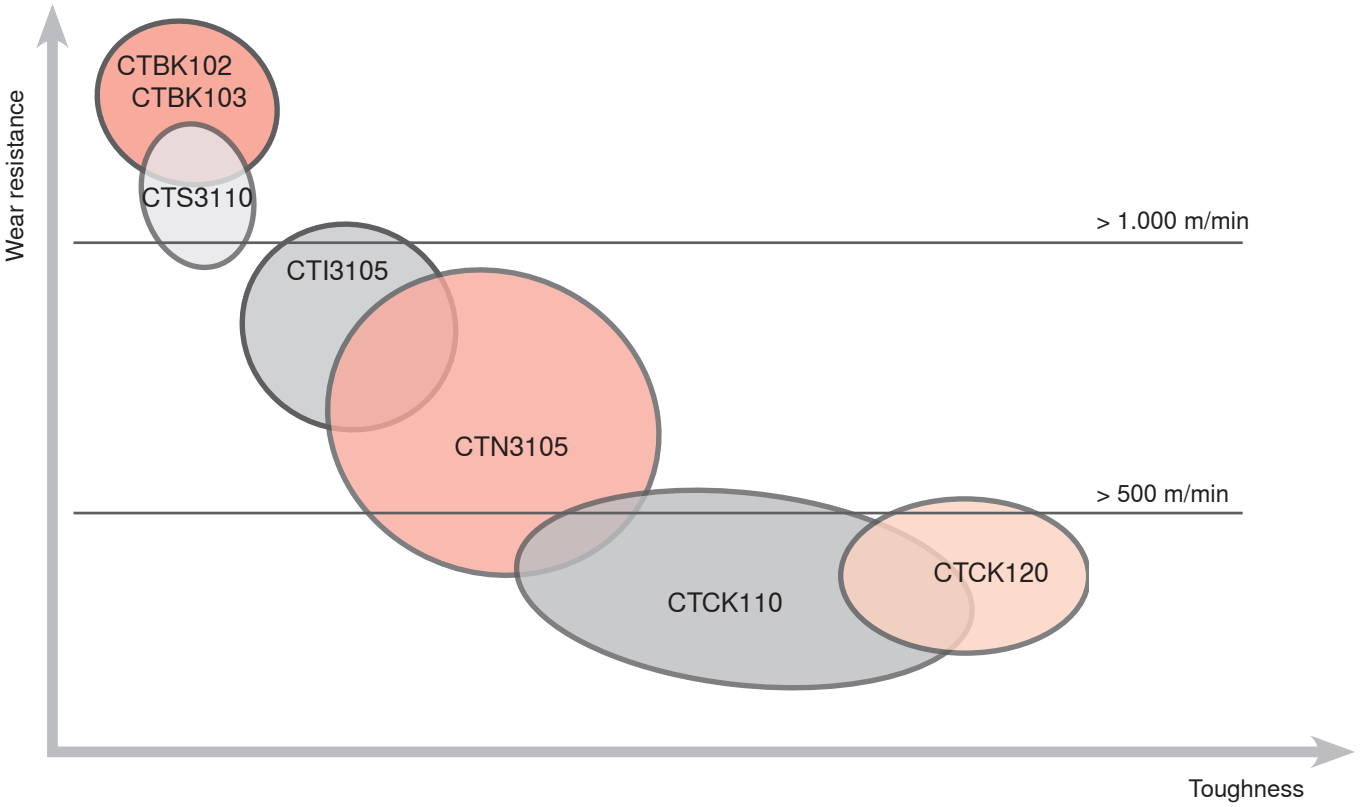
▲ The CERATIZIT shank holder for proven conventional clamping.

Cast iron machining

The term cast iron refers to a group of iron alloys which contain carbon and silicon as well as other constituent parts such as manganese, chrome and nickel.
Cast iron materials (white cast iron, grey cast iron, spheroidal cast iron or cast iron with lamellar graphite) are significantly different from each other in terms of elongation/ductility and tensile strength/hardness. Their machinability thus varies considerably as well. In the following section you will discover more about the properties of cast iron materials and PCBN cutting materials which are suitable for machining them.

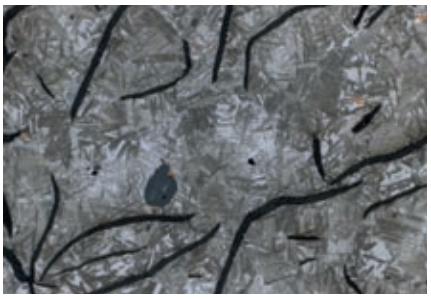


Cast iron



Grey cast iron

Grey cast iron: GG15; GG25; GG35; EN-GJL-150



Recommended application:
v_c = 500 – 2,000 m/min (from 700 m/min on low cutting forces)
a_p = 0.15 – 3.00 mm
f = 0.1 – 1.0 mm/rev (based on the required surface quality)

Short flaky chips (dust), dry machining, high cutting forces due to large chip cross sections, high cutting temperatures.

Soft machining with PCBN
Requirements regarding the cutting material

Wear mechanisms

- ▲ Due to relatively high cutting forces substantial quantities of machining energy are generated and mainly evacuated through the chips
- ▲ The cutting material needs to have high thermal conductivity for the removal of machining energy, therefore solid PCBN inserts are preferred
- ▲ The inserts are either chamfered, or both chamfered and honed
- ▲ The high cutting forces require optimal clamping
- ▲ For demanding applications we recommend our highly stable C-Clamp clamping system
- ▲ Solid PCBN inserts without hole and dimple are clamped using Simplex N
- ▲ For solid PCBN negative inserts with central hole use the MaxiLock D system
- ▲ Using the lever lock is not recommended

Cast iron with lamellar graphite

Graphite lamellae cause interruptions of the cutting operation, therefore impact-resistant grades with high PCBN content and a metal binder are used.

Requirements regarding the cutting material

Interrupted cut:
▲ Exposure to impact and thermal stress
▲ High feed rates and depths of cut

High cutting temperatures:
▲ Dry machining only
▲ Use chamfered or chamfered and honed inserts

Sulphur content

The sulphur content should be higher than 0.1 %, so that a protecting manganese sulphide layer can form during high-temperature machining.
Tool life may be increased by a factor of x5 to x10.

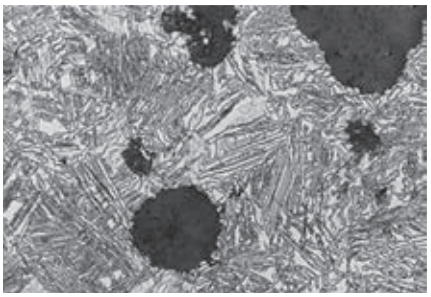
Ageing of grey cast iron

Recrystallisation of the cast iron texture (also possible at room temperature)
Recommendation: store parts at least 4 days. If this is not possible, use carbide or ceramic inserts.
Tool life may be increased by a factor of x5 to x10.
Alloy element: ferrite

Ferrite content

NB: ferrite reduces tool life considerably.
→ factor x2 is possible
The pure ferrite content should be below 5%.
Take varying cast iron quality into account.

Spheroidal cast iron



Up to EN-GJS-300 (GGG30), machining with BH grade: use grades with high PCBN content.
Solid PCBN inserts: CTBK102, CTBK103, or for medium machining use PCBN-tipped inserts:
CTL3215; CTBK104
Starting from EN-GJS-400 (GGG40): machining with BL grade CTL6115 (analogous to steel machining)

Cutting speed

Vc: >700 m/min to 2,000 m/min
Owing to the high cutting speed the cutting force is reduced and then remains almost the same up to 2,000 m/min. This also enables the formation of a **manganese sulphide layer**, tool life variation of up to 100% is possible.

White cast iron

EN-GJN-HV350

Requirements regarding the cutting material

Chilled cast iron

Formation of martensite due to quick cooling, mostly irregular cast surface with sand inclusions, interrupted cut.

Chromium cast iron

Martensite structure, corrosion-resistant, through-hardened irregular cast surface with sand inclusions, interrupted cut, steel inlets.

CBN

▲ Grades with high PCBN content and (therefore maximum toughness and hardness) preferably use solid CBN or full-face inserts.
▲ Use inserts with largest possible radius
▲ Preferably use button inserts
▲ Use chamfered (TN) inserts: or in case of edge chipping, chamfered and honed inserts (SN)

Recommended application:
▲ If possible cut under cast skin and sand inclusions
▲ Avoid interrupted cut

Dry machining

Recommended application:

CTBK104
CBN-tipped inserts for medium machining

v_c = 30–120 m/min
a_p = 0.1–1.0 mm
f = 0.08–0.6 mm/rev.

CTBK102
Solid CBN inserts for rough machining

v_c = 30–120 m/min
a_p = 0.1–3.0 mm
f = 0.08–1.2 mm/rev.

Material descriptions and codes

Material short designations

e.g. EN-GJL-300

Material short designations consist of up to 6 designation options without space, starting with **EN** (European standard) and **GJ** (cast iron; **I** iron)

Designation example:

EN	–	**GJ**	**L**		–	**350**		cast iron with lamellar graphite
EN	–	**GJ**	**L**		–	**HB155**		cast iron with lamellar graphite
EN	–	**GJ**	**L**		–	**350-22U**		spheroidal cast iron
EN	–	**GJ**	**M**	**B**	–	**450-6**		black malleable cast iron
EN	–	**GJ**	**M**	**W**	–	**360-12**	**W**	white malleable cast iron
EN	–	**GJ**	**M**		–	**HV600(XCr14)**		wear-resistant cast iron
EN	–	**GJ**	**L**	**A**	–	**XNiCuCr15-6-2**		austenitic cast iron

Graphite structure

- L Lamellar graphite
- S Spheroidal graphite
- M Malleable carbon
- V Vermicular graphite
- N Non graphite
- Y Special structure

Micro or macro-structure

- A Austenite
- F Ferrite
- P Pearlite
- M Martensite
- L Ledeburite
- Q Quenched
- T Tempered
- B Non decarburising annealed
- W Decarburising annealed

Mechanical properties or chemical composition

Mechanical properties

350	Minimum tensile strength R_m in N/mm^2
350-22	Additional elongation A in %
S	Sample cast separately
U	With cast sample
C	Taken from the cast sample
HB155	max. hardness

Chemical composition
Specifications correspond to steel designations.

Additional requirements

- D Raw casting
- H Heat-treated casting
- W Suitable for welding
- Z Additional requirements

Material codes

e.g. EN-JL1050

Material codes consist of up to 7 designation options without space, starting with **EN** (European standard) and **I** (iron)

Designation example:

EN	–	**J**	**L**	**2**	**0 4**	**7**	cast iron with lamellar graphite and high hardness
EN	–	**J**	**S**	**1**	**0 2**	**2**	spheroidal cast iron with cast sample, characteristic R_m
EN	–	**J**	**M**	**1**	**1 3**	**0**	malleable cast iron without any special requirements, characteristic R_m

Graphite structure

- L Lamellar graphite
- S Spheroidal graphite
- M Malleable carbon
- V Vermicular graphite
- N Non graphite
- Y Special structure

Micro or macro-structure

- 1 Tensile strength
- 2 Hardness
- 3 Chemical composition

Material identifier

Every cast iron material has been assigned a double-digit identifier. A higher number indicates higher resistance.

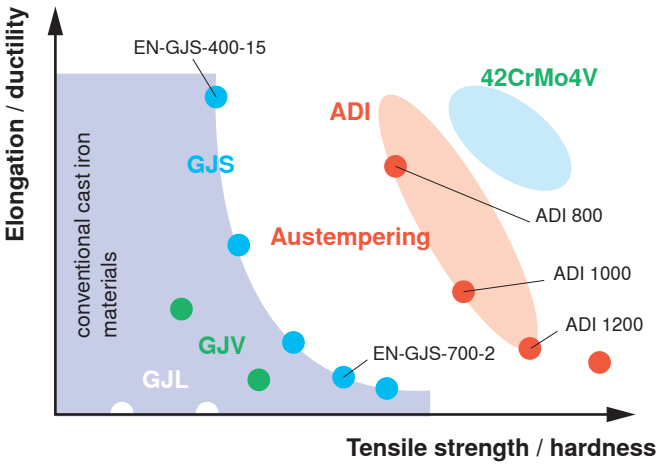
Requirements regarding the material

- 0 No special requirements
- 1 Separately cast sample
- 2 Cast sample
- 3 Sample from the casting
- 4 Toughness at room temperature
- 5 Toughness at low temperatures
- 6 Defined weldability
- 7 Raw casting
- 8 Heat-treated casting
- 9 Additional requirements

CAST IRON OVERVIEW

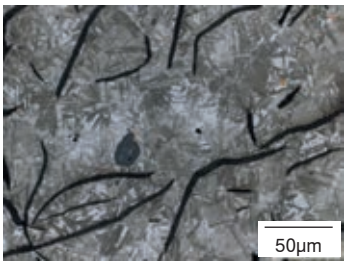
GREY CAST IRON, AUSTEMPERED GREY CAST IRON, COMPACTED GRAPHITE IRON

Cast iron overview



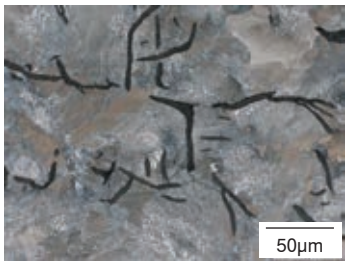
Source: RWTH research on ADI machining

Grey cast iron (EN-GJL)



Tensile strength:	150–450 N/mm^2
Hardness:	HB 125–275
Elongation:	0.3–0.8%
Yield strength:	R_p 0.2 = 98–285 N/mm^2
Machinability:	very good, thanks to lamellae graphite layer and low hardness
Classification:	EN-GJL-200 (old GG20), EN-GJL-250 (old GG25), EN-GJL-300 (old GG30), EN-GJL-350 (oldGG35)

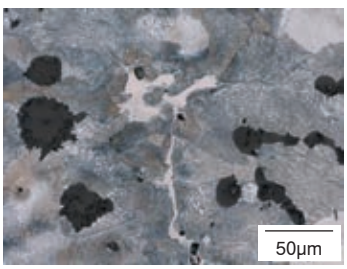
Austempered graphite iron (AGI)



Tensile strength:	170–450 N/mm^2
Hardness:	HB 170–400
Elongation:	0.5–0.9%
Machinability:	higher wear compared to cast iron

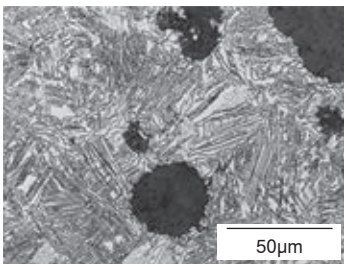
▲ AGI are tempered grey cast iron materials
▲ Heat resistance decisively improves both mechanical properties and toughness decisively
▲ AGI are an alternative to compacted graphite iron

Compacted graphite iron (EN-GJV)



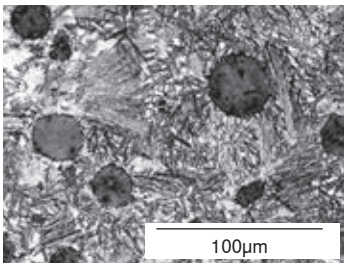
Tensile strength:	300–575 N/mm^2
Hardness:	HB 170–400
Elongation:	0.5–5%
Yield strength:	R_p 0.2 = 210–400 N/mm^2
Machinability:	EN-GJV-300 – good, comparable with GGG40 EN-GJV-450 – difficult, approx. –30% compared to GGG40 EN-GJV-500 – bad, approx. –45% compared to GGG40
Classification:	EN-GJV-300, EN-GJV-350, EN-GJV-400, EN-GJV-450, EN-GJV-500

Spheroidal cast iron (EN-GJS)



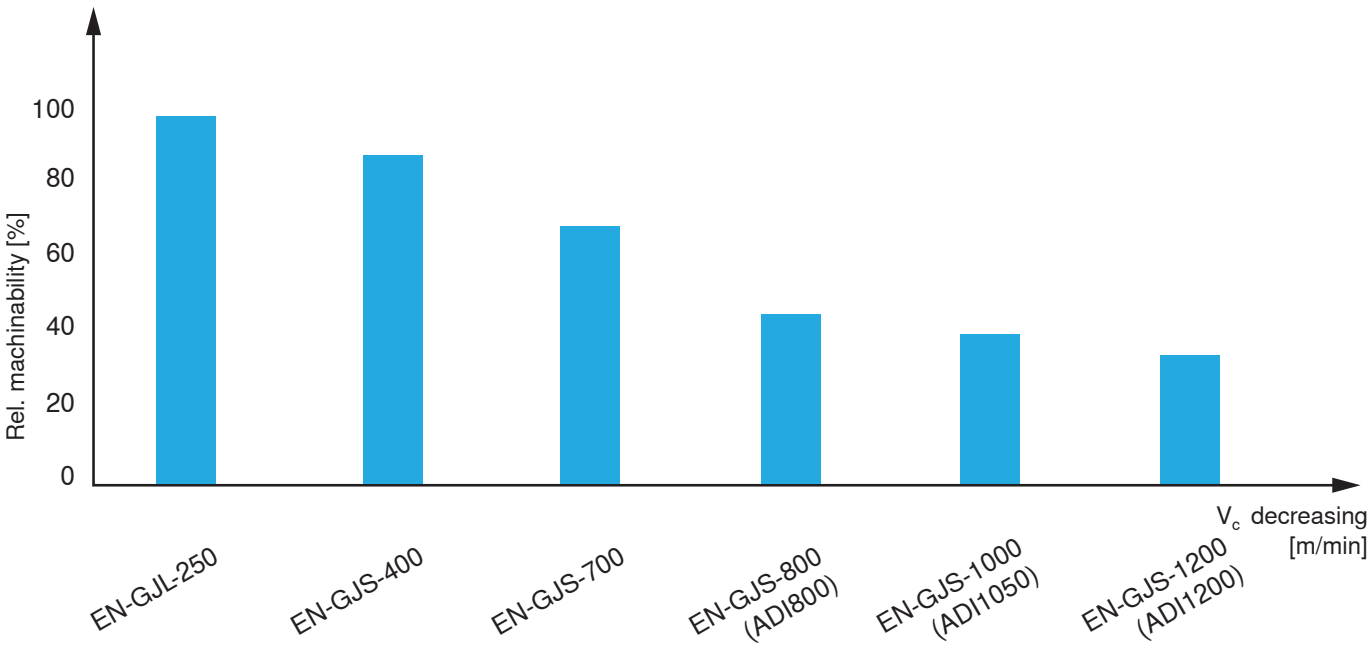
Tensile strength:	350–700 N/mm^2
Elongation:	2–22%
Yield strength:	R_p 0.2 = 220–480 N/mm^2
Machinability:	good, compared to grey cast iron higher wear, particularly on the cast iron skin
Classification:	EN-GJS-400 (old GGG40), EN-GJS-500 (old GGG50), EN-GJS-600 (old GGG60), EN-GJS-700 (old GGG70)

Austempered spheroidal cast iron (ADI)



Tensile strength:	800–1.600 N/mm^2
Hardness:	HBW 300–500
Elongation:	0–10%
Yield strength:	R_p 0.2 = 500–1,300 N/mm^2
Machinability:	ADI800 – 1050 difficult to machine ADI1200 – 1600 bad machinability or not machinable at all
Classification:	EN-GJS-800 (ADI800), EN-GJS-1000 (ADI1050), EN-GJS-1200 (ADI1200), EN-GJS-1400 (ADI1400) ▲ ADI is a tempered sheroidal cast iron ▲ It differs from spheroidal cast iron in so far that it is subject to an additional heat treatment → considerable improvement of the mechanical properties

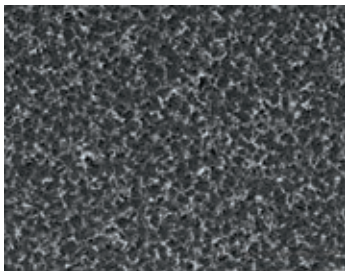
Relative machinability – comparison



GRADES

OVERVIEW INCLUDING MICROGRAPHS

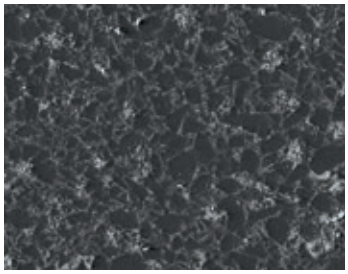
CTBK102	BH-K10 | BH-H25	● ●



Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + metallic binder phase

Recommended application
First choice for cast iron machining with solid PCBN

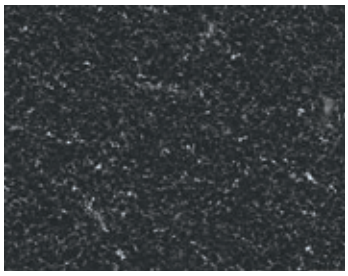
CTBK103	BH-K10 | BH-H25	● ●



Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + metallic binder phase

Recommended application:
First choice for rough and finish machining
of cast iron (EN-GJL)
brake discs with solid PCBN

CTBK104	BH-K10 | BH-H25	● ●



Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + metallic binder phase

Recommended application:
First choice for cast iron and sintered steels when finishing.

Grade designation	Standard designation ISO	Standard designation ANSI	Type of cutting material	Application range 01 05 10 15 20 25 30 35 40 45 50	P Steel	M Stainless	K Cast iron	N Non-ferrous metals	S Heat-resistant	H Hard materials
CTBK102	BH-K10	C3	B				●			
	BH-H25	C2	B							●
CTBK103	BH-K10	C3	B				●			
	BH-H25	C2	B							●
CTBK104	BH-K10	C3	B				●			
	BH-H25	C2	B							●

● Main application
○ Extended application

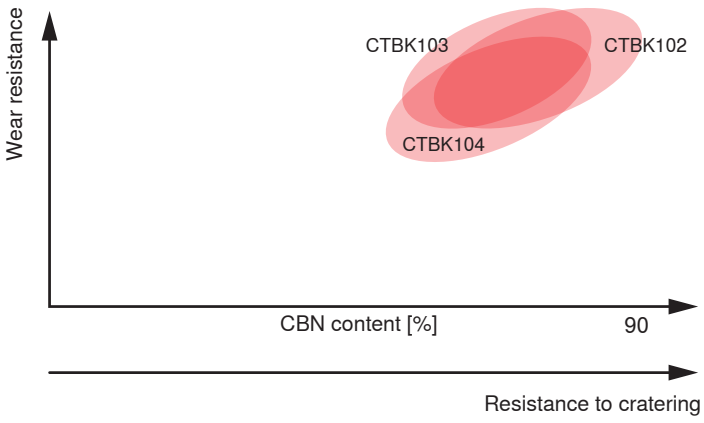
Grade classification according to ISO 513

BL	low PCBN content	40–65% PCBN
BL-C	low PCBN content, coated	40–65% PCBN, coated
BH	high PCBN content	70–95% PCBN
BH-C	high PCBN content, coated	70–95% PCBN, coated

Recommended application

Grey cast iron, white cast iron		high PCBN content, 70–95% PCBN, metallic binder
BH	CTBK102	chamfered (TN)
BH	CTBK103	chamfered (TN)
BH	CTBK104	chamfered (TN), sintered steel (FN, TN)

Application range of PCBN grades



Machining of grey cast iron

Serial components require high cutting parameters to keep the costs per piece as low as possible. A very common automotive application using grey cast iron is brake disk machining. The very fine but also highly abrasive chip evacuation puts the clamping system to a hard test. In case of machining parameters with cutting speeds over 1,000 m/min and feed rates over 0.5 mm/rev. normal steel clamping claws do not last much longer than a cutting edge does.

Results – brake disc machining:

▲ 40% higher cutting speed
▲ 15% higher feed rate
▲ Improved wear
▲ Process reliability

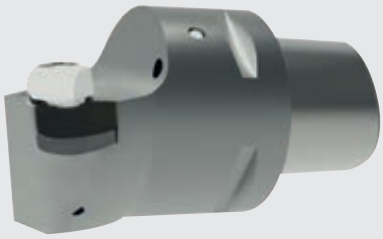
CHIP THICKNESS:

maximum	0.74 mm
on average	0.40 mm

Work piece	brake disc
Material	GG25
Machine	Hessap T.L.
Tool	special R tool holder
Grade	CTBK103, solid PCBN insert

	Competitor	**CERATIZIT**
v_c [m/min]	1,000	**1,400**
f [mm/rev.]	0.7	**0.8**
a_p [mm]	3–4	**3–4**
Tool life [pieces]	1,000	**1,000**

RNGX120400TN-020D-C CTBK103



Comparable standard tool
C5-DR...-C207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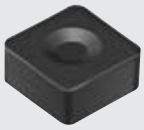
Results
– complete machining of brake disc:

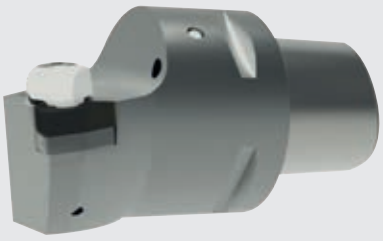
▲ Tool changing intervals reduced by 30%
▲ Better surface quality – is visible
▲ More than 30% higher cutting speed
▲ More than 30% longer tool life

Work piece	brake disc Ø 300 mm
Material	GG25
Machine	Scherer Feinbau
Tool	special finishing tool holder
Grade	CTBK103

	Competitor	**CERATIZIT**
v_c [m/min]	800	**1,050**
f [mm/rev.]	0.5	**0.5**
a_p [mm]	0.3	**0.3**
Tool life [pieces]	450	**600**

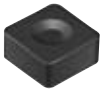


SNGX120416TN-020D-C CTBK103



Comparable standard tool
C5-DR...-C207


Page 32–33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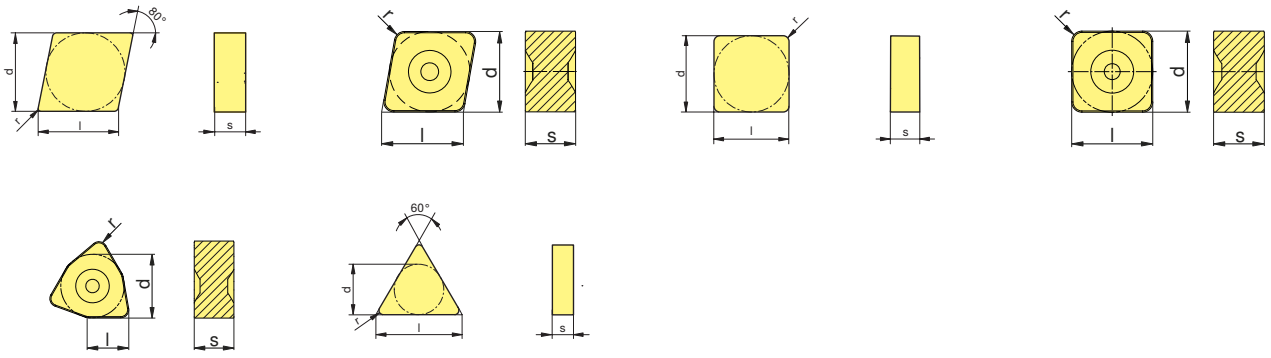
TOOL CONCEPT PROVIDES
MAXIMUM EFFICIENCY

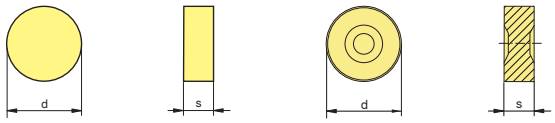
Simplex N / C-Clamp

			P	M	K	N	S	H	CTBK102	CTBK103	d [mm]	l [mm]	s [mm]	r [mm]
CN..N		CNGN 090308TN-020D			●			●	●		9.52	9.70	3.18	0.80
		CNGN 090316TN-020D			●			●	●		9.52	9.70	3.18	1.60
		CNGN 120416TN-020D			●			●	●		12.70	12.90	4.76	1.60
CN..X		CNGX 120416TN-020D-C								●	12.70	12.90	4.76	1.2
SN..N		SNGN 090312TN-020D			●			●	●		9.52	9.52	3.18	1.20
		SNGN 120316TN-020D			●			●	●		12.70	12.70	3.18	1.60
		SNGN 120416TN-020D			●			●	●		12.70	12.70	4.76	1.60
SN..X		SNGX 120416TN-020D-C								●	12.70	12.70	4.76	1.60
WN..X		WNGX 080416TN-020D-C								●	12.70	8.69	4.76	1.60
TN..N		TNGN 110308TN-020D			●			●	●		6.35	11.00	3.18	0.80
									CTBK102	CTBK103	d	l	s	r



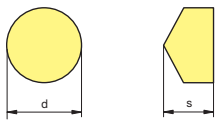
Simplex N / C-Clamp

			P	M	K	N	S	H	CTBK102	CTBK103	d [mm]	s [mm]
RN..N		RNGN 090300TN-020D			●			●	●		9.52	3.18
		RNGN 120300TN-020D			●			●	●		12.70	3.18
		RNGN 120400TN-020D			●			●	●		12.70	4.76
RN..X		RNGX 120400TN-020D-C			●			●		●	12.70	4,76



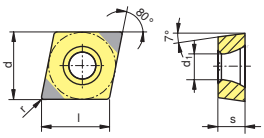
Simplex P

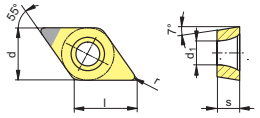
			P	M	K	N	S	H	CTBK102	d [mm]	s [mm]
RC..X		RCGX 060600TN-020D			●			●	●	6,00	6,20
		RCGX 090700TN-020D			●			●	●	9,52	7,70
		RCGX 120700TN-020D			●			●	●	12,70	7,70

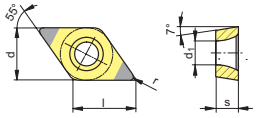


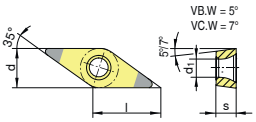
MaxiLock S

			P	M	K	N	S	H	CTBK104	CTL6115	d [mm]	l [mm]	s [mm]	r [mm]	d_1 [mm]
CC..W-B		CCGW 09T304FN_B3			●			●	●		9,52	9,70	3,97	0,40	4,40
		CCGW 09T304SN-013E_B3			●			●		●	9,52	9,70	3,97	0,40	4,40
		CCGW 09T304TN-020D_B3			●			●	●		9,52	9,70	3,97	0,40	4,40
		CCGW 09T308FN_B3			●			●	●		9,52	9,70	3,97	0,80	4,40
		CCGW 09T308SN-013E_B3			●			●		●	9,52	9,70	3,97	0,80	4,40
		CCGW 09T308TN-020D_B3			●			●	●		9,52	9,70	3,97	0,80	4,40
DC..W-A		DCGW 070208FN_A3			●			●	●		6,35	7,75	2,38	0,80	2,80
		DCGW 070208TN-020D_A3			●			●	●		6,35	7,75	2,38	0,80	2,80
DC..W-B		DCGW 11T304FN_B3			●			●	●		9,52	11,60	3,97	0,40	4,40
		DCGW 11T304SN-013E_B3			●			●		●	9,52	11,60	3,97	0,40	4,40
		DCGW 11T304SN-020D_B3			●			●	●		9,52	11,60	3,97	0,40	4,40
		DCGW 11T304TN-020D_B3			●			●	●		9,52	11,60	3,97	0,40	4,40
		DCGW 11T308SN-013E_B3			●			●		●	9,52	11,60	3,97	0,80	4,40
VC..W-B		VBGW 160404SN-013E-B3			●			●		●	9,52	16,60	4,76	0,40	4,40
		VCGW 110302SN-010E_B3			●			●		●	6,35	11,10	3,18	0,20	2,80
		VCGW 110304FN_B3			●			●	●		6,35	11,10	3,18	0,40	2,90
		VCGW 110304TN-020D_B3			●			●	●		6,35	11,10	3,18	0,40	2,90
		VCGW 160408FN_B3			●			●	●		9,52	16,60	4,76	0,80	4,40
		VCGW 160408TN-020D_B3			●			●	●		9,52	16,60	4,76	0,80	4,40
									CTBK104	CTL6115	d	l	s	r	d_1



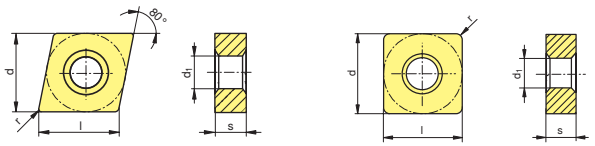






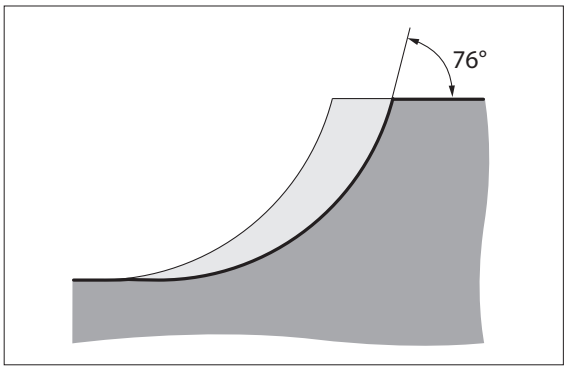
MaxiLock D/N

			P	M	K	N	S	H	CTBK102	d [mm]	l [mm]	s [mm]	r [mm]	d_1 [mm]
CN..A		CNGA 120408TN-020D			●			●	●	12,70	12,90	4,76	0,80	5,16
		CNGA 120412TN-020D			●			●	●	12,70	12,90	4,76	1,20	5,16
SN..A		SNGA 120412TN-020D			●			●	●	12,70	12,70	4,76	1,20	5,16
									CTBK102	d	l	s	r	d_1

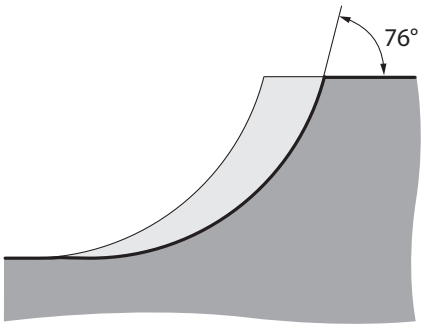


Machining of sintered steel

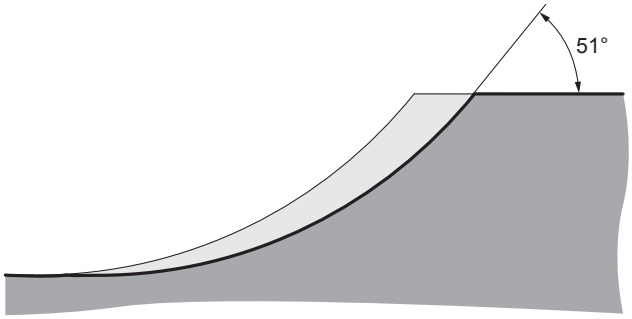
The advantage of using sintered steel components is that complex forms can be produced relatively easy and will be almost ready to use. Nevertheless, pressing and sintering leads to two unfavourable properties in one component for subsequent machining, namely fine, hard particles in a mainly soft structure. Sharp cutting edges on a fine-grain CBN material are called for in order to produce good, burr-free surfaces over the entire service life.



Chip section with feed rate 0.10 mm and depth of cut 0.30 mm



Radius	0.8 mm
R_{ac}	76°
Average chip thickness	0.05 mm



Radius	0.4 mm
R_{ac}	51°
Maximum chip thickness	0.09 mm
Average chip thickness	0.07 mm

Sintered steel with low density
Sint A and Sint B, hardness <HV300 (HRC 30)

Cutting material		Cutting speed	Chip groove
AMZ	coated carbide	v_c = 130 – 170 m/min	-27
H210T	carbide	v_c = 110 – 140 m/min	-27, -25
TCM407	cermet	v_c = 300 – 340 m/min	-SF

Sintered steel of high density
Sint C and Sint D, hardness >HV300 (HRC 30)

Cutting edge: sharp (FN) or chamfered (TN), avoid formation of burrs.
Use of CBN with high CBN content and metal binder.

Cutting material		Recommended application
CTBK104	CBN BH	v_c = 150 – 350 m/min
		a_p = 0.1 – 0.5 mm
		f = 0.05 – 0.4 mm/rev.

Sintered steel of high density
Sint C and Sint D, hardness >HV600 (HRC 55)

Cutting edge: honed (EN) or chamfered and honed (SN),
longer tool life, avoid edge chipping.

Cutting material		Recommended application
CTBK104	CBN BH	v_c = 150 – 350 m/min
CTL6115	CBN BL-C suitable for continuous cut	a_p = 0.1 – 0.5 mm
		f = 0.08 – 0.4 mm/rev.
		dry

PM sintered steel

Requirements regarding the cutting material

Fine hard components in a relatively soft matrix (e.g. Sint D11 and Sint C39) cause considerable clearance face wear and blunt the cutting edge. As a result the surface of the sintered steel deteriorates.

Burrs
The higher cutting pressure and the soft matrix also result in stronger burr formation on the part which has to be machined.

Types of cutting edges:
▲ Sint D11 (soft) FN sharp-edged
▲ Sint C39 (hardened) TN chamfered, sharp-edged

Avoid burr formation

▲ Reduce radius
▲ Adapt chip section, increase ap
▲ Reduce chamfer angle
▲ Reduce edge hone, use FN or TN
▲ Reduce chamfer width
▲ Use coolant
▲ Increase cutting speed

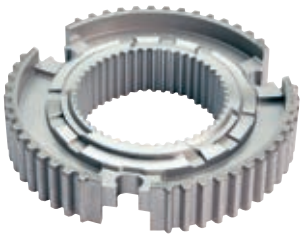
PCBN

▲ Fine-grained PCBN substrate makes sharp cutting edges possible
▲ Effective binding of the PCBN grains thanks to the metal binder
▲ Maximum PCBN content reduces abrasion

Sintered steel components

Chain wheels

Gear parts/ planetary carriers



Synchroniser rings

Variable valve controls

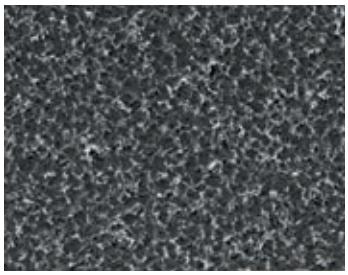
One-way clutches

GRADES

OVERVIEW INCLUDING MICROGRAPHS

CTBK102

BH-K10 | BH-H25

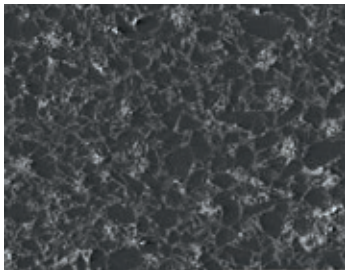


Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + vol.% + metallic binder phase

Recommended application:
First choice for cast iron machining with solid PCBN

CTBK103

BH-K10 | BH-H25

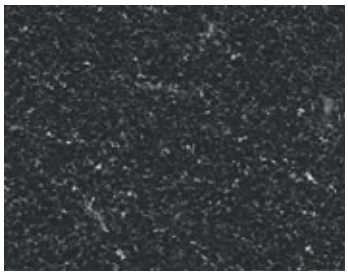


Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + metallic binder phase

Recommended application:
First choice for high-speed rough machining and finishing
of cast iron (EN-GJL);
brake discs with solid PCBN

CTBK104

BH-K10 | BH-H25

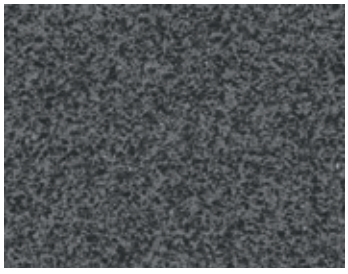


Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + metallic binder phase

Recommended application:
First choice for cast iron and sintered steel finishing

CTL6115

BC-H15



Specification:
Composition: cubic boron nitride (PCBN) | 50 vol.% + ceramic binder phase
Coating specification: PVD TiAlN

Recommended application:
First choice for case-hardened steels (HRC >57) in continuous to slightly interrupted cut

Grade designation	Standard designation ISO	Standard designation ANSI	Cutting material type	Application range 01 05 10 15 20 25 30 35 40 45 50	P Steel	M Stainless	K Cast iron	N Non-ferrous metals	S Heat-resistant	H Hard materials
CTBK102	BH-K10	C3	B				●			
	BH-H25	C2	B							●
CTBK103	BH-K10	C3	B				●			
	BH-H25	C2	B							●
CTBK104	BH-K10	C3	B				●			
	BH-H25	C2	B							●
CTL6115	BC-H15	C3	L							●

● Main application
○ Extended application

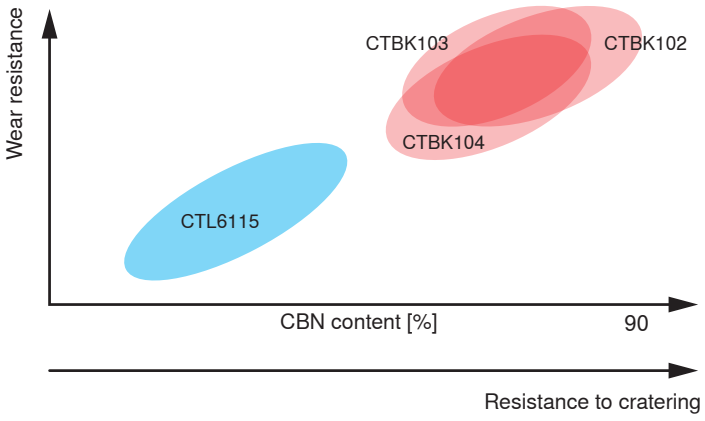
Grade classification according to ISO 513

BL	low PCBN content	40–65% PCBN
BL-C	low PCBN content, coated	40–65% PCBN, coated
BH	high PCBN content	70–95% PCBN
BH-C	high PCBN content, coated	70–95% PCBN, coated

Recommended application

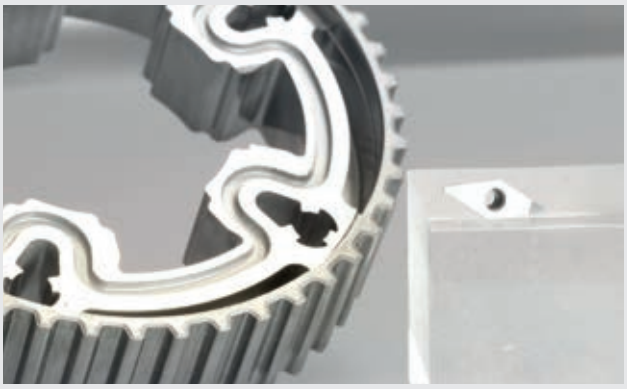
Grey cast iron, white cast iron		high PCBN content, 70–95% PCBN, ceramic binder
BL-C	CTL6115	chamfered and honed (SN)
Grey cast iron, white cast iron		high PCBN content, 70–95% PCBN, metallic binder
BH	CTBK102	chamfered (TN)
BH	CTBK103	chamfered (TN)
BH	CTBK104	chamfered (TN), sintered steel (FN, TN)

Application range of PCBN grades



Machining of sintered steel

The advantage of using sintered steel components is that complex forms can be produced relatively easy and will be almost ready to use. Nevertheless, pressing and sintering leads to two unfavourable properties in one component for subsequent machining: with fine, hard particles in a mainly soft structure. Sharp cutting edges on a fine-grain PCBN material are called for in order to produce good, burr-free surfaces over the entire service life.



Results – stator:

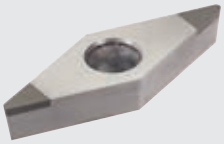
Tool life criterion: burrs on the component

▲ Tool life increased by 45%

CHIP THICKNESS:
maximum 0.09 mm
on average 0.05 mm

Work piece	stator
Material	sintered steel of high density D11
Hardness	HV100 – HV200
Machine	EMAG
Grade	CTBK104 interrupted cut with coolant

	Competitor	**CERATIZIT**
V_c [m/min]	300	**300**
f [mm/rev.]	0.10	**0.10**
a_p [mm]	0.25	**0.25**
Tool life [quantity]	150	**220**



VCGW 110304FN_B3

Maxilock S
SV...2525-11


Page 44–45


Page 48

COST REDUCTION
THROUGH INCREASED TOOL LIFE

Results – synchroniser ring:

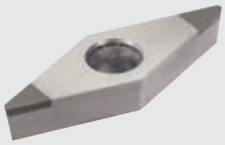
Requirement: surface R_z 5.0

▲ Tool life increased by 15%

CHIP THICKNESS:
maximum 0.07 mm
on average 0.04 mm

Work piece	synchroniser ring
Material	Sint D39 mod. hardened
Hardness	HV240
Machine	EMAG
Grade	CTBK104 interrupted cut, dry machining

	Competitor	**CERATIZIT**
V_c [m/min]	300	**300**
f [mm/rev.]	0.10	**0.10**
a_p [mm]	0.25	**0.25**
Tool life [quantity]	200	**230**



VCGW 160408TN-020D_B4

Maxilock S
SV...2525-1116

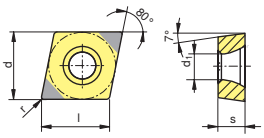

Page 44–45

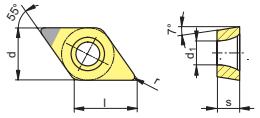

Page 48

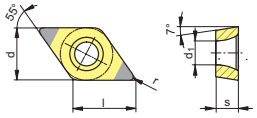
COST REDUCTION
THROUGH INCREASED TOOL LIFE

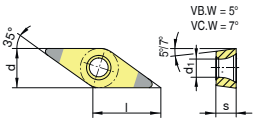
MaxiLock S

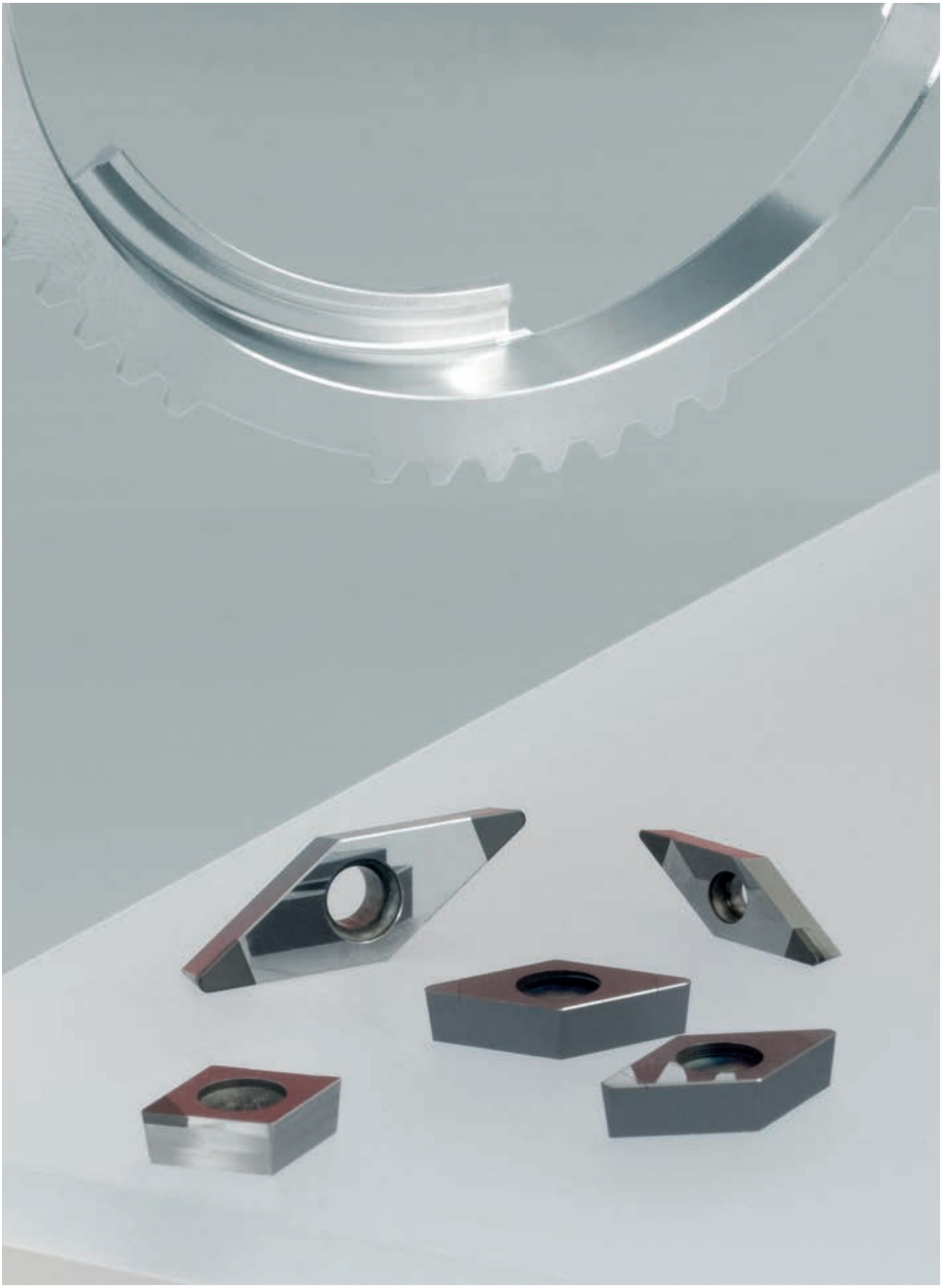
			P	M	K	N	S	H	CTBK104	CTL6115	d [mm]	l [mm]	s [mm]	r [mm]	d_1 [mm]
CC..W-B		CCGW 09T304FN_B3			●			●	●		9,52	9,70	3,97	0,40	4,40
		CCGW 09T304SN-013E_B3			●			●		●	9,52	9,70	3,97	0,40	4,40
		CCGW 09T304TN-020D_B3			●			●	●		9,52	9,70	3,97	0,40	4,40
		CCGW 09T308FN_B3			●			●	●		9,52	9,70	3,97	0,80	4,40
		CCGW 09T308SN-013E_B3			●			●		●	9,52	9,70	3,97	0,80	4,40
		CCGW 09T308TN-020D_B3			●			●	●		9,52	9,70	3,97	0,80	4,40
DC..W-A		DCGW 070208FN_A3			●			●	●		6,35	7,75	2,38	0,80	2,80
		DCGW 070208TN-020D_A3			●			●	●		6,35	7,75	2,38	0,80	2,80
DC..W-B		DCGW 11T304FN_B3			●			●	●		9,52	11,60	3,97	0,40	4,40
		DCGW 11T304SN-013E_B3			●			●		●	9,52	11,60	3,97	0,40	4,40
		DCGW 11T304SN-020D_B3			●			●	●		9,52	11,60	3,97	0,40	4,40
		DCGW 11T304TN-020D_B3			●			●	●		9,52	11,60	3,97	0,40	4,40
		DCGW 11T308SN-013E_B3			●			●		●	9,52	11,60	3,97	0,80	4,40
VC..W-B		VBGW 160404SN-013E-B3			●			●		●	9,52	16,60	4,76	0,40	4,40
		VCGW 110302SN-010E_B3			●			●		●	6,35	11,10	3,18	0,20	2,80
		VCGW 110304FN_B3			●			●	●		6,35	11,10	3,18	0,40	2,90
		VCGW 110304TN-020D_B3			●			●	●		6,35	11,10	3,18	0,40	2,90
		VCGW 160408FN_B3			●			●	●		9,52	16,60	4,76	0,80	4,40
		VCGW 160408TN-020D_B3			●			●	●		9,52	16,60	4,76	0,80	4,40
									CTBK104	CTL6115	d	l	s	r	d_1

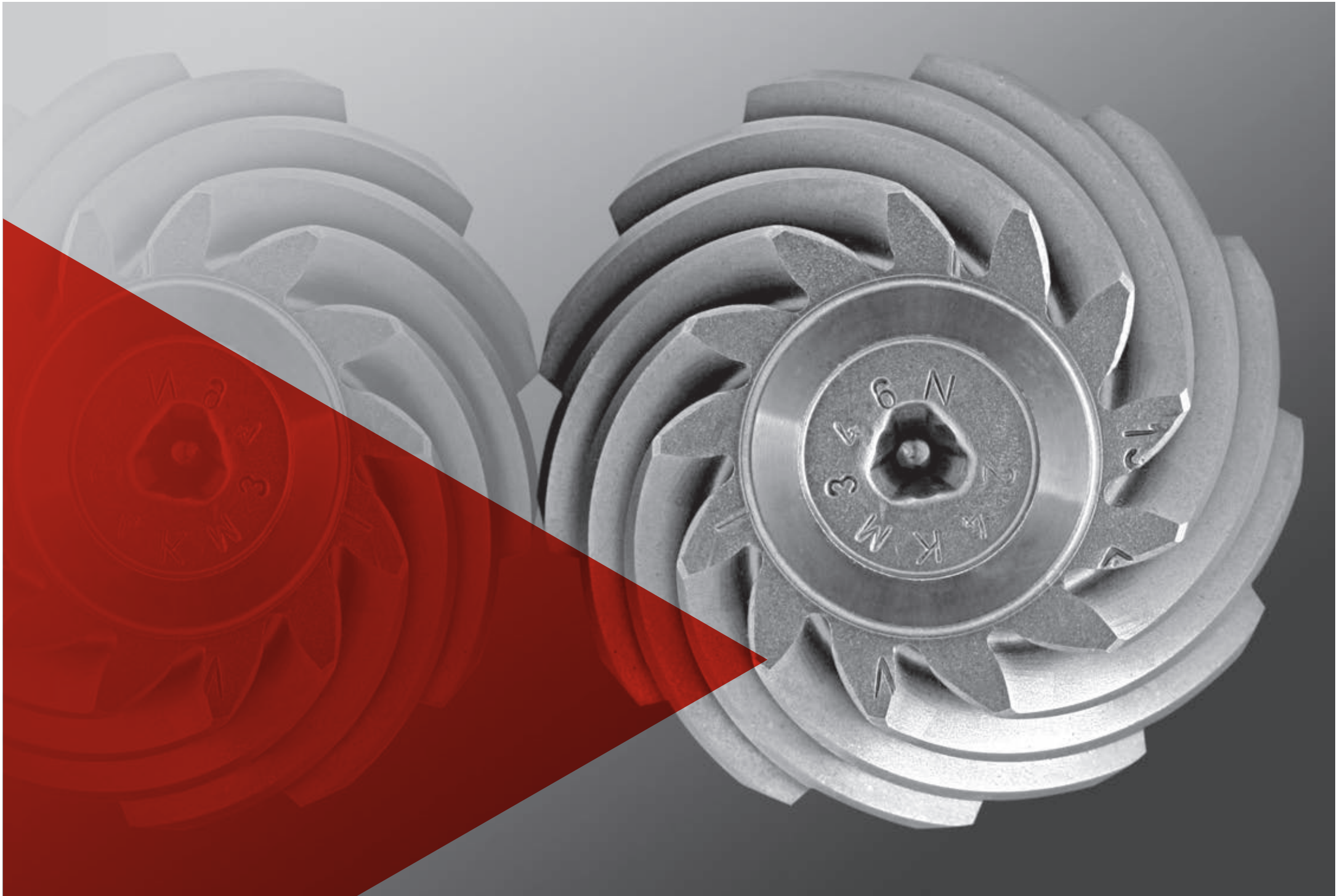












Machining of hardened steel

The demand for hardened components is on the increase, they are frequently used in the automotive industry. Gear parts, such as the drive bevel gear, must be wear-resistant and therefore very hard (min. 57 HRC / 650–700 HV). Precise bearing positions with maximum surface quality are necessary in order to make the bearing sufficiently smooth-running when in use. A decisive success factor in this context is the performance of the cutting edge. As can be seen in the following section, this is an ideal situation for the use of CBN in combination with the special Masterfinish cutting edge geometry.

Basics for the machining of hardened steels

▲ Softening of the chip due to high cutting speed represents the basis for hard machining.
▲ The chip should be glowing red hot.
▲ Annealing colour of the chip should be medium-grey (can be seen from the cooled down back of the chip).

▲ The shear chip is very brittle.
Annealed chips can easily be crumbled between the fingers.
▲ Steel hardness > 57 HRC
▲ Cutting edge is chamfered and honed (SN).
▲ In case of strongly interrupted cut increase chamfer angle > 30°.
Standard range for hardened steel: chamfer 0.13 x 25°.
▲ Don't use coolant for interrupted cut.
▲ Careful soft pre-machining of the components.
Avoid burrs, rough-turn chamfers.
▲ Avoid vibration.
▲ Reduce the feed rate when starting and stopping the cutting operation.
▲ With double-cut strategy, vary the cutting depths.
▲ Chamfer the sharp edges of the work piece or start with radius programme.

Picture shows desired colour after cooling down.

Machining of hardened steel

CTL6115 is the first choice for case-hardened steels (hardness > 57 HRC) for continuous up to slightly interrupted cut.

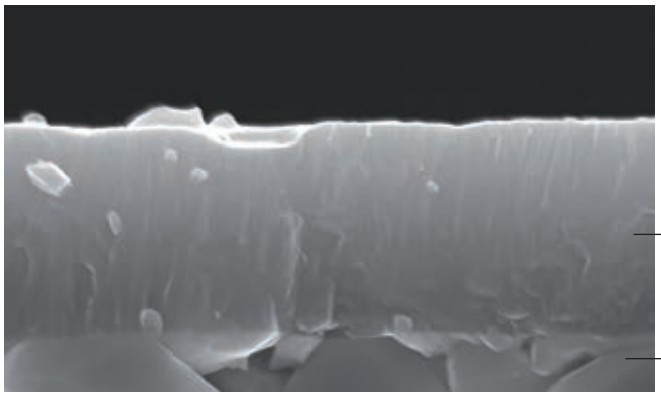
CERATIZIT – PCBN coating

TheTiAIN based PVD coating system improves oxidation resistance and protects against adhesion. The compressive stress resulting from the coating process stabilises the coating, cutting edge and base material system resulting in a better connection to the base material and significantly improved process reliability.

Increasing the tool life and feed rates means that machining times and also the costs per component are notably reduced. The consumption of existing resources is reduced and the user's competitiveness rises notably through the use of the CTL6115 grade.

Cutting material		Application	Composition:
CTL6115	CBN-tipped BL-C	v_c = 100–200 m/min	Cubic boron nitride (CBN) / 50 vol. % + ceramic binder phase with patented PVD coating ▲ Improved oxidation resistance ▲ Protects against adhesions

Patented PVD-TiAIN coating

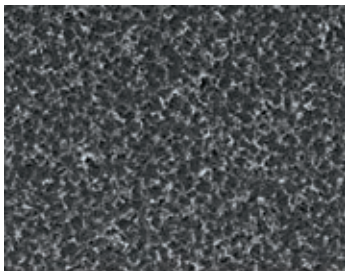


GRADES

OVERVIEW INCLUDING MICROGRAPHS

CTBK102

BH-K10 | BH-H25

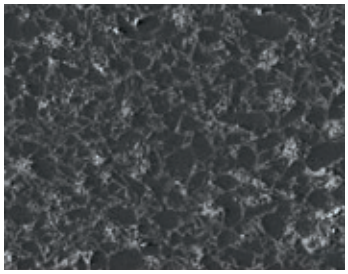


Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + metallic binder phase

Recommended application:
First choice for cast iron machining with solid PCBN

CTBK103

BH-K10 | BH-H25

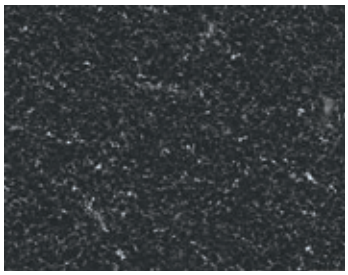


Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + metallic binder phase

Recommended application:
First choice for high-speed roughing and finishing
of cast iron (EN-GJL),
brake discs with solid CBN.

CTBK104

BH-K10 | BH-H25

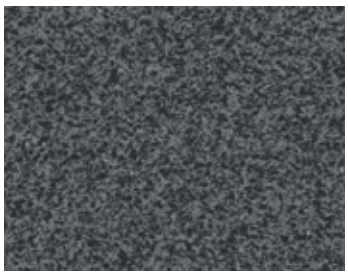


Specification:
Composition: cubic boron nitride (PCBN) | 90 vol.% + metallic binder phase

Recommended application:
First choice for cast iron and sintered steel finishing

CTL6115

BC-H15



Specification:
Composition: cubic boron nitride (PCBN) | 50 vol.% + metallic binder phase
Coating specification: PVD TiAlN

Recommended application:
First choice for case-hardened steels (hardness > 57 HRC) for continuous up to slightly interrupted cut.

Grade designation	Standard designation ISO	Standard designation ANSI	Type of cutting material	Application 01 05 10 15 20 25 30 35 40 45 50	P Steel	M Stainless steel	K Cast iron	N Non-ferrous metals	S Heat-resistant materials	H Hard materials
CTBK102	BH-K10	C3	B				●			
	BH-H25	C2	B							●
CTBK103	BH-K10	C3	B				●			
	BH-H25	C2	B							●
CTBK104	BH-K10	C3	B				●			
	BH-H25	C2	B							●
CTL6115	BC-H15	C3	L							●

● Main application
○ Extended application

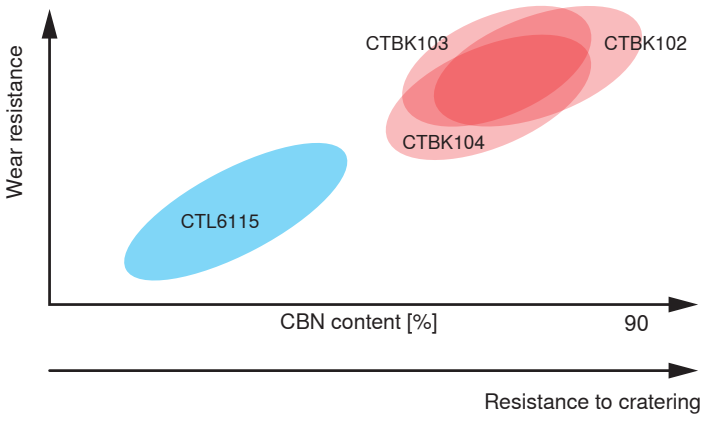
Grade classification according to ISO 513

BL	low PCBN content	40–65% PCBN
BL-C	low PCBN content, coated	40–65% PCBN, coated
BH	high PCBN content	70-95% PCBN
BH-C	high PCBN content, coated	70-95% PCBN, coated

Grade recommendation

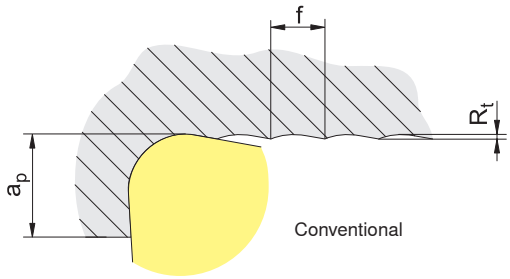
Case-hardened steels: HRC >57		low PCBN content, 40–65% PCBN, ceramic binder, coated
BL-C	CTL6115	chamfered and honed (SN)
Grey cast iron, white cast iron		high PCBN content, 70-95% PCBN, metallic binder
BH	CTBK102	chamfered (TN)
BH	CTBK103	chamfered (TN)
BH	CTBK104	chamfered (TN), sintered steel (FN, TN)

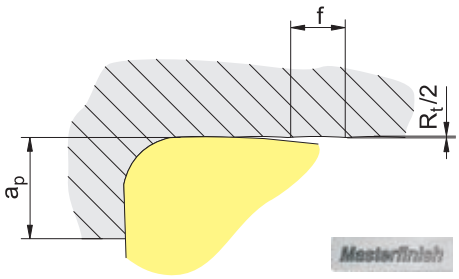
Grade application range of PCBN grades



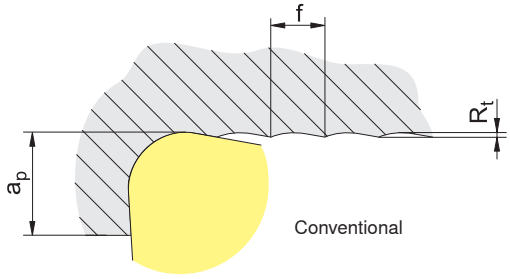
Operating principle / benefit

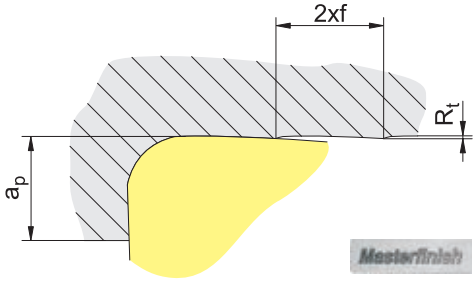
Improved surface
With the same feed rate an insert with 'Masterfinish' cutting edge reaches a roughness value R_a which is many times higher than the one of a conventional insert.

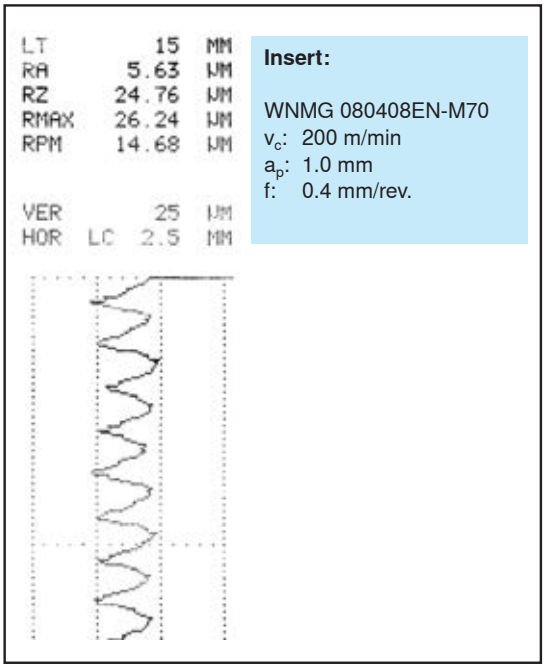


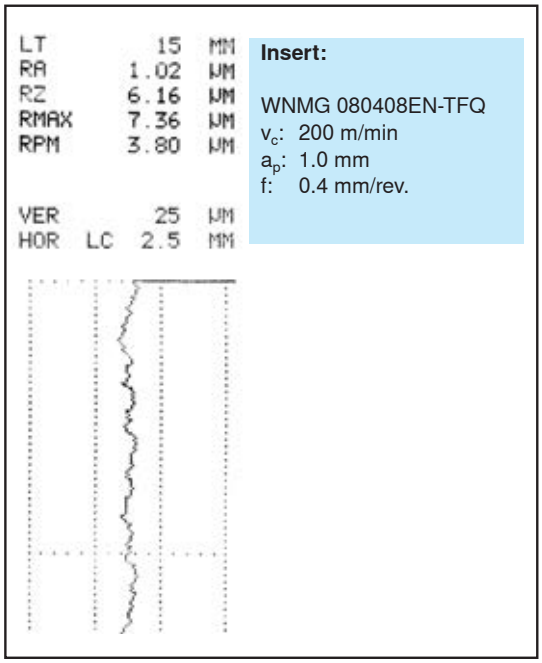


Reduced machining time
If you want to reach the same R_{a-} value as with a standard insert, a twice as high feed rate can be applied for the insert with 'Masterfinish' cutting edge (= shorter production time per component!).

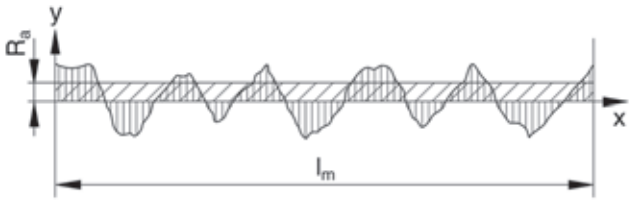








Optimisation of the surface through:
▲ Use larger corner radius
▲ MASTERFINISH
▲ Reduce feed rate
▲ Double-cut strategy
▲ Use sharper cutting edge

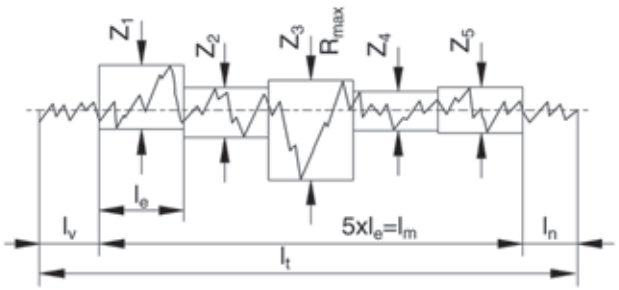


Average roughness value R_a (DIN 4768)

This is defined as the arithmetical mean of the absolute sums of the roughness profile R within the entire measured length l_m.

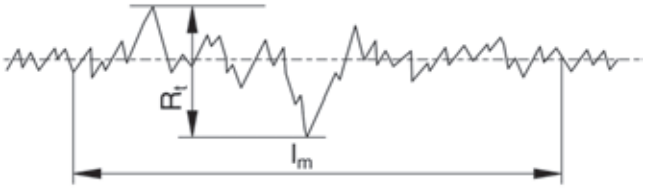
Average roughness depth R_z (DIN 4768)

This is defined as the average value resulting from the single roughness depths of five successive single measured lengths l_e.



Single surface roughness depth Z_1 ... Z_5

This is the vertical distance between the highest and the lowest point of the roughness profile R within a single measured length l_e.



Maximum surface roughness depth R_t (DIN 4768/1)

This is the distance between the elevation and depression of the line within the measured length (reference distance) of profile filtered according to DIN 4768 sheet 1.

Surface quality according to manufacturing method

Surface symbol according to ISO 1302	new	0,025	0,05	0,1	0,2	0,4	0,8	1,6	3,2	6,3	12,5	25	50
Surface symbol according to ISO 3141	previous	▽▽▽▽					▽▽▽		▽▽		▽		
Roughness index		N 1	N 2	N 3	N 4	N 5	N 6	N 7	N 8	N 9	N 10	N 11	N 12
Arithmetic mean value	R_a [µm]	0,025	0,05	0,1	0,2	0,4	0,8	1,6	3,2	6,3	12,5	25	50
Surface roughness depth	R_z [µm]	0,25	0,63	1	1,6	2,5	4-6,3	10	16-25	40	63	100	160
Longitudinal turning Face turning													
Longitudinal turning Face turning													
Longitudinal grinding Surface grinding													

≙ Surface roughness (produced through special methods)

≙ Surface roughness (produced through normal workshop methods)

≙ Surface roughness (produced through rough machining methods)

Machining of hardened steel

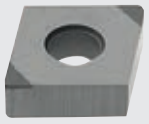
Gear parts like the drive bevel gear must be wear-resistant and so also extremely hard (min. 57 HRC / 650–700 HV). Precise bearing positions with maximum surface quality are necessary in order to make the bearing sufficiently smooth-running when in use. As can be seen in the following machining example, this is an ideal situation for the use of CBN in combination with the special Masterfinish cutting edge geometry.

Results

▲ Quantity per cutting edge increased by 26%
▲ Machining time reduced by 33%

Work piece	drive bevel gear
Material	16MnCr5 / HRC 58-60
Machine	Weisser Univertor
Grade	CTL6115
Use of a CERATIZIT grade and increased feed rate	

	Competitor	**CERATIZIT**
v_c [m/min]	150	**150**
f [mm/rev.]	0.30	**0.40**
a_p [mm]	0.22-0.27	**0.22-0.27**
Tool life [quantity]	157	**198**



CNGA 120408SN-013E_B3

DC...2525...-1112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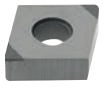
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MACHINING TIME
REDUCED BY 33 %

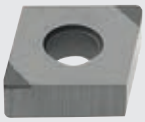
Changeover to MASTERFINISH geometry

Results

▲ R_z value is reduced to 3.73 µm
▲ Quantity per cutting edge increased by 17%
▲ Machining time reduced by 15%

Work piece	drive bevel gear
Material	16MnCr5 / HRC 58-60
Machine	Weisser Univertor
Grade	CTL6115
Changeover to MASTERFINISH, feed rate increased	

	Competitor	**CERATIZIT**
v_c [m/min]	150	**150**
f [mm/rev.]	0.30	**0.35**
a_p [mm]	0.30	**0.30**
Tool life [quantity]	183	**214**



CNGA 120408SNQ-013E_B2

DC...2525...-1112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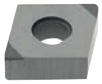
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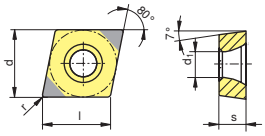
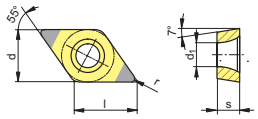
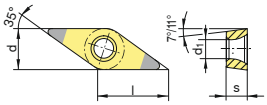
HIGH **SURFACE QUALITY**
THANKS TO OPTIMISED CUTTING EDGE GEOMETRY

MaxiLock S

			P	M	K	N	S	H	CTL6115	d [mm]	l [mm]	s [mm]	r [mm]	d_1 [mm]
CC..W-B		CCGW 09T304SN-013E_B3						●	●	9.52	9.70	3.97	0.40	4.40
		CCGW 09T308SN-013E_B3						●	●	9.52	9.70	3.97	0.80	4.40
DC..W-B		DCGW 11T304SN-013E_B3						●	●	9.52	11.60	3.97	0.40	4.40
		DCGW 11T308SN-013E_B3						●	●	9.52	11.60	3.97	0.80	4.40
VC..W-B		VBGW 160404SN-013E-B3						●	●	9.52	16.60	4.76	0.40	4.40
		VCGW 110302SN-010E_B3						●	●	6.35	11.10	3.18	0.20	2.80
									CTL6115	d	l	s	r	d_1

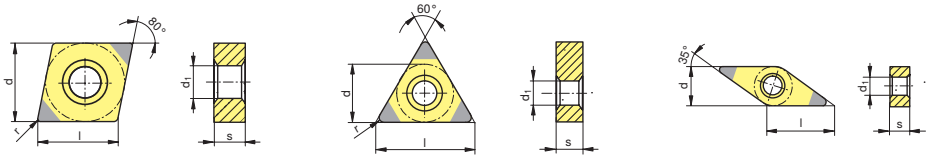






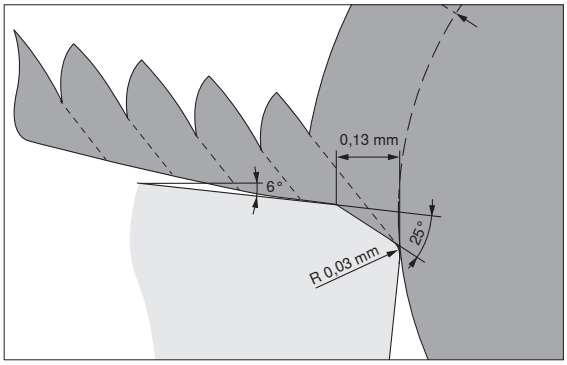
MaxiLock D/N

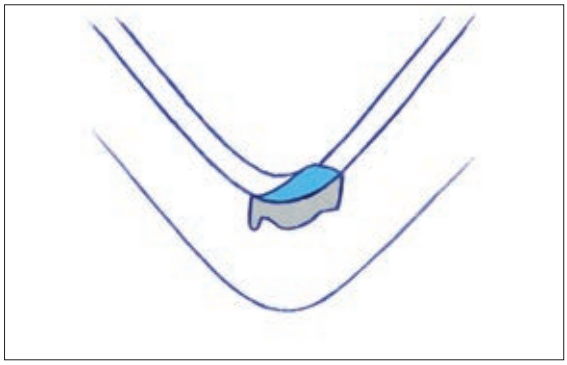
			P	M	K	N	S	H	CTL6115	d [mm]	l [mm]	s [mm]	r [mm]	d_1 [mm]
CN..A-B		CNGA 120404SN-013E_B3						●	●	12.70	12.90	4.76	0.40	5.16
		CNGA 120408SNQ-013E_B2						●	●	12.70	12.90	4.76	0.80	5.16
		CNGA 120408SN-013E_B3						●	●	12.70	12.90	4.76	0.80	5.16
		CNGA 120412SN-013E_B3						●	●	12.70	12.90	4.76	1.20	5.16
DN..A-B		DNGA 150404SN-013E_B3						●	●	12.70	15.50	4.76	0.40	5.16
		DNGA 150408SN-013E_B3						●	●	12.70	15.50	4.76	0.80	5.16
		DNGA 150608SN-013E_B3						●	●	12.70	15.50	6.35	0.80	5.16
		DNGA 150612SN-013E_B3						●	●	12.70	15.50	6.35	1.20	5.16
TN..A-C		TNGA 160408SN-013E_C3						●	●	9.52	16.50	4.76	0.80	3.81
VN..A-B		VNGA 160404SN-013E_B3						●	●	9.52	16.60	4.76	0.40	3.81
		VNGA 160408SN-013E_B3						●	●	9.52	16.60	4.76	0.80	3.81
		VNGX 160408SN-010E_B3						●	●	9.52	16.60	4.76	0.80	3.81
									CTL6115	d	l	s	r	d_1



Technical recommendations

PCBN cutting materials are suitable for a wide variety of machining challenges. This user manual gives you valuable practical tips for the best way of dealing with these. They include for example recommendations for the starting feed rate in relation to a defined roughness value and defined radius, as well as on the matter of chip thickness. Use this manual to learn more about strategies for resolving turning problems and possible options for improving typical wear phenomena.



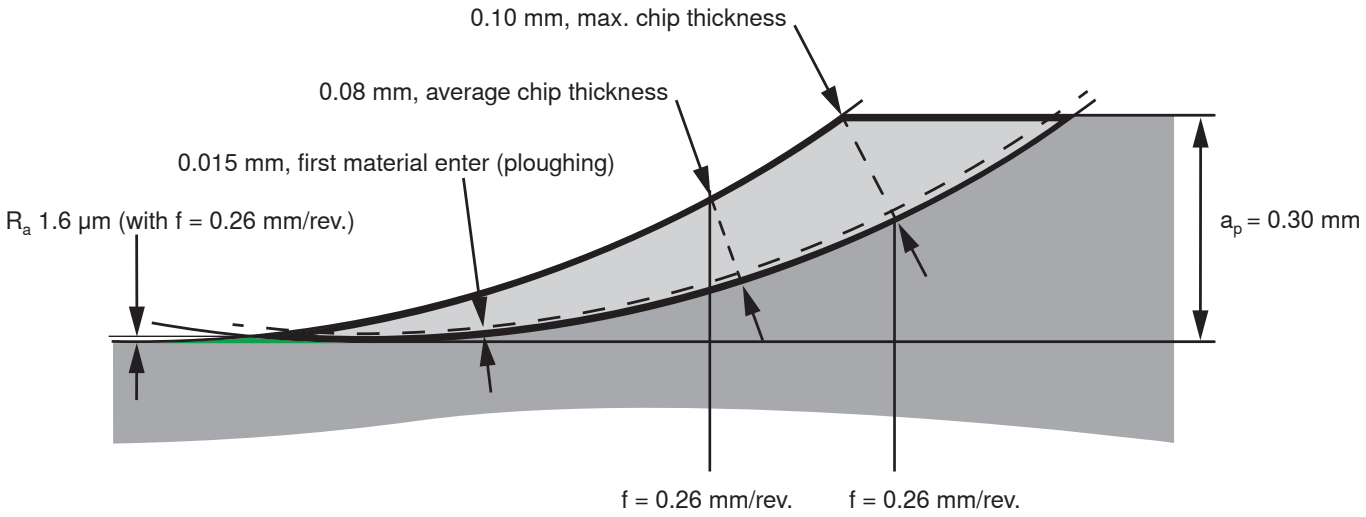


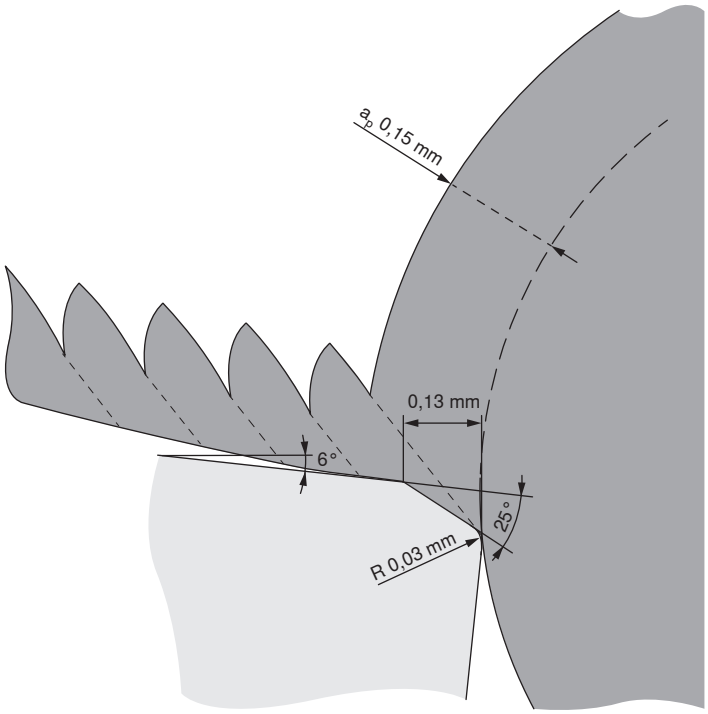
Machining problems – possible approaches
Chip formation / calculation

▲ Hard machining is mostly a finishing operation.
▲ The depths of cut are below 0.5 mm.
▲ Therefore the chips are formed almost exclusively in the radius area.

Example: chip formation in the radius area

Corner radius: r = 1.6 mm
Depth of cut: a_p = 0.30 mm
Feed rate: f = 0.30 mm/rev.





Upon request, we offer inserts with reinforced negative chamfer for severely interrupted cut; these are also available in tougher grades. Please make use of our enquiry form.

Recommendation:
Start feed rate with a defined roughness index and radius

Source: Degner/Lutze/Smejkal, 'Spanende Formung' (Metal cutting)

Parameters:
Roughness index: N7 (R_a 1.6 μm)
Corner radius: 1.6 mm
Recommended start feed rate: f = 0.26 mm/rev.

Surface symbol according to ISO1 R_a	0,2	0,4	0,8	1,6	3,2	6,3	12,5	25,0
Roughness index	N4	N5	N6	N7	N8	N9	N10	N11

	Corner radius mm	Depth of cut a_p mm	max. feed rate for roughness index f/rev. mm							
	1,6		0,09	0,13	0,18	0,26	0,37	0,51	0,72	1,00
		0,30	0,03	0,04	0,06	0,08	0,11	0,16	0,22	0,31

Recommendation:
Average chip thickness (in the radius area) with a defined feed rate and depth of cut

Parameters:
Roughness index: N6 (R_a 0.8 μm)
Feed rate: f = 0.13 mm/rev.
Depth of cut: a_p = 0.5 mm
Average chip thickness 0.07 mm

	Corner radius mm	Depth of cut a_p mm	max. feed rate for roughness index f/rev. mm							
			Average chip thickness with f/rev. mm							
	0,8		0,06	0,09	0,13	0,18	0,26	0,36	0,50	
		0,3	0,03*	0,04*	0,06	0,08	0,11	0,16	0,22	
		0,5	0,03*	0,05	0,07	0,10	0,15	0,20	0,28	

* In steel machining:
feed rate in the area of the cutting edge hone, increase feed rate

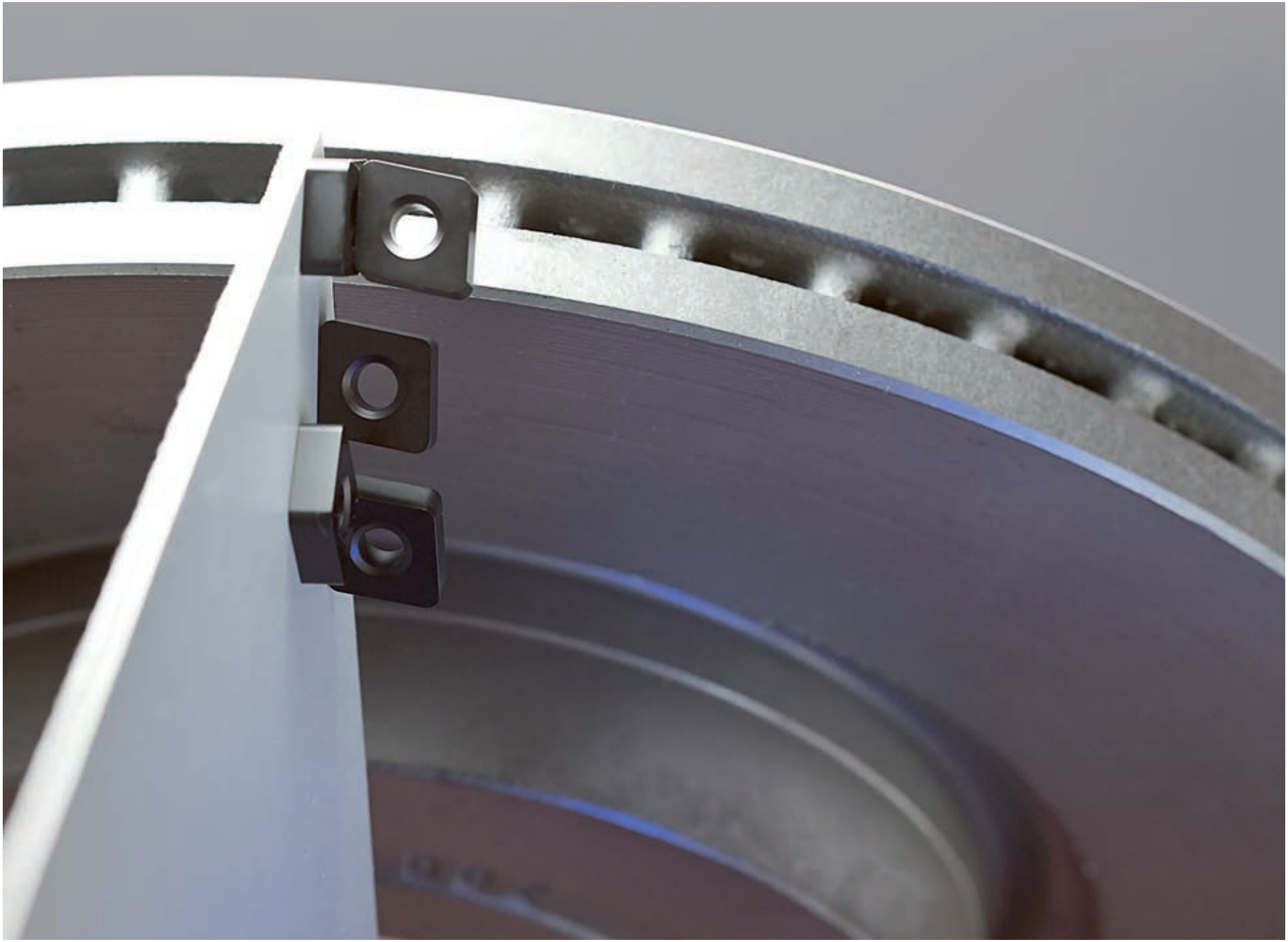
A twice as high feed rate can be applied for the insert with a MASTERFINISH cutting edge if you want to reach the same R_a value as with a standard insert.

Cutting data – feed rate

Source: textbook

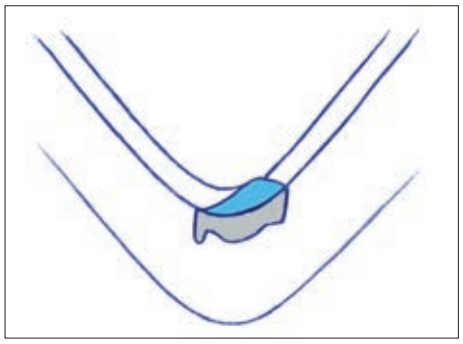
Surface symbol according to ISO1 R_a			0.2	0,4	0,8	1,6	3,2	6,3	12,5	25,0
Roughness index			N4	N5	N6	N7	N8	N9	N10	N11
	Corner radius mm	**Depth of cut a_p mm**	**max. feed rate for roughness index f/rev. mm**							
			Average chip thickness with f/rev. mm							
	**0.2**		0,03	0,05	0,06	0,09	0,13			
		0,3	0,03*	0,04*	0,05	0,08	0,11			
		0,5	0,03*	0,06	0,07	0,10	0,15			
	0,4		0,04	0,07	0,09	0,13	0,18	0,25		
		0,3	0,02*	0,04*	0,06	0,08	0,11	0,15		
		0,5	0,03*	0,06	0,07	0,10	0,14			
	0,8		0,06	0,09	0,13	0,18	0,26	0,36	0,5	
		0,3	0,03*	0,04*	0,06	0,08	0,11	0,16	0,22	
		0,5	0,03*	0,05	0,07	0,10	0,15	0,20	0,28	
	1,2		0,08	0,12	0,16	0,22	0,32	0,44	0,63	
		0,3	0,03*	0,04*	0,06	0,08	0,11	0,16	0,22	
		0,5	0,04*	0,05	0,07	0,10	0,15	0,20	0,29	
	1,6		0,09	0,13	0,18	0,26	0,37	0,51	0,72	1,00
		0,3	0,03*	0,04*	0,06	0,08	0,11	0,16	0,22	0,31
		0,5	0,04*	0,05	0,07	0,10	0,15	0,20	0,28	0,40
		0,8	0,05	0,07	0,09	0,13	0,19	0,26	0,36	0.50
	**r 3.175 Ø 6.35**		0.13	0,18	0,26	0,37	0,52	0,72	1,00	1,40
		0,3	0,03*	0,04*	0,06	0,08	0,11	0,16	0,22	0,30
		0,5	0,04*	0,05	0,07	0,10	0,15	0,20	0,28	0,39
		0,8	0,05	0,06	0,09	0,13	0,18	0,26	0,35	0,50
		1,6	0,07	0,09	0,13	0,19	0,26	0,36	0,50	0,70
	r 4.76 Ø 9.52		0.16	0,22	0,32	0,45	0,62	0,88	1,25	1,75
		0,3	0,03*	0,03*	0,06	0,08	0,11	0,16	0,22	0,31
		0,5	0,04*	0,05	0,07	0,10	0,15	0,20	0,29	0,40
		0,8	0,05	0,06	0,09	0,13	0,18	0,26	0,36	0,51
		1,6	0,07	0,09	0,13	0,18	0,25	0,36	0,51	0,72
		2,5	0,08	0,11	0,16	0,23	0,32	0,45	0,64	0,90
	r 6.35 Ø 12.7		0,18	0,26	0,36	0,51	0,73	1,02	1,45	2,05
		0,3	0,03*	0,04*	0,06	0,08	0,11	0,16	0,22	0,32
		0,5	0,04*	0,05	0,07	0,10	0,14	0,20	0,29	0,41
		0,8	0,05	0,07	0,09	0,13	0,18	0,26	0,36	0,51
		1,6	0,06	0,09	0,13	0,18	0,26	0,36	0,51	0,73
		2,5	0,08	0,12	0,16	0,23	0,32	0,45	0,64	0,91
		3,2	0,09	0,13	0,18	0,26	0,37	0,51	0,73	1,03
		6,4	0,13	0,18	0,26	0,36	0,52	0,72	1,03	1,46

* In steel machining:
avoid feed rate in the area of the cutting edge hone, increase feed rate



TYPES OF WEAR

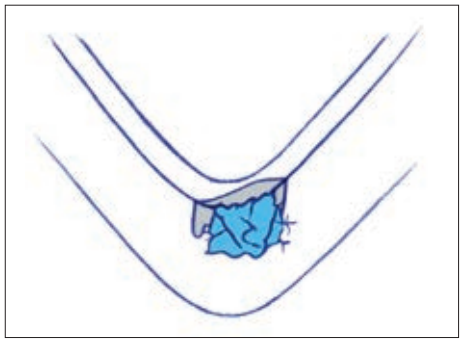
Crater wear



Reason
Crater wear is caused by cratering on the rake face.

Corrective measures
▲ Use a grade which is more resistant to cratering (for example, exchange PCBN-BH for PCBN-BL)
▲ Reduction in cutting speed
▲ Increase feed rate to reduce the friction contact area
▲ Reduce chamfer angle

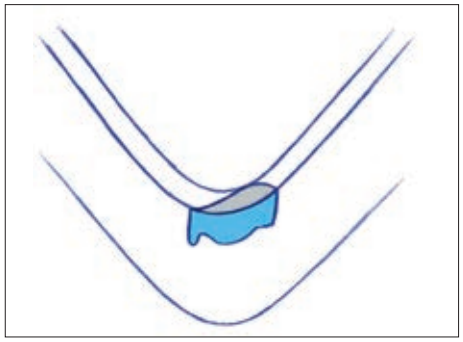
Crater edge rupture



Reason
If the crater wear becomes too great, then the crater edge will rupture.

Corrective measures
▲ Change the insert in a timely manner
▲ Increase feed rate to reduce the friction contact area
▲ Reduce chamfer angle

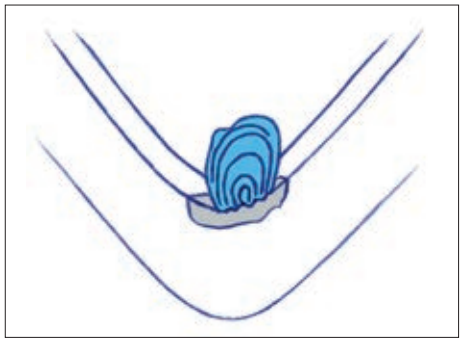
Flank wear



Reason
Abrasion on the clearance face causes clearance face wear.

Corrective measures
▲ Increase feed rate to reduce the friction contact area
▲ Reduce hone
▲ Enlarge clearance angle
▲ Increase cutting depth
▲ Grade not suitable for application (use cemented carbide or ceramic)
▲ Do not use coolant

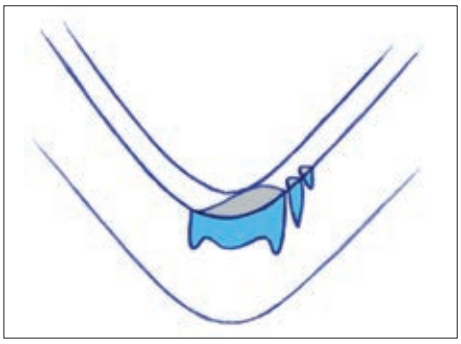
Flaking off on the rake face



Reason
Flaking on the rake face can happen when there are vibrations or with crater wear that is too deep.

Corrective measures
▲ Avoid vibrations, reduce overhang
▲ Change insert in a timely manner
▲ Check tip height
▲ Reduce chamfer angle

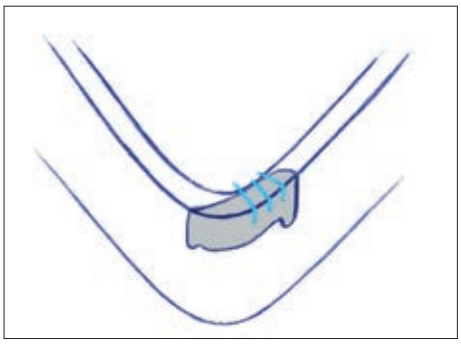
Notching



Reason
Notching happens at the maximum depth of cut.

Corrective measures
▲ Alternate the cutting depth
▲ Do not use coolant
▲ Reduce chip cross section
▲ Enlarge the corner radius (approach angle is thereby reduced)
▲ Use a grade with higher CBN content

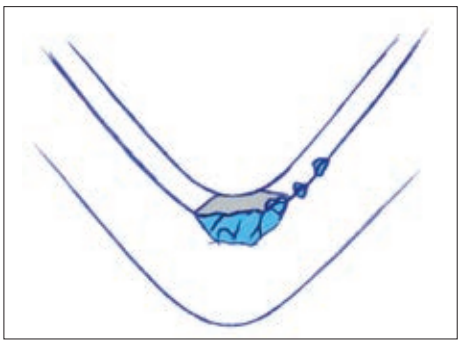
Thermal cracks



Reason
Cracks can appear due to changing cutting temperatures.

Corrective measures
▲ Switch off coolant
▲ Use a grade with higher CBN content
▲ Reduce cutting speed
▲ Decrease the chip cross section (reduce feed rate and cutting depth)
▲ Reduce chamfer angle size
▲ Reduce hone

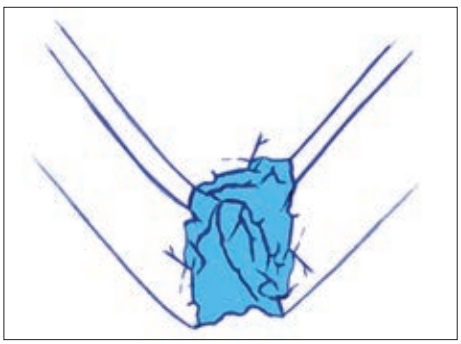
Edge chipping



Reason
Excessive mechanical stress of the cutting edge leads to edge chipping.

Corrective measures
▲ Switch off coolant
▲ Use a grade with higher CBN content
▲ Enlarge chamfer and hone
▲ Check the tip height
▲ For interrupted cut: increase feed rate and thereby reduce the amount of impacts
▲ Use a larger corner radius

Insert breakage



Reason
Breakage of an insert is the result of excessive stress on the insert.

Corrective measures
▲ Switch off coolant
▲ Check the shim and replace if required
▲ Use a grade with higher PCBN content
▲ Enlarge chamfer and hone
▲ Enlarge chamfer angle
▲ Reduce size of the chip cross section (choose larger corner radius)
▲ Reduce cutting depth

TROUBLESHOOTING FOR TURNING PROBLEMS

Problem										
Type of wear							Work piece problems			
Flank wear	Crater wear	Notching	Thermal cracks	Edge chipping	Insert breakage	Flaking	Surface finish	Vibration	Formation of burrs	Corrective measures
	⇩		⇩			⇩	⇧	⇩		Cutting speed v_c
⇧	⇧	⇩	⇩	⇩		⇧	⇩	≈	⇧	Feed rate f
⇧			⇩	⇩					⇧	Depth of cut a_p
	⇩		⇩	⇧	⇧	⇩	⇩		⇩	Chamfer angle 35° heavily interrupted cut Chamfer angle 25° continuous or slightly interrupted cut Chamfer angle 15° continuous or slightly interrupted cut
		⇧		⇧	⇧		⇧	⇩	⇩	Corner radius (larger ↑ ↓ smaller)
⇩	⇩		⇩	⇩	⇧	⇩	⇩	⇩	⇩	Hone
	⇩	⇧	⇧	⇧	⇧					PCBN content (BH / BL; Wear resistance ↑ ↓ Toughness)
				≈	≈	≈	≈	≈		Clamping of tool
				≈	≈	≈	≈	≈		Clamping of work piece
				≈	≈	⇩	⇩	⇩		Overhang
≈				≈	≈	≈	≈	≈		Tip height
□		□	□	□	□				■	Cooling lubricant

⇧ raise, increase, large influence

⇧ raise, increase, small influence

⇩ avoid, reduce, large influence

⇩ avoid, reduce, small influence

≈ check, optimise

■ use

□ don't use

Corrective measures		
Problem	**Possible causes**	**Corrective measures**
Short tool life	▲ Cutting speed is not within the specifications ▲ Chip has not softened	▲ Increase in cutting speed ▲ Ideally the swarf is glowing red hot.
Bad surface quality	▲ Feed rate too high ▲ Corner radius is too small	▲ Reduce feed rate ▲ Increase corner radius ▲ Use MASTERFINISH
Chatter marks	▲ Tool overhang too long	▲ Reduce overhang and use more stable tool holder
Vibration	▲ Cutting pressure too high ▲ Chip section too large ▲ Wrong tip height ▲ Unstable tool or work piece clamping ▲ Insert radius too large, high return forces (tip seat pressure)	▲ Reduce cutting pressure ▲ Reduce chip section ▲ Check / adjust tip height ▲ Use C-Clamp for clamping ▲ Use smaller radius
Burrs on the work piece	▲ When the material is soft (sintered steel) ▲ Cutting pressure too high	▲ Use smaller radius ▲ Reduce chip section ▲ Increase depth of cut ▲ Increase cutting speed ▲ Reduce chamfer angle ▲ Use sharp cutting edge ▲ Use coolant
Notching	▲ Feed rate mark at max. depth of cut	▲ With double-cut strategy, vary the cutting depths.
Notching (chemical)	▲ Deep grooves on the main cutting edge	▲ Check material ▲ E.g. ferrite content too high (e.g. GG25)
Chipping on the work piece	▲ Sharp edge where tool exits	▲ Change machining direction ▲ Reduce feed rate at tool entry and exit

CERATIZIT DESIGNATION SYSTEM

TOOL HOLDERS

D	C	L	N	R		25	25		K	12	-	C2
1	2	3	4	5		6	7		8	9		10

UT50	-	P	C	L	N	R				-12	
0		1	2	3	4	5	6	7		8	9	10

HSK-T63	-	D	C	L	N	R				-12	
0		1	2	3	4	5	6	7		8	9	10

0

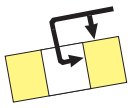
System / size

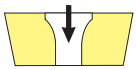
UT = UTS
according to ISO 26622
UT40 = UTS 40 mm
UT50 = UTS 50 mm
UT63 = UTS 63 mm

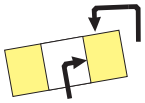
HSK-T
according to ISO 12164
HSK-T63 = 63mm
HSK-T100 = 100mm

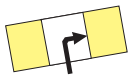
1

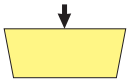
Tool holder

D

Retained from above and via bore

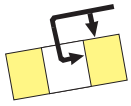
S

Retained via centre screw

M

Retained from above and via bore

P

Retained via the bore

C

Retained from above

X
X special version

C-Clamp2


2

Insert shape

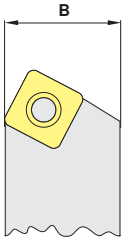
Included angle				35°	V
				55°	D
				75°	E
				80°	C
				86°	M
Included angle				55°	K
				82°	B
				85°	A
Other shapes	90°	L		–	R
	108°	P		90°	S
	120°	H		60°	T
	135°	O		80°	W

6

Shank height

7

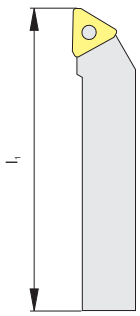
Shank width



8

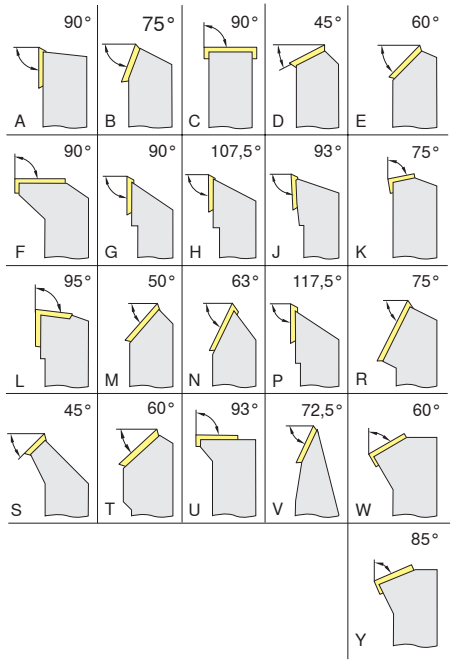
Tool length

l_1 mm	l_1 inch		l_1 mm	l_1 inch	
32	4.000	A	160	4.500	N
40	4.500	B	170	5.500	P
50	5.000	C	180	–	Q
60	6.000	D	200	6.000	R
70	7.000	E	250	7.000	S
80	8.000	F	300	8.000	T
90	5.500	G	350	5.500	U
100	5.625	H	400	3.500	V
110	5.300	J	450	3.500	W
125	14.000	K	500	3.750	Y
140	6.800	L	Special		X
150	4.400	M			



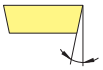
3

Style



4

Clearance angle

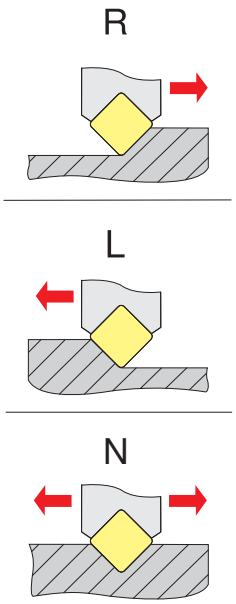


3°	**A**	25°	**F**
5°	**B**	30°	**G**
7°	**C**	0°	**N**
15°	**D**	11°	**P**
20°	**E**	*)	**O**

*) Clearance angles not included within the standard for which particular information is necessary

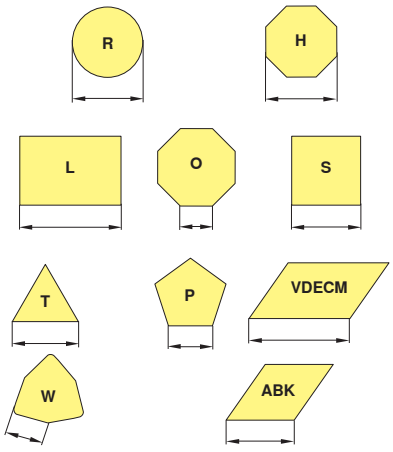
5

Cutting direction



9

Cutting edge length



10

Manufacturer specification

T = lever
Special length (mm)
Insert thickness (other than standard)
Special version (X..)
Machine manufacturer (specific)

C2 = C-Clamp 2.0

CERATIZIT designation system

BORING BARS

A	25	R	D	C	L	N	L	12	
1	2	3	4	5	6	7	8	9	10
UT40-		25	G	-	P	C	L	N	R	-	12	
0	1	2	3		4	5	6	7	8		9	10
HSK-T63-		50	Q	-	D	C	L	N	R	-	12	
0	1	2	3		4	5	6	7	8		9	10

0

System / size

UT = UTS
according to ISO 26622
UT40 = UTS 40 mm
UT50 = UTS 50 mm
UT63 = UTS 63 mm

HSK-T
according to ISO 12164
HSK-T63 = 63mm
HSK-T100 = 100mm

1

Shank type

S	Steel shank	**E**	As C with coolant hole
A	Steel shank with coolant hole	**F**	As C with anti-vibration system
B	Steel shank with anti-vibration system	**G**	As C with coolant hole and anti-vibration system
D	Steel shank with coolant hole and anti-vibration system	**H**	Heavy metal
C	Carbide shank with steel head	**J**	Heavy metal with coolant hole

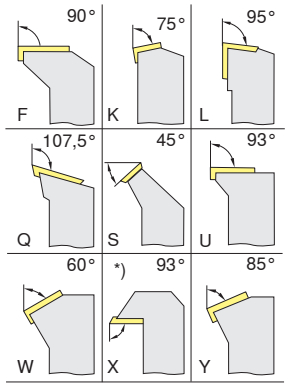
5

Insert shape

Included angle				35°	**V**
				55°	**D**
				75°	**E**
				80°	**C**
				86°	**M**
Included angle				55°	**K**
				82°	**B**
				85°	**A**
90°	**L**		–		**R**
108°	**P**		90°		**S**
120°	**H**		60°		**T**
135°	**O**		80°		**W**

6

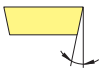
Style



*) CERATIZIT factory standard

7

Clearance angle



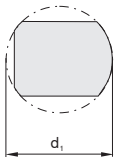
3°	**A**	25°	**F**
5°	**B**	30°	**G**
7°	**C**	0°	**N**
15°	**D**	11°	**P**
20°	**E**	*	**O**

*) Clearance angles not included within the standard for which particular information is necessary

2

Shank diameter

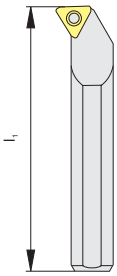
d_1 mm	d_1 inch
08	A double-digit number which shows the boring bar diameter in 1/16 inch.
10	
12	
16	
20	
25	
32	
40	
50	
60	



3

Tool length

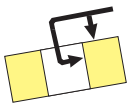
l_1 mm	l_1 inch	
80	3	F
100	3,5	H
110	4	J
125	4,5	K
140	5	L
150	5,5	M
160	6	N
170	6,5	P
180	6,75	Q
200	7	R
250	8	S
300	10	T
350	12	U
400	14	V
450	16	W
500	18	Y
	20	
special		X



4

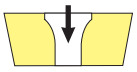
Clamping method

D



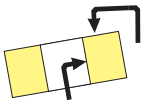
Retained from above and via bore

S



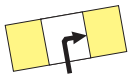
Retained via centre screw

M



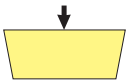
Retained from above and via bore

P



Retained via the bore

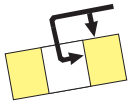
C



Retained from above

X special version

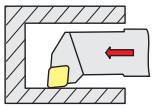
C-Clamp2



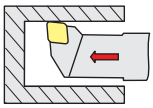
8

Cutting direction

R

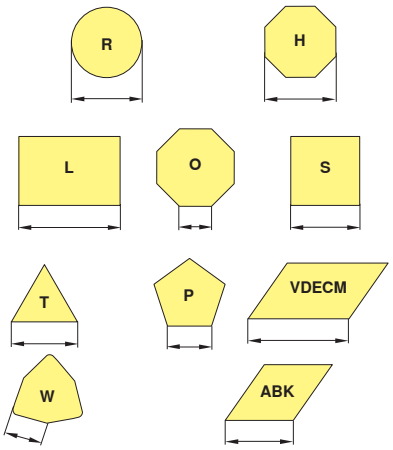


L



9

Cutting edge length



10

Manufacturer specification

T = lever
Special length (mm)
Insert thickness (other than standard)
Special version (X..)
Machine manufacturer (specific)

C2 = C-Clamp 2.0

DESIGNATION SYSTEM ACCORDING TO ISO 1832

INSERTS

Insert, PCBN, ceramic – metric

C	N	G	A	12	04	08	S	N	-	013E	_	B	3
1	2	3	4	5	6	7	8	9		10		11	12

1 Insert shape

Included angle	35°	V
	55°	D
	75°	E
	80°	C
	86°	M
Included angle	55°	K
	82°	B
	85°	A
Other shapes	90°	L
	108°	P
	120°	H
	135°	O
	–	R
	90°	S
	60°	T
	80°	W

2 Clearance angle

3°	A	25°	F
5°	B	30°	G
7°	C	0°	N
15°	D	11°	P
20°	E		

Clearance angles not included within the standard for which particular information is necessary } O

3 Tolerances

	d ±		m ±		s ±	
	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
A	0,025	.0010	0,005	.0002	0,025	.001
F	0,013	.0005	0,005	.0002	0,025	.001
C	0,025	.0010	0,013	.0005	0,025	.001
H	0,013	.0005	0,013	.0005	0,025	.001
E	0,025	.0010	0,025	.0010	0,025	.001
G	0,025	.0010	0,025	.0010	0,13	.005
J	0,05-0,15*	.002-.006*	0,005	.0002	0,025	.001
K	0,05-0,15*	.002-.006*	0,013	.0005	0,025	.001
L	0,05-0,15*	.002-.006*	0,025	.0010	0,025	.001
M	0,05-0,15*	.002-.006*	0,05-0,20	.003-.008*	0,13	.005
N	0,05-0,15*	.002-.006*	0,05-0,20	.003-.008*	0,025	.001
U	0,08-0,25*	.003-.010*	0,13-0,38	.005-.015*	0,13	.005

* depends on insert size

6 Insert thickness

Index			
[inch]	[mm]	[mm]	[inch]
1/16	1,59	01	1
3/32	2,38	02	
1/8	3,18	03	2
5/32	3,97	T3	
3/16	4,76	04	3
7/32	5,56	05	
1/4	6,35	06	4
5/16	7,94	07	5
3/8	9,52	09	6

7 Corner radius

		Index		RN 00 RC MO
[mm]	[inch]	[mm]	[inch]	
≤ 0,05	.0015	00	X0	
0,1	.004	01	0	
0,2	.008	02	.5	
0,4	1/64	04	1	
0,8	1/32	08	2	
1,2	3/64	12	3	
1,6	1/16	16	4	
2,0	5/64	20	5	
2,4	3/32	24	6	
2,8	7/64	28	7	
3,2	1/8	32	8	

8 Cutting edge

F sharp

E honed

T chamfered

S chamfered and honed

K double chamfered

P double chamfered and honed

9 Cutting direction

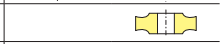
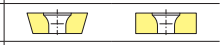
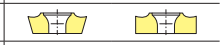
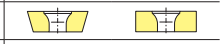
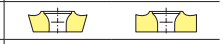
R

L

N

4

Form of top surface

N	
R	
F	
A	
M, P	
G, P	
W	
T	
Q	
U	
B	
H	
C	
J	
X	Special version

[inch]

Changes at inscribed circle IK < 1/4"

IK >1/4"	IK <1/4"
N / R / F	E
A / M / G	D
X	X

5

Cutting edge length

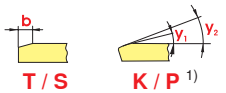
Typ	ISO	ANSI	L [mm]	L [inch]	d [mm]	d [inch]
C	06	2	6,4	.250	6,35	.250
	09	3	9,7	.382	9,525	.375
	12	4	12,9	.508	12,70	.500
	16	5	16,1	.634	15,875	.625
	19	6	19,3	.760	19,05	.750
	25	8	25,8	1.016	25,4	1.000
	32	12	32,24	1.269	31,75	1.250
S	06	2	6,35	.250	6,35	.250
	09	3	9,525	.375	9,525	.375
	12	4	12,7	.500	12,7	.500
	15	5	15,875	.625	15,875	.625
	19	6	19,05	.750	19,05	.750
	25	8	25,4	1.000	25,4	1.000
	31	10	31,75	1.250	31,75	1.250
D	07	2	7,7	.303	6,35	.250
	11	3	11,6	.457	9,525	.375
	15	4	15,5	.610	12,70	.500
V	11	2	11,1	.437	6,35	.250
	16	3	16,6	.653	9,525	.375
	22	4	22,10	.870	12,70	.500

Typ	ISO	ANSI	L [mm]	L [inch]	d [mm]	d [inch]
T	06	1.2	6,9	.272	3,97	.156
	09	1.8	9,6	.378	5,56	.219
	11	2	11,0	.433	6,35	.250
	16	3	16,5	.650	9,525	.375
	22	4	22,0	.079	12,70	.039
	27	5	27,5	1.083	15,875	.625
	33	6	33,0	1.299	19,05	.750
W	06	3	6,5	.256	9,525	.375
	08	4	8,7	.331	12,70	.039
	10	5	10,9	.429	15,875	.625
R	06	2	6,35	.250	6,35	.250
	08	–	8,0	.315	8,0	.315
	09	3	9,52	.375	9,52	.375
	10	–	10,0	.394	10,0	.394
	12	–	12,0	.472	12,0	.472
	12*	4	12,7	.488	12,70	.488
	15	5	15,875	.625	15,875	.625
	16	–	16,0	.630	16,0	.630
	19	6	19,05	.750	19,05	.750
	25	8	25,0	.984	25,0	.984
	25*	–	25,4	1.000	25,4	1.000
	31	10	31,75	1,250	31,75	1,250
	32	–	32,0	1.260	32,0	1.260

*) inch version

10

Chamfer type



T / S K / P 1)

	[mm]	[inch]		
015	0,15	.006	A	05°
020	0,20	.008	B	10°
025	0,25	.010	C	15°
050	0,50	.020	D	20°
075	0,75	.030	E	25°
100	1,00	.040	F	30°

1) For double chamfered cutting edges two letters are used.

For example:

BE = chamfer angle 1 = 10°
chamfer angle 2 = 25°

11

Number of cutting edges

single-sided

A	
B	
C	
D	
G	
H	

total thickness

T	
U	
V	
W	
X	
Y	

bilateral

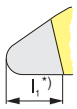
K	
L	
M	
N	
P	
Q	

entire rake face

S	
F	
E	

12

Length of segment



*) approximate dimension in mm

Example:

10 11 12

Chamfer type

013E_B3

I II III IV

I	Chamfer width	b = 0,13 mm
II	Chamfer angle	D = 25°
III	Number of cutting edges	B = 2
IV	Length of segment approx. 3 mm	

CERATIZIT designation system

CUTTING MATERIALS

C T B K 1 0 2

1 2 3 4 5

1 Manufacturer: CERATIZIT

2 Type of cutting material

W Uncoated carbide
C CVD coated carbide
P PVD coated carbide
T Uncoated cermet
E Coated cermet
N Uncoated silicon nitride
M Coated silicon nitride
S Mixed ceramic
K Whisker ceramic
I Sialon
D PCD
⇨ B PCBN
L PCBN coated
H Sintered HSS

3 Main application (material) Variant 1: number

1 Steel
2 Stainless steel
3 Cast iron
4 Light and non ferrous metals, non metals
⇨ 5 Super alloys, titanium
6 Hard materials
7 Universal grade for a variety of applications

Main application (material) Variant 2: ISO letter

P Steel
M Stainless steel
⇨ K Cast iron
N Light and non-ferrous metals, non metals
S Super alloys, titanium
⇨ H Hard materials
X Universal grade for a variety of applications

4 Main application (machining method)

⇨ 1 Turning
2 Milling
3 Parting and grooving
4 Drilling
5 Threading
6 Others
7 Universal grade for a variety of applications

5 ISO 513 application range

For example:
⇨ 01
05
10
15
25
35 ISO P35
.
.
.

HARDNESS VALUES

COMPARISON TABLE

Tensile strength N/mm²	Vickers HV	Brinell HB	Rockwell HRC	Shore C
575	180	171		
595	185	176		
610	190	181		
625	195	185		
640	200	190	12	
660	205	195	13	
675	210	199	14	
690	215	204	15	
705	220	209	15	28
720	225	214	16	
740	230	219	17	29
755	235	223	18	
770	240	228	20.3	30
785	245	233	21.3	
800	250	238	22.2	31
820	255	242	23.1	32
835	260	247	24	33
850	265	252	24.8	
865	270	257	25.6	
880	275	261	26.4	34
900	280	268	27.1	
915	285	271	27.8	35
930	290	276	28.5	
950	295	280	29.2	36
965	300	285	29.8	37
995	310	295	31	38
1030	320	304	32.2	39
1060	330	314	33.3	40
1095	340	323	34.3	41
1125	350	333	35.5	42
1155	360	342	36.6	43
1190	370	352	37.7	44
1220	380	361	38.8	45
1255	390	371	39.8	46
1290	400	380	40.8	47
1320	410	390	41.8	48
1350	420	399	42.7	
1385	430	409	43.6	49
1420	440	418	44.5	
1455	450	428	45.3	51
1485	460	437	46.1	52
1520	470	447	46.9	53
1555	480	465	47.7	54
1595	490	466	48.4	
1630	500	475	49.1	57
1665	510	485	49.8	58
1700	520	494	50.5	59
1740	530	504	51.1	60
1775	540	513	51.7	61
1810	550	523	52.3	62

Tensile strength N/mm²	Vickers HV	Brinell HB	Rockwell HRC	Shore C
1845	560	532	53	63
1880	570	542	53.6	64
1920	580	551	54.1	65
1955	590	561	54.7	66
1995	600	570	55.2	67
2030	610	580	55.7	68
2070	620	589	56.3	69
2105	630	599	56.8	70
2145	640	608	57.3	71
2180	650	618	57.8	72
2210	660	628	58.3	73
2240	665	633	58.8	74
2280	670	638	59.3	
2310	675	643	59.8	75
2350	680	648	60.3	76
2380	685	653	61.1	77
2410	690	658	61.3	78
2450	695	663	61.7	79
2480	710	668	62.2	80
2520	720	678	62.6	81
2550	730	683	63.1	82
2590	740	693	63.5	
2630	750	703	63.9	83
2660	760	708	64.3	84
2700	770	718	64.7	85
2730	780	723	65.1	
2770	790	733	65.5	86
2800	800	738	65.9	
2840	810	748	66.3	87
2870	820	753	66.7	88
2910	830	763	67	
2940	840	768	67.4	89
2980	850		67.7	
3010	860		68.1	90
3050	870		68.4	
3080	880		68.7	91
3120	890		69	
3150	900		69.3	92
3190	910		69.6	
3220	920		69.9	
3260	930		70.1	

The figures given are approximate according to DIN EN ISO18265 (02-2004)

MATERIALS

COMPARISON TABLE

DIN	Material No.:	BS	AFNOR	SS	AISI	Japan JIS	Kc1.1 N/mm²	mc	VDI 3323 group
10 SPb 20	1.0722		10 PbF 2		11 L 08		1350	0,20	**1**
100 Cr 6	1.2067	BL 3	Y 100 C 6		L 3	SUJ2	1775	0,24	**6/9**
105 WCr 6	1,2419		105 WC 13			SKS31	1775	0,24	**6/9**
12 CrMo 9 10	1,7380	1501-622 Gr. 31; 45	10 CD 9.10	2218	A 182-F22	SPVA,SCMV4	1675	0,24	**6/7**
12 Ni 19	1,5680		Z 18 N 5		2515		2450	0,23	**10/11**
13 CrMo 4 4	1,7335	1501-620 Gr. 27	15 CD 3.5	2216	A 182-F11; F12	SPVAF12	1675	0,24	**6/7**
14 MoV 6 3	1,7715	1503-660-440					1675	0,24	**6/7**
14 Ni 6	1,5622		16 N 6		A 350-LF 5		1675	0,24	**6/7**
14 NiCr 10	1,5732		14 NC 11		3415	SNC415(H)	1675	0,24	**6/7**
14 NiCr 14	1,5752	655 M 13	12 NC 15		3310; 9314	SNC815(H)	1675	0,24	**6/7**
14 NiCrMo 13 4	1,6657						1675	0,24	**6/7**
15 Cr 3	1,7015	523 M 15	12 C 3		5015		1675	0,24	**6/7**
15 CrMo 5	1,7262		12 CD 4			SCM415(H)	1675	0,24	**6/7**
15 Mo 3	1,5415	1501-240	15 D 3	2912	A 204 Gr. A		1675	0,24	**6/7**
16 MnCr 5	1,7131	527 M 17	16 MC 5	2511	5115	SCR415	1675	0,24	**6/7**
16 Mo 5	1,5423	1503-245-420			4520	SB450M	1675	0,24	**6/7**
17 CrNiMo 6	1,6587	820 A 16	18 NCD 6				1675	0,24	**6/7**
21 NiCrMo 2	1,6523	805 M 20	20 NCD 2	2506	8620	SNCM220(H)	1725	0,24	**6/8**
25 CrMo 4	1,7218	1717 CDS 110	25 CD 4 S	2225	4130	SM420;SCM430	1725	0,24	**6/8**
28 Mn 6	1,1170	150 M 28	20 M 5		1330		1500	0,22	**2**
32 CrMo 12	1,7361	722 M 24	30 CD 12	2240			1775	0,24	**6/9**
34 Cr 4	1,7033	530 A 32	32 C 4		5132	SCR430(H)	1725	0,24	**6/8**
34 CrMo 4	1,7220	708 A 37	35 CD 4	2234	4135; 4137	SCM432;SCCRM3	1775	0,24	**6/9**
34 CrNiMo 6	1,6582	817 M 40	35 NCD 6	2541	4340	SNCM447	1775	0,24	**6/9**
35 S 20	1,0726	212 M 36	35 MF 4	1957	1140		1525	0,22	**2/3**
36 CrNiMo 4	1,6511	816 M 40	40 NCD 3		9840	SNCM447	1775	0,24	**6/9**
36 Mn 5	1,1167						1525	0,22	**2/3**
36 NiCr 6	1,5710	640 A 35	35 NC 6		3135	SNC236	1800	0,24	**3/9**
38 MnSi 4	1,5120						1800	0,24	**3/9**
39 CrMoV 13 9	1,8523	897 M 39					1775	0,24	**6/9**
40 Mn 4	1,1157	150 M 36	35 M 5		1039		1525	0,22	**2/3**
40 NiCrMo 2 2	1,6546	311-Type 7	40 NCD 2		8740	SNCM240	1775	0,24	**6/9**
41 Cr 4	1,7035	530 M 40	42 C 4		5140	SCR440(H)	1775	0,24	**6/9**
41 CrAlMo 7	1,8509	905 M 39	40 CAD 6.12	2940	A 355 Cl. A	SACM645	1775	0,24	**6/9**
41 CrMo 4	1,7223	708 M 40	42 CD 4 TS	2244	4142; 4140	SCM440	1775	0,24	**6/9**
42 Cr 4	1,7045	530 A 40	42 C 4 TS	2245	5140	SCr440	1775	0,24	**6/9**
42 CrMo 4	1,7225	708 M 40	42 CD 4	2244	4142; 4140	SCM440(H)	1775	0,24	**6/9**
45 WCrV 7	1,2542	BS 1		2710	S 1		1775	0,24	**6/9**
50 CrV 4	1,8159	735 A 50	50 CV 4	2230	6150	SUP10	1775	0,24	**6/9**
55 Cr 3	1,7176	527 A 60	55 C 3	2253	5155	SUP9(A)	1775	0,24	**6/9**
55 NiCrMoV 6	1,2713		55 NCDV 7		L 6	SKH1;SKT4	1775	0,24	**6/9**
55 Si 7	1,0904	250 A 53	55 S 7	2085; 2090	9255		1775	0,24	**6/9**
58 CrV 4	1,8161						1775	0,24	**6/9**
60 SiCr 7	1,0961		60 SC 7		9262		1775	0,24	**6/9**
9 SMn 28	1,0715	230 M 07	S 250	1912	1213	SUM22	1350	0,21	**1**
9 SMn 36	1,0736	240 M 07	S 300		1215		1350	0,21	**1**
9 SMnPb 28	1,0718		S 250 Pb	1914	12 L 13	SUM22L	1350	0,21	**1**
9 SMnPb 36	1,0737		S 300 Pb	1926	12 L 14		1350	0,21	**1**
Al99	3,0205						700	0,25	**21**
AlCuMg1	3,1325						700	0,25	**22**
AlMg1	3,3315						700	0,25	**21**

DIN	Material No.:	BS	AFNOR	SS	AISI	Japan JIS	Kc1.1 N/mm²	mc	VDI 3323 group
AlMgSi1	3.2315						700	0,25	**22**
C 105 W1	1.1545		Y1 105	1880	W 110	SK3	1675	0,24	**3**
C 125 W	1,1663		Y2 120		W 112		1675	0,24	**3**
C 15	1,0401	080 M 15	AF3 7 C 12; XC 18	1350	1015	S15C	1350	0,21	**1**
C 22	1,0402	050 A 20	AF 42 C 20	1450	1020	S20C, S22C	1350	0,21	**1**
C 35	1,0501	060 A 35	AF 55 C 35	1550	1035	S35C	1525	0,22	**2/3**
C 45	1,0503	080 M 46	AF 65 C 45	1650	1045	S45C	1525	0,22	**2/3**
C 55	1,0535	070 M 55		1655	1055	S55C	1675	0,24	**3**
C 60	1,0601	080 A 62	CC 55		1060	S60C	1675	0,24	**3**
Cf 35	1,1183					S35C	1525	0,22	**2/3**
Cf 53	1,1213					S50C	1525	0,22	**2/3**
Ck 101	1,1274	060 A 96		1870	1095		1675	0,24	**3**
Ck 15	1,1141	080 M 15	XC 15; XC 18	1370	1015	S15C	1350	0,21	**1**
Ck 55	1,1203	070 M 55	XC 55		1055	S55C	1675	0,24	**3**
Ck 60	1,1221	080 A 62	XC 60	1665; 1678	1060	S58C	1675	0,24	**3**
CoCr20W15Ni	2,4764						3300	0,24	**35**
CuZn15	2,0240						700	0,27	**27**
CuZn36Pb3	2,0375						700	0,27	**26**
E-Cu57	2,0060						700	0,27	**28**
G-AlSi10Mg	3,2381						700	0,25	**24**
G-AlSi12	3,2581						700	0,25	**23**
G-AlSi9Cu3	3,2163						700	0,25	**23**
G-CuSn5ZnPb	2,1096						700	0,27	**26**
G-CuZn40Fe	2,0590						700	0,27	**28**
G-X 120 Mn 12	1,3401	Z 120 M 12	Z 120 M 12		A 128 (A)		3300	0,24	**35**
G-X 20 Cr 14	1,4027	420 C 29	Z 20 C 13 M			SCS2	1875	0,21	**12/13**
G-X 40 NiCrSi 38 18	1,4865	330 C 40					2600	0,24	**31**
G-X 45 CrSi 9 3	1,4718	401 S 45	Z 45 CS 9		HNV 3		2450	.23	**10/11**
G-X 5 CrNi 13 4	1,4313	425 C 11	Z 5 CN 13.4	2385	CA 6-NM		1875	0,21	**12/13**
G-X 5 CrNiMoNb 18 10	1,4581	318 C 17	Z 4 CNDNb 18.12 M				2150	.0,2	**14**
G-X 6 CrNi 18 9	1,4308	304 C 15	Z 6 CN 18.10 M	2333	CF-8		2150	.0,2	**14**
G-X 6 CrNiMo 18 10	1,4408						2150	.0,2	**14**
G-X 7 Cr 13	1,4001						1875	0,21	**12/13**
GG-10	.6010		Ft 10 D	01 10-00	A48-20 B	FC100	1150	.0,2	**15**
GG-15	.6015	Grade 150	Ft 15 D	01 15-00	A48-25 B	FC150	1150	.0,2	**15**
GG-20	.6020	Grade 220	Ft 20 D	01 20-00	A48-30 B	FC200	1150	.0,2	**15**
GG-25	.6025	Grade 260	Ft 25 D	01 25-00	A48-40 B	FC250	1250	0,24	**15/16**
GG-30	.6030	Grade 300	Ft 30 D	01 30-00	A48-45 B	FC300	1350	0,28	**16**
GG-35	.6035	Grade 350	Ft 35 D	01 35-00	A48-50 B	FC350	1350	0,28	**16**
GG-40	.6040	Grade 400	Ft 40 D	01 40-00	A48-60 B	FC400	1350	0,28	**16**
GGG-35.3	.7033					FCD350	1225	0,25	**17**
GGG-40	.7040	SNG 420/12	FGS 400-12	0717-02	60-40-18	FCD400	1225	0,25	**17**
GGG-40.3	.7043	SNG 370/17	FGS 370-17	0717-15		FCD400	1225	0,25	**17**
GGG-50	.7050	SNG 500/7	FGS 500-7	0727-02	65-45-12	FCD500	1350	0,28	**18**
GGG-60	.7060	SNG 600/3	FGS 600-3	0732-03	80-55-06	FCD600	1350	0,28	**18**
GGG-70	.7070	SNG 700/2	FGS 700-2	0737-01	100-70-03	FCD700	1350	0,28	**18**
GGG-NiCr 20 2	.7660	S-NiCr 20 2	S-NC 20 2		A 439 Type D-2		1350	0,28	**18**
GGG-NiMn 13 7	.7652	S-NiMn 13 7	S-NM 13 7				1350	0,28	**18**
GS-Ck 45	1,1191	080 M 46	XC 42	1672	1045	S45C	1525	0,22	**2/3**
GTS-35-10	.8135	B 340/12	MN 35-10				1225	0,25	**19**
GTS-45-06	.8145	P 440/7					1420	0,3	**20**

MATERIALS

COMPARISON TABLE

DIN	Material No.:	BS	AFNOR	SS	AISI	Japan JIS	Kc1.1 N/mm²	mc	VDI 3323 group
GTS-55-04	.8155	P 510/4	MP 50-5				1420	0,3	**20**
GTS-65-02	.8165	P 570/3	MP 60-3				1420	0,3	**20**
GTS-70-02	.8170	P 690/2	IP 70-2				1420	0,3	**20**
NiCr20TiAl	2,4631	HR 401; 601	Nimonic 80 A				3300	0,24	**33**
NiCr22Mo9Nb	2,4856		Inconel 625				3300	0,24	**33**
NiCu30Al	2,4375		Monel K 500				3300	0,24	**34**
NiFe25Cr20NbTi	2,4955						3300	0,24	**34**
S 18-0-1	1,3355	BT 1	Z 80 WCV 18-04-01		T 1		2450	0,23	**10/11**
S 18-1-2-5	1,3255	BT 4	Z 80 WKCV 18-05-04-0		T 4		2450	0,23	**10/11**
S 2-9-2	1,3348		Z 100 DCWV 09-04-02-	2782	M 7		2450	0,23	**10/11**
S 6-5-2	1,3343	BM 2	Z 85 WDCV 06-05-04-0	2722	M 2	SKH9; SKH51	2450	0,23	**10/11**
S 6-5-2-5	1,3243		Z 85 WDKCV 06-05-05-	2723		SKH55	2450	0,23	**10/11**
TiAl6V4	3,7165	TA 10 bis TA 13	T-A 6 V				2110	0,22	**37**
X 10 Cr 13	1,4006	410 S 21	Z 12 C 13	2302	410; CA-15	SUS410	1875	0,21	**12/13**
X 10 CrNiMoNb 18 12	1,4583				318		2150	0,2	**14**
X 10 CrNiS 18 9	1,4305	303 S 21	Z 10 CNF 18.09	2346	303		2150	0,2	**14**
X 100 CrMoV 5 1	1,2363	BA 2	Z 100 CDV 5	2260	A 2		2450	0,23	**10/11**
X 12 CrMoS 17	1,4104		Z 10 CF 17	2383	430 F	SUS430F	1875	0,21	**12/13**
X 12 CrNi 17 7	1,4310	301 S 21	Z 12 CN 17.07		301		2150	0,2	**14**
X 12 CrNi 22 12	1,4829					SUS301	1350	0,28	**16**
X 12 CrNi 25 21	1,4845	310 S24	Z 12 CN 25.20	2361	310 S	SUH310; SUS310S	2150	0,2	**14**
X 12 CrNiTi 18 9	1,4878	321 S 20	Z 6 CNT 18.12 (B)	2337	321		2150	0,2	**14**
X 12 NiCrSi 36 16	1,4864	NA 17	Z 12 NCS 37.18		330	SUH330	2600	0,24	**31**
X 15 CrNiSi 20 12	1,4828	309 S 24	Z 15 CNS 20.12		309	SUH309	1350	0,28	**16**
X 165 CrMoV 12	1,2601			2310			2450	0,23	**10/11**
X 2 CrNiMo 18 13	1,4440						2150	0,2	**14**
X 2 CrNiMoN 17 13 3	1,4429	316 S 62	Z 2 CND 17.13 Az	2375	316 LN	SUS316LN	2150	0,2	**14**
X 2 CrNiN 18 10	1,4311	304 S 62	Z 2 CN 18 .10	2371	304 LN	SUS304LN	2150	0,2	**14**
X 20 CrNi 17 2	1,4057	431 S 29	Z 15 CN 16.02	2321	431	SUS431	1875	0,21	**12/13**
X 210 Cr 12	1,2080	BD 3	Z 200 C 12		D 3		2450	0,23	**10/11**
X 210 CrW 12	1,2436			2312			2450	0,23	**10/11**
X 30 WCrV 9 3	1,2581	BH 21	Z 30 WCV 9		H 21	SKD5	2450	0,23	**10/11**
X 40 CrMoV 5 1	1,2344	BH 13	Z 40 CDV 5	2242	H 13	SKD61	2450	0,23	**10/11**
X 46 Cr 13	1,4034	420 S 45	Z 40 C 14				1875	0,21	**12/13**
X 5 CrNi 18 9	1,4301	304 S 15	Z 6 CN 18.09	2332; 2333	304; 304 H	SUS304	2150	0,2	**14**
X 5 CrNiMo 17 13 3	1,4436	316 S 16	Z 6 CND 17.12	2343	316	SUS316	2150	0,2	**14**
X 5 CrNiMo 18 10	1,4401	316 S 16	Z 6 CND 17.11	2347	316	SUS316	2150	0,2	**14**
X 53 CrMnNiN 21 9	1,4871	349 S 54	Z 52 CMN 21.09		EV 8		1875	0,21	**12/13**
X 6 Cr 13	1,4000	403 S 17	Z 6 C 13	2301	403	SUS403	1875	0,21	**12/13**
X 6 Cr 17	1,4016	430 S 15	Z 8 C 17	2320	430	SUS430	1875	0,21	**12/13**
X 6 CrMo 17	1,4113	434 S 17	Z 8 CD 17.01	2325	434	SUS434	1875	0,21	**12/13**
X 6 CrNiMoTi 17 12 2	1,4571	320 S 31	Z 6 CNT 17.12	2350	316 Ti		2150	0,2	**14**
X 6 CrNiNb 18 10	1,4550	347 S 17	Z 6 CNNb 18.10	2338	347		2150	0,2	**14**
X 6 CrNiTi 18 10	1,4541	321 S 12	Z 6 CNT 18.10	2337	321		2150	0,2	**14**
X2 CrNi 18-8	1,4317						2150	0,2	**14**

OEM services

We not only offer you excellent cutting tools but also elaborate customised complete solutions. Every project is managed and centrally coordinated by a dedicated OEM team. The experts at the CERATIZIT centre of excellence for cutting tool solutions are concerned to meet your individual requirements providing complete process solutions and tool packages for the most varied challenges. In this way you can count on being given the solution best adapted to your needs.

COMPLETE PROCESS SOLUTIONS

CERATIZIT OEM SERVICES

Customised complete solutions

In collaboration with machine manufacturers CERATIZIT offers complete process solutions. We not only supply you with excellent cutting tools, we will also give you the expert support you need when implementing your specific concept on site with CERATIZIT OEM services.

Here is what you can expect:
▲ Analysis and optimisation of machining processes
▲ Offer of suitable tool packages
▲ Time studies
▲ Recommendation of cutting data
▲ Detailed technical information
▲ Support on site

CERATIZIT OEM Services

For every project we set up a dedicated team of experts comprising various specialisations. Make use of the fund of knowledge we have amassed at the CERATIZIT cutting tools centre – ranging from application engineering to design, comprising construction, production, sales and logistics.

In this way we are able to guarantee maximum professionalism and reliability as well as solutions that are individually adapted to your needs. Additionally, we will help you to implement your specific concept on site.

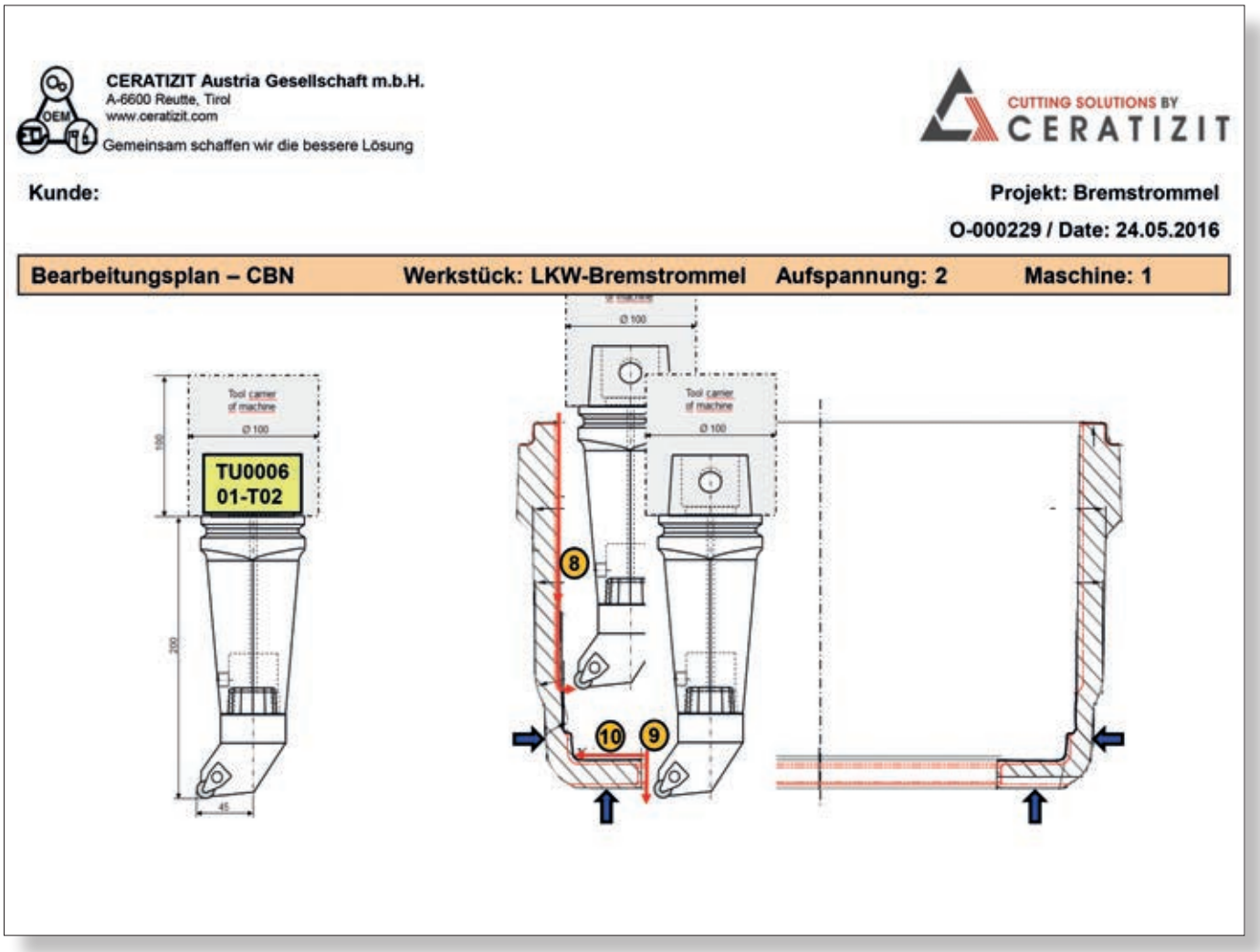
Our OEM services include:

▲ Definition of machining phases
▲ Determination of cutting data and calculation of machining times
▲ Calculation of machining costs per piece
▲ Projection of tooling costs per piece
▲ Calculation of performance (cutting forces, spindle power, torque moment)
▲ Tool mounting and presetting
▲ Support during final acceptance and commissioning runs
▲ Detailed project documentation

A detailed operation plan

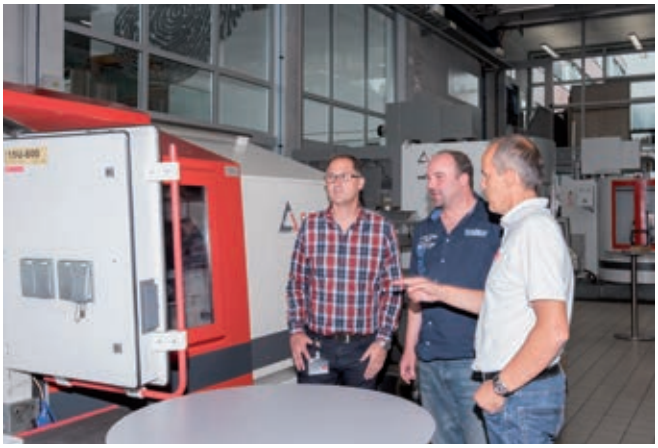
First of all CERATIZIT's OEM team draws up a detailed operation plan for the work piece. This is where the different working steps are defined and numbered. The suitable tools for the job are allocated directly in optical terms. They can immediately be identified by their designation (e.g. TU001) in subsequent lists and plans. This way you can see at a glance which tool package is going to be used for which working step.

Example: machining of a truck brake drum



Machining study

The OEM machining study lists all the defined working steps by number, allocates the various tools to each step and provides all the associated information, cutting parameters and calculated machining times.
In this way the machining study gives a perfect overview of all the intended operations – all entirely in keeping with our customers' individual specifications and requirements.



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CUTTING SOLUTIONS BY CERATIZIT

Kunde

Projekt: Lkw-Bremsscheibe

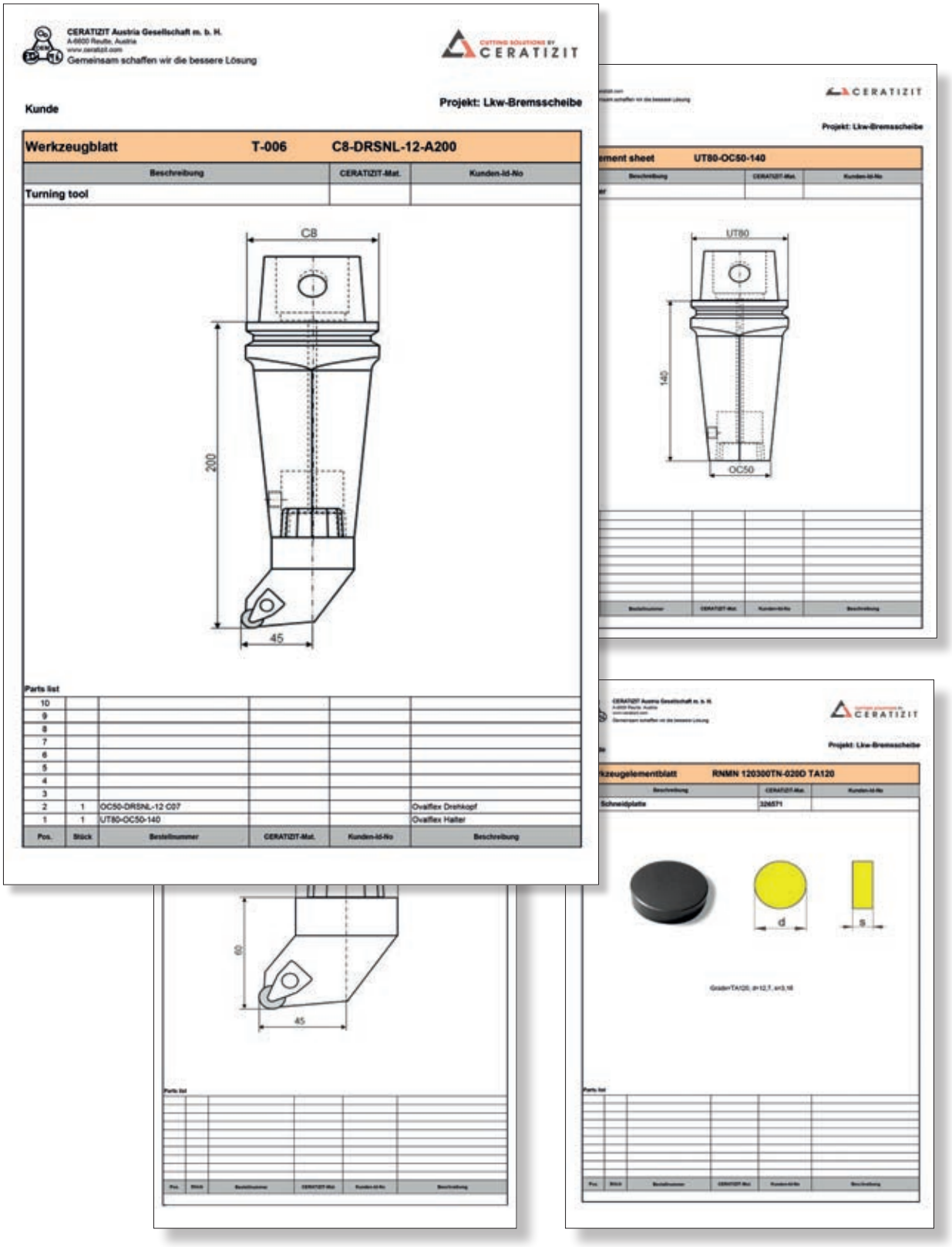
Bearbeitungsstudie: Werkstück: Lkw-Bremsscheibe **Aufspannung: 2** **Maschine: 1**

Operationen			Werkzeug					Dimensionen			Schnittparameter						Oberfläche	Zeitberechnung			
No.	Type	Description	No.	Pos.	c	z	Spindle	D mm	d mm	L mm	v_c m/min	n min^{-1}	f_z mm	v_f mm/min	a_p mm	i	R_a µm	t_c sec	t_n sec	t_g sec	t_{EA} %
1	Nebenzeit	Werkstückwechsel		00-T00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
2	Längsdrehen	Außen Ø 444	T-002	01-T01	1	1	1	444	0	16	800	573	0,8	458	3	1	12,7	2,09	0	2,09	100
3	Plandrehen	Ø 466 - Ø 444	T-002	01-T01	1	1	1	468	444	12	800	574	0,8	447	3	1	12,7	1,61	0	1,61	100
4	Plandrehen	Ø 444 - Ø 404	T-002	01-T01	1	1	1	446	400	23	800	637	0,8	482	3	1	12,7	2,86	0	2,86	100
5	Längsdrehen	Schruppen ID Ø 409 - 2 Schnitte	T-002	01-T01	2	1	1	409	0	196	800	622	0,8	498	3	2	12,7	47,27	0	47,27	100
6	Längsdrehen	ID Ø 396	T-002	01-T01	2	1	1	396	0	32	800	643	0,8	514	3	1	12,7	3,73	0	3,73	100
7	Längsdrehen	ID Ø 390	T-002	01-T01	2	1	1	390	0	24	800	652	0,8	522	3	1	12,7	2,76	0	2,76	100
8	Längsdrehen	Schlichten Ø410 mm	T-006	01-T02	1	1	1	410	0	190	1000	776	0,8	621	0,5	1	3,15	18,36	0	18,36	100
9	Längsdrehen	Schlichten Ø 282 F8	T-006	01-T02	1	1	1	282	0	20	1000	1128	0,8	902	0,5	1	3,15	1,33	0	1,33	100
10	Plandrehen	Schlichten Ø 282 to Ø 390	T-006	01-T02	1	1	1	390	280	55	1000	1137	0,8	767	0,5	1	3,15	4,3	0	4,3	100
11	Nebenzeit	Positionierelemente zurück		00-T00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
12	Plandrehen	Schlichten Rückseite Ø 282 - Ø 390	T-005	01-T03	1	1	1	390	280	55	1000	1137	0,55	527	0,5	1	5,95	6,26	0	6,26	100

Legende: Pos. = Werkzeug und Position am Werkzeugträger, c = Schnittkante, an einem Werkzeug mit mehren unterschiedlichen Schneiden, z = Effective Schneidenzahl, i = Anzahl Schnitte, Ra = Oberflächen qualität,
tc = Schnittzeit, tn = Nebenzeit, tg = Gesamtzeit, tEa % = Anteil zur Taktzeit

Tooling studies

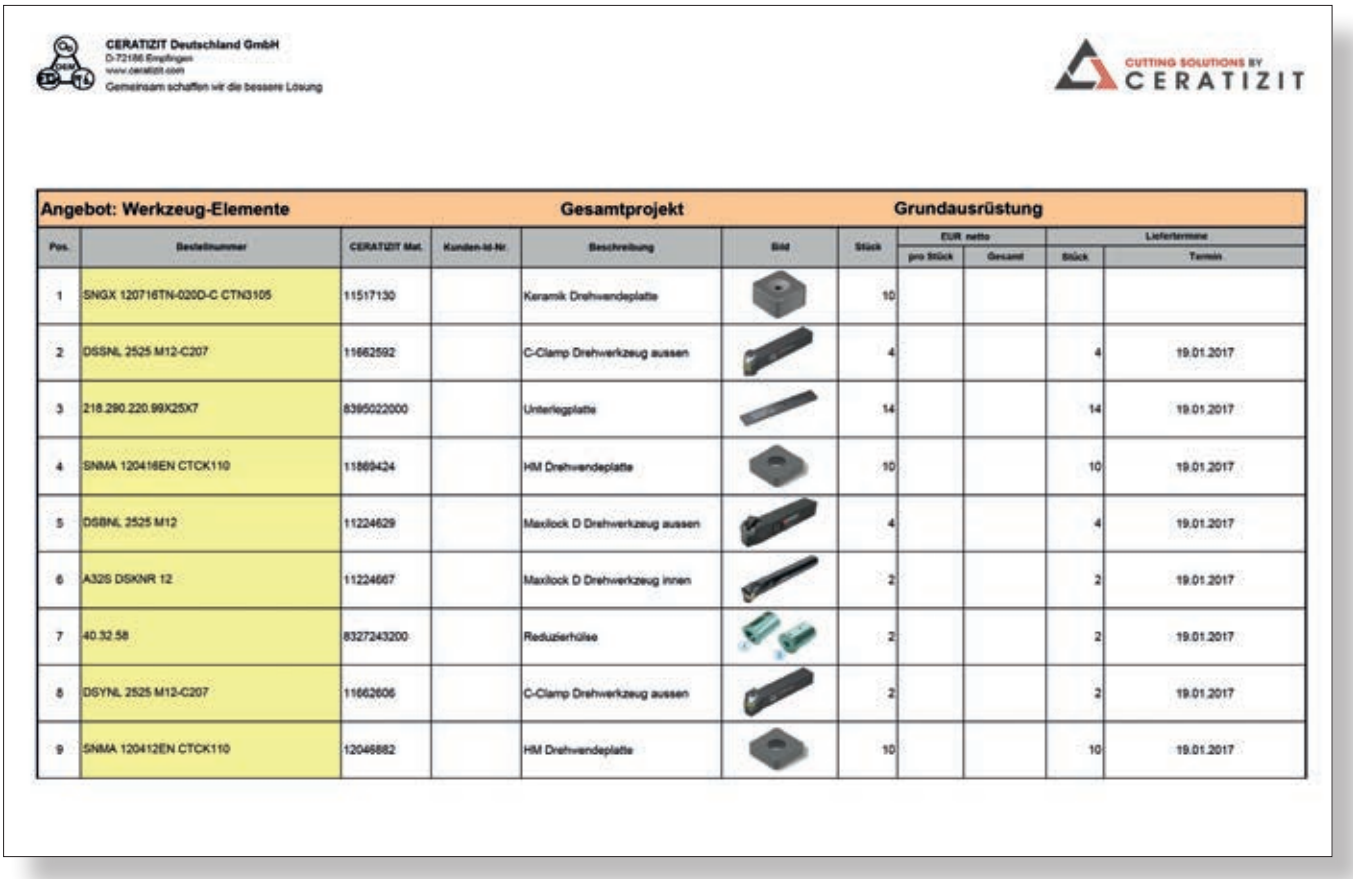
The tooling sheets provide detailed information about the the different tools and tool holders to be used. The technical drawings convey precise specifications as to the dimensions, interfaces and clamping mechanisms. The tooling sheets provide you with all the information you need for an optimal workflow.



Tooling elements

The tool element sheets give an overview of all components used including the ordering descriptions for each. They convey information about the necessary basic equipment of tool systems and inserts, including specifications of the calculated annual requirement and the computed order date.

If you are interested in CERATIZIT OEM service, please send your enquiry to: info.austria@ceratizit.com



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CUTTING SOLUTIONS BY CERATIZIT

Angebot: Werkzeug-Elemente				Gesamtprojekt			Grundausrüstung			
							EUR netto		Liefertermine	
Pos.	Bestellnummer	CERATIZIT Mat.	Kunden-Id-Nr.	Beschreibung	Bild	Stück	pro Stück	Gesamt	Stück	Termin
1	SNGX 120716TN-020D-C CTN3105	11517130		Keramik Drehwendeplatte		10				
2	DSSNL 2525 M12-C207	11662592		C-Clamp Drehwerkzeug aussen		4			4	19.01.2017
3	218.290.220.99X25X7	8395022000		Unterlegplatte		14			14	19.01.2017
4	SNMA 120416EN CTCK110	11869424		HM Drehwendeplatte		10			10	19.01.2017
5	DSBNL 2525 M12	11224629		Maxilock D Drehwerkzeug aussen		4			4	19.01.2017
6	A32S DSKNR 12	11224667		Maxilock D Drehwerkzeug innen		2			2	19.01.2017
7	40.32.58	8327243200		Reduzierhülse		2			2	19.01.2017
8	DSYNL 2525 M12-C207	11662606		C-Clamp Drehwerkzeug aussen		2			2	19.01.2017
9	SNMA 120412EN CTCK110	12046882		HM Drehwendeplatte		10			10	19.01.2017


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