



The Multifunction  
**Catalog**

TEAM CUTTING TOOLS



klenk

CERATIZIT is a high-tech engineering group specialized in tooling and hard material technologies.

**Tooling the Future**

[www.ceratizit.com](http://www.ceratizit.com)

**Welcome!**



**Local Distribution  
Partner**



**Technical Sales  
Engineer**

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## Welcome to CERATIZIT

CERATIZIT has been a pioneer in the field of demanding carbide solutions for machining and wear protection for more than 95 years, controlling the entire value chain from powder to the finished end product.

With exclusive access to the highest quality carbide raw materials, CERATIZIT offers more than 130 carbide grades and as a full-range supplier manufactures highly specialized cutting tools, indexable inserts, rods made of hard materials and wear parts.

With more than 9,000 employees worldwide at 34 production sites and a sales network of more than 70 branches, the CERATIZIT Group is a global player in the carbide

industry. As a technology leader, CERATIZIT continually invests in research and development and owns more than 1,000 patents.

Under the motto "Tooling the Future," our innovative materials and applications help our customers develop a variety of machines and products that shape our immediate environment and are part of our everyday lives.

The goal remains the same: CERATIZIT provides competitive advantages through new technological standards, innovative materials and coatings as well as unique carbide products.



## Why Choose CERATIZIT



CERATIZIT is recognized as a **premium brand** offering a **full range** of cutting tools.



We are a **"best in class"** **innovator** and the **fastest growing supplier** of cutting tools within our focus segments.



We are fully committed to **deliver the highest customer value** and continually strive for **outstanding performance and results**.

CERATIZIT USA works diligently to meet business partner's expectations. As a leader in materials technology, CERATIZIT continuously invests in research and development and holds over 1,000 patents. As a business partner you can draw on CERATIZIT's expertise as a leading supplier of cutting tools and carbide solutions. A line-up of benefits include:

- ▲ Highly skilled specialists in a variety of fields
- ▲ Monitoring and controlling every step of the production process is our way of life
- ▲ Our modern production facilities are continuously being updated
- ▲ Our optimized production processes reduce costs and ensure high quality while being mindful of the environment
- ▲ Technical support
- ▲ Technical training
- ▲ The majority of our standard products are available from stock
- ▲ Real time product availability check
- ▲ Up-to-date technical information and graphic illustrations
- ▲ Featured products ship the same day if ordered by 5 p.m. EST
- ▲ We work only with the most reliable service providers in the sector



It couldn't be easier

## Ordering via the Online Shop

In the online shop you can select and order your tool with a mouse click, 24 hours a day, 7 days a week. All your transactions including those in the past can be viewed clearly and easily in the online shop. Register and use our service: [e-techstore.com](http://e-techstore.com). For more information about [e-techstore.com](http://e-techstore.com), our products or to place an order, contact Customer Care by calling (800) 783-2280 or email [info.usa@ceratizit.com](mailto:info.usa@ceratizit.com).



From single items to large orders!

## There are no minimum order quantities

No matter which tool you need, we promise you quick and uncomplicated delivery, even if you only order one item! We do not have minimum order quantities.



Where is my order right now?

## Order Delivery Tracking

For those who do not want to lose sight of their order: With the shipment number you can track the current status of your order online – no matter how your order was placed.



## OEM service

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

### Your service package

Every project is supported by a large team comprising various specializations and fields of expertise. No matter whether project leader, employees in the field or in the office, engineers, construction, production or logistics – you will benefit from the full range of services of an international company with a world-wide service network:

- Definition of machining phases with tool assignment
- 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)
- Testing at the Michigan based CERATIZIT Technical Center
- Support during final acceptance and commissioning runs
- Detailed project documentation

## Everything from one source – operating globally for you

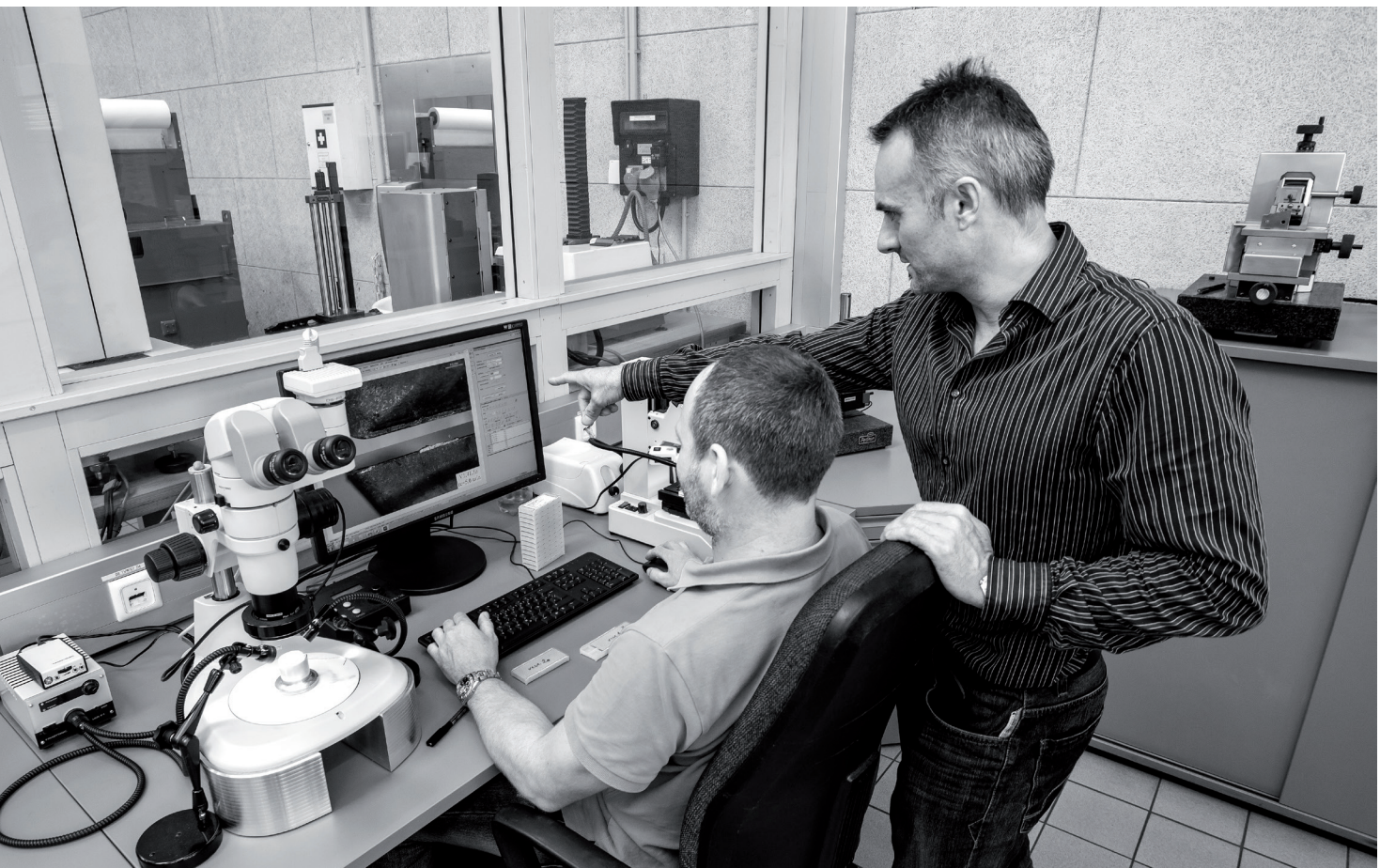
Our OEM team coordinates every project centrally from our center of excellence for Cutting Solutions by CERATIZIT in Reutte, Austria. In this way we are able to guarantee maximum professionalism and reliability as well as solutions that are individually adapted to your requirements. Additionally, we will provide you with the expert support you need when implementing your specific concept on site.

### Cutting materials

Based on the application we recommend the suitable cutting material and coating: no matter whether carbide, cermets, cutting ceramic, PCD or CBN. We're vertically integrated and control the entire manufacturing process in house. This enables us to offer you first class quality.

### Standard tools

We provide a wide range of inserts and solid carbide tools for cutting tool applications, including multi-function tools. Discover the performance capacity and reliability of our products for yourself.



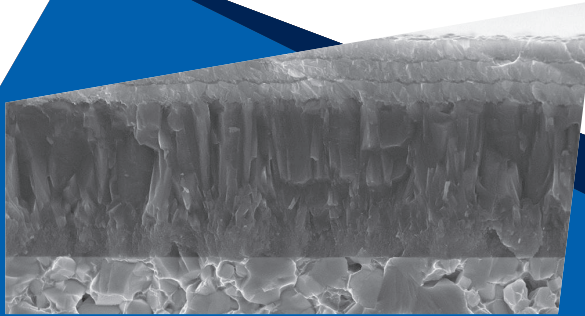
# Dragonskin by CERATIZIT

## The latest generation of coating technology

Decades of experience coupled to consistent and constant development are in the unique Dragonskin coating technology. Thanks to our innovative design and expertise in powder metallurgy, we – and above all you – achieve an unmatched level of performance in machining.

Like the Dragon's invulnerability, Dragonskin coating technology offers the highest levels of protection against wear and is designed with its impermeable layer for the most adverse requirements. The result is an extremely hard and durable surface with a satin finish.

The perfect combination of state-of-the-art high-performance substrates and new coating structures enable high cutting speeds and increased process reliability. A proven – up to 80 % – increased performance through the latest Dragonskin coating technology offers you a significant competitive advantage.



Dragonskin Coating

**DRAGONSKIN**

### Dragonskin – The coatings for the highest performance

The product category Dragonskin is intended to help make tools easily recognizable and quick to find using CERATIZIT's high-performance coating technology. All products that are marked with the Dragonskin icon represent unmatched performance, maximum tool life and maximum process reliability.







# LEGENDARY PERFORMANCE





# DRAGONSKIN

## Introduction

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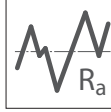
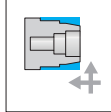


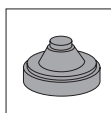
## Inserts

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## Tools

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## EcoCut - the original multi-function tool

EcoCut unites the capabilities of tools for the machining of internal and external profiles as well as for drilling. The reduced number of tools frees up additional turret positions on the machine. Simultaneously, the setting and programming time is minimized.

### EcoCut Mini

The solid carbide tool EcoCut Mini is available in diameters from .078" to .315".

During the optimization process of the system, CERATIZIT developed two additional carbide grades: CTWN425 – uncoated and sharp-edged, for aluminum and non-ferrous metals; CTPP435 – coated and wear-resistant for all other materials.

The EcoCut program consists of the 'Classic' tools with indexable inserts, and the solid carbide tools, 'Mini'. This allows drilling diameters between .315" to 1.26".

### Features

- Improved toughness
- Increased heat resistance
- Increased transverse rupture strength
- Optimized resistance to edge chipping



## EcoCut Classic

The EcoCut Classic has wide application ranges to cover all materials of the ISO material groups P, M, K and S. In addition, the EcoCut Classic offers great versatility, giving the user enormous benefits to bore, turn and drill with one tool.

The toolholder is designed for better stability and has a low vibration with a chip booster for perfect cooling and chip evacuation.

The large, stable insert geometry provides the user increased process security, machining parameters and tool life.

### Toolholder benefits

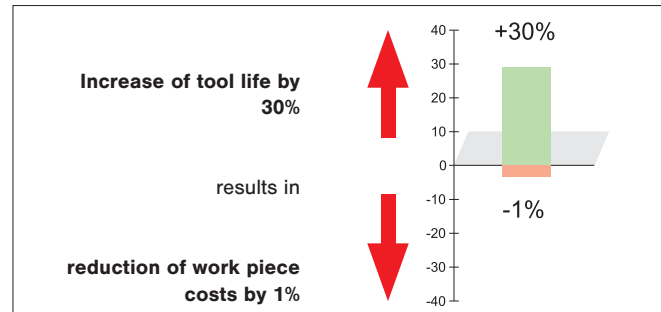
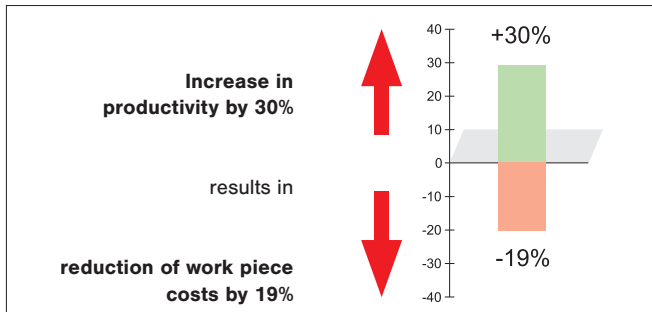
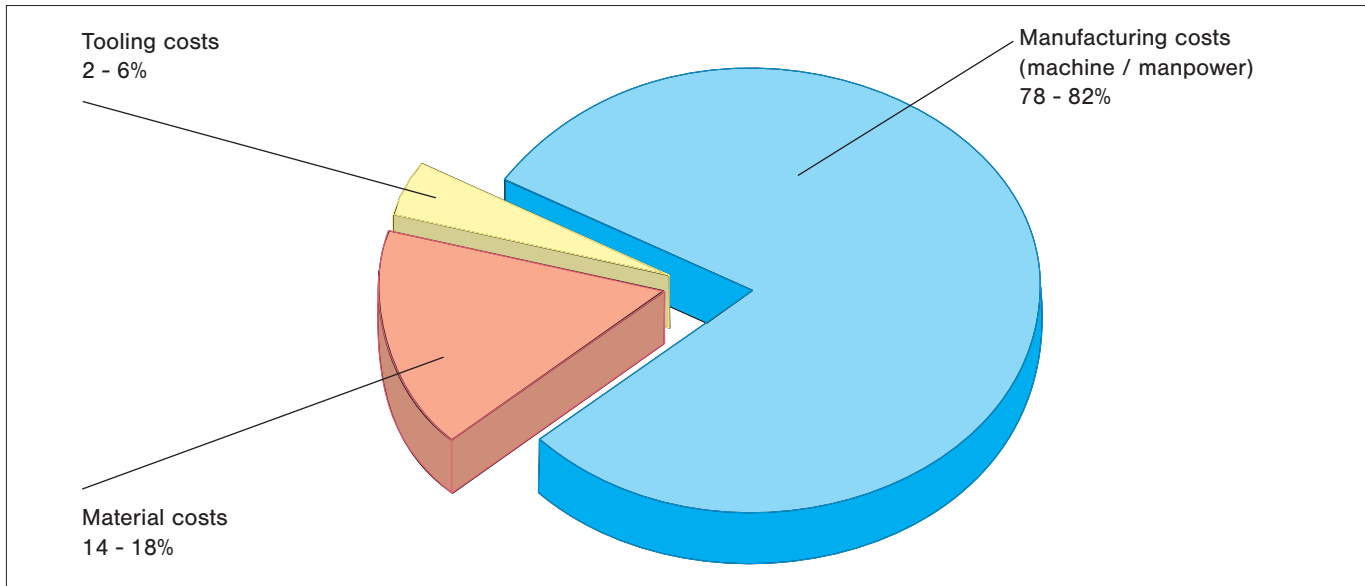
- High surface quality
- Perfect chip control and evacuation
- Maximum process security

### Insert benefits

- Reduced machining time
- Increased productivity
- Reduced tooling costs



## How CERATIZIT can help reduce costs



### Increase in productivity (parts produced per time unit)

Improved utilization of the available machine capacity leads to considerable cost reduction per work piece. In this context CERATIZIT EcoCut makes a decisive contribution through:

- fewer tool changes
- increase of cutting speed  $v_c$
- increase of feed rate  $f$
- increase of depth of cut  $a_p$

As the average tool costs amount to only 2 - 6% of the work piece costs, prolonging tool life typically can only reduce total costs minimally.

## More productive thanks to EcoCut – continuous cost savings



### Advantages with EcoCut

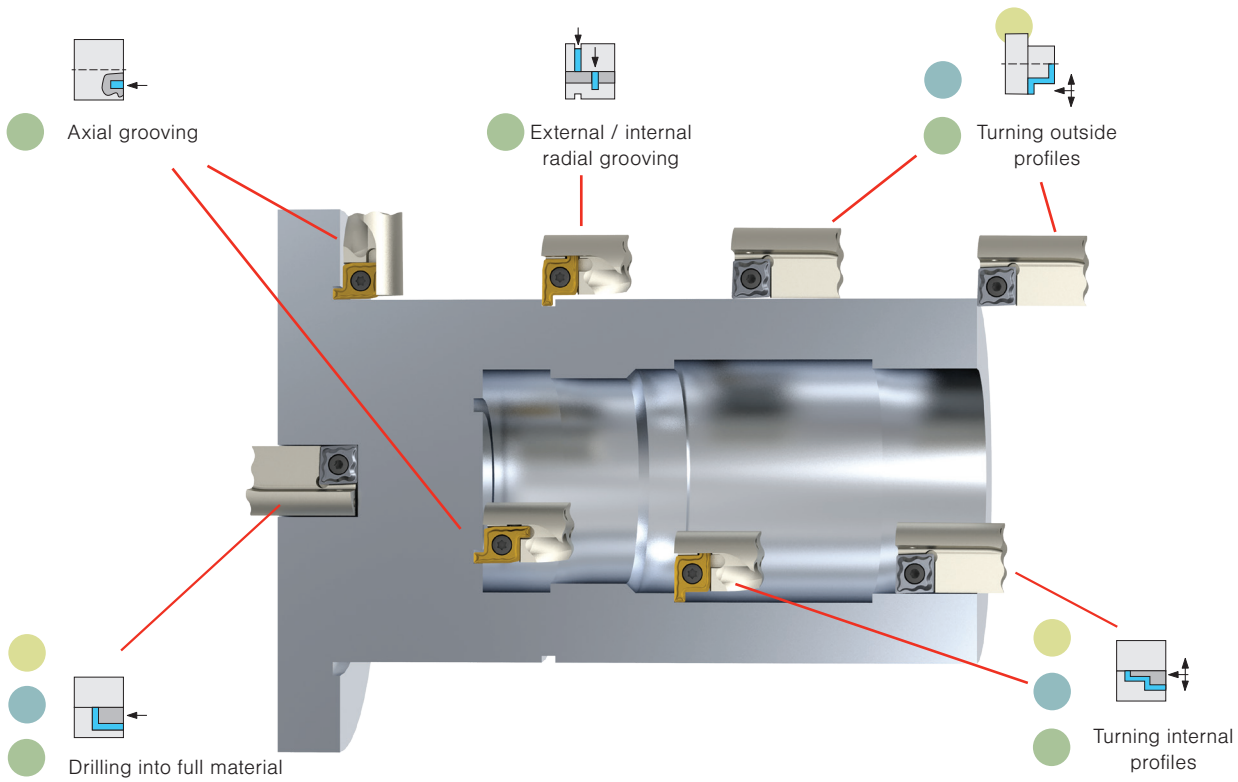
- ▲ reduced machining time
- ▲ reduced need for tool positions
- ▲ generates flat bottom of hole
- ▲ less programming
- ▲ lower set-up costs / reduced setting time
- ▲ time savings due to fewer tool changes
- ▲ drilling, turning and boring applications



Turning Tool

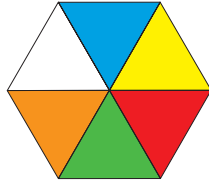
Drill

Boring Bar



	Tools:			Applications					Pages
	Dimension	Hole Ø mm	max. hole depth mm						
EcoCut Mini	2,25xD	2-8	4,5-18	✓	✓	✓			25-26
	4xD	2-8	8-32	✓	✓	✓			25-26
EcoCut Classic	1,5xD	8-32	12-48	✓	✓	✓			20
	2,25xD	8-32	18-72	✓	✓	✓			21
	3xD	8-32	24-96	✓	✓	✓			22
EcoCut ProfileMaster	1,5xD	10-32	15-48	✓	✓	✓	✓	✓	51
	2,25xD	10-32	22,5-72	✓	✓	✓	✓	✓	52
EcoCut HSK-T	2,25xD	25-32	56,2-72	✓	✓	✓			23

**i** EcoCut tools are suitable for off-center drilling. This permits certain deviations from the nominal tool diameter to be achieved → **For details, see the technical information.**



### Material

Based on VDI 3323 CERATIZIT's MasterGuide divides materials into six main groups (P, M, K, N, S, H). Each is given a color, according to the system partly adopted in ISO 513.

**P** Steel

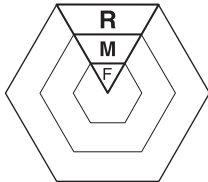
**M** Stainless steel

**K** Cast iron

**N** Non-ferrous metals and non-metals

**S** Heat-resistant alloys, titanium

**H** Hard materials



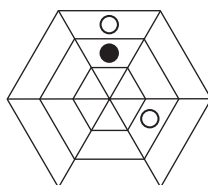
### Machining application type

Each colored segment is divided into three sections, and each section indicates the relevant machining application type:

**R = rough machining**

**M = medium machining**

**F = fine machining**



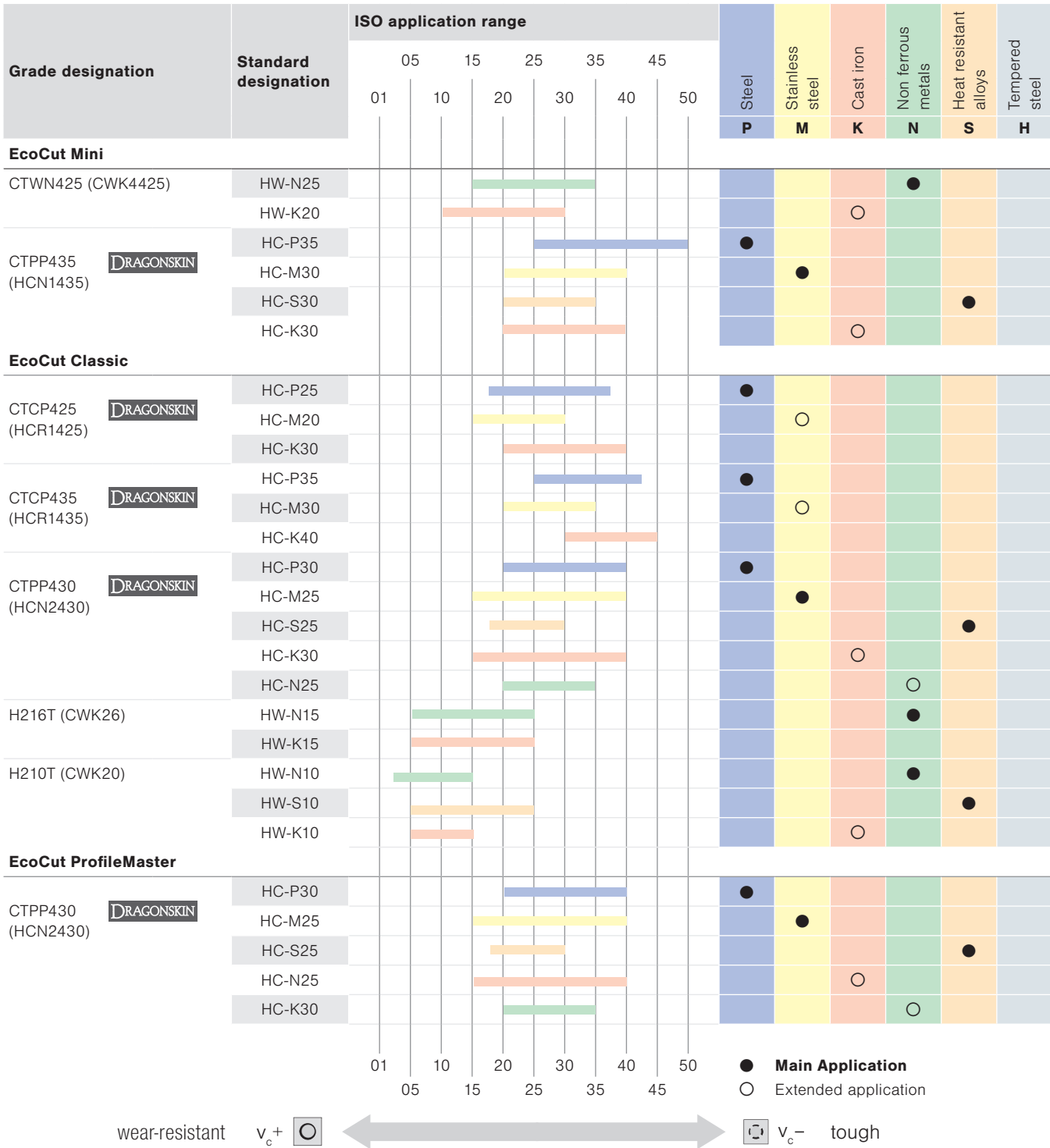
### Application

The ideal application area for the insert is indicated by a black circle. Extended applications are indicated by an open circle. The CERATIZIT MasterGuide provides you with an easily understandable structure for choosing a product and enables you to reduce grade and geometry stocks.

- Main application
- Extended application



# Application



## Grades Overview

### EcoCut Classic

#### CTCP425

- ▲ Carbide, Ti+Al<sub>2</sub>O<sub>3</sub>-coated
- ▲ ISO | P25 | K30 | M20
- ▲ The wear-resistant choice for steel and cast iron materials under stable conditions and at high cutting speeds

DRAGONSKIN

#### CTCP435

- ▲ Carbide, Ti+Al<sub>2</sub>O<sub>3</sub>-coated
- ▲ ISO | P35 | K40 | M30
- ▲ The reliable choice for steel and cast iron materials under unstable conditions

DRAGONSKIN

#### CTPP430

- ▲ Carbide, TiAlN-coated
- ▲ ISO | P30 | M25 | S25 | K30 | N25
- ▲ The universal high-performance grade for steel, austenitic steel and heat-resistant alloys

DRAGONSKIN

#### H210T

- ▲ Carbide, uncoated
- ▲ ISO | N10 | S10 | K10
- ▲ The wear-resistant carbide grade for machining aluminium and other non-ferrous metals

#### H216T

- ▲ Carbide, uncoated
- ▲ ISO | K15 | N15
- ▲ The uncoated carbide grade for machining aluminium and other non-ferrous metals
- ▲ Also highly suitable for HSC machining

### EcoCut Mini

#### CTPP435

- ▲ Carbide, TiAlN-coated
- ▲ ISO | P35 | M30 | S30 | K30
- ▲ The universal high-performance grade for steel, austenitic steel and heat-resistant alloys

DRAGONSKIN

#### CTWN425

- ▲ Carbide, uncoated
- ▲ ISO | N25 | K20
- ▲ The uncoated carbide grade for machining aluminium and other non-ferrous metals

### EcoCut ProfileMaster

#### CTPP430

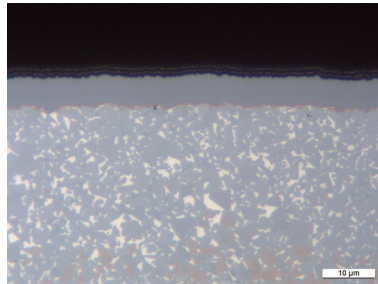
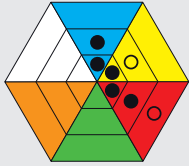
- ▲ Carbide, TiAlN-coated
- ▲ ISO | P30 | M25 | S25 | K30 | N25
- ▲ The universal high-performance grade for steel, austenitic steel and heat-resistant alloys

DRAGONSKIN

**CTCP425**

DRAGONSKIN

HC-P25  
HC-M20  
HC-K30



**Composition:**

Co 7%; mixed carbides 8.1%; WC balance

**Grain size:**

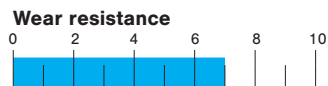
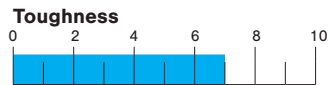
1 - 2 µm

**Hardness:**

HV 1450

**Coating specification:**

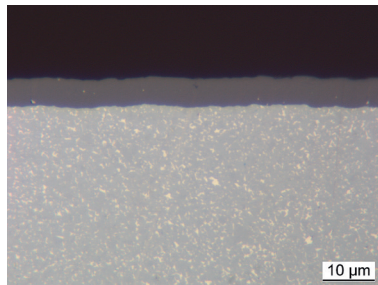
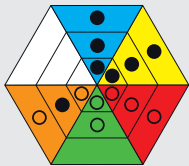
CVD  
Ti (C,N) + Al<sub>2</sub>O<sub>3</sub>  
7.5 µm



**CTPP430**

DRAGONSKIN

HC-P30  
HC-M25  
HC-S25



**Composition:**

Co 9.0%; other .75%; WC balance

**Grain size:**

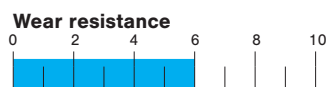
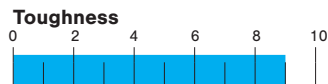
.85 µm

**Hardness:**

HV 1590

**Coating specification:**

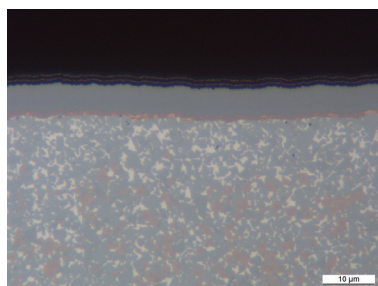
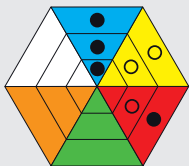
PVD  
TiAlN; 7 µm



**CTCP435**

DRAGONSKIN

HC-P35  
HC-M30  
HC-K40



**Composition:**

Co 9.6%; mixed carbides 7.8%; other .4%; WC balance

**Grain size:**

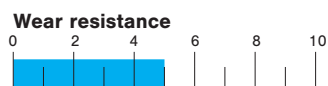
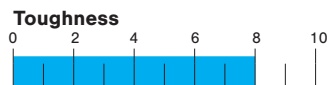
1 - 2 µm

**Hardness:**

HV 1400

**Coating specification:**

CVD  
Ti (C,N) + Al<sub>2</sub>O<sub>3</sub>  
7.5 µm



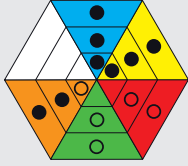
**CTPP435**

DRAGONSKIN

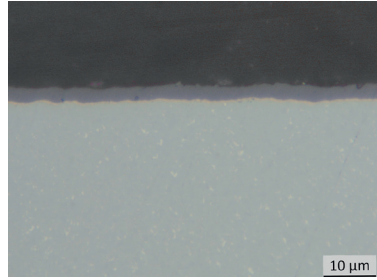
HC-P35

HC-M30

HC-S30



EcoCut Mini



**Composition:**

Co 10.3%; other 1.2%; WC balance

**Grain size:**

.7 μm

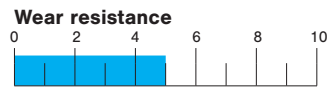
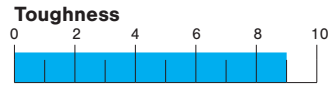
**Hardness:**

HV<sub>30</sub> 1600

**Coating specification:**

PVD

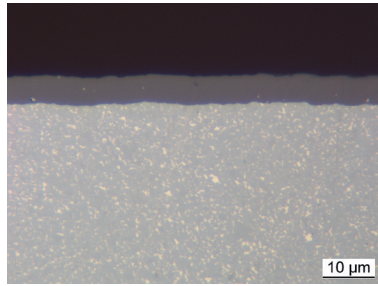
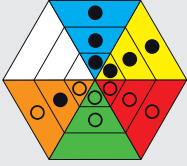
TiN / TiAlN; 3 μm



**CTPP430**

DRAGONSKIN

HC-P30  
HC-M25  
HC-S25



**Composition:**

Co 9.0%; other .75%; WC balance

**Grain size:**

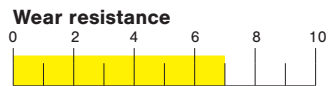
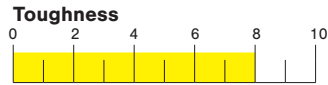
.85 µm

**Hardness:**

HV 1590

**Coating specification:**

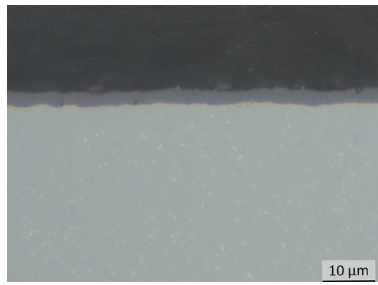
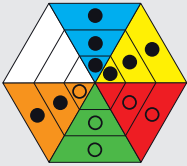
PVD  
TiAlN; 7 µm



**CTPP435**

DRAGONSKIN

HC-P35  
HC-M30  
HC-S30



**Composition:**

Co 10.3%; other 1.2%; WC balance

**Grain size:**

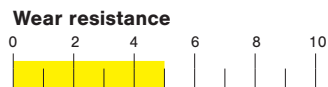
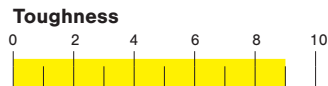
.7 µm

**Hardness:**

HV<sub>30</sub> 1600

**Coating specification:**

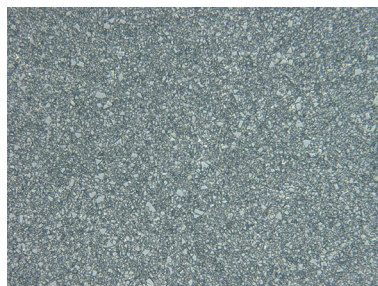
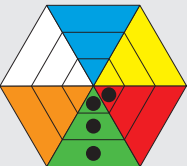
PVD  
TiN / TiAlN; 3 µm



EcoCut Mini

**H216T**

HW-K15



**Composition:**

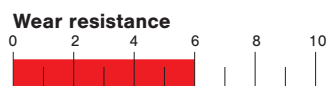
Co 6.0%; WC balance

**Grain size:**

1 µm

**Hardness:**

HV<sub>30</sub> 1630



**Properties, application:**

- Ideal for aluminum
- High wear resistance
- High heat resistance
- Low tendency for adhesion

# CERATIZIT \ Grade description

Stainless steel / cast iron

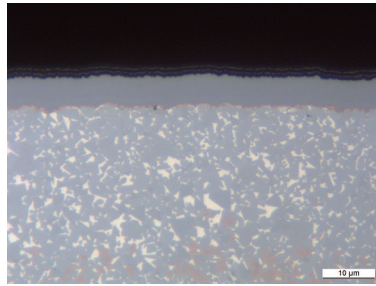
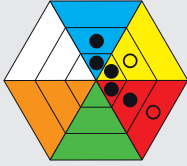
## CTCP425

DRAGONSKIN

HC-P25

HC-M20

HC-K30



### Composition:

Co 7%; mixed carbides 8.1%; WC balance

### Grain size:

1 - 2 µm

### Hardness:

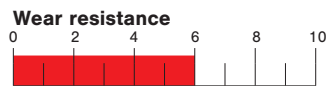
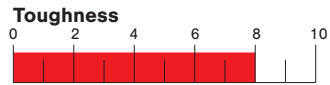
HV 1450

### Coating specification:

CVD

Ti (C,N) + Al<sub>2</sub>O<sub>3</sub>

7.5 µm



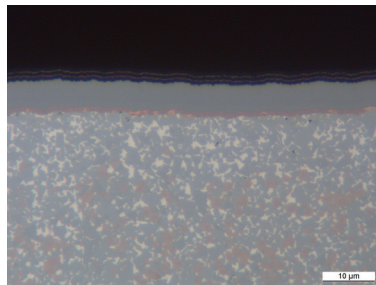
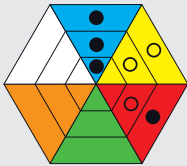
## CTCP435

DRAGONSKIN

HC-P35

HC-M30

HC-K40



### Composition:

Co 9.6%; mixed carbides 7.8%; other .4%; WC balance

### Grain size:

1 - 2 µm

### Hardness:

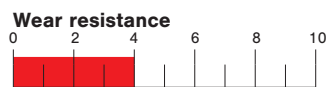
HV 1400

### Coating specification:

CVD

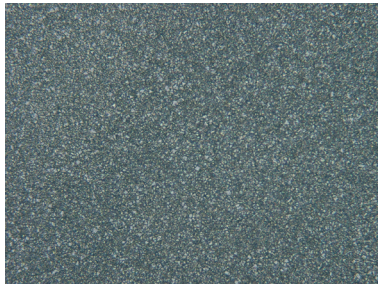
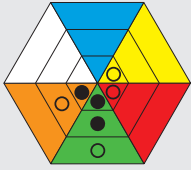
Ti (C,N) + Al<sub>2</sub>O<sub>3</sub>

7.5 µm



**H210T**

HW-M10  
HW-K10



**Composition:**

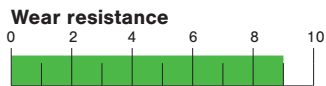
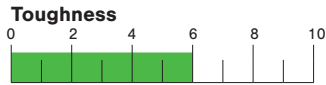
Co 6.0%; WC balance

**Grain size:**

.8 μm (submicron grade)

**Hardness:**

HV 1850

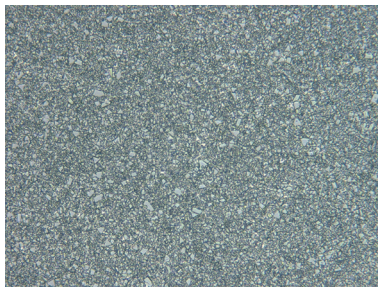
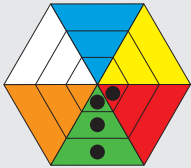


**Properties, application:**

- Ideal for heat-resistant alloys, titanium, refractory metals (W, Mo), aluminum and glass & carbon fiber reinforced plastics
- Low tendency for adhesion

**H216T**

HW-K15



**Composition:**

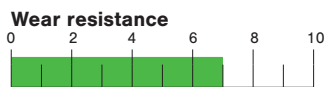
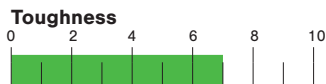
Co 6.0%; WC balance

**Grain size:**

1 μm

**Hardness:**

HV<sub>30</sub> 1630

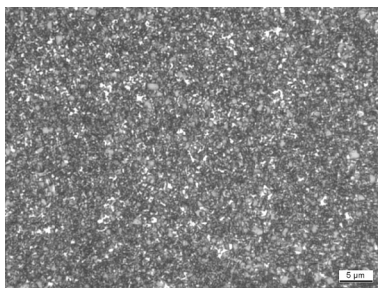
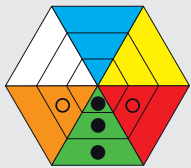


**Properties, application:**

- Ideal for aluminum
- High wear resistance
- High heat resistance
- Low tendency for adhesion

**CTWN425**

HW-N25



**Composition:**

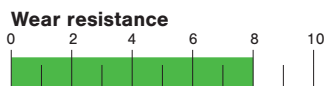
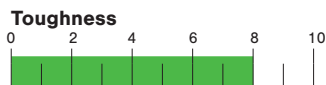
Co 10.3%; other 1.2%; WC balance

**Grain size:**

.7 μm (submicron grade)

**Hardness:**

HV<sub>30</sub> 1600



For EcoCut Mini

# CERATIZIT \ Grade description

Non-ferrous metals and non-metals / heat-resistant alloys / titanium

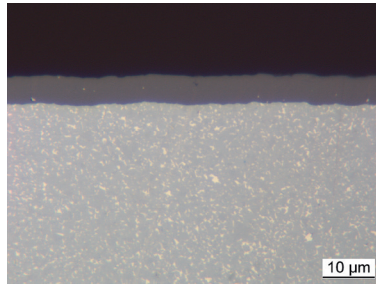
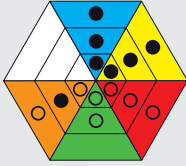
## CTPP430

DRAGONSKIN

HC-P30

HC-M25

HC-S25



### Composition:

Co 9.0%; other .75%; WC balance

### Grain size:

.85 μm

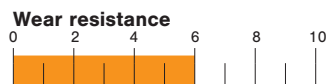
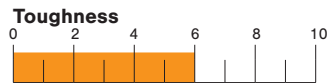
### Hardness:

HV 1590

### Coating specification:

PVD

TiAlN; 7 μm



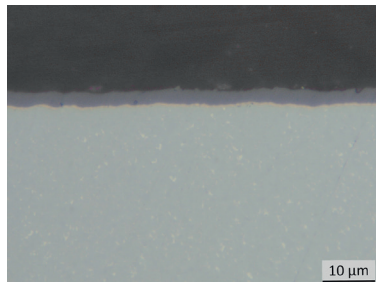
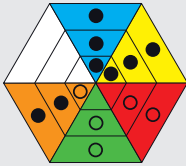
## CTPP435

DRAGONSKIN

HC-P35

HC-M30

HC-S30



### Composition:

Co 10.3%; other 1.2%; WC balance

### Grain size:

.7 μm

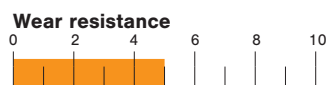
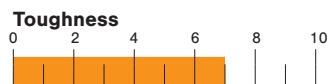
### Hardness:

HV<sub>30</sub> 1600

### Coating specification:

PVD

TiN / TiAlN; 3 μm

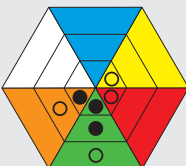


EcoCut Mini

## H210T

HW-M10

HW-K10



### Composition:

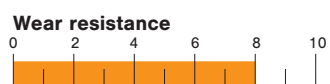
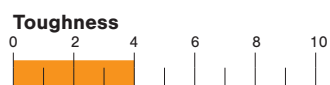
Co 6.0%; WC balance

### Grain size:

.8 μm (submicron grade)

### Hardness:

HV 1850

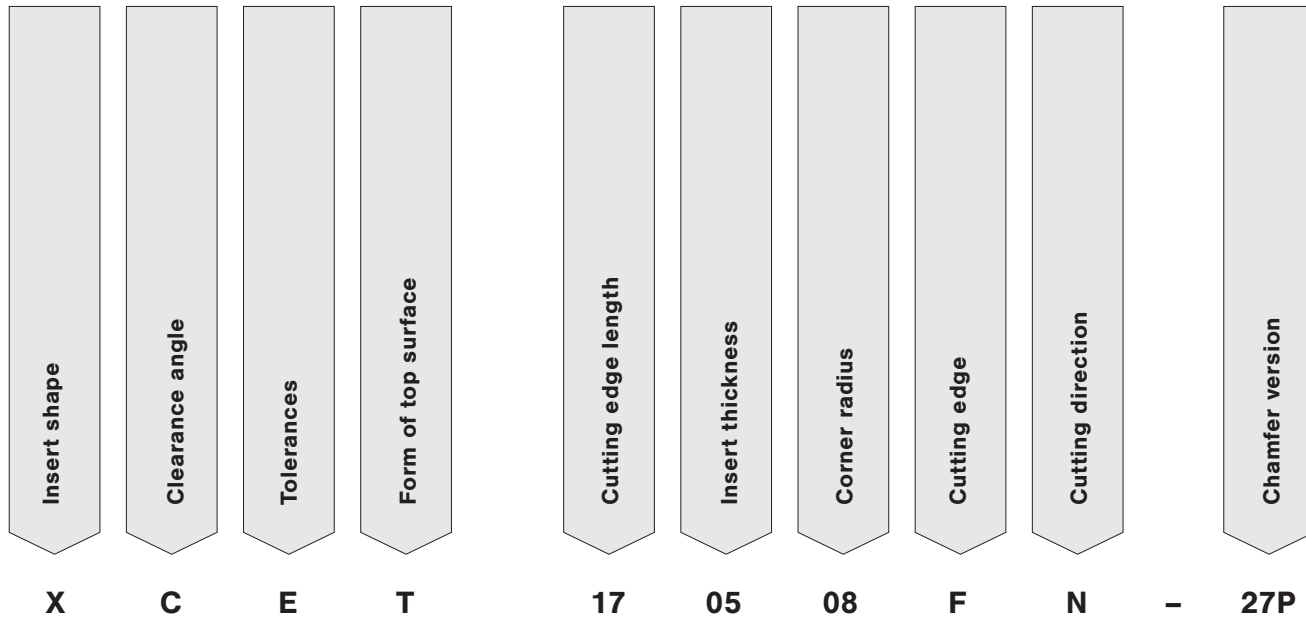


### Properties, application:

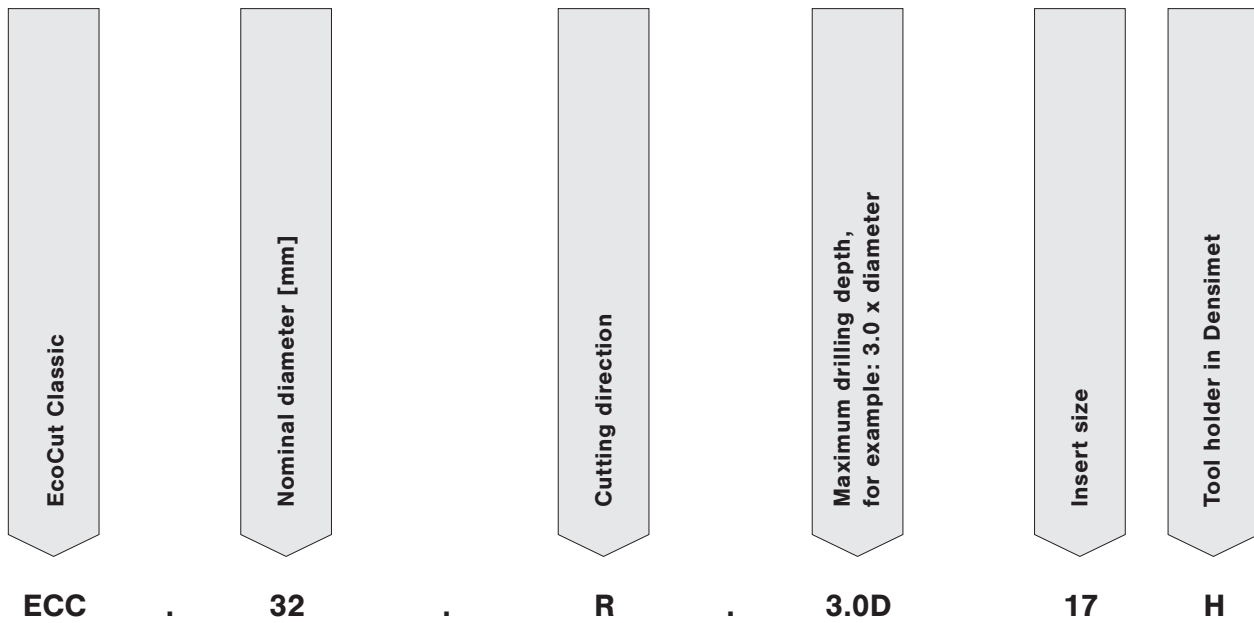
- Ideal for heat-resistant alloys, titanium, refractory metals (W, Mo), aluminum and glass & carbon fiber reinforced plastics
- Low tendency for adhesion







Inserts

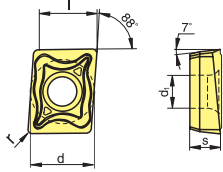


Tools

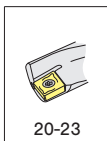





P			●	●	●
M	○		○	●	○
K	○	●	●	○	●
N	●	●		○	
S	●			●	
H					

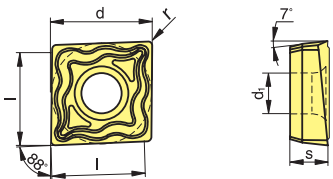
		H210T	H216T	CTCP425 DRAGONSKIN	CTPP430 DRAGONSKIN	CTCP435 DRAGONSKIN	d	l	s	r	d <sub>i</sub>
							[inch]	[inch]	[inch]	[inch]	[inch]
-27P			●				.177	.157	.071	.008	.083
			●				.177	.157	.071	.008	.083
			●				.177	.157	.071	.016	.083
			●				.177	.157	.071	.016	.083
-27Q**		●					.177	.157	.071	.008	.083
		●					.177	.157	.071	.008	.083
		●					.177	.157	.071	.016	.083
		●					.177	.157	.071	.016	.083
ER-EL				●	●	●	.177	.157	.071	.008	.083
				●	●	●	.177	.157	.071	.008	.083
				●	●	●	.177	.157	.071	.016	.083
				●	●	●	.177	.157	.071	.016	.083
-M50Q				●			.177	.157	.071	.016	.083
				●			.177	.157	.071	.016	.083
		H210T	H216T	CTCP425 DRAGONSKIN	CTPP430 DRAGONSKIN	CTCP435 DRAGONSKIN	d	l	s	r	d <sub>i</sub>



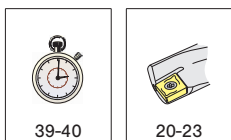
\*\*27Q Chip groove has **MasterFinish** wiper edge. See pge 29-31 for details




			Material					d	l	s	r	d <sub>1</sub>
			P	M	K	N	S					
			H									
			H210T	H216T	CTCP425 DRAGONSKIN	CTPP430 DRAGONSKIN	CTCP435 DRAGONSKIN	[inch]	[inch]	[inch]	[inch]	[inch]
-27P		XCET 050202FN-27P		●				.228	.197	.083	.008	.089
		XCET 050204FN-27P		●				.228	.197	.083	.016	.089
		XCET 060202FN-27P		●				.256	.236	.094	.008	.098
		XCET 060204FN-27P		●				.256	.236	.094	.016	.098
		XCET 070304FN-27P		●				.299	.276	.125	.016	.110
		XCET 080304FN-27P		●				.335	.315	.125	.016	.134
		XCET 09T304FN-27P		●				.378	.354	.156	.016	.134
		XCET 10T304FN-27P		●				.417	.394	.156	.016	.173
		XCET 10T308FN-27P		●				.417	.394	.156	.031	.173
		XCET 130404FN-27P		●				.531	.492	.187	.016	.209
		XCET 130408FN-27P		●				.531	.492	.187	.031	.209
		XCET 170508FN-27P		●				.689	.630	.219	.031	.209
-27Q**		XCET 050202FN-27Q	●					.228	.197	.083	.008	.089
		XCET 050204FN-27Q	●					.228	.197	.083	.016	.089
		XCET 060202FN-27Q	●					.256	.236	.094	.008	.098
		XCET 060204FN-27Q	●					.256	.236	.094	.016	.098
		XCET 070304FN-27Q	●					.299	.276	.125	.016	.110
		XCET 080304FN-27Q	●					.335	.315	.125	.016	.134
		XCET 09T304FN-27Q	●					.378	.354	.156	.016	.134
		XCET 10T304FN-27Q	●					.417	.394	.156	.016	.173
		XCET 10T308FN-27Q	●					.417	.394	.156	.031	.173
		XCET 130404FN-27Q	●					.531	.492	.187	.016	.209
		XCET 130408FN-27Q	●					.531	.492	.187	.031	.209
		XCET 170508FN-27Q	●					.689	.630	.219	.031	.209
EN		XCNT 050202EN			●	●	●	.228	.197	.083	.008	.089
		XCNT 050204EN			●	●	●	.228	.197	.083	.016	.089
		XCNT 060202EN			●	●	●	.256	.236	.094	.008	.098
		XCNT 060204EN			●	●	●	.256	.236	.094	.016	.098
		XCNT 070304EN			●	●	●	.299	.276	.125	.016	.110
		XCNT 080304EN			●	●	●	.335	.315	.125	.016	.134
		XCNT 09T304EN			●	●	●	.378	.354	.156	.016	.134
		XCNT 10T304EN			●	●	●	.417	.394	.156	.016	.173
		XCNT 10T308EN			●	●	●	.417	.394	.156	.031	.173
		XCNT 130404EN			●	●	●	.531	.492	.187	.016	.209
		XCNT 130408EN			●	●	●	.531	.492	.187	.031	.209
		XCNT 170508EN			●	●	●	.689	.630	.219	.031	.209

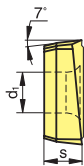
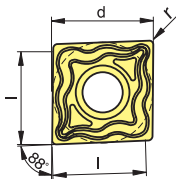


\*\*27Q Chip groove has **MasterFinish** wiper edge. See pge 29-31 for details

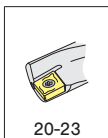


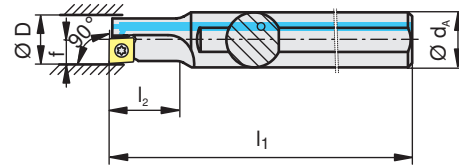
P			●	●	●
M	○		○	○	○
K	○	●	●	○	●
N	●	●		○	
S	●			●	
H					

			H210T	H216T	CTCP425 DRAGONSKIN	CTPP430 DRAGONSKIN	CTCP435 DRAGONSKIN	d	l	s	r	d <sub>i</sub>
								[inch]	[inch]	[inch]	[inch]	[inch]
-M50Q** 	XCNT 050204EN-M50Q				●			.228	.197	.083	.016	.089
	XCNT 060204EN-M50Q				●			.256	.236	.094	.016	.098
	XCNT 070304EN-M50Q				●			.299	.276	.125	.016	.110
	XCNT 080304EN-M50Q				●			.335	.315	.125	.016	.134
	XCNT 09T304EN-M50Q				●			.378	.354	.156	.016	.134
	XCNT 10T304EN-M50Q				●			.417	.394	.156	.016	.173
	XCNT 10T308EN-M50Q				●			.417	.394	.156	.031	.173
	XCNT 130404EN-M50Q				●			.531	.492	.187	.016	.209
	XCNT 130408EN-M50Q				●			.531	.492	.187	.031	.209
	XCNT 170508EN-M50Q				●			.689	.630	.219	.031	.209
			H210T	H216T	CTCP425 DRAGONSKIN	CTPP430 DRAGONSKIN	CTCP435 DRAGONSKIN	d	l	s	r	d <sub>i</sub>



\*\*M50Q Chip groove has **MasterFinish** wiper edge. See pge 29-31 for details

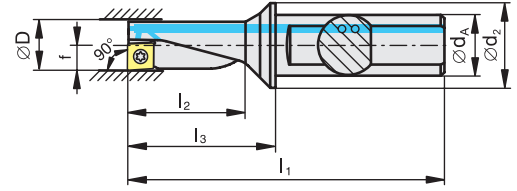




D <sub>min</sub> [inch]	Type, description	LNR 	d <sub>A</sub> [inch]	l <sub>1</sub> [inch]	l <sub>2</sub> [inch]	f [inch]		
.315	ECC 08R-1.5D 04-E	R	.500	3.1	.470	.157	XC.. 0401..	E01
.315	ECC 08L-1.5D 04-E	L	.500	3.1	.470	.157	XC.. 0401..	E01
.394	ECC 10R-1.5D 05-E	R	.500	3.5	.590	.197	XC.. 0502..	E02
.394	ECC 10L-1.5D 05-E	L	.500	3.5	.590	.197	XC.. 0502..	E02
.472	ECC 12R-1.5D 06-E	R	.625	3.9	.710	.236	XC.. 0602..	E03
.472	ECC 12L-1.5D 06-E	L	.625	3.9	.710	.236	XC.. 0602..	E03
.551	ECC 14R-1.5D 07-E	R	.625	4.3	.830	.276	XC.. 0703..	E04
.551	ECC 14L-1.5D 07-E	L	.625	4.3	.830	.276	XC.. 0703..	E04
.630	ECC 16R-1.5D 08-E	R	.750	4.9	.940	.315	XC.. 0803..	E05
.630	ECC 16L-1.5D 08-E	L	.750	4.9	.940	.315	XC.. 0803..	E05
.709	ECC 18R-1.5D 09-E	R	1.000	5.3	1.060	.354	XC.. 09T3..	E05
.709	ECC 18L-1.5D 09-E	L	1.000	5.3	1.060	.354	XC.. 09T3..	E05
.787	ECC 20R-1.5D 10-E	R	1.000	5.9	1.180	.394	XC.. 10T3..	E06
.787	ECC 20L-1.5D 10-E	L	1.000	5.9	1.180	.394	XC.. 10T3..	E06
.984	ECC 25R-1.5D 13-E	R	1.250	7.0	1.480	.492	XC.. 1304..	E07
.984	ECC 25L-1.5D 13-E	L	1.250	7.0	1.480	.492	XC.. 1304..	E07
1.260	ECC 32R-1.5D 17-E	R	1.500	7.8	1.890	.630	XC.. 1705..	E07
1.260	ECC 32L-1.5D 17-E	L	1.500	7.8	1.890	.630	XC.. 1705..	E07

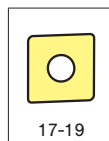
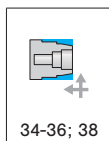
E01	11161940-10001230/M1,8X3,8/T06	8095010000-SD-T06	11843205
E02	169858-7883215/M2,2X4,0/T07	8095010100-SD-T07	11843205
E03	169857-7883214/M3,0X5,7/T08	8095010200-SD-T08	11488748
E04	54976-7722111/M3,5X7,2/T15	8095010500-SD-T15	11206195
E05	165795-7883209/M3,5X8,6/T15	8095010500-SD-T15	11843208
E06	12052233-M5,0X10,8-20IP/10022539	8095010600-SD-T20	

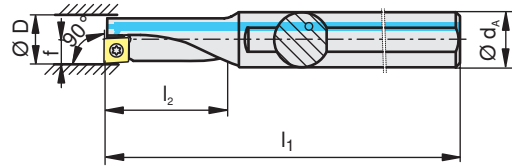
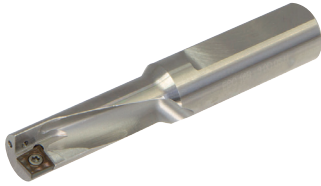
 39-40	 34-36; 38	 17-19
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$D_{\min}$ [inch]	Type, description	LNR 	$d_1$ [inch]	$d_2$ [inch]	$l_1$ [inch]	$l_2$ [inch]	$l_3$ [inch]	$f$ [inch]		
.315	ECC 08R-2.25D 04-E	R	.375	.590	2.3	.710	.870	.157	XC.. 0401..	E01
.315	ECC 08L-2.25D 04-E	L	.375	.590	2.3	.710	.870	.157	XC.. 0401..	E01
.394	ECC 10R-2.25D 05-E	R	.500	.708	2.7	.890	1.085	.197	XC.. 0502..	E02
.394	ECC 10L-2.25D 05-E	L	.500	.708	2.7	.890	1.085	.197	XC.. 0502..	E02
.472	ECC 12R-2.25D 06-E	R	.625	.866	3.0	1.060	1.300	.236	XC.. 0602..	E03
.472	ECC 12L-2.25D 06-E	L	.625	.866	3.0	1.060	1.300	.236	XC.. 0602..	E03
.551	ECC 14R-2.25D 07-E	R	.625	.906	3.2	1.240	1.520	.276	XC.. 0703..	E04
.551	ECC 14L-2.25D 07-E	L	.625	.906	3.2	1.240	1.520	.276	XC.. 0703..	E04
.630	ECC 16R-2.25D 08-E	R	.750	1.102	3.7	1.420	1.730	.315	XC.. 0803..	E05
.630	ECC 16L-2.25D 08-E	L	.750	1.102	3.7	1.420	1.730	.315	XC.. 0803..	E05
.709	ECC 18R-2.25D 09-E	R	1.000	1.417	4.3	1.590	2.110	.354	XC.. 09T3..	E05
.709	ECC 18L-2.25D 09-E	L	1.000	1.417	4.3	1.590	2.110	.354	XC.. 09T3..	E05
.787	ECC 20R-2.25D 10-E	R	1.000	1.378	4.4	1.770	2.170	.394	XC.. 10T3..	E06
.787	ECC 20L-2.25D 10-E	L	1.000	1.378	4.4	1.770	2.170	.394	XC.. 10T3..	E06
.984	ECC 25R-2.25D 13-E	R	1.250	1.732	5.0	2.210	2.715	.492	XC.. 1304..	E07
.984	ECC 25L-2.25D 13-E	L	1.250	1.732	5.0	2.210	2.715	.492	XC.. 1304..	E07
1.260	ECC 32R-2.25D 17-E	R	1.500	2.126	6.2	2.830	3.460	.630	XC.. 1705..	E07
1.260	ECC 32L-2.25D 17-E	L	1.500	2.126	6.2	2.830	3.460	.630	XC.. 1705..	E07

E01	11161940-10001230/M1,8X3,8/T06	8095010000-SD-T06	11843205
E02	169858-7883215/M2,2X4,0/T07	8095010100-SD-T07	11843205
E03	169857-7883214/M3,0X5,7/T08	8095010200-SD-T08	11488748
E04	54976-7722111/M3,5X7,2/T15	8095010500-SD-T15	11206195
E05	165795-7883209/M3,5X8,6/T15	8095010500-SD-T15	11843208
E06	12052233-M5,0X10,8-20IP/10022539	8095010600-SD-T20	





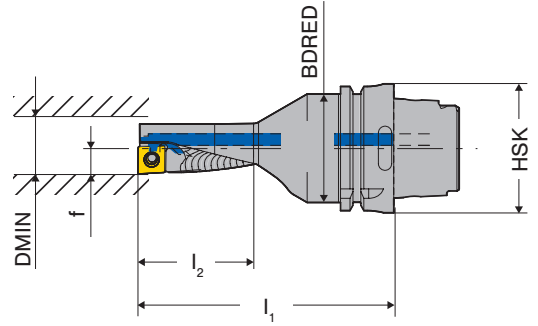
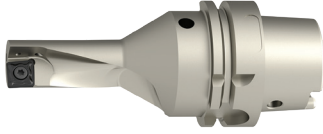
D <sub>min</sub> [inch]	Type, description	LNR 	d <sub>A</sub> [inch]	l <sub>1</sub> [inch]	l <sub>2</sub> [inch]	f [inch]		
.315	ECC 08R-3.0D 04 H-E	R	.500	3.1	.940	.157	XC.. 0401..	E01
.315	ECC 08L-3.0D 04 H-E	L	.500	3.1	.940	.157	XC.. 0401..	E01
.394	ECC 10R-3.0D 05 H-E	R	.500	3.3	1.180	.197	XC.. 0502..	E02
.394	ECC 10L-3.0D 05 H-E	L	.500	3.3	1.180	.197	XC.. 0502..	E02
.472	ECC 12R-3.0D 06 H-E	R	.625	3.7	1.420	.236	XC.. 0602..	E03
.472	ECC 12L-3.0D 06 H-E	L	.625	3.7	1.420	.236	XC.. 0602..	E03
.551	ECC 14R-3.0D 07 H-E	R	.625	3.9	1.650	.276	XC.. 0703..	E04
.551	ECC 14L-3.0D 07 H-E	L	.625	3.9	1.650	.276	XC.. 0703..	E04
.630	ECC 16R-3.0D 08 H-E	R	.750	4.3	1.890	.315	XC.. 0803..	E05
.630	ECC 16L-3.0D 08 H-E	L	.750	4.3	1.890	.315	XC.. 0803..	E05
.709	ECC 18R-3.0D 09 H-E	R	1.000	5.0	2.120	.354	XC.. 09T3..	E05
.709	ECC 18L-3.0D 09 H-E	L	1.000	5.0	2.120	.354	XC.. 09T3..	E05
.787	ECC 20R-3.0D 10 H-E	R	1.000	5.1	2.360	.394	XC.. 10T3..	E06
.787	ECC 20L-3.0D 10 H-E	L	1.000	5.1	2.360	.394	XC.. 10T3..	E06
.984	ECC 25R-3.0D 13 H-E	R	1.250	5.9	2.950	.492	XC.. 1304..	E07
.984	ECC 25L-3.0D 13 H-E	L	1.250	5.9	2.950	.492	XC.. 1304..	E07
1.260	ECC 32R-3.0D 17 H-E	R	1.500	7.2	3.780	.630	XC.. 1705..	E07
1.260	ECC 32L-3.0D 17 H-E	L	1.500	7.2	3.780	.630	XC.. 1705..	E07



EcoCut Classic Tools

Multi-function tools

E01	11161940-10001230/M1,8X3,8/T06	8095010000-SD-T06	11843205
E02	169858-7883215/M2,2X4,0/T07	8095010100-SD-T07	11843205
E03	169857-7883214/M3,0X5,7/T08	8095010200-SD-T08	11488748
E04	54976-7722111/M3,5X7,2/T15	8095010500-SD-T15	11206195
E05	165795-7883209/M3,5X8,6/T15	8095010500-SD-T15	11843208
E06	12052233-M5,0X10,8-20IP/10022539	8095010600-SD-T20	




 39-40	 34-36; 38	 45	 17-19
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$D_{min}$ [inch]	Type, description	Adapter	$l_1$ [inch]	$l_2$ [inch]	BDRED [inch]	f [inch]		
.984	HSK-T63-EC-25L-2.25D 13	HSK-T 63	4.921	2.224	2.087	.492	XC...1304...	E01
.984	HSK-T63-EC-25R-2.25D 13	HSK-T 63	4.921	2.224	2.087	.492	XC...1304...	E01
1.260	HSK-T63-EC-32L-2.25D 17	HSK-T 63	4.921	2.835	2.087	.630	XC...1705...	E01
1.260	HSK-T63-EC-32R-2.25D 17	HSK-T 63	4.921	2.835	2.087	.630	XC...1705...	E01

EcoCut Classic Tools

Multi-function tools

		
E01	8095011400-SD-T20-100mm MS	7095028000-M4,5x10,5/T20

 39-40	 34-36; 38	 Densimet 45	 17-19
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The EcoCut is designed to be a 4-in-1 tool – you can face turn, ID/OD turn, bore and drill a true flat-bottom hole.

This unique tool will save you time and money while reducing the number of tools in your turret.

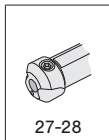
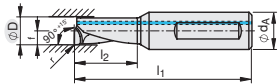


P	●			
M	●			
K	○			
N	●	○		
S	●			
H				

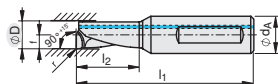
	CTWN425	CTPP435 DRAGONSKIN				RL	D	d <sub>A</sub>	l <sub>1</sub>	l <sub>2</sub>	r	f
							[inch]	[inch]	[inch]	[inch]	[inch]	[inch]
ECM 02.5L-2.25D-27	●					L	.098	.157	1.142	.222	.004	.049
ECM 02.5L-4.00D-27	●					L	.098	.157	1.299	.394	.004	.049
ECM 02.5R-2.25D-27	●					R	.098	.157	1.142	.222	.004	.049
ECM 02.5R-4.00D-27	●					R	.098	.157	1.299	.394	.004	.049
ECM 02L-2.25D-27	●					L	.079	.157	1.102	.177	.004	.039
ECM 02L-4.00D-27	●					L	.079	.157	1.220	.315	.004	.039
ECM 02R-2.25D-27	●					R	.079	.157	1.102	.177	.004	.039
ECM 02R-4.00D-27	●					R	.079	.157	1.220	.315	.004	.039
ECM 03.5L-2.25D-27	●					L	.138	.157	1.260	.310	.004	.069
ECM 03.5L-4.00D-27	●					L	.138	.157	1.457	.551	.004	.069
ECM 03.5R-2.25D-27	●					R	.138	.157	1.260	.310	.004	.069
ECM 03.5R-4.00D-27	●					R	.138	.157	1.457	.551	.004	.069
ECM 03L-2.25D-27	●					L	.118	.157	1.220	.266	.004	.059
ECM 03L-4.00D-27	●					L	.118	.157	1.378	.472	.004	.059
ECM 03R-2.25D-27	●					R	.118	.157	1.220	.266	.004	.059
ECM 03R-4.00D-27	●					R	.118	.157	1.378	.472	.004	.059
ECM 04L-2.25D-27	●					L	.157	.236	1.378	.354	.008	.079
ECM 04L-4.00D-27	●					L	.157	.236	1.614	.630	.008	.079
ECM 04R-2.25D-27	●					R	.157	.236	1.378	.354	.008	.079
ECM 04R-4.00D-27	●					R	.157	.236	1.614	.630	.008	.079
ECM 05L-2.25D-27	●					L	.197	.236	1.457	.443	.008	.098
ECM 05L-4.00D-27	●					L	.197	.236	1.772	.787	.008	.098
ECM 05R-2.25D-27	●					R	.197	.236	1.457	.443	.008	.098
ECM 05R-4.00D-27	●					R	.197	.236	1.772	.787	.008	.098
ECM 06L-2.25D-27	●					L	.236	.315	1.496	.531	.008	.118
ECM 06L-4.00D-27	●					L	.236	.315	1.929	.945	.008	.118
ECM 06R-2.25D-27	●					R	.236	.315	1.496	.531	.008	.118
ECM 06R-4.00D-27	●					R	.236	.315	1.929	.945	.008	.118
ECM 07L-2.25D-27	●					L	.276	.315	1.654	.620	.008	.138
ECM 07L-4.00D-27	●					L	.276	.315	2.087	1.102	.008	.138
ECM 07R-2.25D-27	●					R	.276	.315	1.654	.620	.008	.138
ECM 07R-4.00D-27	●					R	.276	.315	2.087	1.102	.008	.138
ECM 08L-2.25D-27	●					L	.315	.315	1.772	.709	.008	.157
ECM 08L-4.00D-27	●					L	.315	.315	2.244	1.260	.008	.157
ECM 08R-2.25D-27	●					R	.315	.315	1.772	.709	.008	.157
ECM 08R-4.00D-27	●					R	.315	.315	2.244	1.260	.008	.157
	CTWN425	CTPP435 DRAGONSKIN				RL	D	d <sub>A</sub>	l <sub>1</sub>	l <sub>2</sub>	r	f



-27



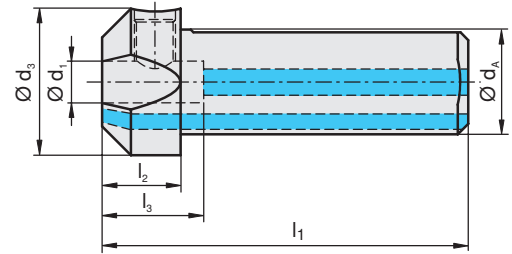
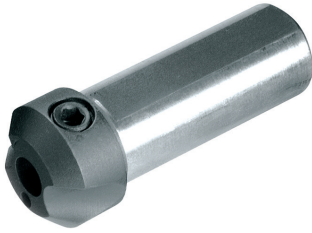
		P	M	K	N	S	H			RL	D	d <sub>A</sub>	l <sub>1</sub>	l <sub>2</sub>	r	f
		CTWN425	CTPP435	DRAGONSKIN					[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]
	ECM 02.5L-2.25D		●					L	.098	.157	1.142	.222	.004	.049		
	ECM 02.5L-4.00D		●					L	.098	.157	1.299	.394	.004	.049		
	ECM 02.5R-2.25D		●					R	.098	.157	1.142	.222	.004	.049		
	ECM 02.5R-4.00D		●					R	.098	.157	1.299	.394	.004	.049		
	ECM 02L-2.25D		●					L	.079	.157	1.102	.177	.004	.039		
	ECM 02L-4.00D		●					L	.079	.157	1.220	.315	.004	.039		
	ECM 02R-2.25D		●					R	.079	.157	1.102	.177	.004	.039		
	ECM 02R-4.00D		●					R	.079	.157	1.220	.315	.004	.039		
	ECM 03.5L-2.25D		●					L	.138	.157	1.260	.310	.004	.069		
	ECM 03.5L-4.00D		●					L	.138	.157	1.457	.551	.004	.069		
	ECM 03.5R-2.25D		●					R	.138	.157	1.260	.310	.004	.069		
	ECM 03.5R-4.00D		●					R	.138	.157	1.457	.551	.004	.069		
	ECM 03L-2.25D		●					L	.118	.157	1.220	.266	.004	.059		
	ECM 03L-4.00D		●					L	.118	.157	1.378	.472	.004	.059		
	ECM 03R-2.25D		●					R	.118	.157	1.220	.266	.004	.059		
	ECM 03R-4.00D		●					R	.118	.157	1.378	.472	.004	.059		
	ECM 04L-2.25D		●					L	.157	.236	1.378	.354	.008	.079		
	ECM 04L-4.00D		●					L	.157	.236	1.614	.630	.008	.079		
	ECM 04R-2.25D		●					R	.157	.236	1.378	.354	.008	.079		
	ECM 04R-4.00D		●					R	.157	.236	1.614	.630	.008	.079		
	ECM 05L-2.25D		●					L	.197	.236	1.457	.443	.008	.098		
	ECM 05L-4.00D		●					L	.197	.236	1.772	.787	.008	.098		
	ECM 05R-2.25D		●					R	.197	.236	1.457	.443	.008	.098		
	ECM 05R-4.00D		●					R	.197	.236	1.772	.787	.008	.098		
	ECM 06L-2.25D		●					L	.236	.315	1.496	.531	.008	.118		
	ECM 06L-4.00D		●					L	.236	.315	1.929	.945	.008	.118		
	ECM 06R-2.25D		●					R	.236	.315	1.496	.531	.008	.118		
	ECM 06R-4.00D		●					R	.236	.315	1.929	.945	.008	.118		
	ECM 07L-2.25D		●					L	.276	.315	1.654	.620	.008	.138		
	ECM 07L-4.00D		●					L	.276	.315	2.087	1.102	.008	.138		
	ECM 07R-2.25D		●					R	.276	.315	1.654	.620	.008	.138		
	ECM 07R-4.00D		●					R	.276	.315	2.087	1.102	.008	.138		
	ECM 08L-2.25D		●					L	.315	.315	1.772	.709	.008	.157		
	ECM 08L-4.00D		●					L	.315	.315	2.244	1.260	.008	.157		
	ECM 08R-2.25D		●					R	.315	.315	1.772	.709	.008	.157		
	ECM 08R-4.00D		●					R	.315	.315	2.244	1.260	.008	.157		
		CTWN425	CTPP435	DRAGONSKIN					RL	D	d <sub>A</sub>	l <sub>1</sub>	l <sub>2</sub>	r	f	



39-40

32-33; 37

27-28

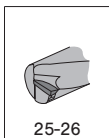


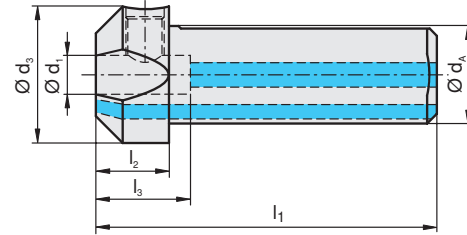
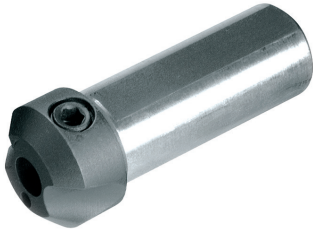
EcoCut Mini Adapters




Multi-function tools



d <sub>1</sub> [inch]	Type, description	LNR 							
			d <sub>A</sub> [inch]	d <sub>3</sub> [inch]	l <sub>1</sub> [inch]	l <sub>2</sub> [inch]	l <sub>3</sub> [inch]		
.157	EC-ADX12-04-E	N	.750	.984	2.500	.551	.709	ECM...	E02
.236	EC-ADX12-06-E	N	.750	.984	2.500	.551	.709	ECM..	E01
.315	EC-ADX12-08-E	N	.750	.984	2.500	.551	.709	ECM..	E01

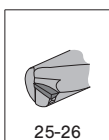
E01	310720-7897990/M8X1X8 DIN913
E02	12059687-S-M5x10 ISO 4026





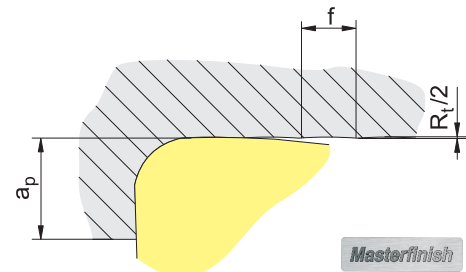
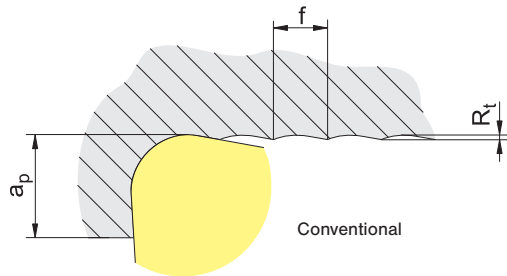
d <sub>i</sub> [inch]	Type, description	LNR 							
			d <sub>A</sub> [inch]	d <sub>s</sub> [inch]	l <sub>1</sub> [inch]	l <sub>2</sub> [inch]	l <sub>3</sub> [inch]		
.157	ECA 0750-04	N	.750	.787	3.937	.551	.709	ECM...	E01
.157	ECA 1000-04	N	1.000	.984	4.331	.551	.709	ECM...	E02
.236	ECA 0750-06	N	.750	.866	3.937	.551	.709	ECM...	E03
.236	ECA 1000-06	N	1.000	.984	4.331	.551	.709	ECM...	E03
.315	ECA 0750-08	N	.750	.866	3.937	.551	.709	ECM...	E03
.315	ECA 1000-08	N	1.000	.984	4.331	.551	.709	ECM...	E03

	
E01	234219-S-M5X8 DIN 913
E02	12059687-S-M5x10 ISO 4026
E03	310720-7897990/M8X1X8 DIN913

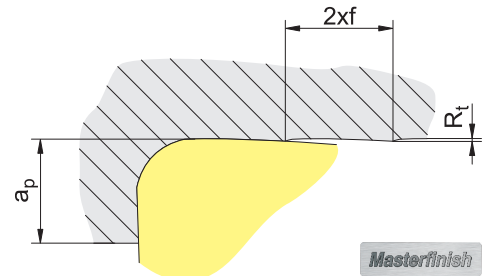
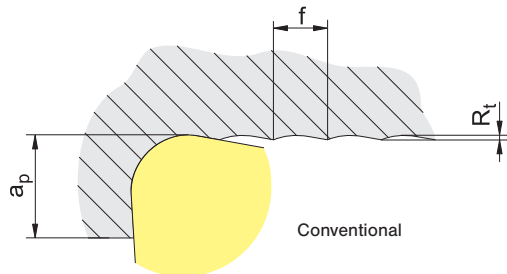


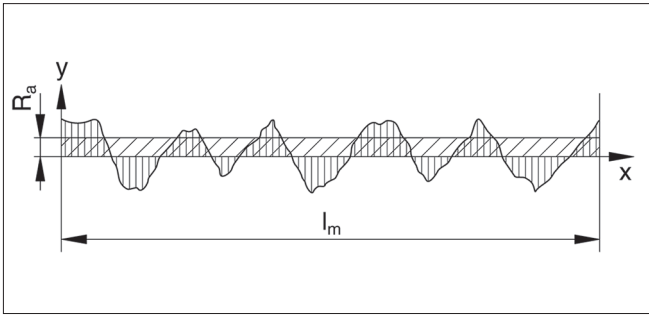
**Improved surface finish**

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!).



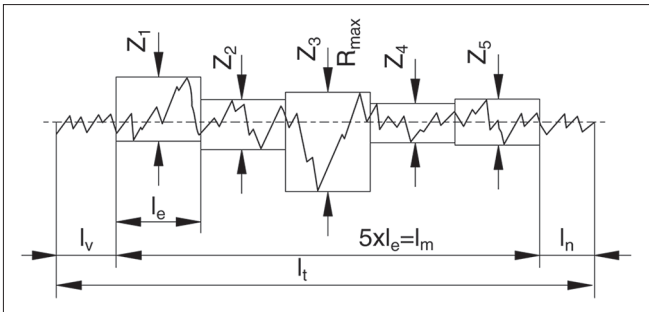


### Average roughness value $R_a$ (DIN 4768)

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

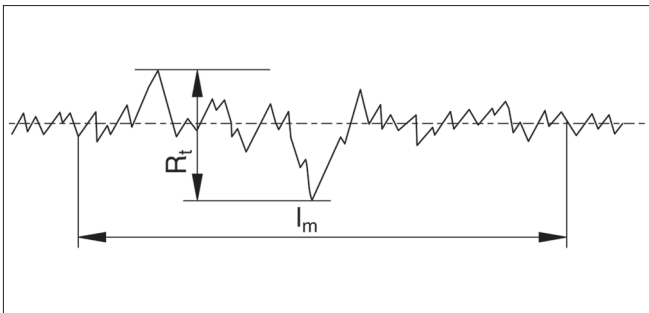
### Average roughness depth $R_z$ (DIN 4768)

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 $Z_1 \dots Z_5$

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



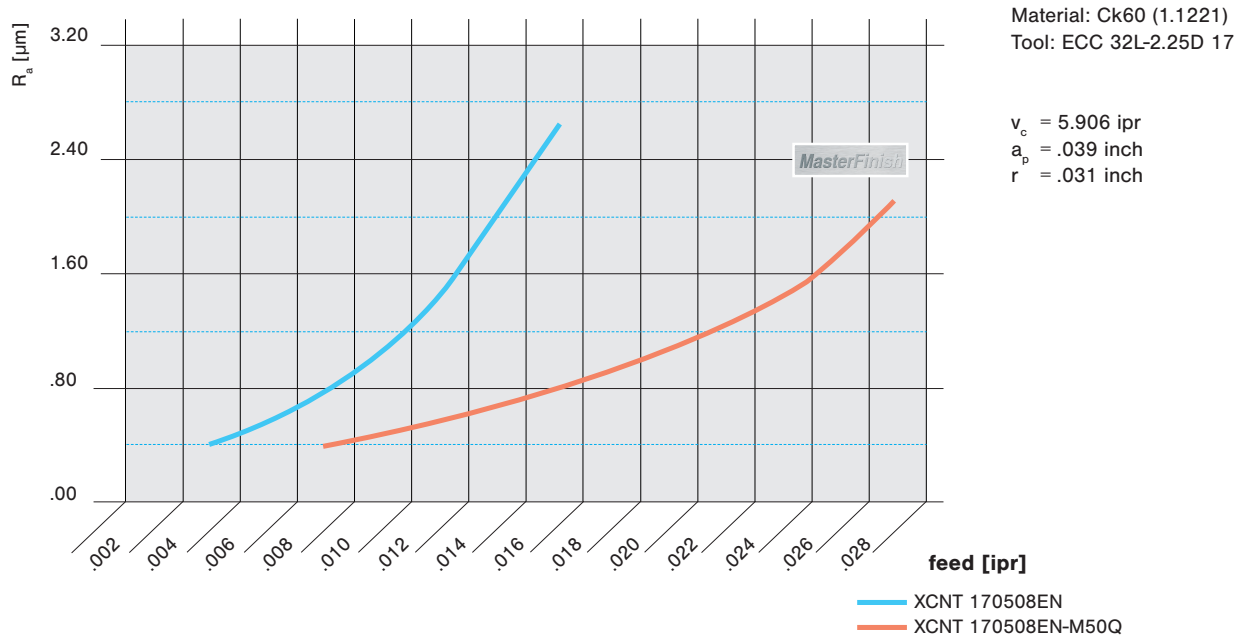
### Maximum surface roughness depth $R_t$ (DIN 4768/1)

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

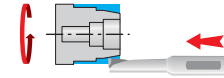
Surface symbol according to ISO 1302	new	.025	.05	.1	.2	.4	.8	1.6	3.2	6.3	12.5	25	50
Surface symbol according to ISO 3141	until now	▽▽▽▽					▽▽▽		▽▽		▽		
Roughness index		N 1	N 2	N 3	N 4	N 5	N 6	N 7	N 8	N 9	N 10	N 11	N 12
Arithmetic mean value	$R_a$ [μm]	.025	.05	.1	.2	.4	.8	1.6	3.2	6.3	12.5	25	50
Surface roughness depth	$R_z$ [μm]	.25	.63	1	1.6	2.5	4-6.3	10	16-25	40	63	100	160
Longitudinal turning Face turning													
Longitudinal turning Face turning							MasterFinish						
Longitudinal grinding Surface grinding													

≙ Surface roughness (produced through special methods)
  ≙ Surface roughness (produced through normal workshop methods)
  ≙ Surface roughness (produced through rough machining methods)

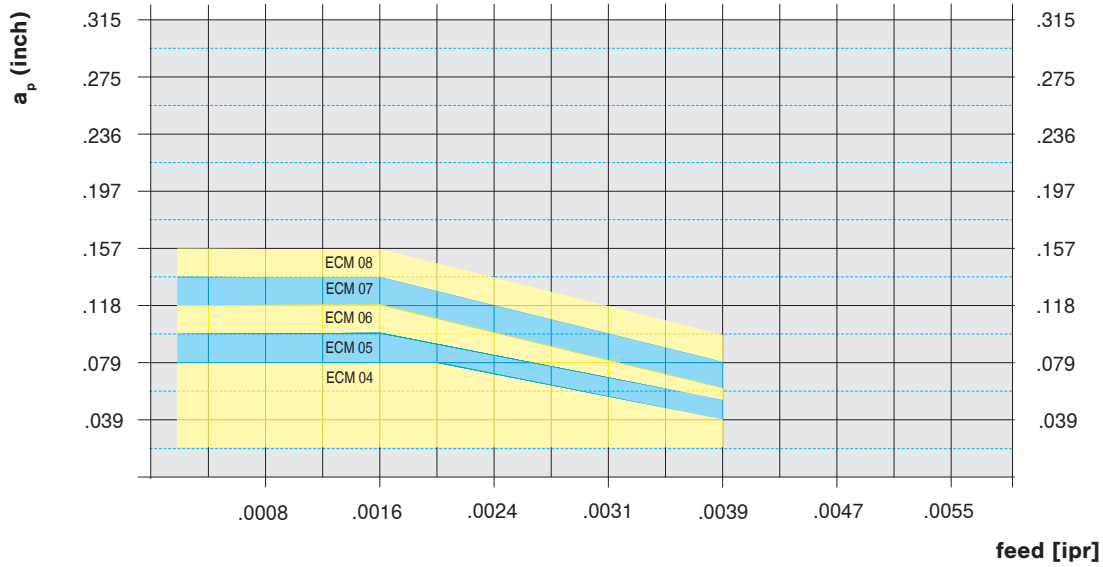




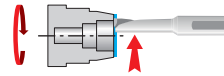
Longitudinal turning



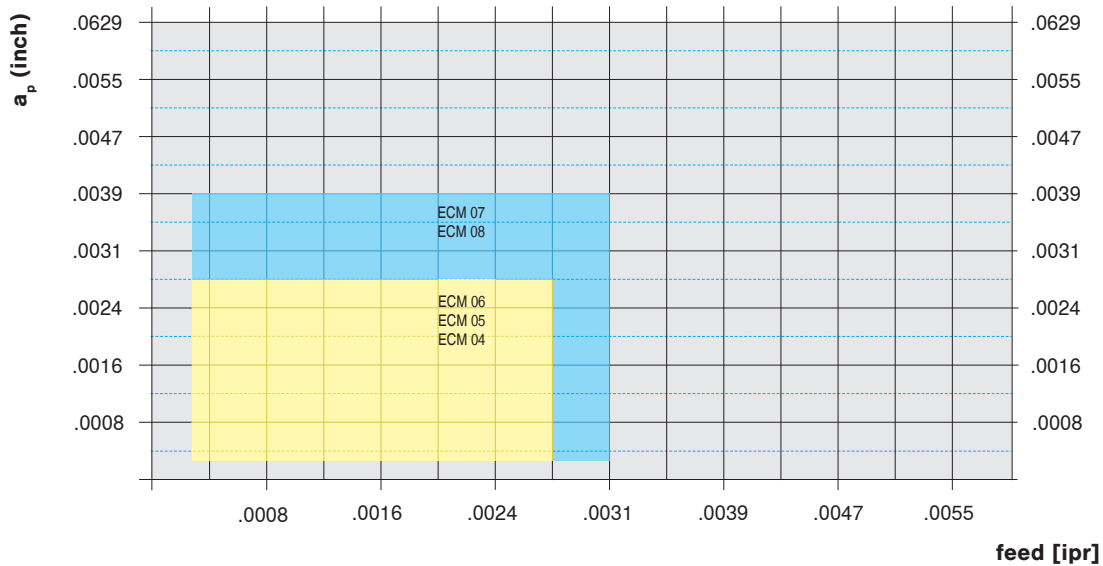
2.25D



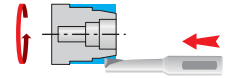
Face turning



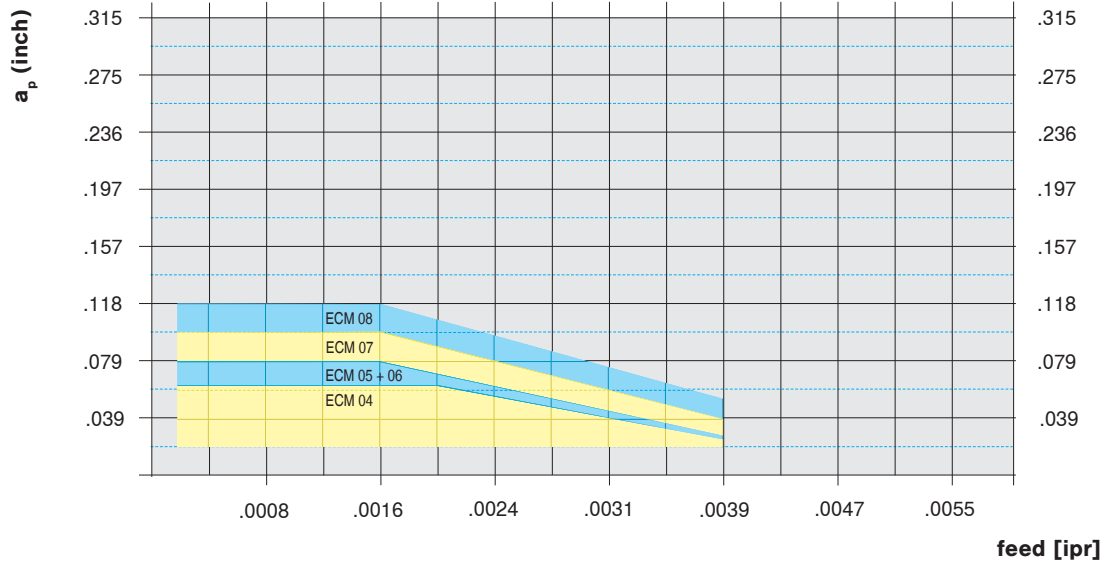
2.25D



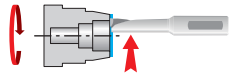
**Longitudinal turning**



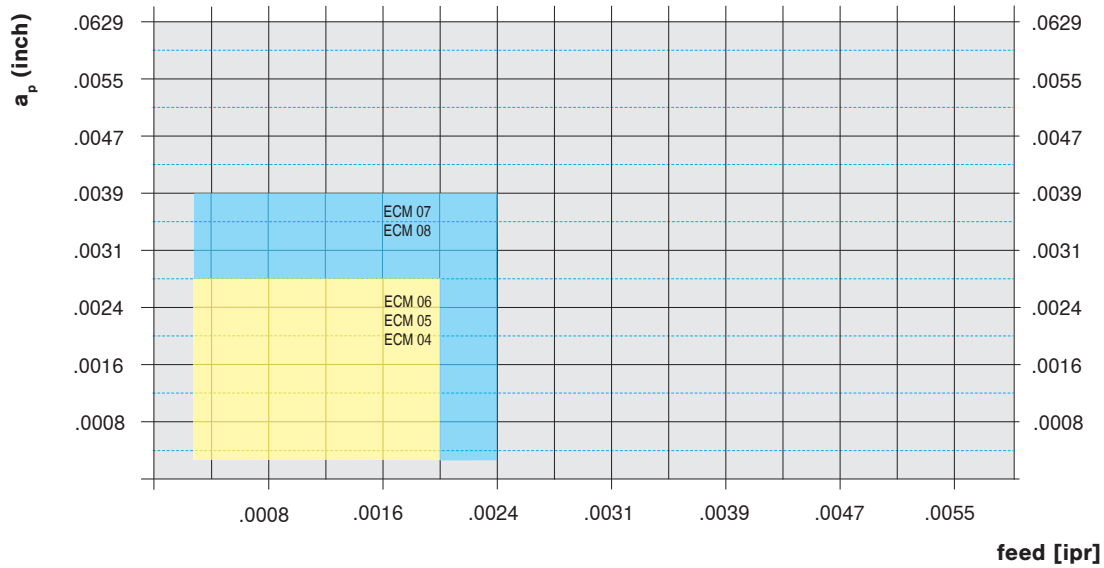
**4.0D**



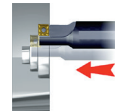
**Face turning**



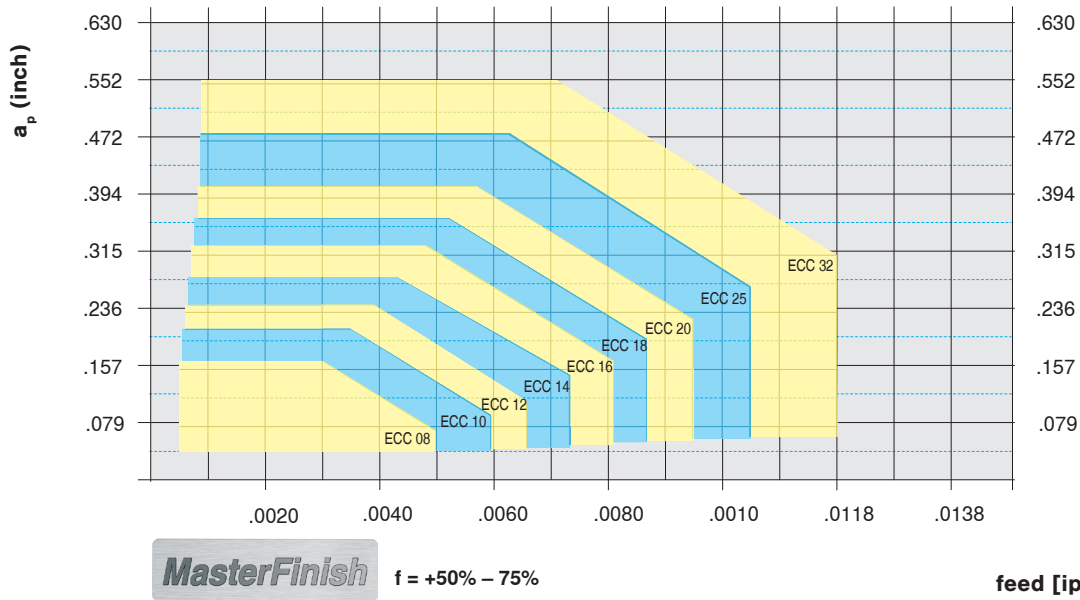
**4.0D**



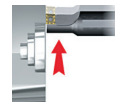
Longitudinal turning



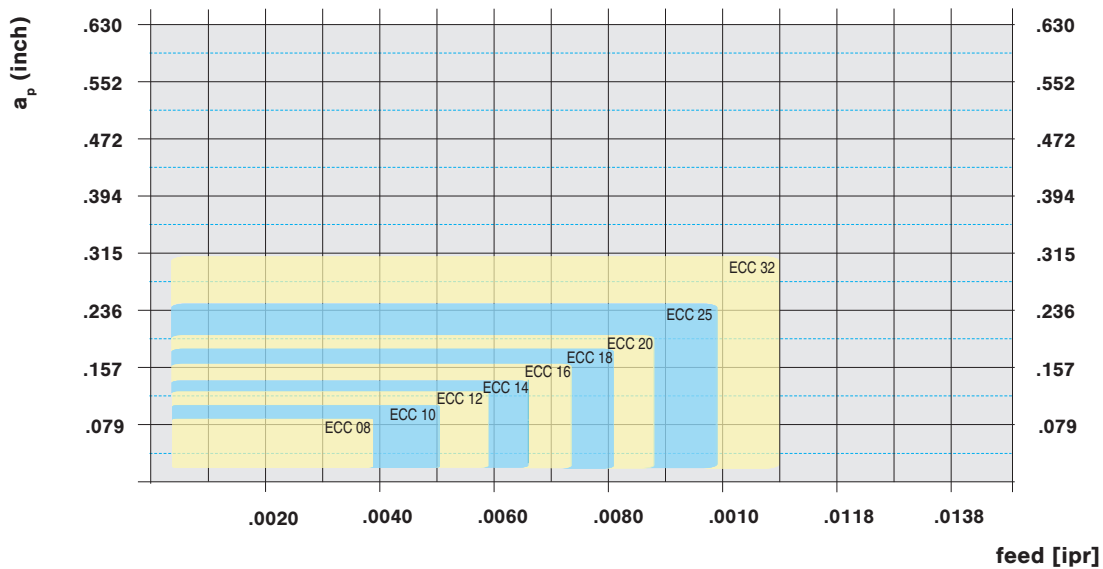
1.5D



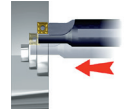
Face turning



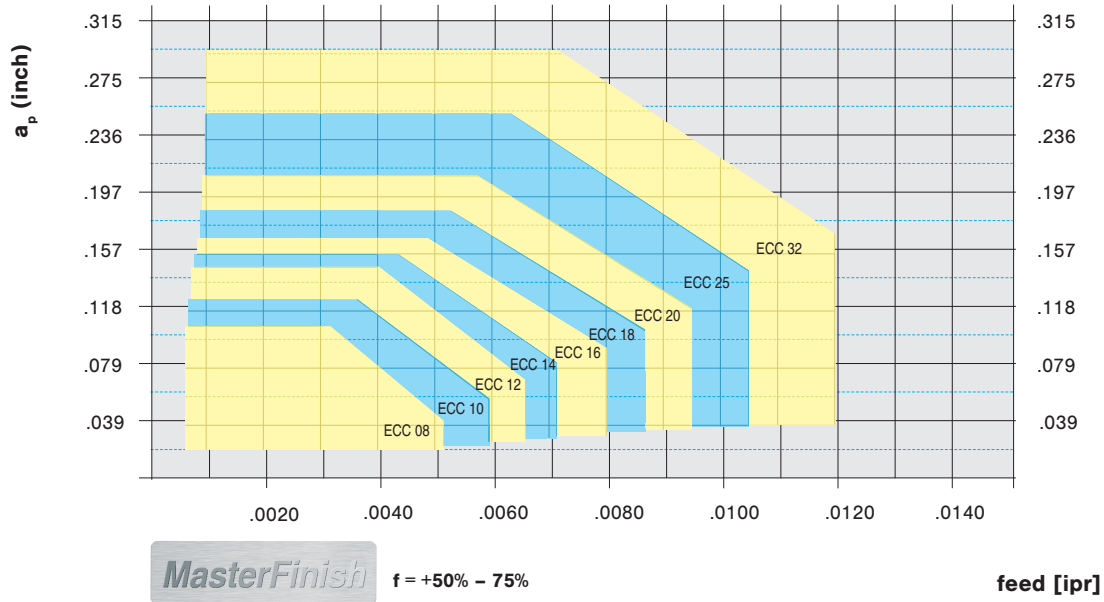
1.5D



**Longitudinal turning**



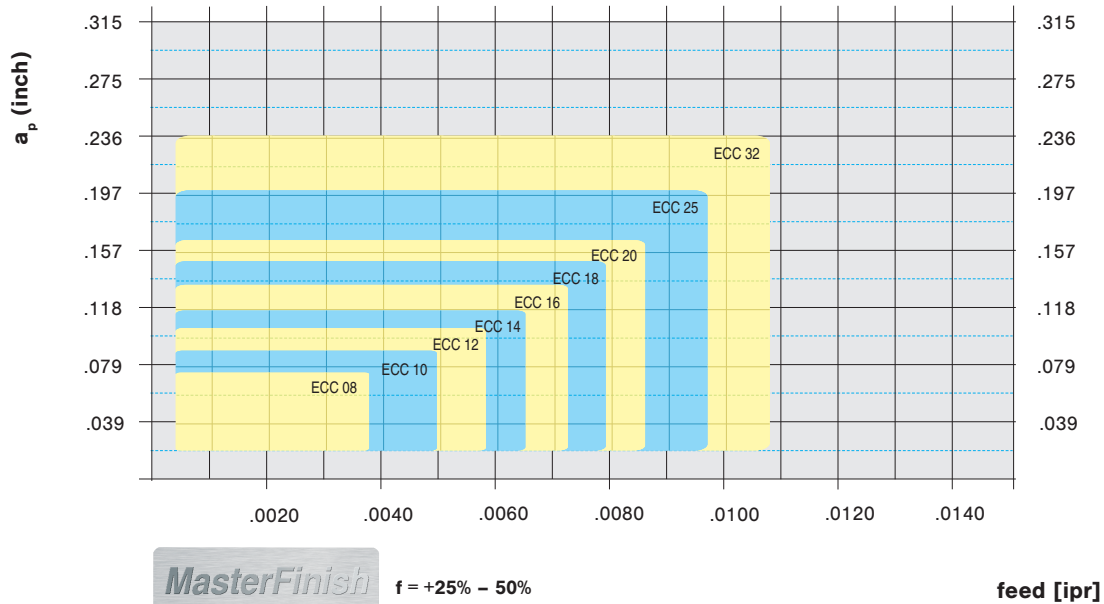
**2.25D**



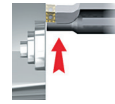
**Face turning**



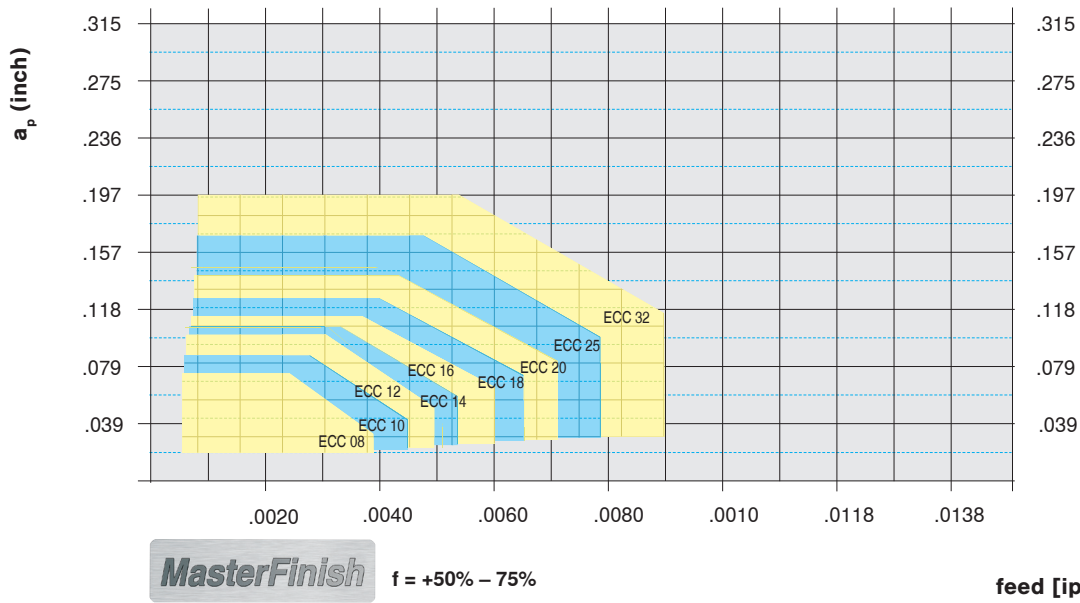
**2.25D**



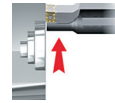
Longitudinal turning



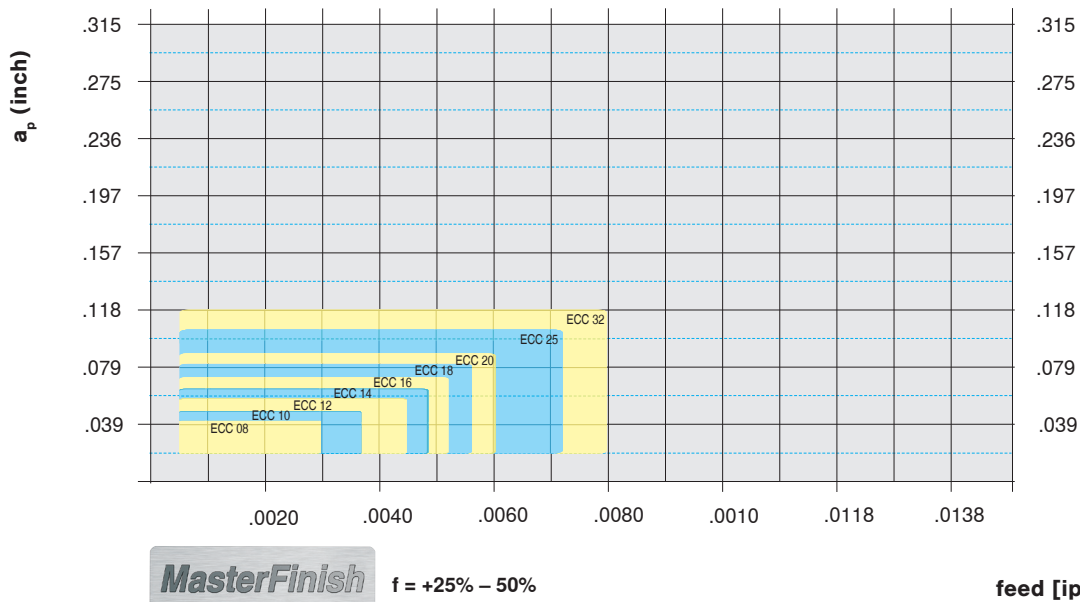
3.0D



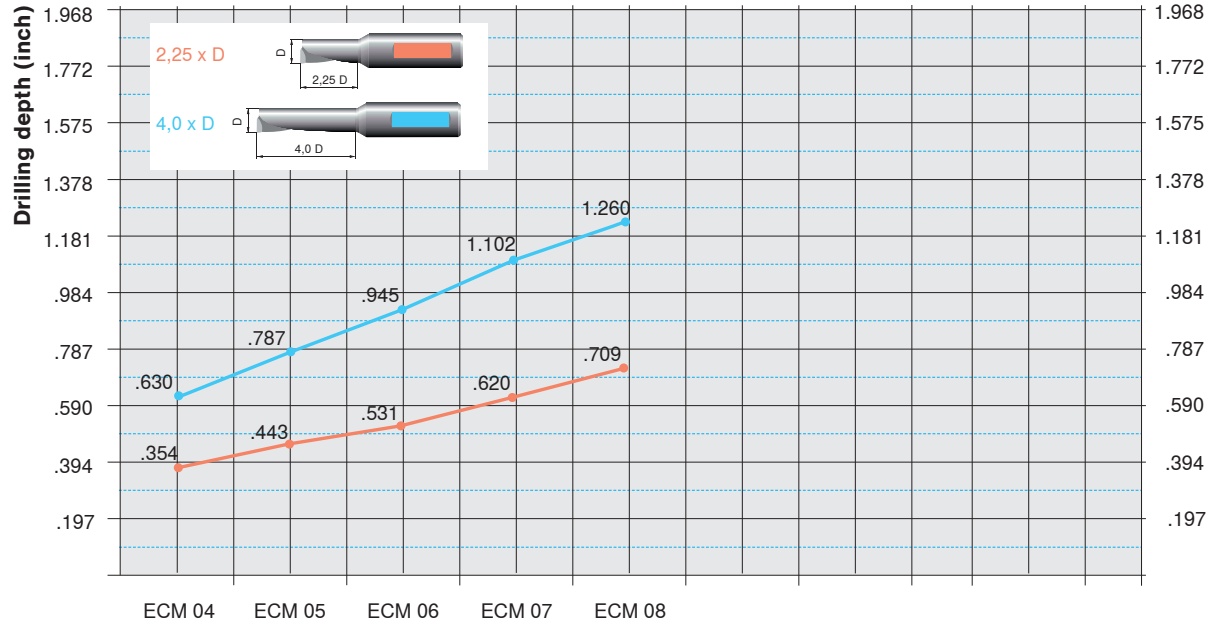
Face turning



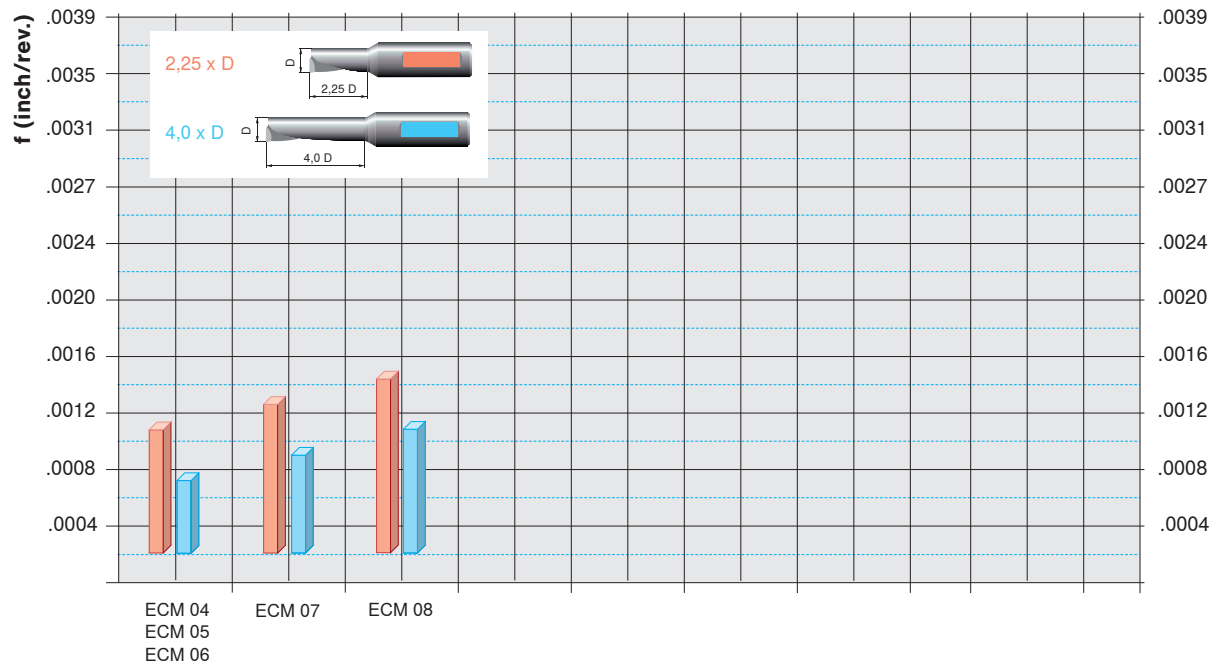
3.0D



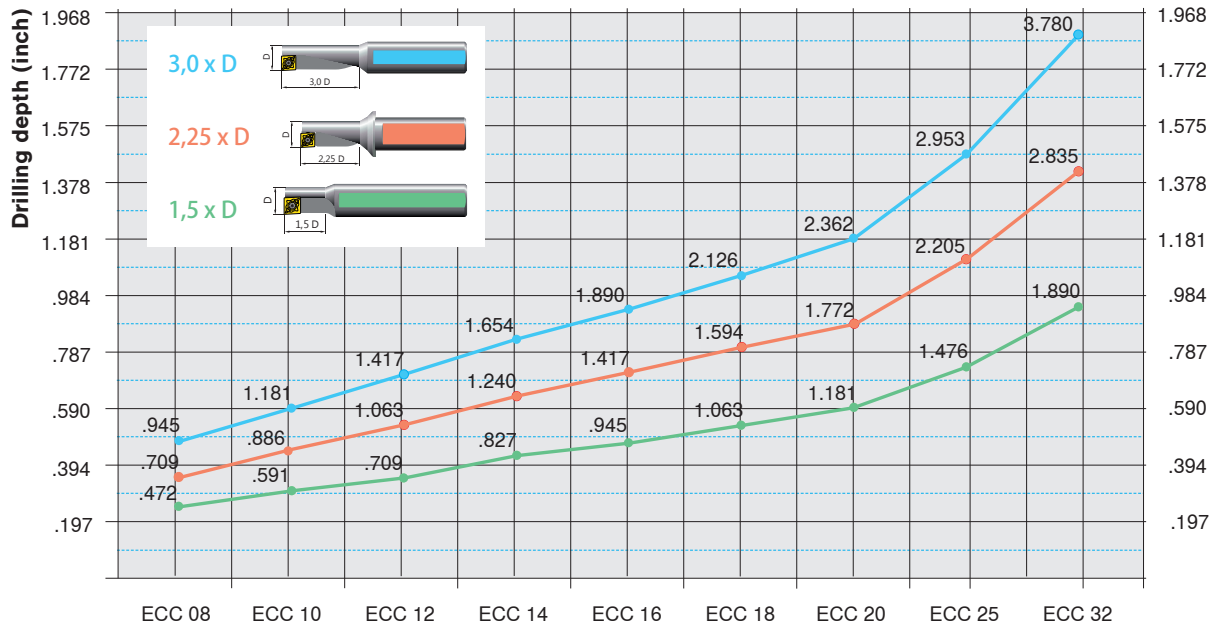
**Drilling depth**



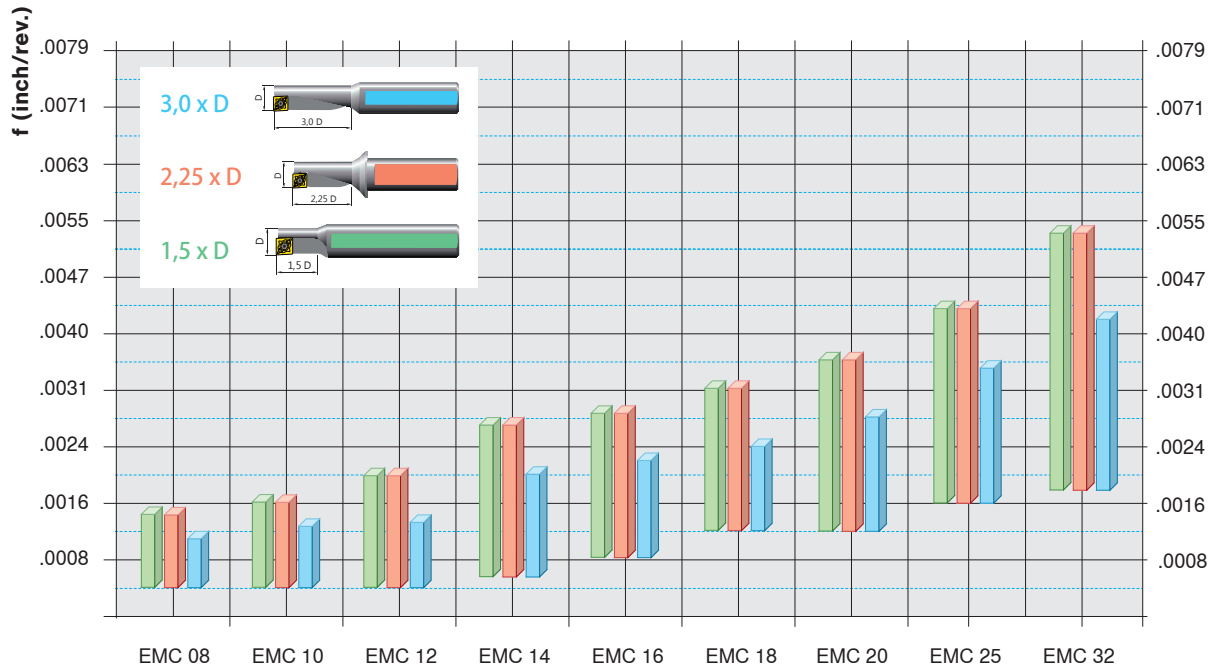
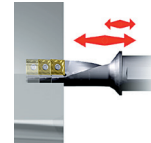
**Drilling feed rate**



Drilling depth



Drilling feed rate



	Work piece material	Type of treatment / alloy		VDI 3323 group	Hardness HB
<b>A</b>	Non alloyed steel	annealed	≤ .15% C	1	125
		annealed	.15% - .45% C	2	150 - 250
		tempered	≥ .45% C	3	300
	Low alloyed steel	annealed		6	180
		tempered		7 / 8	250 - 300
		tempered		9	350
	High alloyed steel	annealed		10	200
		tempered		11	350
	Corrosion-resistant steel	annealed	ferritic	12	200
		tempered	martensitic	13	325
<b>R</b>	Stainless steel	annealed	ferritic / martensitic	14	200
		quenched	austenitic	14	180
		quenched	duplex	14	230 - 260
		hardened	martensitic / austenitic	14	330
<b>F</b>	Gray cast iron		pearlitic / ferritic	15	180
			pearlitic / martensitic	16	260
	Spheroidal cast iron		ferritic	17	160
			pearlitic	18	-
	Malleable cast iron		ferritic	19	130
			pearlitic	20	230
<b>N</b>	Aluminum wrought alloys	non hardened		21	60
		hardened		22	100
	Aluminum cast alloys	non hardened	< 12% Si	23	80
		hardened	< 12% Si	24	90
		non hardened	> 12% Si	25	130
	Copper and copper alloys (bronze, brass)		machining alloy stock (1% Pb)	26	-
			brass, red bronze	27	90
			bronze	28	100
			lead-free copper and electrolytic copper	29	100
	Non-metallic materials		thermosetting plastics	29	-
		fiber-reinforced plastics	29	-	
		hard rubber	30	-	
<b>S</b>	Heat-resistant alloys	annealed	Fe-base	31	200
		hardened	Fe-base	32	280
		annealed	Ni or Co-base	33	250
		hardened	Ni or Co-base 30 - 58 HRC	34	-
		cast	Ni or Co-base 1500 - 2200 N/mm <sup>2</sup>	35	-
	Titanium alloys		pure titanium	36	R <sub>m</sub> 440*
		alpha + beta alloys	37	R <sub>m</sub> 1050*	
<b>H</b>	Tempered steel	hardened and tempered		38	55 HRC
		hardened and tempered		39	60 HRC
	Chilled castings	cast		40	400
	Tempered cast iron	hardened and tempered		40	55 HRC

\* R<sub>m</sub> = ultimate tensile strength, measured in MPa



Uncoated carbide			Coated carbide			
H210T	H216T	CTWN425*	CTCP425	CTPP430	CTCP435	CTPP435*
$v_c$ [sfpm]	$v_c$ [sfpm]	$v_c$ [sfpm]	$v_c$ [sfpm]	$v_c$ [sfpm]	$v_c$ [sfpm]	$v_c$ [sfpm]
-	-	-	492 - 985	394 - 821	460 - 919	197 - 755
-	-	-	394 - 722	263 - 591	328 - 657	197 - 525
-	-	-	328 - 657	197 - 525	263 - 591	164 - 427
-	-	-	394 - 722	263 - 591	328 - 657	197 - 525
-	-	-	328 - 591	197 - 492	263 - 525	164 - 427
-	-	-	263 - 492	197 - 427	230 - 460	164 - 328
-	-	-	361 - 624	263 - 558	328 - 591	197 - 460
-	-	-	230 - 492	164 - 427	197 - 460	131 - 328
-	-	-	361 - 722	164 - 657	328 - 657	131 - 657
-	-	-	328 - 591	164 - 492	263 - 492	131 - 492
-	-	-	394 - 722	164 - 525	328 - 657	131 - 657
-	-	-	328 - 657	164 - 591	328 - 591	131 - 591
-	-	-	-	164 - 427	-	131 - 328
-	-	-	-	164 - 394	-	131 - 263
455 - 656	394 - 525	263 - 460	427 - 919	394 - 657	394 - 821	328 - 591
328 - 525	294 - 458	197 - 394	427 - 919	328 - 591	394 - 821	263 - 525
522 - 656	425 - 558	295 - 492	394 - 919	394 - 657	361 - 821	328 - 591
361 - 492	294 - 425	197 - 361	394 - 919	328 - 591	361 - 821	263 - 525
525 - 722	458 - 656	197 - 591	361 - 919	295 - 525	328 - 821	328 - 657
458 - 589	394 - 525	328 - 460	361 - 919	230 - 492	328 - 821	295 - 525
984 - 9840	984 - 11480	263 - 6566	-	263 - 6566	263 - 6566	263 - 6566
656 - 8200	656 - 6560	263 - 4925	-	263 - 4925	263 - 4925	263 - 4925
1312 - 6560	1312 - 4920	263 - 4925	-	263 - 4925	263 - 4925	263 - 4925
1312 - 5904	1312 - 4920	263 - 4268	-	263 - 4268	263 - 4268	263 - 4268
656 - 3280	656 - 2624	263 - 1970	-	263 - 1970	263 - 1970	263 - 1970
820 - 2624	820 - 1968	263 - 1313	-	263 - 1313	263 - 1313	263 - 1313
656 - 2624	656 - 1968	263 - 1313	-	263 - 1313	263 - 1313	263 - 1313
492 - 1968	492 - 1312	263 - 985	-	263 - 985	263 - 985	263 - 985
492 - 1312	492 - 984	263 - 657	-	263 - 657	263 - 657	263 - 657
328 - 7216	261 - 589	66 - 525	-	197 - 525	197 - 525	197 - 525
263 - 656	197 - 492	197 - 460	-	164 - 460	164 - 460	164 - 460
328 - 656	328 - 820	164 - 657	-	263 - 657	263 - 657	263 - 657
115 - 164	-	263 - 131	-	66 - 295	66 - 164	66 - 164
82 - 130	-	82 - 98	-	66 - 295	66 - 131	66 - 131
82 - 130	-	66 - 98	-	66 - 295	49 - 66	49 - 66
66 - 97	-	66 - 82	-	66 - 295	33 - 66	33 - 66
48 - 82	-	49 - 82	-	66 - 295	33 - 66	33 - 66
261 - 458	-	49 - 328	-	131 - 328	164 - 394	164 - 394
130 - 328	-	98 - 197	-	98 - 295	98 - 164	98 - 164
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

\* EcoCut Mini



### Mounting of the insert

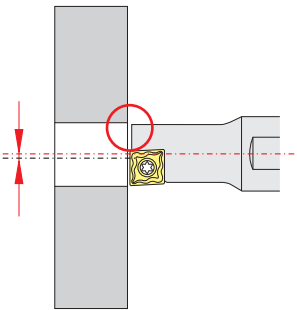
For tools  $\varnothing$  8 mm right-hand or left-hand inserts are required.  
From  $\varnothing$  10-32 mm neutral inserts are applied.



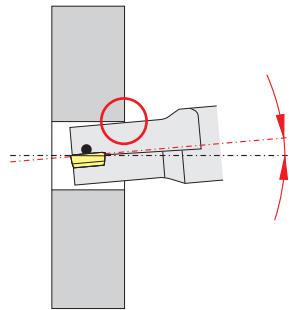
### Through hole

With through holes a sharp-edged disk is created as tool break-out occurs. Safety measures are necessary.

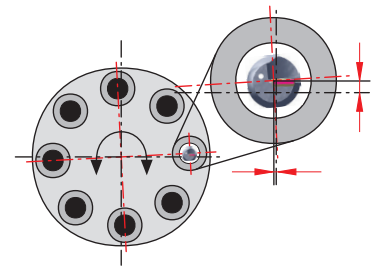
### Axial displacement of the machine



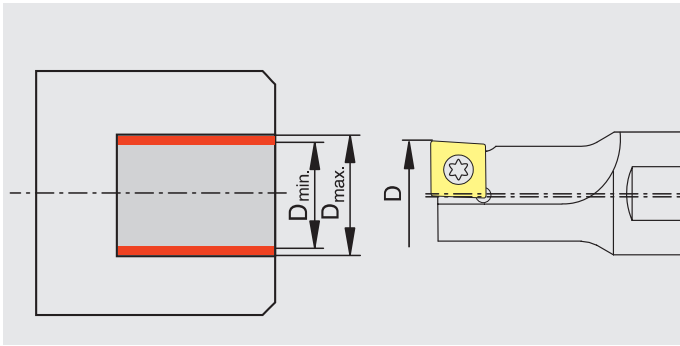
Displacement in x-direction



Angular error



Turret position error



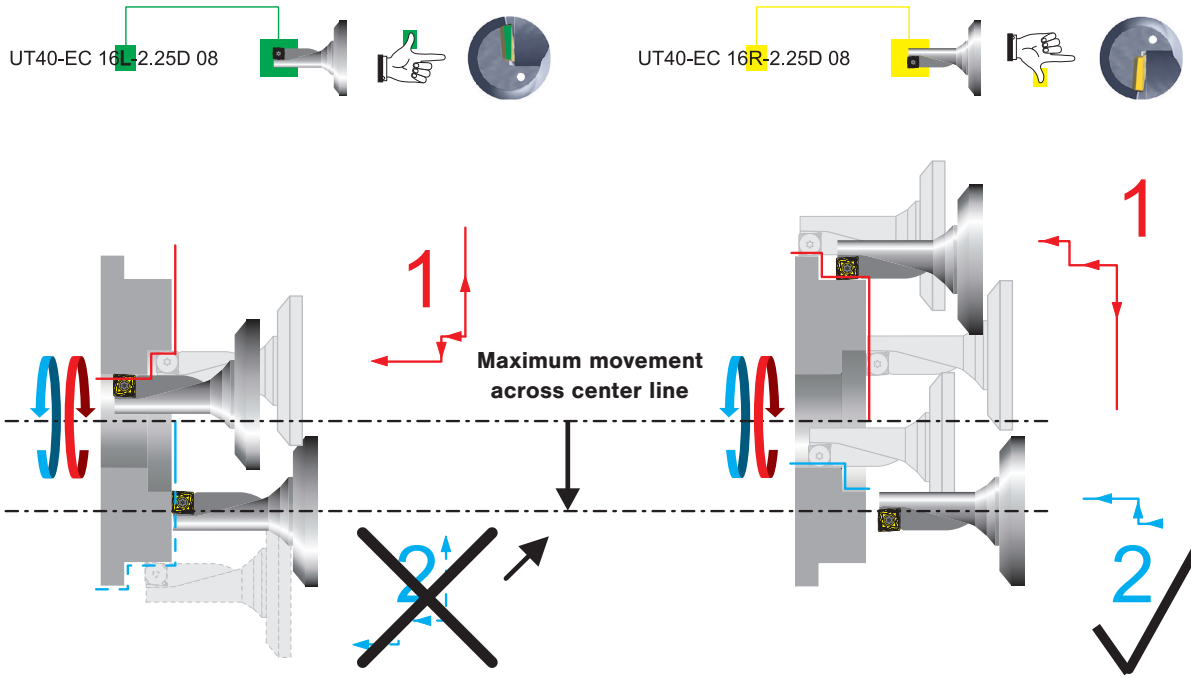
## Off-center drilling

Thanks to the special construction of EcoCut tools and inserts off-center drilling is possible. Thus desired deviations from the tool's nominal diameter can be obtained (see table below).

Type of tool Solid carbide	Nominal tool D [inch]	Work piece bore diameter	
		D <sub>min</sub> [inch]	D <sub>max</sub> [inch]
ECM 04 L/R - 2.25D	.157	.154	.165
ECM 05 L/R - 2.25D	.197	.193	.205
ECM 06 L/R - 2.25D	.236	.232	.244
ECM 07 L/R - 2.25D	.276	.272	.283
ECM 08 L/R - 2.25D	.315	.311	.323

Type of tool	Nominal tool D [inch]	Work piece bore diameter	
		D <sub>min</sub> [inch]	D <sub>max</sub> [inch]
ECC 08 L/R - ... 04	.315	.309	.327
ECC 10 L/R - ... 05	.394	.388	.413
ECC 12 L/R - ... 06	.472	.467	.492
ECC 14 L/R - ... 07	.551	.542	.571
ECC 16 L/R - ... 08	.63	.624	.65
ECC 18 L/R - ... 09	.709	.703	.728
ECC 20 L/R - ... 10	.787	.78	.807
ECC 25 L/R - ... 13	.984	.976	1.016
ECC 32 L/R - ... 17	1.26	1.252	1.299

## Machining across center line

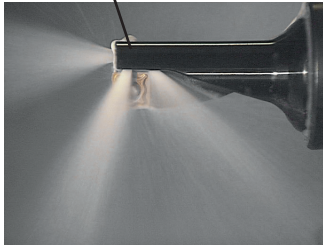
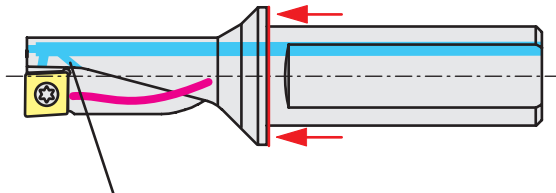
**Situation:**

In case of insufficient movement of the machine across the center line the external diameter cannot be machined with the same tool.

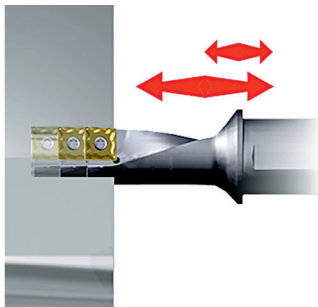
**Solution**

Use a right-hand EcoCut tool.

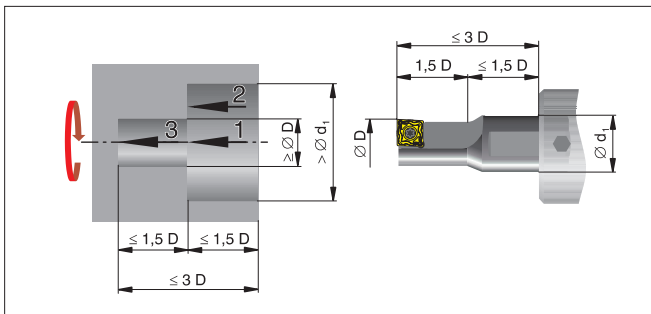
Chip booster/coolant pressure



EcoCut offers an innovative detail solution for **range 2.25D**, namely additional bidirectional coolant supply for better chip evacuation. An additional **backwards directed coolant stream** improves chip transportation from the flute area. Minimum coolant pressure required 22 - 44 psi.



If the necessary coolant pressure is not available, it can be advantageous to interrupt the cutting action in order to clear the bore.



Deep bores up to 3xD

With a stepped bore approach EcoCut tools EC..15D can be machined with holes of up to three times the nominal diameter (see picture). Operation sequences 1, 2 and 3 respectively should be followed.

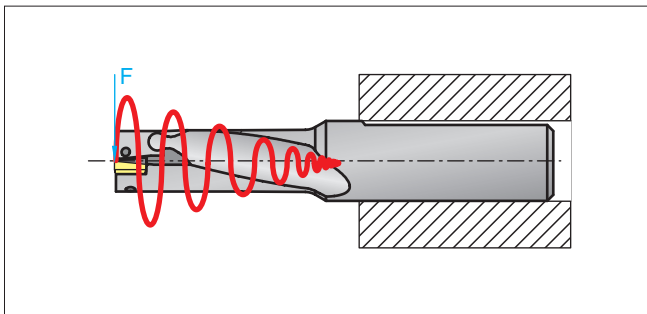
## The advantages of DENSIMET compared to steel

Our EcoCut 3.0D series offers maximized performance. The tools have been developed for bigger drilling depths and maximum precision requirements. The material used here is DENSIMET, a PLANSEE tungsten heavy metal alloy. The high modulus of elasticity as well as its density give this alloy

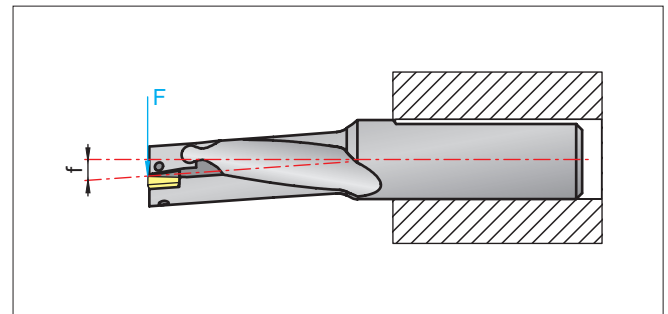
very good vibration-damping and minimal deflection properties. The result is highest precision and repeatability, excellent surface quality and improved tool life.



Material	Nominal tool Ø Modulus of elasticity (N/mm <sup>2</sup> )	Density (g/mm <sup>3</sup> )
Steel	210 000	7,85
<b>DENSIMET</b>	360 000	17,50

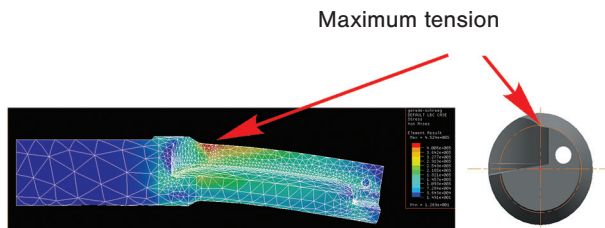


Vibration-damping

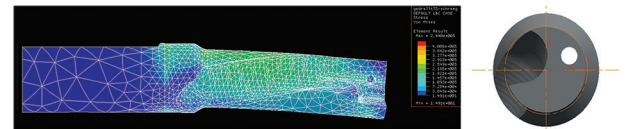


40% lower deflection than steel

### Chip flute design

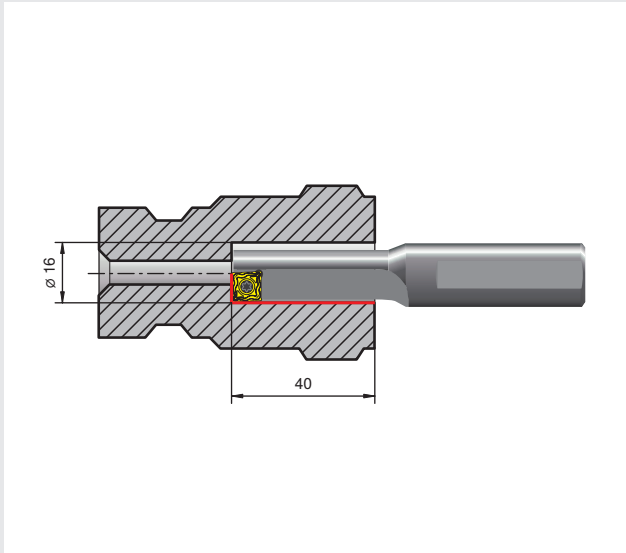


Version with straight chip flute



Version with helical chip flute

Up to 50% reduced tensions in the tool through Finite Element Modelling (FEM), optimized chip pocket design.



### Technical data

<b>Work piece</b>	bush
<b>Material</b>	C45 ANSI 1045
<b>Tensile strength</b>	730 - 900 N/mm <sup>2</sup>
<b>Tool</b>	ECC 16L-3.0D 08 H
<b>Insert</b>	XCNT 080304EN CTCP435
<b>Competitor</b>	2 tools

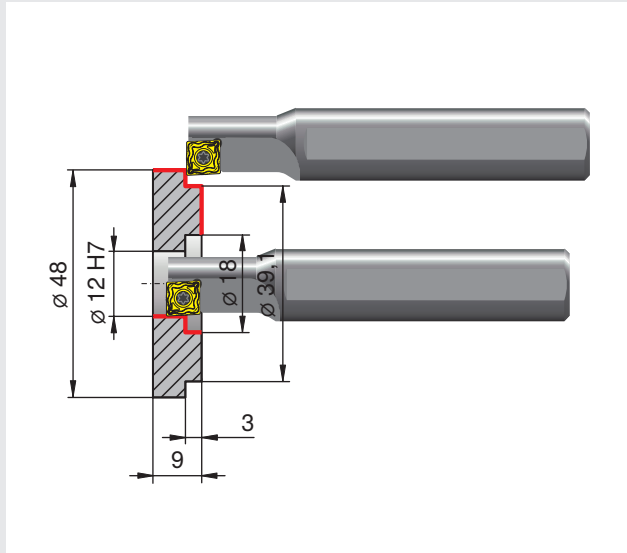
		Drilling
V <sub>c</sub>	[inch/min]	6.929
f	[inch]	.002
a <sub>p</sub>	[Ø inch]	.63

### Criteria

- Deep hole with 90° shoulder applying only one tool

### Result

- Machining time reduced by 50% compared to original machining method



### Technical data

<b>Work piece</b>	flange
<b>Material</b>	ANSI 5115
<b>Tensile strength</b>	800 - 900 N/mm <sup>2</sup>
<b>Tool</b>	ECC 12L-1.5D 06
<b>Insert</b>	XCNT 060204EN CTCP435
<b>Competitor</b>	3 tools

		Drilling	Boring	Face turning	External turning
V <sub>c</sub>	[inch/min]	5.906	5.906	7.874	5.906
f	[inch]	.001	.004	.004	.004

### Criteria

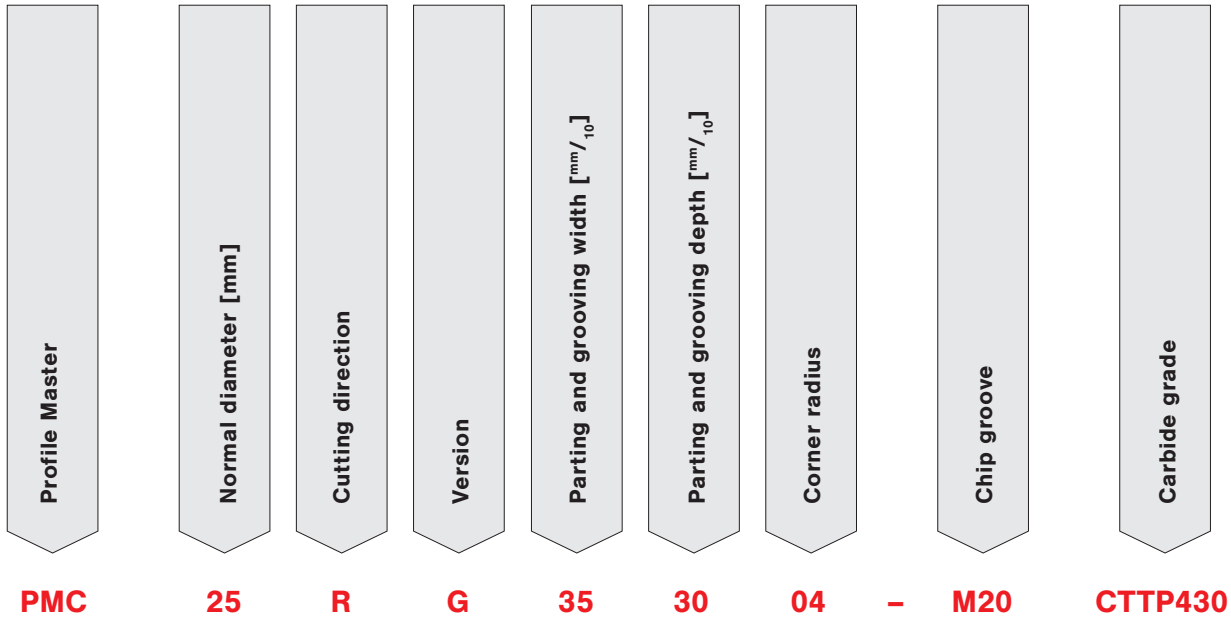
- Increase in productivity
- Fewer tools in the turret
- Reduction of tooling costs

### Result

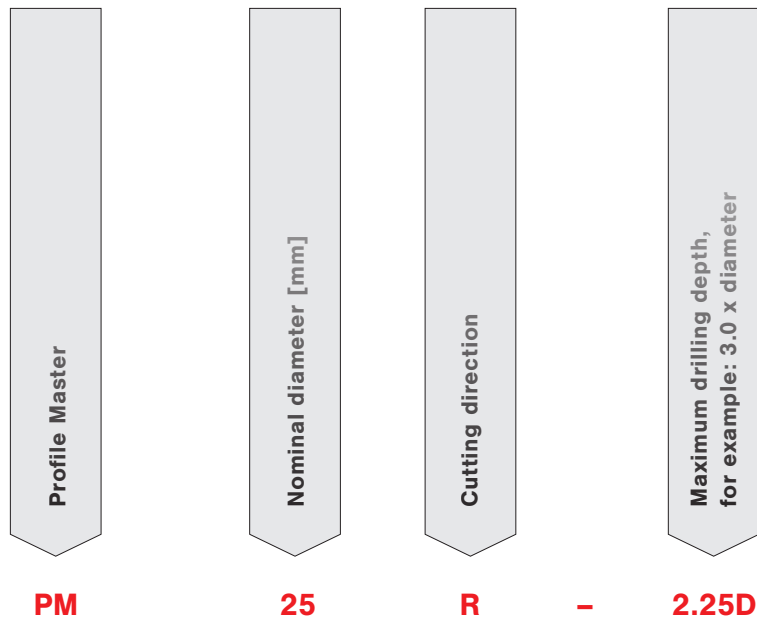
- 1 tool instead of 3
- Machining time reduced by 45%
- 2 additional tools in the turret



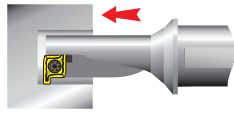
Inserts



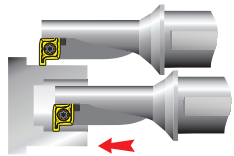
Tools



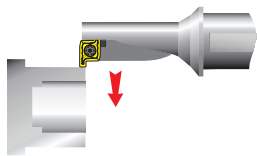
## Machining methods - radial application 90°



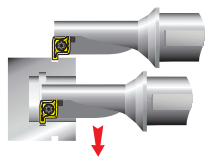
**1** Drilling into solid material with flat bottom holes



**2** Boring applications



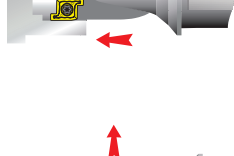
**3** External turning applications



**4** Internal turning applications



**5** Turning of face profiles

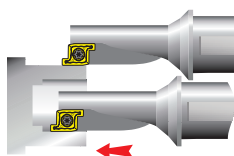


**6** External radial grooving

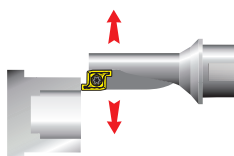


**7** Internal radial grooving

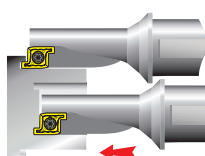
## Machining methods - radial application 0°



**1** External turning applications



**2** Boring applications



**3** Turning of face profiles




**4** External radial grooving

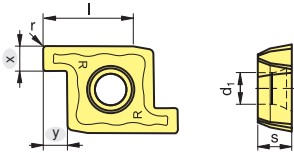


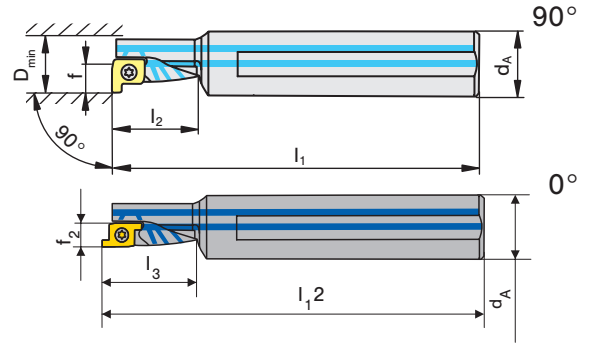
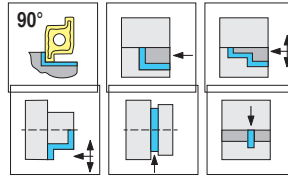
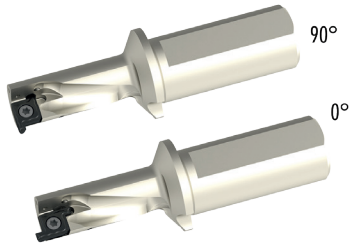
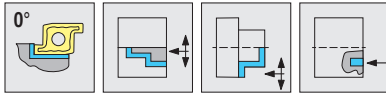
**5** Internal radial grooving



When changing from internal to external machining, reverse direction of rotation

		P	M	K	N	S	H	CTPP430 DRAGONSKIN	CTCP435 DRAGONSKIN				x	y	l	s	d <sub>1</sub>	r	
													[in]	[in]	[in]	[in]	[in]	[in]	[in]
-M20			●					●					.079	.059	.197	.083	.083	.016	
		PM 10RG 201504	●											.079	.059	.197	.083	.083	.016
		PM 12LG 201804	●											.079	.071	.236	.091	.098	.016
		PM 12RG 201804	●											.079	.071	.236	.091	.098	.016
		PM 16LG 252004	●											.098	.079	.315	.110	.134	.016
		PM 16RG 252004	●											.098	.079	.315	.110	.134	.016
		PM 20LG 302504	●							●				.118	.098	.394	.150	.161	.016
		PM 20LG 302504	●											.118	.098	.394	.150	.161	.016
		PM 20RG 302504	●											.118	.098	.394	.150	.161	.016
		PM 25LG 353004	●											.138	.118	.492	.177	.173	.016
		PM 25RG 353004	●								●			.138	.118	.492	.177	.173	.016
		PM 25RG 353004	●											.138	.118	.492	.177	.173	.016
		PM 32LG 404004	●											.157	.157	.630	.217	.236	.016
		PM 32RG 404004	●											.157	.157	.630	.217	.236	.016
								CTPP430 DRAGONSKIN	CTCP435 DRAGONSKIN				x	y	l	s	d <sub>1</sub>	r	



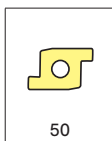
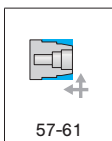


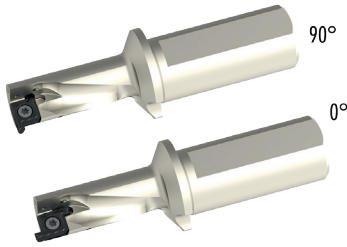
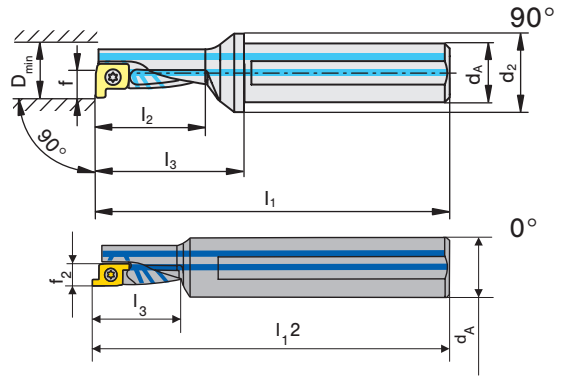
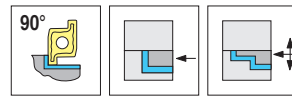
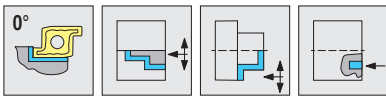
ProfileMaster Tools

Multi-function tools

D <sub>min</sub> [in]	Type, description	LNR 	d <sub>A</sub> [in]	l <sub>1</sub> [in]	l <sub>1,2</sub> (0°) [in]	l <sub>2</sub> [in]	l <sub>3</sub> (0°) [in]	f [in]	f <sub>2</sub> (0°) [in]	Torque moment [ft lb]		
.394	PM 10L-1.5D-E	L	.500	3.150		.591		.197		.295	PM 10R/L...	E01
.394	PM 10R-1.5D-E	R	.500	3.150		.591		.197		.295	PM 10R/L...	E01
.472	PM 12L-1.5D-E	L	.625	3.543		.709		.236		.738	PM 12R/L...	E02
.472	PM 12R-1.5D-E	R	.625	3.543		.709		.236		.738	PM 12R/L...	E02
.630	PM 16L-1.5D-E	L	.750	5.000	5.012	.945	1.035	.315	.224	1.623	PM 16R/L...	E03
.630	PM 16R-1.5D-E	R	.750	5.000	5.012	.945	1.035	.315	.224	1.623	PM 16R/L...	E03
.787	PM 20L-1.5D-E	L	1.000	5.906	6.016	1.181	1.291	.394	.283	1.623	PM 20R/L...	E04
.787	PM 20R-1.5D-E	R	1.000	5.906	6.016	1.181	1.291	.394	.283	1.623	PM 20R/L...	E04
.984	PM 25L-1.5D-E	L	1.250	7.087	7.217	1.476	1.606	.492	.362	2.360	PM 25R/L...	E05
.984	PM 25R-1.5D-E	R	1.250	7.087	7.217	1.476	1.606	.492	.362	2.360	PM 25R/L...	E05
1.260	PM 32L-1.5D-E	L	1.500	7.874	8.043	1.890	2.059	.630	.461	3.688	PM 32R/L...	E06
1.260	PM 32R-1.5D-E	R	1.500	7.874	8.043	1.890	2.059	.630	.461	3.688	PM 32R/L...	E06

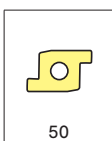
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E02	169858-7883215/M2,2X4,0/T07		8095010100-SD-T07
E03	169857-7883214/M3,0X5,7/T08		8095010200-SD-T08
E04	54976-7722111/M3,5X7,2/T15		8095010500-SD-T15
E05	165795-7883209/M3,5X8,6/T15		8095010500-SD-T15
E06	12052233-M5,0X10,8-20IP/10022539		8095010600-SD-T20



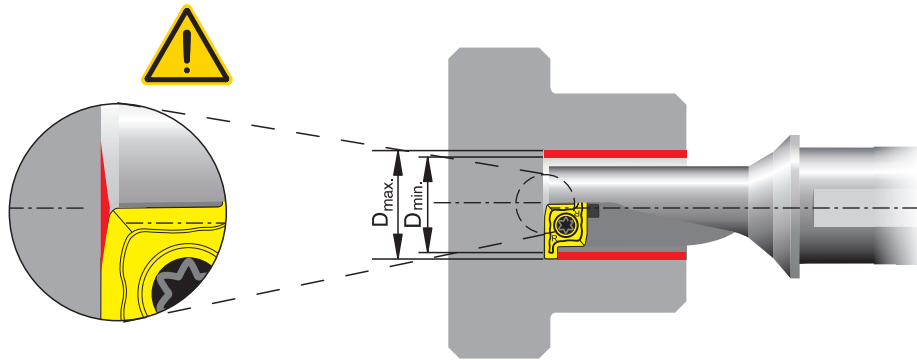


D <sub>min</sub> [in]	Type, description	L N R	d <sub>A</sub> [in]	l <sub>1</sub> [in]	l <sub>2</sub> (0°) [in]	l <sub>2</sub> [in]	l <sub>3</sub> (0°) [in]	f [in]	f <sub>2</sub> (0°) [in]	Torque moment [ft lb]		
.394	PM 10L-2.25D-E	L	.500	2.821		.846		.197		.295	PM 10R/L...	E01
.394	PM 10R-2.25D-E	R	.500	2.821		.846		.197		.295	PM 10R/L...	E01
.472	PM 12L-2.25D-E	L	.625	3.049		1.024		.236		.738	PM 12R/L...	E02
.472	PM 12R-2.25D-E	R	.625	3.049		1.024		.236		.738	PM 12R/L...	E02
.630	PM 16L-2.25D-E	L	.750	3.832	3.911	1.339	1.417	.315	.224	1.623	PM 16R/L...	E03
.630	PM 16R-2.25D-E	R	.750	3.832	3.911	1.339	1.417	.315	.224	1.623	PM 16R/L...	E03
.787	PM 20L-2.25D-E	L	1.000	4.413	4.512	1.693	1.791	.394	.283	1.623	PM 20R/L...	E04
.787	PM 20R-2.25D-E	R	1.000	4.413	4.512	1.693	1.791	.394	.283	1.623	PM 20R/L...	E04
.984	PM 25L-2.25D-E	L	1.250	5.233	5.312	2.116	2.244	.492	.362	2.360	PM 25R/L...	E05
.984	PM 25R-2.25D-E	R	1.250	5.233	5.312	2.116	2.244	.492	.362	2.360	PM 25R/L...	E05
1.260	PM 32L-2.25D-E	L	1.500	6.215	6.293	2.717	2.874	.630	.461	3.688	PM 32R/L...	E06
1.260	PM 32R-2.25D-E	R	1.500	6.215	6.293	2.717	2.874	.630	.461	3.688	PM 32R/L...	E06

E01	11161940-10001230/M1,8X3,8/T06		8095010000-SD-T06
E02	169858-7883215/M2,2X4,0/T07		8095010100-SD-T07
E03	169857-7883214/M3,0X5,7/T08		8095010200-SD-T08
E04	54976-7722111/M3,5X7,2/T15		8095010500-SD-T15
E05	165795-7883209/M3,5X8,6/T15		8095010500-SD-T15
E06	12052233-M5,0X10,8-20IP/10022539		8095010600-SD-T20



## Off-center drilling



Due to the special construction of ProfileMaster tools and inserts off-centre drilling is possible. Thus desired deviations from the tool's nominal diameter can be obtained (see table below).

Type of tool	Nominal tool diameter	Drilling diameter (work piece)	
	D [mm]	D <sub>min</sub> [mm]	D <sub>max</sub> [mm]
PMC 10R/L ...	10	9,85	12
PMC 12R/L ...	12	11,85	15
PMC 16R/L ...	16	15,85	19
PMC 20R/L ...	20	19,80	24
PMC 25R/L ...	25	24,80	29
PMC 32R/L ...	32	31,80	38

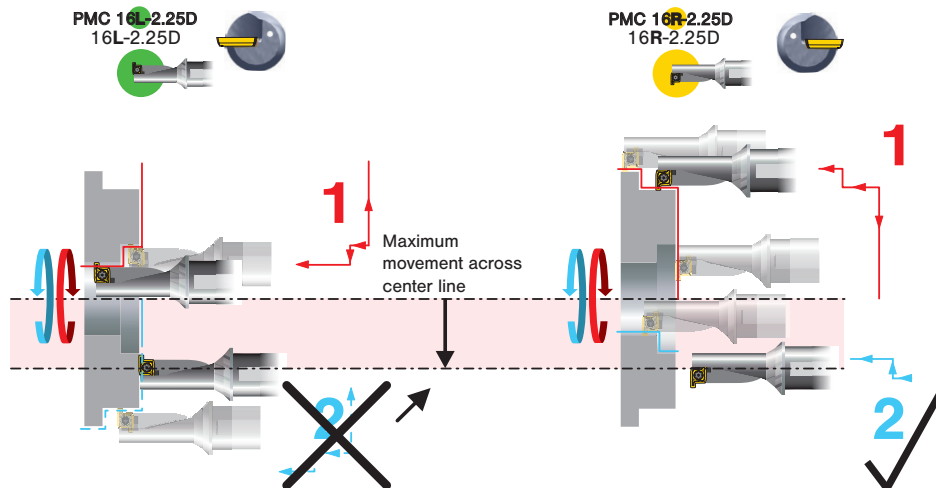
## Machining across center line

### Situation:

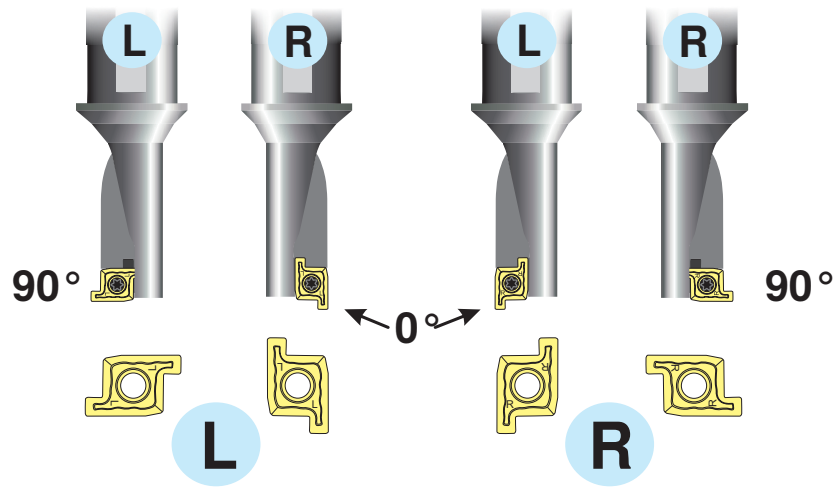
In case of insufficient movement of the machine across the centre line the external diameter cannot be machined with the same tool.

### Solution:

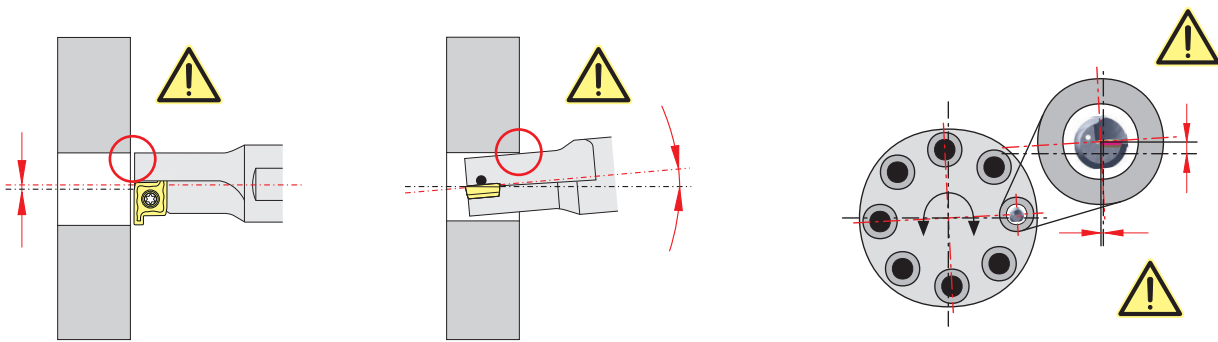
Use a right-hand ProfileMaster tool.



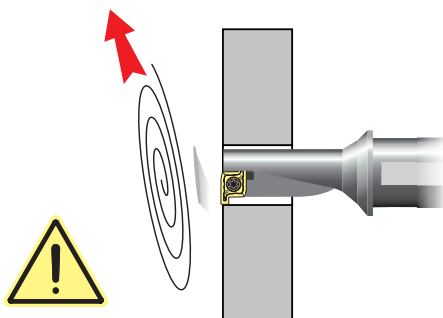
Mounting of the insert



Axial displacement of the machine



Through hole



With through holes a **sharp-edged disk** as tool break-out occurs. Safety measures are necessary.

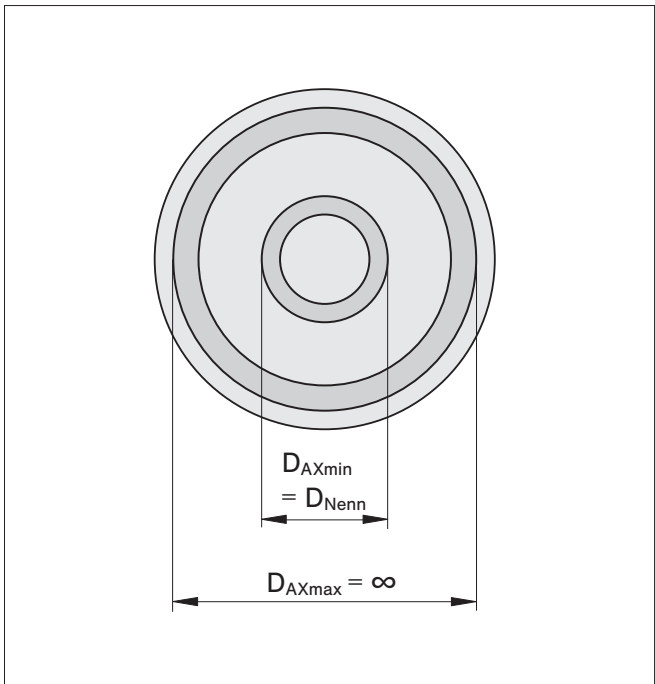
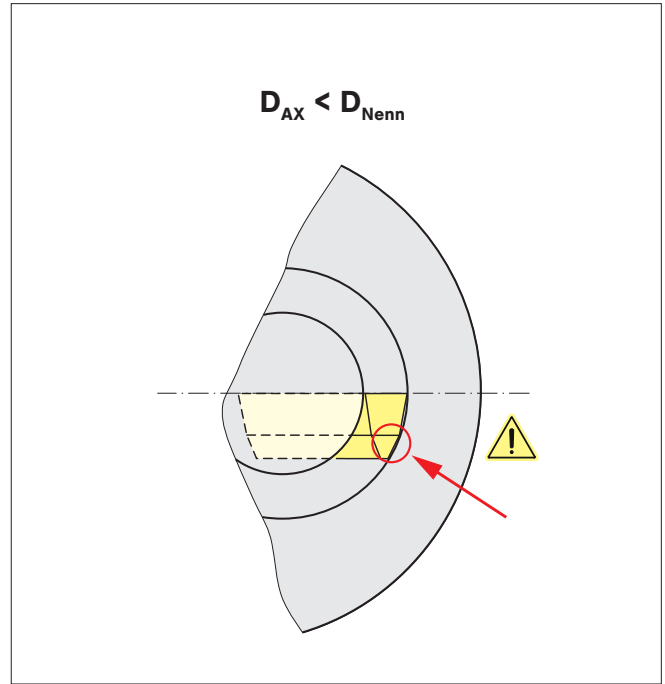
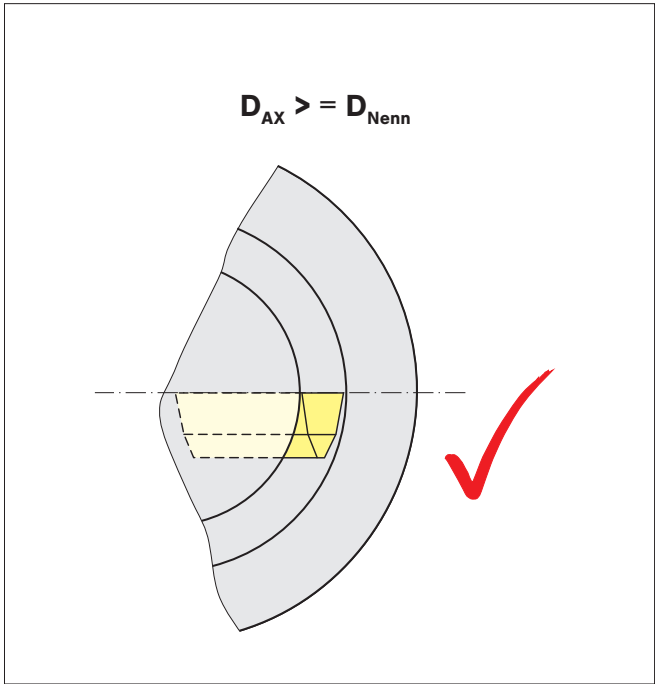
**Axial grooving - application 0°**

$D_{AXmin} = D_{Nenn}$

0° 90°

**!** With PMC 10 and PMC 12 axial grooving is not possible.

$D_{Nenn}$ Inch	$D_{AXmin}$ Inch	$D_{AXmax}$ Inch
.630	.630	∞
.787	.787	∞
.984	.984	∞
1.260	1.260	∞



If the first cut is carried out with a diameter which is smaller than the nominal tool diameter  $D_{Nenn}$  (90° application), collision will result.

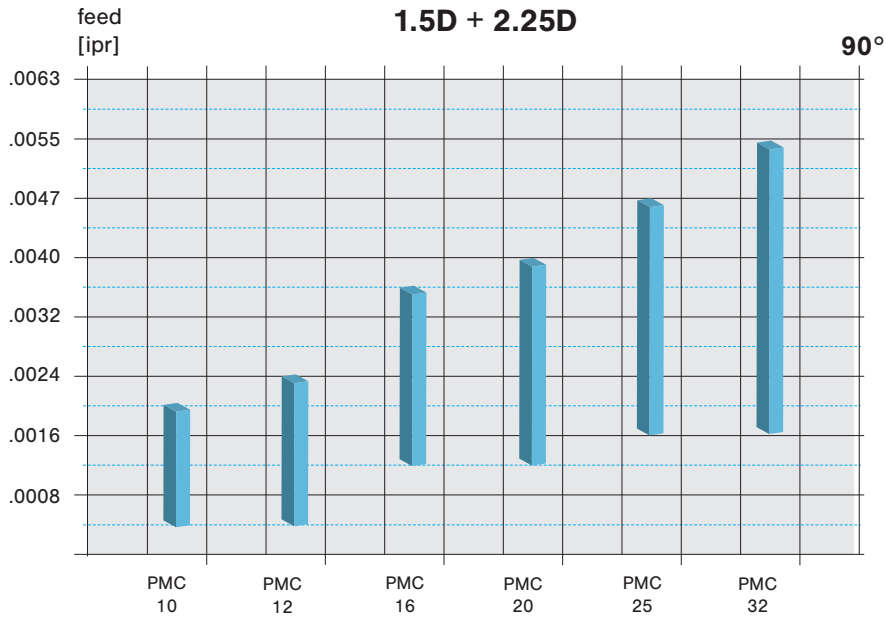
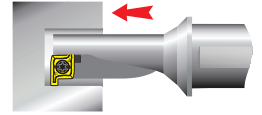


	<p><b>Criteria:</b></p> <ul style="list-style-type: none"> <li>▲ Problems due to lack of turret positions &gt;</li> <li>▲ Optimisation of machining time</li> </ul>										
<p><b>Technical data:</b></p> <table border="0"> <tr> <td>Work Piece:</td> <td>HSK100 ADAPTER 1.2343 / X38</td> </tr> <tr> <td>Material:</td> <td>CrMoV 5 1</td> </tr> <tr> <td>Tensile Strength</td> <td>approx. 1100 N/mm<sup>2</sup></td> </tr> <tr> <td>Insert:</td> <td>PM 16RG 252004-M20 CTP2440</td> </tr> <tr> <td>Competitor:</td> <td>2 tools</td> </tr> </table>	Work Piece:	HSK100 ADAPTER 1.2343 / X38	Material:	CrMoV 5 1	Tensile Strength	approx. 1100 N/mm <sup>2</sup>	Insert:	PM 16RG 252004-M20 CTP2440	Competitor:	2 tools	<p><b>Results:</b></p> <ul style="list-style-type: none"> <li>▲ Only 1 tool instead of 2 &gt;</li> <li>▲ 1 free turret position</li> </ul> <p><b>Cutting Parameters:</b></p> <p><math>V_c = 492</math> sfm  <math>f = .0059</math> inch/rev.  <math>a_p = .0394</math> inch</p>
Work Piece:	HSK100 ADAPTER 1.2343 / X38										
Material:	CrMoV 5 1										
Tensile Strength	approx. 1100 N/mm <sup>2</sup>										
Insert:	PM 16RG 252004-M20 CTP2440										
Competitor:	2 tools										

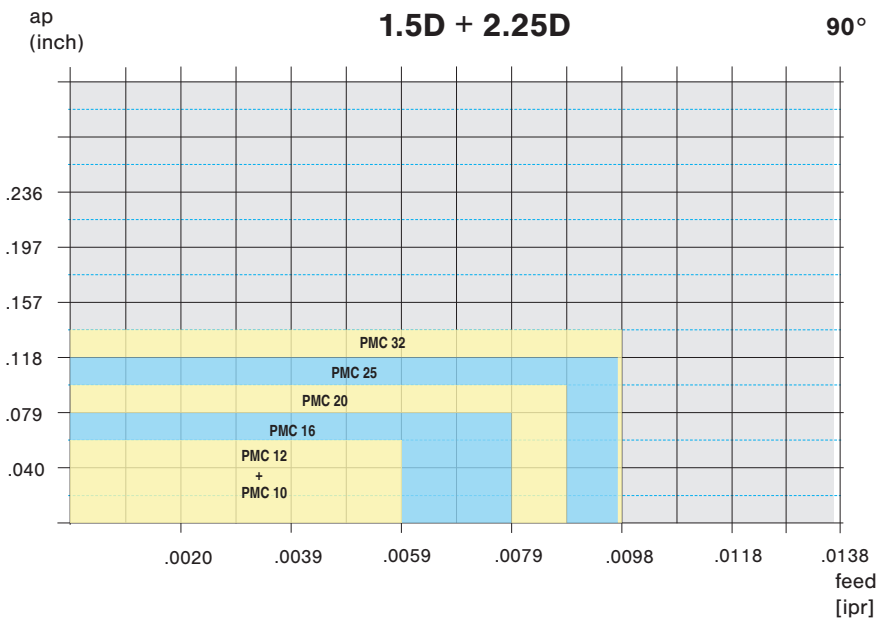
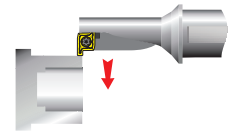
	<p><b>Criteria:</b></p> <ul style="list-style-type: none"> <li>▲ Increase in productivity &gt;</li> <li>▲ 1 free turret position</li> </ul>																						
<p><b>Technical data:</b></p> <table border="0"> <tr> <td>Work piece:</td> <td>piston</td> </tr> <tr> <td>Material:</td> <td>1.756 / 35SPb20+C</td> </tr> <tr> <td>Tool:</td> <td>PMC 16R-1.5D</td> </tr> <tr> <td>Insert:</td> <td>PM 16RG 252004-M20 CTC1435</td> </tr> <tr> <td>Competitor</td> <td>2 tools</td> </tr> </table>	Work piece:	piston	Material:	1.756 / 35SPb20+C	Tool:	PMC 16R-1.5D	Insert:	PM 16RG 252004-M20 CTC1435	Competitor	2 tools	<p><b>Results:</b></p> <ul style="list-style-type: none"> <li>▲ Machining time reduced by 50% &gt;</li> <li>▲ Enhanced groove quality</li> </ul> <table border="1"> <thead> <tr> <th colspan="2">Cutting Parameters:</th> </tr> <tr> <th>CERATIZIT</th> <th>Competitor</th> </tr> </thead> <tbody> <tr> <td><math>V_c = 344</math> sfm</td> <td><math>V_c = 344</math> sfm</td> </tr> <tr> <td><math>a_p = .0118 - .197</math> inch</td> <td><math>a_p = .0118 - .197</math> inch</td> </tr> <tr> <td><math>f_{turning} = .0059</math> inch/rev.</td> <td><math>f_{turning} = .0039</math> inch/rev.</td> </tr> <tr> <td><math>f_{grooving} = .0024</math> inch/rev.</td> <td><math>f_{grooving} = .0024</math> inch/rev.</td> </tr> </tbody> </table>	Cutting Parameters:		CERATIZIT	Competitor	$V_c = 344$ sfm	$V_c = 344$ sfm	$a_p = .0118 - .197$ inch	$a_p = .0118 - .197$ inch	$f_{turning} = .0059$ inch/rev.	$f_{turning} = .0039$ inch/rev.	$f_{grooving} = .0024$ inch/rev.	$f_{grooving} = .0024$ inch/rev.
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CERATIZIT	Competitor																						
$V_c = 344$ sfm	$V_c = 344$ sfm																						
$a_p = .0118 - .197$ inch	$a_p = .0118 - .197$ inch																						
$f_{turning} = .0059$ inch/rev.	$f_{turning} = .0039$ inch/rev.																						
$f_{grooving} = .0024$ inch/rev.	$f_{grooving} = .0024$ inch/rev.																						



Drilling

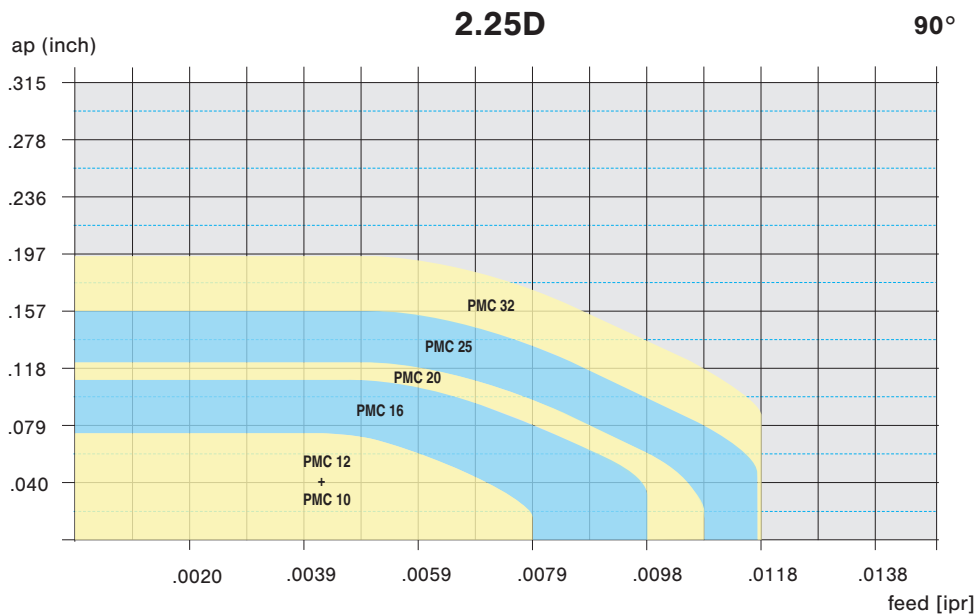
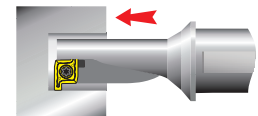
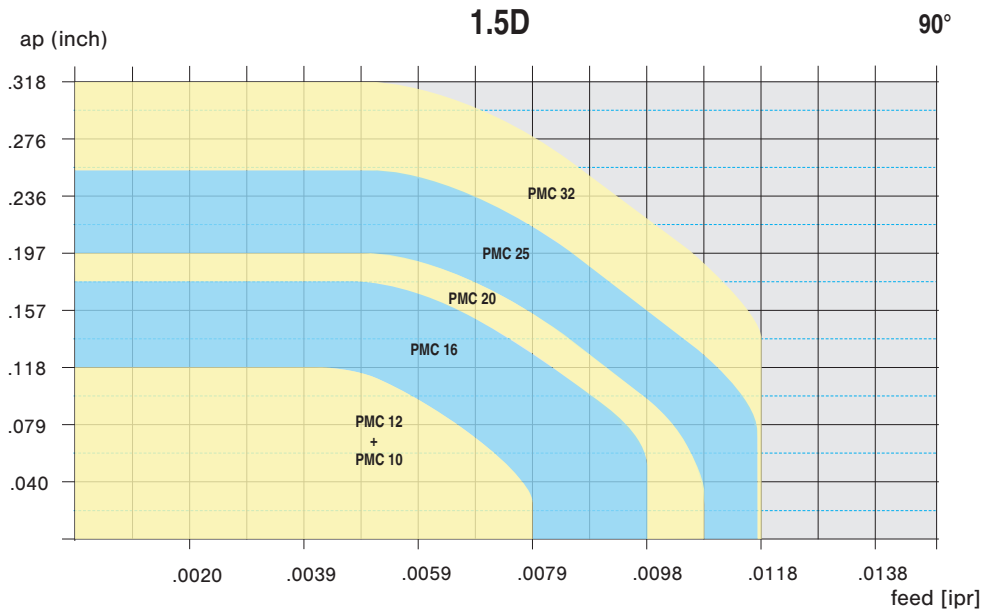
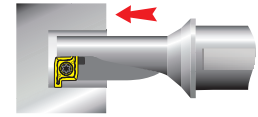


Face turning



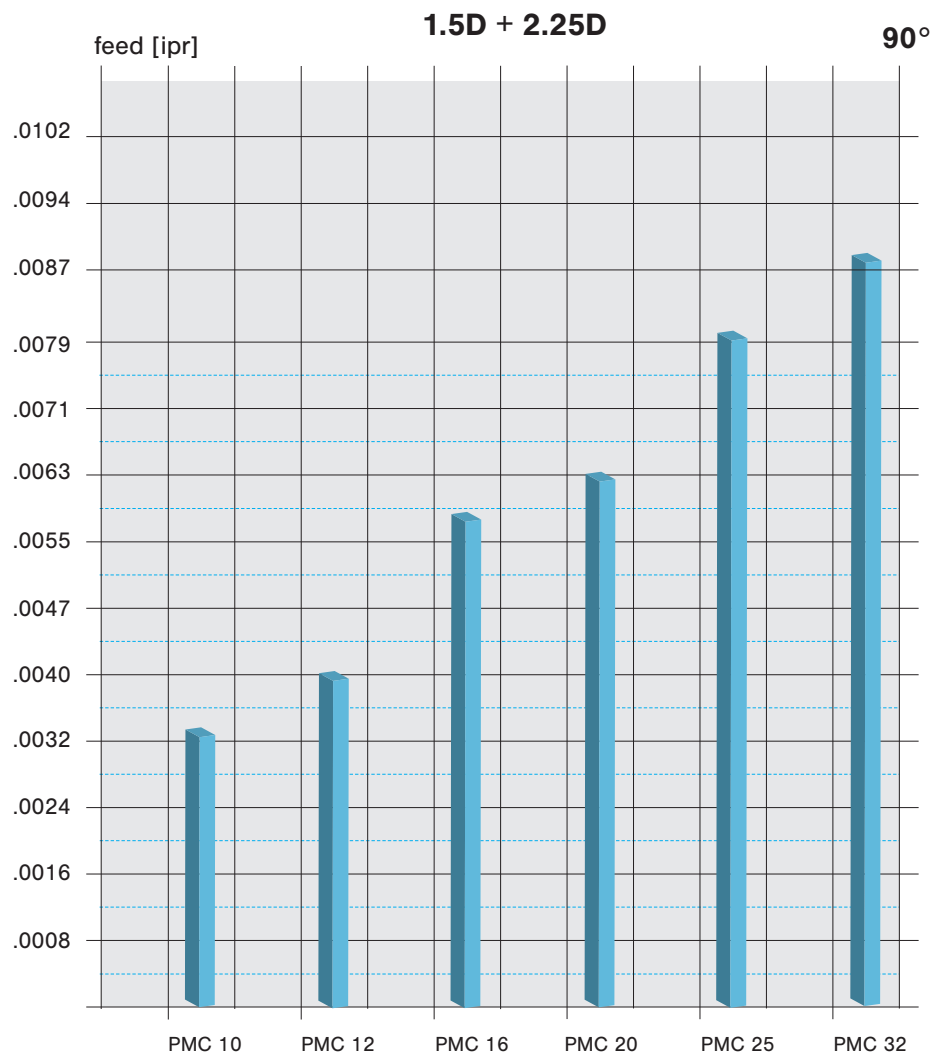
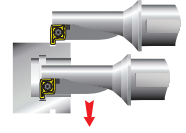


**Longitudinal turning**



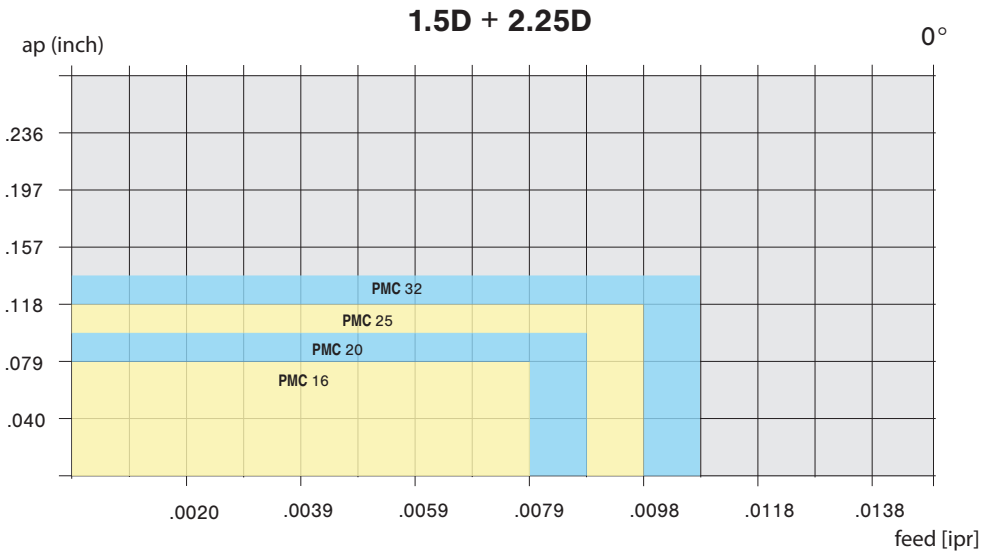
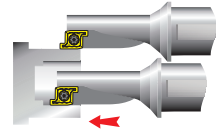


### Radial grooving - internal + external

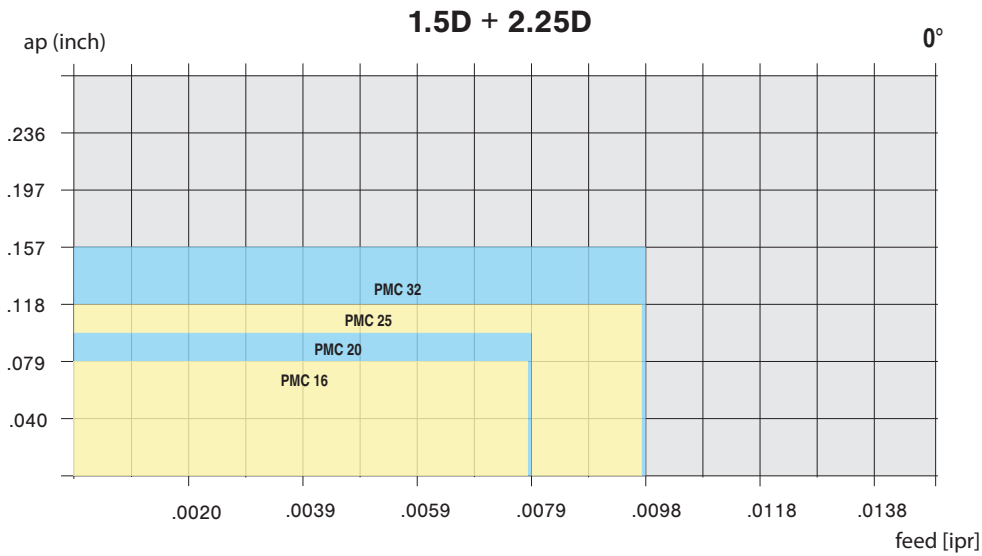
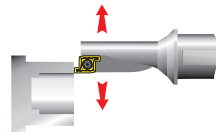




**Longitudinal turning**

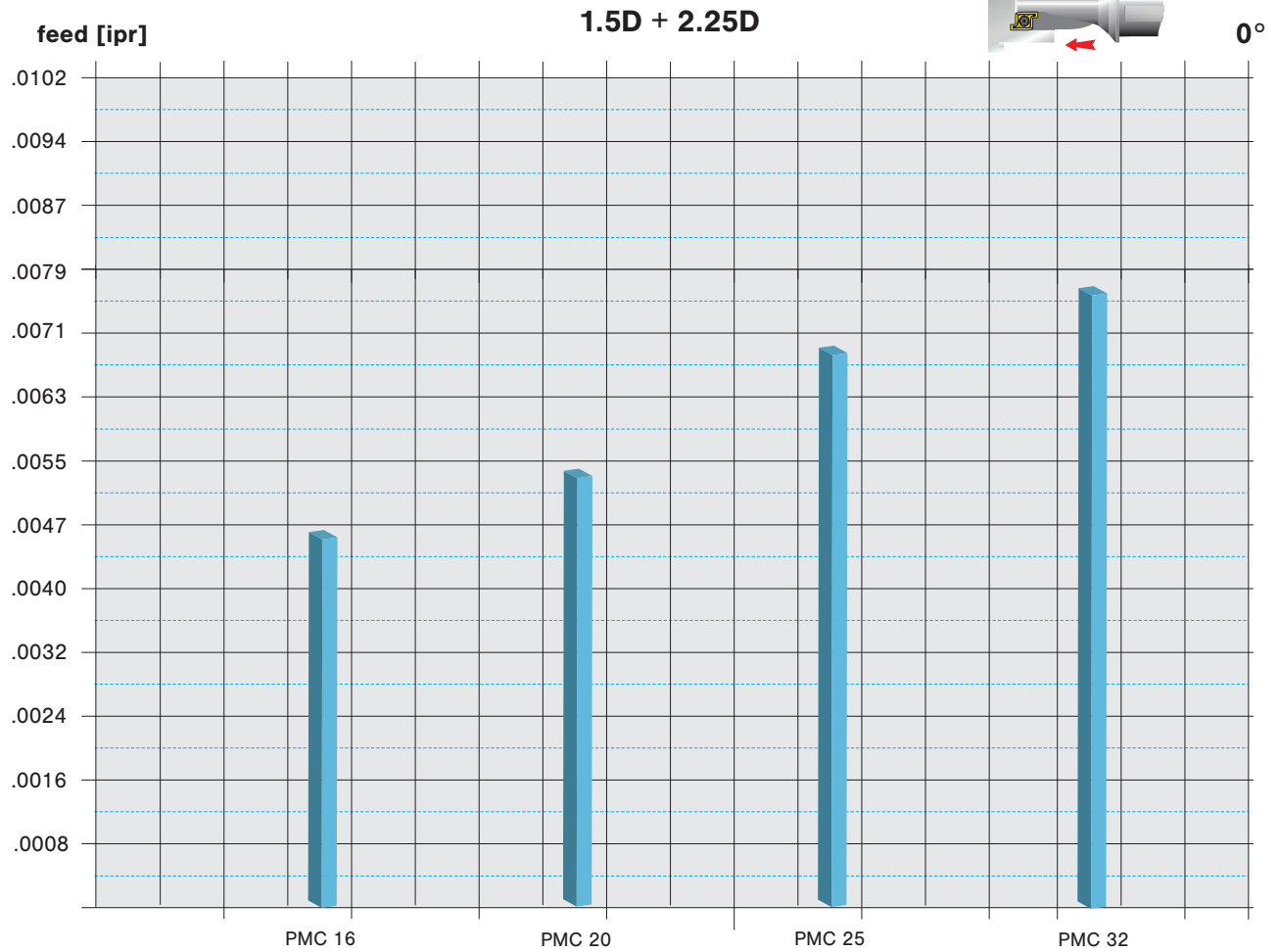


**Face turning**





### Axial grooving - internal + external



With PMC 10 and PMC 12 axial grooving is not possible.

Type of problem								Corrective measures	
Type of wear				Work piece problems		Chip control			
Edge chipping	Built-up edge	Flank wear	Plastic deformation	Vibration	Surface quality	Chip too long (tangled swarf)	Chip too short (fragmented chip)		
	↑	↓	↓	↓ ↑	↓ ↑	↓		Cutting speed	Cutting values
↓		~	↓	↓ ↑	↓	↑	↓	Feed rate	
↑		↑	↑	↓	↑			Corner radius	Selection of inserts
↓		↑	↑					Cutting material	
~				~	~			Clamping of tool	General criteria
~				~	~			Clamping of work piece	
~				~	↓			Overhang	
~		~		~	~			Tip height	
	●	●	●		●	●		Cooling lubricant	

↑ raise, increase, large influence

↑ raise, increase low influence

↓ avoid, reduce large influence

↓ avoid, reduce low influence

~ check, optimise

● use

**Corrective measures**

larger  
↓ ↑  
smaller

wear resistance  
↓ ↑  
toughness

Blank lined area for notes.



Blank lined area for notes, consisting of 20 horizontal grey bars.

Blank lined area for notes, consisting of 18 horizontal grey bars.

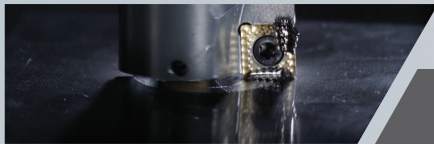


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