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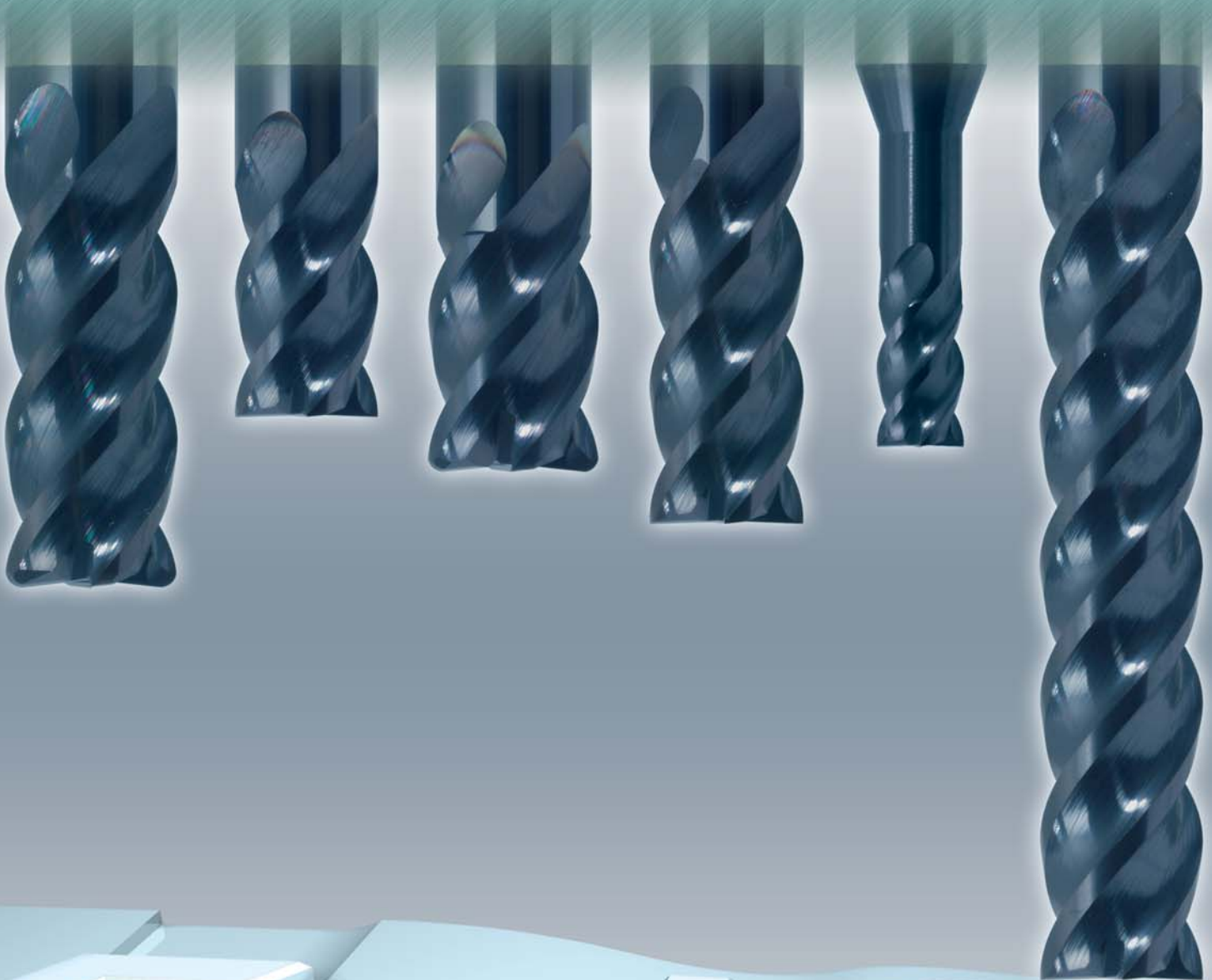
No. 405

Epoch21

EPP Epoch Power Mill

An Innovation in Multifunction End Mill Design

Micro Grain Carbide - TiAlN Century Coated



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 FEATURES

An innovation in end mill design. Can be used efficiently on existing machinery, but to even better effect on equipment using High Speed Machining techniques.

Even at large depths of cut, table feeds of more than twice that of other end milling cutters can be used.

Epoch Power Mill is a multi function cutter, which is used to reduce cycle times of operations on CNC and conventional machines.

Epoch Power Mill have a wide application area, offering long tool life on a variety of materials, from mild steel to heat resisting steels and other difficult to machine materials.

The **Epoch Power Mill** corner radius cutters are suitable for 3D profile features, as well as producing stress free corners. The high helix angle reduces the possibility of chatter. Flute shape ensures smooth ejection of chips, preventing re-cutting and edge damage. Cutter cross section is designed to have maximum rigidity.

 BESONDERHEITEN

Die Innovation im Fräserdesign. Eine neue Fräsergeometrie erlaubt den Einsatz sowohl auf konventionellen Maschinen als auch in der HSC-Technologie.

Auch bei Einsatz mit hohen Auskräglängen können die Tischvorschübe gegenüber herkömmlichen Wettbewerbsfräsern verdoppelt werden.

Epoch Power Mill ist ein Werkzeug, das die Bearbeitungszeiten auf CNC- und konventionellen Maschinen stark reduziert.

Epoch Power Fräser bieten viele Einsatzmöglichkeiten, die darüber hinaus längste Standzeiten in unterschiedlichen Werkstoffen, wie z.B. weichen, hitzebeständigen und schwer zu zerspanenden Stählen ermöglichen.

Epoch Power Mill mit Eckenradius sind sehr gut in der 3D-Bearbeitung einzusetzen, darüber hinaus schützen die Eckenradien die empfindlichen Schneidkanten vor Ausbrüchen. Der starke Drallwinkel verringert den Schnittdruck und somit Vibrationen bei hohen Vorschüben und hohen Auskräglängen. Die Geometrie der Spankammer ermöglicht eine weiche Spanabfuhr und verhindert jeglichen Spänestau oder das nochmalige Schneiden eines Spanes. Der vergrößerte Kerndurchmesser erhöht die Stabilität (Deflektion) des Fräasers.

 CARACTÉRISTIQUES

Une nouvelle innovation dans la géométrie des fraises. Peut être utilisée efficacement sur les machines existantes mais avec de biens meilleurs résultats sur des équipements utilisant les techniques d'usinage grande vitesse.

Même avec de grandes profondeurs de passe, des gammes d'avances supérieures au double de celles des autres fraises peuvent être utilisées. La fraise **Epoch Power Mill** est une fraise multi-usages qui est utilisée pour réduire les temps de cycle sur machines CNC et conventionnelles. Elle offre une grande plage d'utilisation avec une longue durée de vie dans des matériaux variés, de l'acier doux aux aciers réfractaires ainsi que pour d'autres matériaux difficiles à usiner.

Les fraises **Epoch Power Mill** à angle rayonné sont appropriées pour l'usinage en 3D sans angles vifs. L'important angle d'hélice diminue les risques de vibrations. La forme de denture garantit une évacuation régulière des copeaux en évitant le réusinage et la détérioration des arêtes de coupe. La section de l'âme de l'outil est appropriée pour obtenir un maximum de rigidité.

 CARACTERÍSTICAS

La última novedad en diseño de fresas. Capaz de rendir eficazmente en máquinas convencionales, pero todavía más espectacular utilizando las técnicas del mecanizado a alta velocidad.

Incluso en las pasadas más profundas pueden utilizarse avances de mesa de más del doble de lo usual.

La **Epoch Power Mill** es una fresa multifunción que se utiliza para reducir los tiempos de trabajo en centros CNC y máquinas convencionales.

La **Epoch Power Mill** tiene un amplio campo de aplicación y una gran duración en diversos tipos de materiales, desde aceros convencionales hasta templados y otros materiales de difícil mecanización.

Las **Epoch Power Mill** con radio son útiles tanto para el mecanizado 3D como para realizar ángulos de fondo reforzados. Su pronunciada hélice reduce la posibilidad de vibraciones. La forma del canal de desprendimiento expulsa suavemente la viruta evitando el remecanizado de la misma y el mellado del filo. La estructura de la sección transversal está diseñada para obtener una máxima rigidez.

 CARATTERISTICHE

Una innovazione nel design delle frese frontali. Possono essere usate con buon rendimento sulle macchine tradizionali, ma permettono risultati ancora migliori nelle macchine ad alta velocità.

Anche a profondità di taglio elevate è possibile utilizzare velocità di avanzamento della tavola più che doppie rispetto alle altre frese a codolo tradizionali.

Epoch Power Mill è una fresa multifunzionale utilizzata per ridurre i tempi di ciclo della lavorazione su macchine a controllo numerico e su macchine convenzionali.

Le frese **Epoch Power Mill** hanno un'ampia gamma di applicazioni, permettendo una lunga durata dell'utensile su una ampia gamma di materiali che va dall'acciaio dolce agli acciai resistenti al calore ed altri materiali di difficile lavorazione.

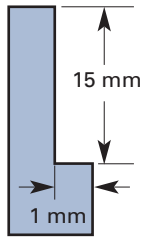
Le frese **Epoch Power Mill** toriche sono adatte per la fresatura a profilo tridimensionale come pure per la produzione di angoli privi di tensioni. L'angolo dell'elica elevato riduce la possibilità di vibrazioni. La forma del canale di spogli assicura un'espulsione dolce dei trucioli, che evita il taglio multiplo e danni ai taglienti. La sezione trasversale della fresa è studiata per ottenere la massima rigidità.

Field Data

Cutting Performance | Performancevergleich | Performances de coupe | Rendimiento | Risultati di taglio

Tool life in 1.050

D = Ø 10 mm
N = 2,800 min⁻¹
V_c = 88 m/min
V_f = 1,000 mm/min
Ad = 15 x Rd = 1.0 mm
Machining Center,
Dry, Down-Cut



Epoch Power Mill Ø 10 mm, 4 flutes

53 m

Competitor A
coated, 4 flutes

25 m

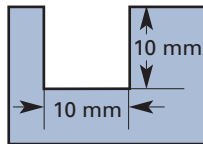
Competitor B
coated, 3 flutes, helix

23 m

Cutting length (meter)

Slotting in stainless steel 1.4301

D = Ø 10 mm
N = 640 min⁻¹
V_c = 20 m/min
V_f = 50 ~ 250 mm/min
Ad = 10 mm
Machining Center with oil



Epoch Power Mill Ø 10 mm, 4 flutes

250

Competitor A
coated, 4 flutes

100

Competitor B
coated, 2 flutes


50


V_f mm/min Table feed





Applications | Bearbeitungen | Applications | Aplicaciones | Applicazioni Pocketing | Taschenfräsen | Fraisage des poches | Cajeados | Lavorazione tasche




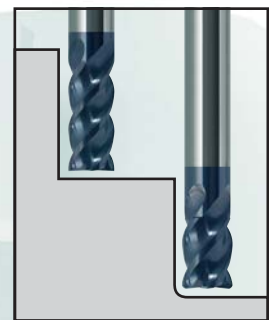
 In long reach applications, interference is avoided by adopting a design where the shank diameter is less than that of the cutting diameter. The shank diameter conforms to normal chucking standards.

 Große Tiefen, bzw. lange Auskräglängen, ermöglicht der extra lange, abgesetzte Schaft. Der genormte Schaftdurchmesser (6, 8, 10 mm...) ist immer kleiner als der Schneidendurchmesser.

 Pour les usinages profonds, les interférences sont supprimées en utilisant des diamètres de queue inférieurs à ceux de la partie coupante tout en respectant les dimensions standard de queue pour le serrage en mandrins.

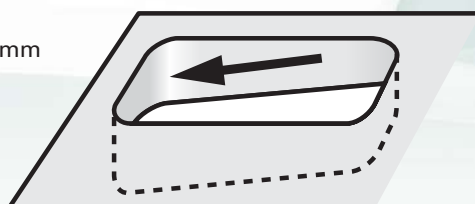
 En mecanizados profundos se evita el talonamiento del mango mediante la utilización de mangos o cuellos de diámetro inferior al de la fresa. Los diámetros de mango son normalizados.

 In applicazioni con profondità elevata di fresatura, si evita l'interferenza adottando un design in cui il diametro del codolo è inferiore al diametro di taglio. Il diametro del codolo è adeguato ai normali portautensili standard.



1.050 Ramp Milling

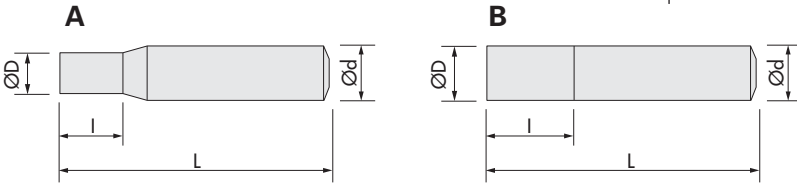
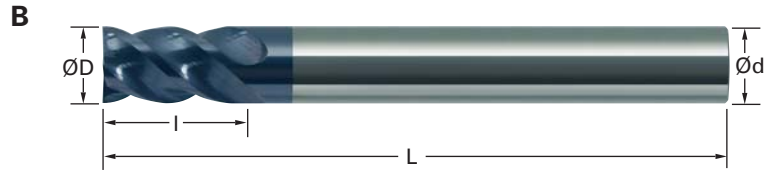
D = Ø 10 mm, R 0.5 mm
N = 2,500 min⁻¹
V_c = 79 m/min
V_f = 800 mm/min
Ad = 2°
Machining Center



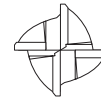
Micro Grain Carbide – TiAlN Century Coated

EPPS | Epoch Power Mill Short

Q max High Efficient	▽ Roughing	▽▽ Semi-Finishing	▽▽▽ Finishing	HRC 60	No. of Teeth 4
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Rake Angle
Positive



DØ3.0	-0.014/-0.028
DØ4.0~Ø6.0	-0.020/-0.038
DØ8.0~Ø20.0	-0.025/-0.047
d	h6

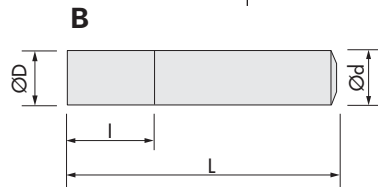
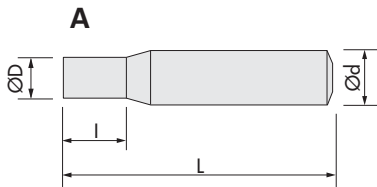
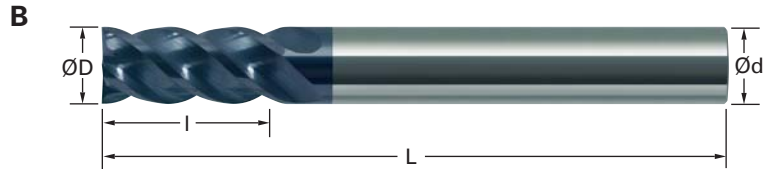
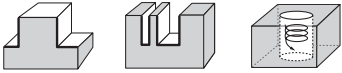
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EP 230	EPPS-4040	■	4		4	6						60	6	A
EP 231	EPPS-4050	■	4		5	7.5						60	6	A
EP 232	EPPS-4060	■	4		6	9						60	6	B
EP 233	EPPS-4080	■	4		8	12						75	8	B
EP 234	EPPS-4100	■	4		10	15						80	10	B
EP 235	EPPS-4120	■	4		12	18						100	12	B
EP 236	EPPS-4160	■	4		16	24						110	16	B
EP 237	EPPS-4200	■	4		20	30						125	20	B

■ = Stock | Germany

Micro Grain Carbide – TiAlN Century Coated

EPP | Epoch Power Mill

Q max High Efficient	 Roughing	 Semi-Finishing	 Finishing	HRC 60	No. of Teeth 4
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Rake Angle
Positive



DØ3.0	-0.014/-0.028
DØ4.0~Ø6.0	-0.020/-0.038
DØ8.0~Ø20.0	-0.025/-0.047
d	h6

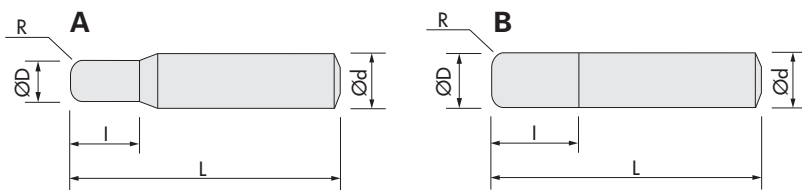
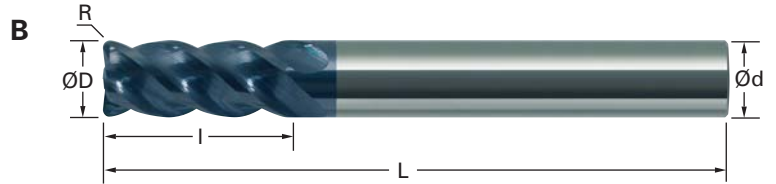
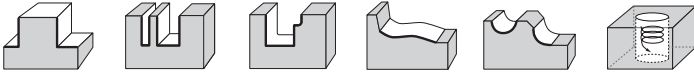
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EP 032	EPP-4040	■	4		4	11						60	6	A
EP 033	EPP-4050	■	4		5	13						60	6	A
EP 034	EPP-4060	■	4		6	13						60	6	B
EP 035	EPP-4080	■	4		8	19						75	8	B
EP 036	EPP-4100	■	4		10	22						80	10	B
EP 037	EPP-4120	■	4		12	26						100	12	B
EP 038	EPP-4160	■	4		16	32						110	16	B
EP 039	EPP-4200	■	4		20	38						125	20	B
EP 040	EPPSET-0100	■	4		6/8/10	13/19/22						60/75/80	6/8/10	B

■ = Stock | Germany

Micro Grain Carbide – TiAlN Century Coated

EPP-00 | Epoch Power Mill Corner Radius

Q max High Efficient	▽ Roughing	▽▽ Semi-Finishing	▽▽▽ Finishing	HRC 60	No. of Teeth 4
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Rake Angle
Positive



R	± 0.015
DØ3.0	-0.014/-0.028
DØ4.0~Ø6.0	-0.020/-0.038
DØ8.0	-0.025/-0.047
d	h6

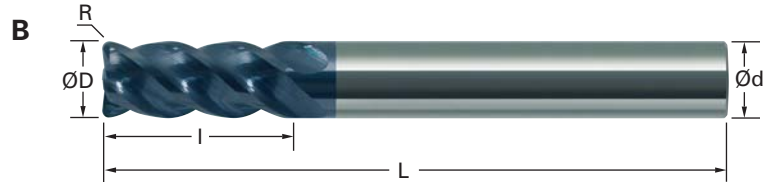
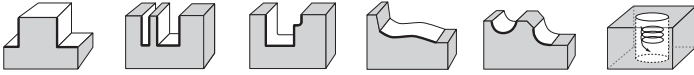
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EP 042	EPP-4030-05	■	4	0.5	3	8						60	6	A
EP 043	EPP-4040-02	■	4	0.2	4	11						60	6	A
EP 044	EPP-4040-05	■	4	0.5	4	11						60	6	A
EP 045	EPP-4040-10	■	4	1	4	11						60	6	A
EP 046	EPP-4050-02	■	4	0.2	5	13						60	6	A
EP 047	EPP-4050-05	■	4	0.5	5	13						60	6	A
EP 048	EPP-4050-10	■	4	1	5	13						60	6	A
EP 049	EPP-4060-03	■	4	0.3	6	13						60	6	B
EP 050	EPP-4060-05	■	4	0.5	6	13						60	6	B
EP 051	EPP-4060-10	■	4	1	6	13						60	6	B
EP 052	EPP-4060-15	■	4	1.5	6	13						60	6	B
EP 053	EPP-4080-03	■	4	0.3	8	19						75	8	B
EP 054	EPP-4080-05	■	4	0.5	8	19						75	8	B
EP 055	EPP-4080-10	■	4	1	8	19						75	8	B
EP 056	EPP-4080-15	■	4	1.5	8	19						75	8	B
EP 057	EPP-4080-20	■	4	2	8	19						75	8	B

■ = Stock | Germany

Micro Grain Carbide – TiAlN Century Coated

EPP-00 | Epoch Power Mill Corner Radius

Q max High Efficient	▽ Roughing	▽▽ Semi-Finishing	▽▽▽ Finishing	HRC 60	No. of Teeth 4
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Rake Angle
Positive



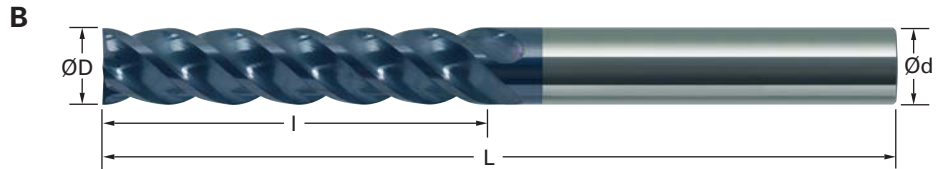
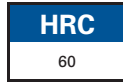
R	± 0.015
DØ10.0~Ø20.0	-0.025/-0.047
d	h6

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EP 059	EPP-4100-10	■	4	1	10	22						80	10	B
EP 060	EPP-4100-15	■	4	1.5	10	22						80	10	B
EP 061	EPP-4100-20	■	4	2	10	22						80	10	B
EP 062	EPP-4120-05	■	4	0.5	12	26						100	12	B
EP 063	EPP-4120-10	■	4	1	12	26						100	12	B
EP 146	EPP-4120-15	■	4	1.5	12	26						100	12	B
EP 147	EPP-4120-20	■	4	2	12	26						100	12	B
EP 148	EPP-4160-10	■	4	1	16	32						110	16	B
EP 149	EPP-4160-15	■	4	1.5	16	32						110	16	B
EP 150	EPP-4160-20	■	4	2	16	32						110	16	B
EP 151	EPP-4160-30	■	4	3	16	32						110	16	B
EP 152	EPP-4200-10	■	4	1	20	38						125	20	B
EP 153	EPP-4200-15	■	4	1.5	20	38						125	20	B
EP 154	EPP-4200-20	■	4	2	20	38						125	20	B
EP 155	EPP-4200-30	■	4	3	20	38						125	20	B

■ = Stock | Germany

Micro Grain Carbide – TiAlN Century Coated

EPPL | Epoch Power Mill Long



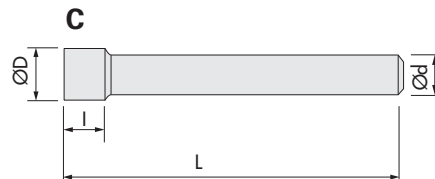
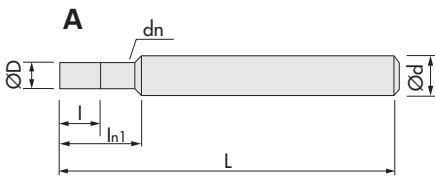
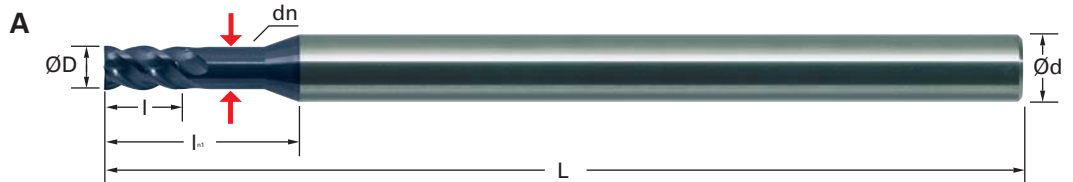
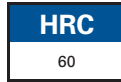
DØ6.0	-0.020/-0.038
DØ8.0~Ø20.0	-0.025/-0.047
d	h6

ID Code	Item No.	Stock	Z	R	ØD	l	dn	l ₁	l _{n1}	l _{n2}	l _s	L	d	Type
EP 238	EPPL-4060	■	4		6	25						70	6	B
EP 239	EPPL-4080	■	4		8	35						90	8	B
EP 240	EPPL-4100	■	4		10	45						100	10	B
EP 241	EPPL-4120	■	4		12	55						120	12	B
EP 242	EPPL-4160	■	4		16	65						135	16	B
EP 243	EPPL-4200	■	4		20	75						155	20	B

■ = Stock | Germany

Micro Grain Carbide – TiAlN Century Coated

EPPLS | Epoch Power Mill Long Shank



DØ3.0	-0.014/-0.028
DØ4.0~Ø5.0	-0.020/-0.038
DØ7.0~Ø17.0	-0.025/-0.047
d	h6



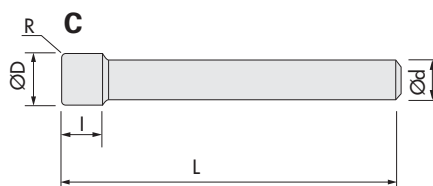
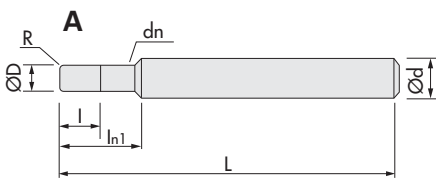
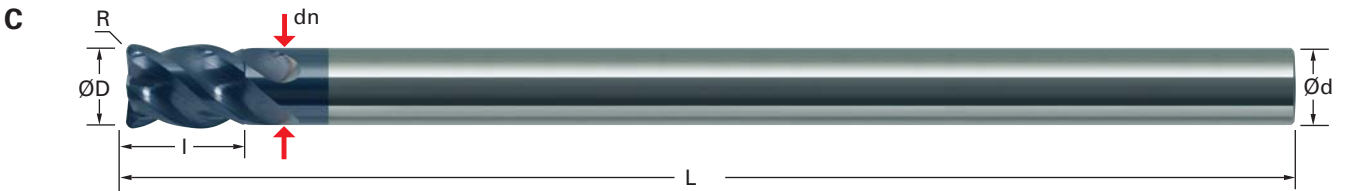
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EP 157	EPPLS-4040	■	4	4	4	6	3.8		14			80	6	A
EP 158	EPPLS-4050	■	4	5	5	7.5	4.8		17.5			100	6	A
EP 159	EPPLS-4070	■	4	7	7	9						120	6	C
EP 160	EPPLS-4090	■	4	9	9	12						135	8	C
EP 161	EPPLS-4110	■	4	11	11	15						150	10	C
EP 162	EPPLS-4130	■	4	13	13	18						160	12	C
EP 163	EPPLS-4170	■	4	17	17	24						180	16	C

■ = Stock | Germany

Micro Grain Carbide – TiAlN Century Coated

EPPLS-00 | Epoch Power Mill Long Shank Corner Radius

Semi-Finishing	Finishing	HRC 60	No. of Teeth 4
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R	± 0.015
DØ3.0	-0.014/-0.028
DØ4.0~Ø5.0	-0.020/-0.038
DØ7.0~Ø11.0	-0.025/-0.047
d	h6

Rake Angle
Positive



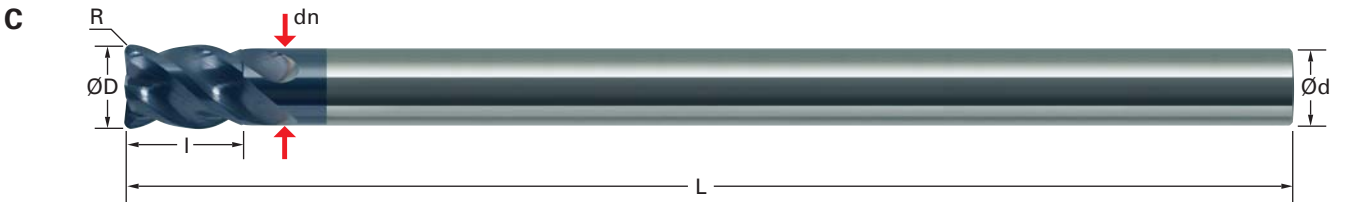
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EP 166	EPPLS-4040-02	■	4	0.2	4	6	3.8		14			80	6	A
EP 167	EPPLS-4040-05	■	4	0.5	4	6	3.8		14			80	6	A
EP 168	EPPLS-4050-02	■	4	0.2	5	7.5	4.8		17.5			100	6	A
EP 169	EPPLS-4050-05	■	4	0.5	5	7.5	4.8		17.5			100	6	A
EP 170	EPPLS-4070-03	■	4	0.3	7	9						120	6	C
EP 171	EPPLS-4070-05	■	4	0.5	7	9						120	6	C
EP 172	EPPLS-4070-10	■	4	1	7	9						120	6	C
EP 173	EPPLS-4090-05	■	4	0.5	9	12						135	8	C
EP 174	EPPLS-4090-10	■	4	1	9	12						135	8	C
EP 175	EPPLS-4090-15	■	4	1.5	9	12						135	8	C
EP 176	EPPLS-4110-05	■	4	0.5	11	15						150	10	C
EP 177	EPPLS-4110-10	■	4	1	11	15						150	10	C
EP 178	EPPLS-4110-15	■	4	1.5	11	15						150	10	C

■ = Stock | Germany

Micro Grain Carbide – TiAlN Century Coated

EPPLS-00 | Epoch Power Mill Long Shank Corner Radius

 Semi-Finishing	 Finishing	HRC 60	No. of Teeth 4
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Rake Angle
Positive



R	± 0.015
DØ13.0~Ø17.0	-0.025/-0.047
d	h6

ID Code	Item No.	Stock	Z	R	ØD	l	dn	l ₁	l _{n1}	l _{n2}	l _s	L	d	Type
EP 179	EPPLS-4130-05	■	4	0.5	13	18						160	12	C
EP 180	EPPLS-4130-10	■	4	1	13	18						160	12	C
EP 181	EPPLS-4130-15	■	4	1.5	13	18						160	12	C
EP 182	EPPLS-4130-20	■	4	2	13	18						160	12	C
EP 183	EPPLS-4170-10	■	4	1	17	24						180	16	C
EP 184	EPPLS-4170-15	■	4	1.5	17	24						180	16	C
EP 185	EPPLS-4170-20	■	4	2	17	24						180	16	C

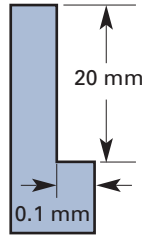
■ = Stock | Germany

Technique

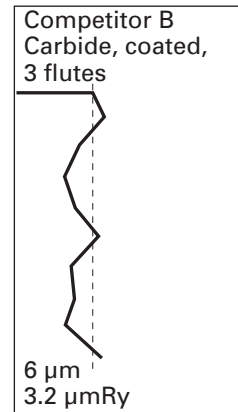
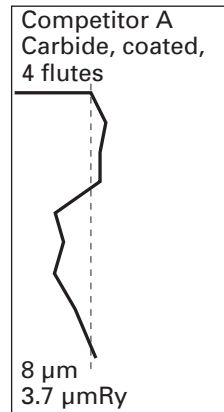
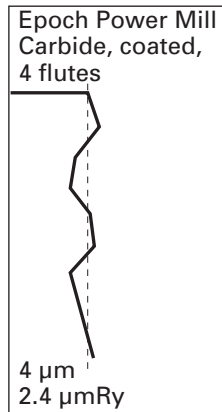
1.2379 (42HRC)

Pre-hardened steel

D = Ø 10 mm
N = 1,600 min⁻¹
V_e = 50 m/min
V_f = 220 mm/min
Ad = 20 x Rd = 0.1 mm
 Machining Center,
 Dry, Down-Cut

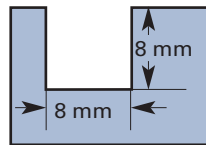


Surface deflection



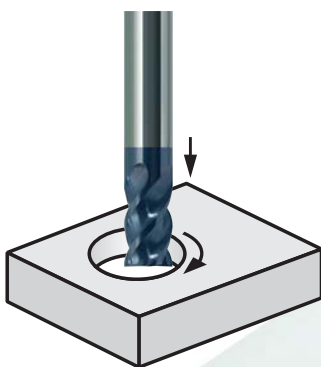
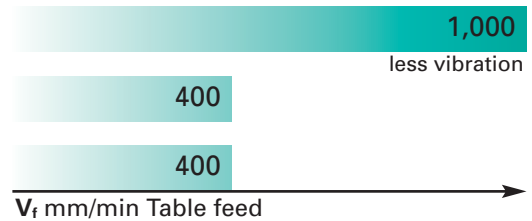
1.2311 (HB200) slotting of SKD11

D = Ø 8 mm
N = 3,200 min⁻¹
V_e = 80 m/min
V_f = 400 ~ 1,000 mm/min
Ad = 8 mm
 Machining Center, dry



Epoch Power Mill Ø 8 mm, 4 flutes

Competitor A
 coated, 2 flutes
 Competitor B
 coated, 4 flutes



Helical machining

(for drilling holes from solid and boring out existing holes)

Zirkularfräsen

(erstellen einer Bohrung aus dem Vollen und vergrößern vorhandener Bohrungen)

Fraisage hélicoidal

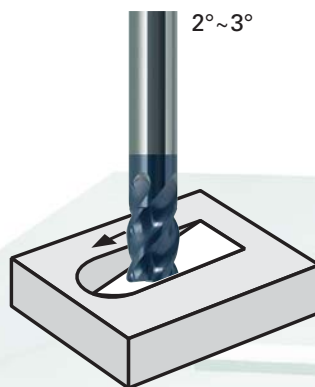
(pour perçage dans la masse et réalésage de trous existants)

Taladrado/Mandrinado

(para taladrar en sólido y mandrinar por interpolación)

Lavorazione elicoidale

(per praticare fori su materiale duro e alesare i fori esistenti)



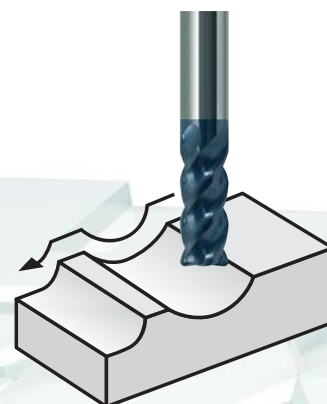
Ramp milling

Rampenfräsen

Fraisage oblique

Mecanizado en rampa

Fresatura a rampa



3D Contouring

3D Konturfräsen

Contournage 3D

Mecanizado 3D

Contornatura 3D

 **NOTES:**

1. Climb milling should always be used. A mineral oil based cutting fluid should be used when cutting steels. A water soluble cutting fluid should be used when **High Speed Machining**. Cast irons and non ferrous materials may be cut dry or with a water soluble cutting fluid. If cutting dry it is recommended an air blast is used to flush the swarf away from the cutting area and prevent re-cutting of the chip occurring.
2. Best result will be obtained when maximum rigidity is achieved, for example using a 50 taper spindle, minimum tool overhang and maximum component stability.
3. Adjust the recommended cutter speed and feed according to the prevailing conditions, that is, depths of cut, workpiece rigidity and cutter overhang.

 **TECHNISCHER ANHANG:**

1. Gleichlaufräsen sollte immer angewandt werden. Bei der Bearbeitung von Stählen wäre eine Mineralölkühlung von Vorteil. Bei der HSC-Bearbeitung sollte mit Emulsion gefahren werden. Guss- und Nichteisen-Materialien können "trocken" oder "nass" bearbeitet werden. Bei der Trockenbearbeitung ist eine Luftkühlung von Vorteil, um die Späne aus dem Schneidbereich zu befördern und ein Nachschneiden der Späne zu verhindern.
2. Beste Ergebnisse werden erzielt, wenn eine hohe Stabilität im Umfeld zu finden ist, z.B. ISO 50, kurze Ausraglängen und gute Werkstückspannung.
3. Die Schnittwerte sollten dem Umfeld, wie Eingriffstiefen, Werkstückspannung und Ausraglängen angepasst werden.

 **REMARQUES:**

1. Un fluide de coupe à base d'huile minérale doit être utilisé pour l'usinage des aciers. Une huile soluble doit être utilisée pour l'usinage à grande vitesse. La fonte et les matériaux non ferreux peuvent être usinés à sec ou avec de l'huile soluble. En cas d'usinage à sec, l'emploi de l'air comprimé est recommandé pour dégager la zone de coupe et éviter le réusinage des copeaux.
2. Les meilleurs résultats sont obtenus quand la rigidité est optimale, par exemple en utilisant un cône de broche 50, un porte-à-faux minimum de l'outil et une stabilité maximum des équipements.
3. Adapter les vitesses de coupe et avances recommandées en fonction des conditions de fonctionnement telles que profondeur de passe, rigidité de la pièce usinée et porte-à-faux de l'outil.

 **NOTAS:**

1. Siempre hay que trabajar en el +/- (Contrapelo). Se debe utilizar aceite de corte en la mecanización de aceros. Se debe utilizar emulsión para el mecanizado a alta velocidad. La fundición y los materiales no férreos pueden mecanizarse en seco o con emulsión. Si se mecaniza en seco se recomienda la utilización de aire para evacuar la viruta y evitar el remecanizado de la misma.
2. El mejor resultado se obtiene con la máxima rigidez, usando por ejemplo un cono 50, el menor volado de herramienta posible y la fijación mas estable posible del componente mecanizado.
3. La velocidad de corte y el avance deben ajustarse a las demas condiciones de trabajo, tales como, profundidad de corte, amarre de la pieza, y volado de la herramienta.

 **NOTE:**

1. Utilizzare sempre la fresatura concorde. Per il taglio dell'acciaio utilizzare un liquido da taglio a base di olio minerale. Per la lavorazione su macchine ad alta velocità utilizzare un liquido da taglio solubile in acqua. La ghisa ed altri materiali non ferrosi possono essere tagliati a secco o con un liquido da taglio solubile in acqua. Qualora sia raccomandato il taglio a secco, viene utilizzato un soffio d'aria per allontanare gli sfridi dalla zona di taglio ed evitare il taglio ripetuto dei trucioli.
2. I risultati migliori si ottengono realizzando la massima rigidità, per esempio mediante l'uso di un mandrino ISO 50, con la minima lunghezza a sbalzo dell'utensile e la massima stabilità dei componenti.
3. Regolare la velocità di taglio e di avanzamento raccomandate in base alle condizioni esistenti, ovvero profondità del taglio, rigidità del pezzo in lavorazione e lunghezza a sbalzo della fresa.

 **MATERIAL CLASSIFICATION:**

- I. Carbon Steels, Construction Steels
up to 200HB (~700 N/mm²)
- II. Alloy Steels, Case Hardening Steels,
Heat Treatable Steels
200~300HB (~1,000 N/mm²)
- III. Alloy Steels
30~45HRC (~1,400 N/mm²)
- IV. Tool Steels (hot & cold), Hardened Steels
45~55HRC (~2,000 N/mm²)
- V. Tool Steels (cold), Hardened Steels, HSS
55~70HRC (2,000 N/mm² ~)
- VI. Stainless Steels
20~40HRC (800~1,200 N/mm²)
- VII. Heat Resisting Steels, Titanium,
Nickel & Cobalt Alloys, incl. Inconel
25~60HRC (850~2,180 N/mm²)
- VIII. Cast Irons (GG), Ductile Cast Iron (GGG)
GG~120HB (100~400 N/mm²)
GGG~240HB (350~800 N/mm²)
- IX. Aluminium, Copper Alloys, incl. Brass

 **MATERIALKLASSIFIKATION:**

- I. Kohlenstoffstähle, Baustähle
bis 200HB (~700 N/mm²)
- II. Legierte Stähle, Einsatzstähle,
Hitzebehandelbare Stähle
200~300HB (~1.000 N/mm²)
- III. Legierte Stähle
30~45HRC (~1.400 N/mm²)
- IV. Werkzeugstähle (warm & kalt), Gehärtete Stähle
45~55HRC (~2.000 N/mm²)
- V. Werkzeugstähle (kalt), Gehärtete Stähle, HSS
55~70HRC (2.000 N/mm² ~)
- VI. Rostfreie Stähle
20~40HRC (800~1.200 N/mm²)
- VII. Hitzebeständige Stähle,
Titan, Nickel & Kobalt Legierungen, inkl. Inconel
25~60HRC (850~2.180 N/mm²)
- VIII. Gusseisen (GG), Schmiedbares Gusseisen (GGG)
GG~120HB (100~400 N/mm²)
GGG~240HB (350~800 N/mm²)
- IX. Aluminium, Kupfer-Legierungen, inkl. Bronze

 **CLASSIFICATION POUR LES MATIERES:**

- I. Acier au carbone, Acier de construction
jusqu'à 200HB (~700 N/mm²)
- II. Acier allié, Acier coulé,
200~300HB (~1.000 N/mm²)
- III. Acier allié
30~45HRC (~1.400 N/mm²)
- IV. Acier à outil, Acier traité
45~55HRC (~2.000 N/mm²)
- V. Acier à outil, Acier traité, Acier rapide
55~70HRC (2.000 N/mm² ~)
- VI. Acier inoxydable
20~40HRC (800~1.200 N/mm²)

- VII. Acier résistant à la chaleur, Titane,
Nickel et alliage, Inconel
25~60HRC (850~2.180 N/mm²)
- VIII. Fonte malléable (GG), Fonte sphéroïdale (GGG)
GG~120HB (100~400 N/mm²)
GGG~240HB (350~800 N/mm²)
- IX. Aluminium et alliage de cuivre, Laiton

 **CLASIFICACION DE MATERIAL:**

- I. Acero, Acero de construcción
hasta 200HB (~700 N/mm²)
- II. Acero aleado, Acero de cementación,
Acero termo-tratable
200~300HB (~1.000 N/mm²)
- III. Acero aleado
30~45HRC (~1.400 N/mm²)
- IV. Acero de herramienta (frio & caliente),
Acero endurecido
45~55HRC (~2.000 N/mm²)
- V. Acero de herramienta (frio), Acero endurecido,
Acero rápido
55~70HRC (2.000 N/mm² ~)
- VI. Acero inoxidable
20~40HRC (800~1.200 N/mm²)
- VII. Acero termo-resistente,
Aleaciones exóticas (Ti, Ni, Co)
25~60HRC (850~2.180 N/mm²)
- VIII. Fundición (GG), Fundición maleable (GGG)
GG~120HB (100~400 N/mm²)
GGG~240HB (350~800 N/mm²)
- IX. Aleaciones de aluminio y cobre, Lató

 **CLASSIFICAZIONE DEL MATERIALE:**

- I. acciaio al carbonio, acciaio da costruzione
superiore a 200HB (~700 N/mm²)
- II. acciaio legato,
acciaio flammato (tempra ad induzione)
200~300HB (~1.000 N/mm²)
- III. acciaio legato
30~45HRC (~1.400 N/mm²)
- IV. acciaio per utensile (caldo & freddo),
acciaio temprato
45~55HRC (~2.000 N/mm²)
- V. acciaio per utensile (freddo), acciaio temprato, HSS
55~70HRC (2.000 N/mm² ~)
- VI. acciaio inossidabile
20~40HRC (800~1.200 N/mm²)
- VII. acciaio resistente al calore,
Ti-, Ni-, Co-legato, Inconel
25~60HRC (850~2.180 N/mm²)
- VIII. ghisa (GG), ghisa malleabile (GGG)
GG~120HB (100~400 N/mm²)
GGG~240HB (350~800 N/mm²)
- IX. Al-, Cu-legato, Ottone

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