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Epoch21

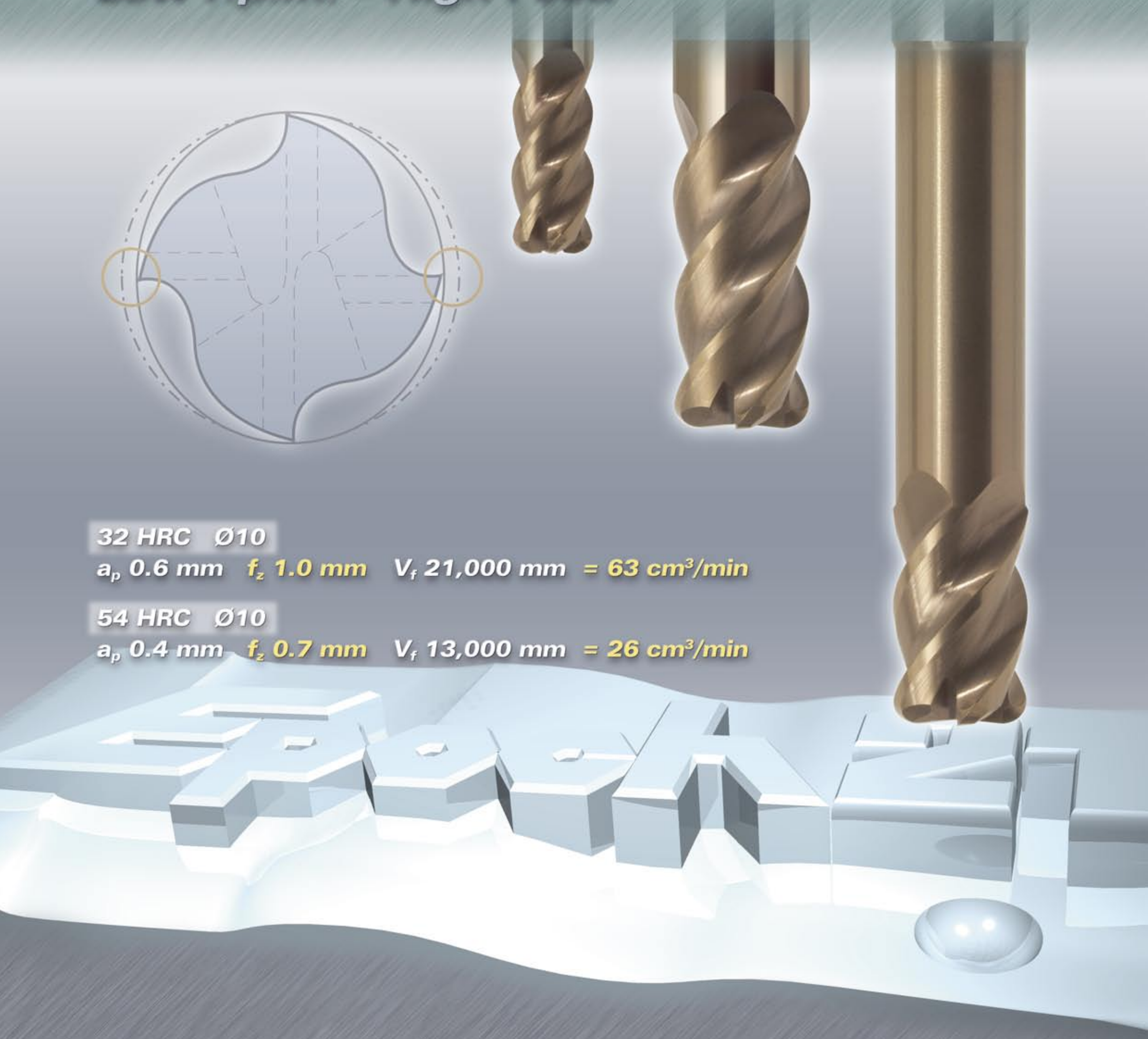
Nano-PVD Coating
TH45+

Epoch Turbo High Feed Radius

Solid Carbide Corner Radius for high efficient machining

4-flute Corner Radius End Mill · Extremely high cutting efficiency

Low r.p.m. – High Feed



32 HRC Ø10
a_p 0.6 mm f_z 1.0 mm V_f 21,000 mm = 63 cm^3/min

54 HRC Ø10
a_p 0.4 mm f_z 0.7 mm V_f 13,000 mm = 26 cm^3/min

Hitachi Tool Engineering Europe GmbH
www.high-speed-cutting.com

Solid Carbide Corner Radius End Mill for high efficient machining

FEATURES

- The special oval flute shape reduces vibration even in deep cutting operations.
- Even though it has 4 flutes it maintains sufficient chip pockets for high feed with superior chip removal. Processing can be performed at a never achieved rate, which will provide a rapid increase in efficiency
- The unique high strength cutting radius enables high feed per tooth feed rates.
- Many dimension variations, 8 straight and 14 long neck versions to cover most applications

DO YOU RUN INTO THE FOLLOWING PROBLEMS WHEN CUTTING

- Need shorter cutting times but don't know which tool to use
- I don't have a high rotational speed machine so I can't perform high efficient cutting
- Cutting efficiency drops when deep cutting
- Ball end mills are the limit for high efficient cutting

The newly developed Epoch Turbo mill is an ultra hard solid carbide radius end mill which can solve the above problems, greatly shortening manufacturing lead times and reducing costs.

BESONDERHEITEN

- Die neuartige ovale Anordnung der Schneiden (siehe auch Abb. Oval-Effekt) vermeidet Vibrationen, selbst bei Bearbeitungen in tiefen Konturen.
- Trotz seiner 4 Schneiden besitzt der Epoch Turbo Mill ausreichend große Spankammern, die auch bei hohen Vorschüben eine hervorragende Spanabfuhr garantieren. Fräsbearbeitungen können dadurch in viel kürzerer Zeit durchgeführt werden und die Effizienz wird enorm gesteigert.
- Zusätzlich verfügt der Epoch Turbo Mill über eine außergewöhnlich stabile Radiusschneide, die extrem hohe Vorschübe pro Zahn ermöglicht.
- Der Epoch Turbo Mill ist in 8 kurzen und 14 langen Ausführungen mit abgesetzten Nutzlängen erhältlich. Dadurch eignet sich der Epoch Turbo Mill für ein breites Spektrum an Bearbeitungen.

WENN SIE BEI IHREN BEARBEITUNGEN DIE FOLGENDEN PROBLEME HABEN

- Sie benötigen kürzere Bearbeitungszeiten, wissen aber nicht, welches Werkzeug Ihnen diesen Vorteil bringen würde
- Sie besitzen kein HSC-Bearbeitungszentrum und sind daher überzeugt, nicht effizient zerspanen zu können
- Ihre Effizienz in der Zerspanung nimmt bei tiefen Bearbeitungen ab
- Durch den Einsatz von Kugelfräsern ist die Effizienz Ihrer Bearbeitungsmethoden limitiert

Mit dem neu entwickelten Epoch Turbo Mill, einem ultra harten VHM-Radiusfräser, können Sie alle oben genannten Zerspanungs-Probleme lösen. Er ermöglicht eine enorme Verkürzung Ihrer Fertigungszeiten und hilft Ihnen, Kosten zu senken.

CARATTERISTICHE

- La speciale forma ovale della sezione del tagliente (due denti con diametro nominale e due con diametro scaricato), consente di ridurre le vibrazioni, specie nei casi di lavorazioni con forte sporgenza dell'utensile.
- Nonostante sia un utensile a 4 taglienti, la speciale affilatura consente di mantenere spazio a sufficienza per l'evacuazione dei trucioli, avendo così la possibilità di aumentare l'avanzamento e quindi avere maggiore asportazione. La lavorazione verrà eseguita con avanzamenti mai visti prima, con il risultato di avere un rapido aumento dell' efficienza.
- La caratteristica affilatura del tagliente sul raggio, consente di ottenere una sezione resistente molto robusta, quindi sopportare forti avanzamenti al tagliente.
- Diverse possibilità di scelta, 8 versioni con gambo dritto e 14 con gambo rastremato, per consentire l'utilizzo nelle più svariate applicazioni.

I PROBLEMI CHE SI INCONTRANO QUANDO SI È IN FRESATURA

- Necessità di impiegare minor tempo ma non si sa quale utensile utilizzare.
- Non si ha la macchina con un sufficiente numero di giri al mandrino, così non si può avere un' alta efficenza nella lavorazione.
- L' efficienza di taglio diminuisce quando si hanno lavorazioni in profondità.
- L' utensile sferico è limitato per avere un' alta efficienza nella lavorazione.

La nuova Epoch Turbo è una fresa raggiata costruita in micrograna ultra dura, in grado di risolvere i problemi sopra elencati, accorciando enormemente i tempi di fresatura e riducendo così i costi nel processo di fresatura.

CARACTERÍSTICAS

- El diseño ovalado de los labios reduce las vibraciones incluso en mecanizados profundos.
- Aun teniendo 4 labios el canal de evacuación de viruta es suficientemente grande como para mantener unos altísimos avances. Los trabajos pueden realizarse con parámetros nunca antes soñados, mejorando de forma inmediata en cuanto a eficiencia.
- El exclusivo diseño del radio del filo permite unos muy elevados avances por diente.
- La gama inicial, con 8 fresas rectas y 14 largas de cuello rebajado, cubre la mayoría de necesidades.

¿TIENE UD. LOS SIGUIENTES PROBLEMAS CUANDO MECANIZA?

- Necesita reducir tiempos pero no se que herramienta usar.
- No tiene máquina de alta velocidad y por tanto no pude realizar un mecanizado eficiente.
- La eficiencia baja drásticamente en mecanizados profundos.
- Las fresas esféricas son las que permiten un nivel de eficiencia mayor.

La nueva Epoch Turbo es una fresa tórica en metal ultra duro que puede resolver todos estos problemas, reduciendo drásticamente los tiempos y costes del mecanizado.

Solid Carbide Corner Radius End Mill for high efficient machining

APPLICATIONS

- La forme spéciale des dents avec réduction du périmètre externe des dents esclaves réduit les phénomènes de broutement et de vibrations même lors d'opérations profondes.
- Bien que cette fraise ait 4 dents, elle possède des poches à copeaux suffisamment importantes pour assurer l'évacuation des copeaux dans des conditions d'avances extrêmement élevées. Les taux d'enlèvement atteints n'ont encore jamais été réalisés, et vous apporterons une augmentation de productivité rapide et significative.
- Le design haute résistance de la section rayonnée vous permettra d'atteindre de très hautes avances par dent.
- La gamme, composée de 8 références de fraises droites et de 14 références de fraises longues dégagées, vous permettra de faire face à la plupart des applications.

RENCONTREZ VOUS LES PROBLÈMES D'USINAGE SUIVANTS ?

- J'ai besoin de réduire mes temps d'usinage sans savoir quels outils utiliser…
- Je n'ai pas de machine avec forte vitesse de rotation, je ne peux donc pas travailler en haute productivité…
- Les performances d'usinage chutent lors d'usinages profonds…
- Je suis limité à l'utilisation de fraises hémisphériques lors d'applications hautes performances…

La fraise Epoch Turbo torique, développée tout dernièrement est fabriquée dans un carbure Ultra Dur et permet de résoudre tous les problèmes évoqués ci-dessus en diminuant considérablement les temps d'usinage et les coûts de production.

1

OVAL EFFECT

- The special oval shape with reduced diameter connects to end cutting flutes, vibrations are reduced when cutting corner or deep sections. This gives a higher level of cutting efficiency than previously achieved.
- Please be careful when measuring the tool to take the diameter of the main flute and not the diameter of the reduced slave flute.

TURBO MILL AXIAL CROSS SECTION DIAGRAM

1. Main flute (nominal diameter)
2. Slave flute (reduced diameter)
3. Clearance (free space between main- and slave flute)
4. Cross-section is oval

DER OVAL-EFFEKT

- Durch die spezielle ovale Geometrie mit zwei im Durchmesser reduzierten Schneiden werden Vibrationen vermindert, speziell bei Bearbeitungen in Ecken / Umschlingungen und in tiefen Einsatzbereichen. Dies steigert die Effizienz Ihrer Fräsbearbeitungen auf ein vorher nicht erreichbares Niveau
- Bitte achten Sie bei der Werkzeugeinmessung darauf, dass der Nenndurchmesser gemessen wird und nicht der Durchmesser der reduzierten Schneiden

QUERSCHNITT DES EPOCH TURBO MILL

1. Hauptschneide (Nenndurchmesser)
2. Nebenschneide (Reduzierter Durchmesser)
3. Differenzbereich (Freiraum zwischen Haupt- und Nebenschneide)
4. Querschnitt (Ovale Form)

EFFETTO OVALE

- La speciale affilatura con riduzione di diametro su due taglienti, consente la diminuzione delle vibrazioni quando con il percorso utensile si arriva sugli spigoli e nelle lavorazioni in profondità. Questo porta ad avere un' efficienza in fresatura mai vista precedentemente.
- Occorre fare attenzione quando si misura il diametro della fresa, in quanto due denti formano un diametro mentre gli altri due sono scaricati.

SEZIONE ASSIALE DI UNA FRESA EPOCH TURBO MILL

1. Tagliente principale (Diametro nominale)
2. Tagliente secondario (Diametro scaricato)
3. Scarico (Differenza tra diametro principale e secondario)
4. La sezione risultante è ovale

EFECTO OVAL

- La especial geometría oval reduce las vibraciones tanto en las esquinas como en las zonas profundas. Esto permite conseguir un elevado nivel de eficiencia nunca antes logrado.
- Al medir el diámetro de la herramienta hay que tener la precaución de hacerlo en los labios principales y no en los secundarios.

DIAGRAMA DE LA SECCIÓN AXIAL.

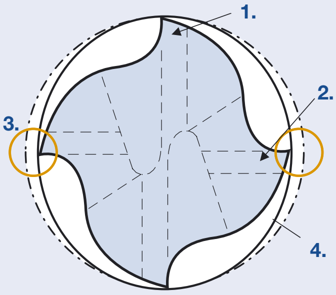
1. Labios principales (Diámetro nominal)
2. Labios secundarios (Diámetro reducido)
3. Diferencial entre labios
4. La sección es ovalada

EFFET DE L'OVALE

- La double forme ovale due au diamètre réduit des dents esclaves ajoutées aux rayons suppriment les vibrations lors d'usinage instables d'angles ou d'opération de fraisage profond, ceci permet d'être plus efficace que jamais.
- Faites attention en mesurant l'oscillation et le diamètre de l'outil.

DIAGRAMME AXIAL DE COUPE DE LA FRAISE EPOCH TURBO

1. Dent principale
2. Dent esclave
3. Dégagement
4. La forme croisée ovale



Solid Carbide Corner Radius End Mill for high efficient machining

2

EFFECT WHEN CUTTING NEAR WALLS

1. Due to the reduced diameter of the slave flutes during side milling only two flutes are in contact
2. During face milling all four flutes are in contact, which enables high feed rates
3. The clearance between main flute and slave flute reduces vibration
4. Corner radius
5. Oval shape
6. Depth of cut
7. Slave flute rotation locus
8. Main flute rotation locus

AUSWIRKUNG BEI BEARBEITUNGEN IM BEREICH DER SEITENWÄNDE

1. Durch die im Durchmesser reduzierten Nebenschneiden sind seitlich nur zwei Schneiden im Einsatz
2. Stirnseitig arbeiten alle vier Schneiden und erlauben daher sehr hohe Vorschübe
3. Der Differenzbereich zwischen Haupt- und Nebenschneide vermindert das Auftreten störender Vibrationen
4. Eckenradius
5. Ovale Form
6. Eingriffstiefe
7. Rotationsumfang der Nebenschneide
8. Rotationsumfang der Hauptschneide

EFFETTI IN FRESATURA DI PARETI VERTICALI

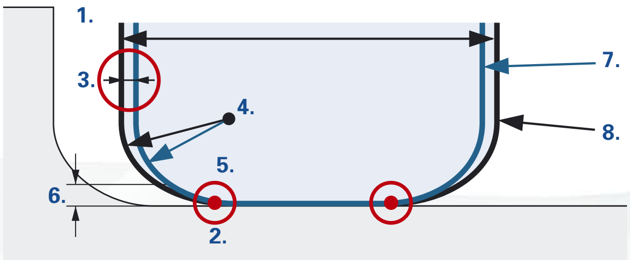
1. A causa della riduzione del diametro sui denti secondari, durante la lavorazione dei fianchi solo due denti sono in contatto
2. Durante la lavorazione del piano tutti i 4 denti sono in contatto, consentendo così di lavorare con grande avanzamento.
3. La differenza di diametro tra il tagliente principale e quello secondario permette alla fresa di non entrare in vibrazione.
4. Spigolo raggiato
5. Forma ovale
6. Profondità di taglio
7. Posizione del tagliente secondario in rotazione
8. Posizione del tagliente primario in rotazione

MECANIZADO PRÓXIMO A PAREDES

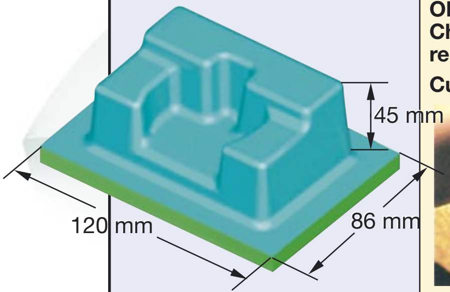
1. Gracias al menor diámetro de los labios secundarios, durante estos procesos de contoneado solo 2 labios están activos
2. Frontalmente trabajan los cuatro labios por igual permitiendo unos muy altos niveles de avance.
3. El diferencial entre el labio principal y el secundario reduce la vibración
4. Radio
5. Geometría oval
6. Profundidad de pasada (a_p)
7. Figura generada por el labio secundario
8. Figura generada por el labio principal

EFFET LORS D'USINAGE CONTRE UNE PAROI VERTICALE

1. Le diamètre extérieur relié à la dent esclave est plus petit, mais la jointure de la dent maîtresse et de la dent esclave est identique.
2. Le 4 dents opèrent en même temps sur la profondeur de coupe, ce qui permet de soutenir de hautes avances.
3. Le soulagement d'arc de la section rayonnée et de la dent externe supprime les vibrations.
4. Rayon
5. Coupe ovale
6. Profondeur de coupe
7. Parcours des dents esclaves
8. Parcours des dents maîtresses



Comparison of time required for cutting the mould shown (roughing only)



Epoch Turbo Mill

Tool size = Ø10 x R2 x 4 flutes
n = 2,500 min^{-1}
V_c = 79 m/min
V_f = 5,000 mm/min
f_z = 0.5 mm/tooth
a_p x a_e = 0.32 mm x 3 mm
OH = 60 (L/D=6)
Chip removal = 4.8 cm^3/min

Cutting time: 81 min

Radius end mill of competitor A

Tool size = Ø10 x R2 x 4 flutes
n = 3,800 min^{-1}
V_c = 119 m/min
V_f = 6,880 mm/min
f_z = 0.45 mm/tooth
a_p x a_e = 0.14 mm x 3 mm
OH = 60 (L/D=6)
Chip removal = 2.9 cm^3/min

Cutting time: 135 min

Ball end mill of competitor B

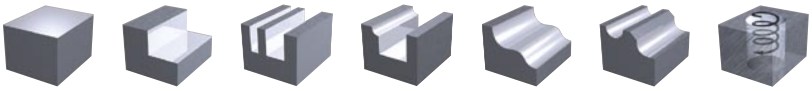
Tool size = R5 x 2 flutes
n = 7,200 min^{-1}
V_c = 226 m/min
V_f = 900 mm/min
f_z = 0.06 mm/tooth
a_p x a_e = 1 mm x 2.5 mm
OH = 60 (L/D=6)
Chip removal = 2.25 cm^3/min

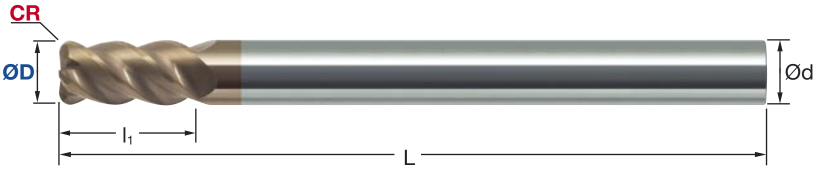
Cutting time: 162 min

Cutting cost comparison			**Epoch Turbo Mill**	**Radius end mill of competitor A**	**Ball end mill of competitor B**
€	Tool Cost	€ price/tool	150	100	100
P	Tool Life	pcs/tool	3	1	1
Td	Tool Replacement	min	2	2	2
M	Machine Cost	€/min	0.8	0.8	0.8
Tc	Production Time	min/pcs	81	135	162
K	Production Cost	price/pcs	115.33	209.60	231.20
	Ratio Comparison		**50%**	**90%**	**100%**

EPOCH TURBO | High Feed Radius End Mill

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





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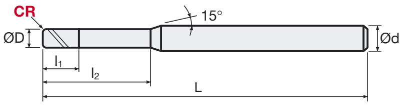
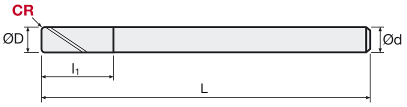


B



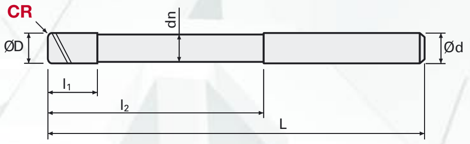
Carbide	TH45+
Micro Grain	Nano-PVD Coating

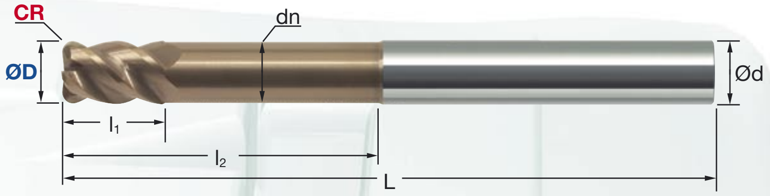
D	0 / -0.015
R	± 0.015
ød	h5

ID Code	Item Code	Stock	ØD	CR	l_2	l_1	dn	L	d	Type
EP367	**ETM-4020-05**	■	**2**	**0.5**	6	4	-	70	6	A
EP368	**ETM-4030-08**		**3**	**0.8**	9	6				
EP369	**ETM-4040-10**		**4**	**1.0**	12	8				
EP370	**ETM-4050-12**		**5**	**1.2**	15	10				
EP371	**ETM-4060-15**		**6**	**1.5**	-	12		90		B
EP372	**ETM-4080-20**		**8**	**2.0**		16		100	8	
EP373	**ETM-4100-20**		**10**			20		110	10	
EP374	**ETM-4120-20**		**12**			24		120	12	

■ = Stock | Germany

C





ID Code	Item Code	Stock	ØD	CR	l_2	l_1	dn	L	d	Type
EP377	**ETMLN-4040-20-10**	■	**4**	**1.0**	20	6	3.8	70	4	C
EP378	**ETMLN-4040-28-10**				28					
EP379	**ETMLN-4060-30-15**		**6**	**1.5**	30	9	5.7	75	6	
EP380	**ETMLN-4060-42-15**				42			90		
EP381	**ETMLN-4060-54-15**				54			100		
EP382	**ETMLN-4080-40-20**		**8**	**2.0**	40	12	7.6	85	8	
EP383	**ETMLN-4080-56-20**				56			100		
EP384	**ETMLN-4080-72-20**				72			120		
EP385	**ETMLN-4100-50-20**		**10**		50	15	9.5	100	10	
EP386	**ETMLN-4100-70-20**				70			120		
EP387	**ETMLN-4100-90-20**				90			140		
EP388	**ETMLN-4120-60-20**		**12**		60	18	11.5	110	12	
EP389	**ETMLN-4120-84-20**				84			135		
EP390	**ETMLN-4120-108-20**				108			160		

■ = Stock | Germany

3

Recommended Cutting Conditions 5 Types

▷	**Standard condition (Low revolution, High feed)**	General purpose condition for low-speed use. Provides stable high efficiency cutting with the longest tool-life.
	High speed condition (High revolution, High feed)	Condition for use with high-performance high-speed machines capable of high feed rates. Enables ultra-high-efficiency cutting by enabling higher feed rates due to higher rotation speed.
	High depth of cut condition (Low revolution, High depth of cut)	Conditions for machines which are not capable of the feed rates of the standard condition, but which have sufficient rigidity. The reduced feed rate is compensated for by setting a large cutting depth, minimizing reductions in work efficiency.
	Low load condition (Medium revolution, High feed)	Condition which reduces cutting load by reducing the per-flute feed rate. Since cutting resistance can be reduced, it enables use even on machines with low rigidity.
▷▷▷	**Finish condition (Condition for finish cutting)**	High-accuracy finishing is possible (Tolerance on dia. is 0 to -0.015 mm and tolerance on R is +/- 0.015 mm)

▷	**Standard-Schnittwerte (Niedrige Umdrehungen, hoher Vorschub)**	Schnittwerte für generelle Bearbeitungen bei niedrigen Geschwindigkeiten. Sie bieten Ihnen eine stabile effiziente Bearbeitung bei langer Werkzeuglebensdauer.
	Hochgeschwindigkeits-Schnittwerte (Hohe Drehzahlen, Hoher Vorschub)	Schnittwerte für den Einsatz auf HSC-Bearbeitungszentren mit der Möglichkeit für hohe Vorschubraten. Ermöglicht erheblich effizientere Bearbeitungen durch höhere Vorschubwerte aufgrund der höheren Drehzahlen.
	Schnittwerte für Bearbeitungen mit großen Eingriffstiefen (Geringe Drehzahlen, Hohe Eingriffstiefe)	Diese Schnittwerte eignen sich speziell für Bearbeitungszentren welche die Standard-Bedingungen nicht erreichen können, jedoch über eine ausreichende Stabilität verfügen. Die reduzierten Vorschubwerte werden hier durch eine hohe Eingriffstiefe kompensiert, wobei die Effizienz der Bearbeitung nur minimal eingeschränkt wird.
	Schnittwerte für Maschinen mit geringer Antriebsleistung (Mittlere Drehzahlen, Hoher Vorschub)	Schnittwerte für verringerten Schnittdruck durch die Reduzierung des Vorschubs pro Zahn. Durch die Verringerung des Schnittwiderstandes, eignet sich der Epoch Turbo Mill auch für den Einsatz auf Maschinen mit geringer Stabilität
▷▷▷	**Schlicht-Bearbeitungen (Schnittwerte für die Schlicht-Bearbeitung)**	Hochgenaues Schlichten ist möglich (Durchmesser-Toleranz: 0 bis -0,015 mm, Radius-Toleranz: +/- 0,015 mm)

▷	**Condizioni base (basso numero di giri, alto avanzamento)**	Condizioni di lavoro generali per lavorazioni lente. Consente lavorazioni ad alto rendimento con lunga durata del tagliente
	Condizioni per alta velocità (alto numero di giri, alto avanzamento)	Condizioni d'uso per alte prestazioni con macchine ad alta velocità e in grado di fresare con alti avanzamenti. Consenti di avere alti rendimenti di lavorazione incrementando l'avanzamento in funzione dell'aumento del numero di giri del mandrino.
	Condizioni in caso di alta profondità di passata (basso numero di giri, alta profondità di taglio)	Condizioni per macchine che non sono in grado di avere alti avanzamenti in condizioni normali, ma che hanno sufficiente rigidità. La riduzione degli avanzamenti e compensate settando una maggiore profondità di passata, minimizzando la riduzione dell' efficienza di lavoro.
	Basse condizioni di sforzo (numero di giri medio, alti avanzamenti)	Condizioni in cui si reduce lo sforzo di lavoro riducendo l'avanzamento al dente. Siccome la resistenza penetrante può essere ridotta, è possibile utilizzare queste condizioni anche su macchine con rigidità bassa
▷▷▷	**Condizioni di finitura (Condizioni per lavorazioni di finitura)**	E' possibile ottenere una super finitura (la tolleranza sul diametro è 0/-0,015 mm quella sul R è +/- 0,015 mm)

▷	**Condiciones de desbaste Condiciones estándar (Pocas revoluciones, Alto avance)**	Condiciones generales para pocas revoluciones. Nos proporciona un mecanizado eficaz y estable con una inmejorable vida de herramienta.
	Condiciones de alta velocidad (Altas revoluciones, Muy Alto Avance)	Condiciones para máquinas de alta velocidad capaces de trabajar a altos avances. Permite mecanizados increíblemente eficientes. El disponer de más revoluciones permite la utilización de avances aún mayores.
	Condiciones de gran a_p (Pocas revoluciones, Gran pasada axial)	Condiciones para máquinas que no pueden trabajar en los niveles de avance que requieren las condiciones estándar pero si disponen de suficiente rigidez. El menor nivel de avance se compensa con una mayor pasada axial (Ap), minimizando la reducción de eficiencia.
	Condiciones de bajo esfuerzo (Revoluciones medias, Alto avance)	Estas condiciones disminuyen el esfuerzo mediante la reducción del avance por diente. El poder reducir el esfuerzo, permite utilizar la herramienta en máquinas poco rígidas.
▷▷▷	**Condiciones de acabado (Condiciones de corte para aca-**	Permite acabados de alta precisión (La tolerancia diametral es de 0 a -0,015 mm y la tolerancia de radio es de +/- 0,015 mm)

▷	**Conditions standard (Faible rotation, Hautes avances)**	Conditions d'usage général pour utilisation à basse vitesse. Permet un usinage stable très efficace avec la durée de vie la plus longue.
	Conditions Haute vitesse (Hautes rotations, Hautes avances)	Conditions à utiliser avec des machines UGV hautes performances capables de hautes avances. Obtention de Ultra Hautes Efficacité rendue possible par de hautes avances dues à une vitesse de rotation plus importante.
	Conditions pour usinages hautes profondeurs (Faible rotation, Haute profondeur de coupe)	Conditions pour des machines incapables d'atteindre les conditions d'avances des conditions standard, mais qui sont rigides. L'avance réduite est compensée par une grande profondeur de passe, minimisant ainsi les réductions d'efficacité de travail.
	Conditions pour faible charge (Rotation moyenne, Hautes avances)	Conditions qui réduisent les efforts de coupe en réduisant l'avance par dent. Puisque les efforts de coupe sont réduits, on peut utiliser ces conditions sur des machines moins rigides.
▷▷▷	**Conditions de finition (Conditions pour usinage de finition)**	Les finitions Hautes tolérances sont possibles (La tolérance sur le dia. est de 0 à -0,015 mm et la tolérance sur le R est de +/- 0,015 mm).

Solid Carbide Corner Radius End Mill for high efficient machining

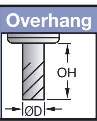
4

How to find Cutting Conditions

Example: ① **Material** **HRC 50**
② **End Mill** **Ø10 R2**
③ **Overhang** **80 mm = 8 x Ø**

Material	Ratio to standard depth of cut	Cutting Condition	Ø2	Ø3	Ø4	Ø5	Ø6	Ø8	② Ø10	Ø12
			CR 0.5	CR 0.8	CR 1	CR 1.2	CR 1.5	CR 2	CR 2	CR 2
Cast Iron, Carbon Steels, Alloy Steels HB150~250	1	n	12,000	8,000	6,000	4,800	4,000	3,000	2,400	2,000
		f_z	0.11	0.19	0.27	0.33	0.42	0.56	0.70	0.80
		V_f	5,380	6,050	6,380	6,380	6,720	6,720	6,720	6,380
Tool Steels HRC25~35	1	n	11,000	7,400	5,600	4,500	3,700	2,800	2,200	1,900
		f_z	0.10	0.17	0.24	0.30	0.38	0.51	0.64	0.73
		V_f	4,510	5,110	5,450	5,470	5,680	5,730	5,630	5,540
Pre-hardened Steels HRC35~45	1	n	10,000	6,900	5,200	4,100	3,400	2,600	2,100	1,700
		f_z	0.08	0.14	0.19	0.24	0.30	0.40	0.50	0.57
		V_f	3,200	3,730	3,950	3,900	4,080	4,160	4,200	3,880
① Hardened Steels HRC45~55	0.7	n	8,000	5,300	4,000	3,200	2,700	2,0 n =	1,600	1,300
		f_z	0.08	0.14	0.19	0.24	0.30	0. f_z =	0.50	0.57
		V_f	2,560	2,860	3,040	3,040	3,240	3,2 V_f =	3,200	2,960
Hardened Steels HRC55~60	0.5	n	8,000	5,300	4,000	3,200	2,700	2,000	1,600	1,300
		f_z	0.03	0.05	0.08	0.10	0.12	0.16	0.20	0.23
		V_f	1,020	1,140	1,220	1,220	1,300	1,280	1,280	1,190

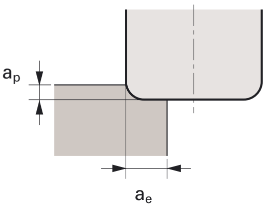
Ratio of Cutting Depth / ØD x L



Material	Ratio	Overhang		Factor	Ø2		Ø3		Ø4		Ø5		Ø6		Ø8		Ø10		Ø12	
					CR 0.5		CR 0.8		CR 1		CR 1.2		CR 1.5		CR 2		CR 2		CR 2	
					a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e
Cast Iron, Carbon Steels, Alloy Steels HB150~250	1	5	x Dia	0.3	0.150		0.240		0.300		0.360		0.450		0.600		0.600		0.600	
		8	x Dia	0.23	0.115	0.5	0.184	0.7	0.230	1	0.276	1.3	0.345	1.5	0.460	2	0.460	3	0.460	4
		10	x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Tool Steels HRC25~35	1	5	x Dia	0.3	0.150		0.240		0.300		0.360		0.450		0.600		0.600		0.600	
		8	x Dia	0.23	0.115	0.5	0.184	0.7	0.230	1	0.276	1.3	0.345	1.5	0.460	2	0.460	3	0.460	4
		10	x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Pre-hardened Steels HRC35~45	1	5	x Dia	0.3	0.150		0.240		0.300		0.360		0.450		0.600		0.600		0.600	
		8	x Dia	0.23	0.115	0.5	0.184	0.7	0.230	1	0.276	1.3	0.345	1.5	0.460	2	0.460	3	0.460	4
		10	x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Hardened Steels HRC45~55	0.7	5	x Dia	0.3	0.105		0.168		0.210		0.252		0.315		0.420		a_p =	a_e =	0.420	
		③ 8	x Dia	0.23	0.081	0.5	0.129	0.7	0.161	1	0.193	1.3	0.242	1.5	0.322	2	0.322	3	0.322	4
		10	x Dia	0.15	0.053		0.084		0.105		0.126		0.158		0.210		0.210		0.210	
Hardened Steels HRC55~60	0.5	5	x Dia	0.3	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
		8	x Dia	0.23	0.058	0.5	0.092	0.7	0.115	1	0.138	1.3	0.173	1.5	0.230	2	0.230	3	0.230	4
		10	x Dia	0.15	0.038		0.060		0.075		0.090		0.113		0.150		0.150		0.150	

Overhangfactor

Overhang	factor
5D	0.30
6D	0.27
7D	0.25
8D	0.23
9D	0.19
10D	0.15



Calculation of a_e

a_e = (Ø/2)-R

Example:

Ø10 R2.0 = 3 mm

Calculation of a_p

Overhangfactor x Ratio x Corner Radius (CR)

Example:

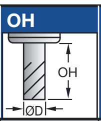
8D (= 0.23) x Ratio (= 0.7) x CR (=2.0) = a_p (0.32 mm)

4

Standard Conditions · Low revolution, High feed

Material	Ratio to standard depth of cut	Cutting Condition	Ø2 CR 0.5	Ø3 CR 0.8	Ø4 CR 1	Ø5 CR 1.2	Ø6 CR 1.5	Ø8 CR 2	Ø10 CR 2	Ø12 CR 2
Cast Iron, Carbon Steels, Alloy Steels HB150~250	1	n	12,000	8,000	6,000	4,800	4,000	3,000	2,400	2,000
		f_z	0.11	0.19	0.27	0.33	0.42	0.56	0.70	0.80
		V_f	5,380	6,050	6,380	6,380	6,720	6,720	6,720	6,380
Tool Steels HRC25~35	1	n	11,000	7,400	5,600	4,500	3,700	2,800	2,200	1,900
		f_z	0.10	0.17	0.24	0.30	0.38	0.51	0.64	0.73
		V_f	4,510	5,110	5,450	5,470	5,680	5,730	5,630	5,540
Pre-hardened Steels HRC35~45	1	n	10,000	6,900	5,200	4,100	3,400	2,600	2,100	1,700
		f_z	0.08	0.14	0.19	0.24	0.30	0.40	0.50	0.57
		V_f	3,200	3,730	3,950	3,900	4,080	4,160	4,200	3,880
Hardened Steels HRC45~55	0.7	n	8,000	5,300	4,000	3,200	2,700	2,000	1,600	1,300
		f_z	0.08	0.14	0.19	0.24	0.30	0.40	0.50	0.57
		V_f	2,560	2,860	3,040	3,040	3,240	3,200	3,200	2,960
Hardened Steels HRC55~60	0.5	n	8,000	5,300	4,000	3,200	2,700	2,000	1,600	1,300
		f_z	0.03	0.05	0.08	0.10	0.12	0.16	0.20	0.23
		V_f	1,020	1,140	1,220	1,220	1,300	1,280	1,280	1,190

Ratio of Cutting Depth / ØD x L

Material	Ratio	OH	Factor	Ø2 CR 0.5		Ø3 CR 0.8		Ø4 CR 1		Ø5 CR 1.2		Ø6 CR 1.5		Ø8 CR 2		Ø10 CR 2		Ø12 CR 2	
				a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e
Cast Iron, Carbon Steels, Alloy Steels HB150~250	1	5 x Dia	0.3	0.150		0.240		0.300		0.360		0.450		0.600		0.600		0.600	
		8 x Dia	0.23	0.115	0.5	0.184	0.7	0.230	1	0.276	1.3	0.345	1.5	0.460	2	0.460	3	0.460	4
		10 x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Tool Steels HRC25~35	1	5 x Dia	0.3	0.150		0.240		0.300		0.360		0.450		0.600		0.600		0.600	
		8 x Dia	0.23	0.115	0.5	0.184	0.7	0.230	1	0.276	1.3	0.345	1.5	0.460	2	0.460	3	0.460	4
		10 x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Pre-hardened Steels HRC35~45	1	5 x Dia	0.3	0.150		0.240		0.300		0.360		0.450		0.600		0.600		0.600	
		8 x Dia	0.23	0.115	0.5	0.184	0.7	0.230	1	0.276	1.3	0.345	1.5	0.460	2	0.460	3	0.460	4
		10 x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Hardened Steels HRC45~55	0.7	5 x Dia	0.3	0.105		0.168		0.210		0.252		0.315		0.420		0.420		0.420	
		8 x Dia	0.23	0.081	0.5	0.129	0.7	0.161	1	0.193	1.3	0.242	1.5	0.322	2	0.322	3	0.322	4
		10 x Dia	0.15	0.053		0.084		0.105		0.126		0.158		0.210		0.210		0.210	
Hardened Steels HRC55~60	0.5	5 x Dia	0.3	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
		8 x Dia	0.23	0.058	0.5	0.092	0.7	0.115	1	0.138	1.3	0.173	1.5	0.230	2	0.230	3	0.230	4
		10 x Dia	0.15	0.038		0.060		0.075		0.090		0.113		0.150		0.150		0.150	

NOTE

1. Use a highly rigid and accurate machine possible.
2. These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
3. If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

BEMERKUNG

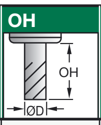
1. Nutzen Sie für die Bearbeitungen die Maschine mit der höchsten Genauigkeit und der höchsten Steifigkeit.
2. Die in der Tabelle angegebenen Schnittbedingungen stellen eine generelle Empfehlung dar. Die Werte sollten immer an die jeweilige Bearbeitung, deren Form und die verwendete Maschine angepasst werden.
3. Sollte die Ihnen verfügbare Drehzahl niedriger als der in der Tabelle angegebene Wert sein, sollte der Vorschub im gleichen Verhältnis reduziert werden.

4

High Speed Conditions · High revolution, High feed

Material	Ratio to standard depth of cut	Cutting Condition	Ø2 CR 0.5	Ø3 CR 0.8	Ø4 CR 1	Ø5 CR 1.2	Ø6 CR 1.5	Ø8 CR 2	Ø10 CR 2	Ø12 CR 2
Cast Iron, Carbon Steels, Alloy Steels HB150~250	0.8	n	20,000	13,300	9,900	8,000	6,600	5,000	4,000	3,300
		f_z	0.11	0.19	0.27	0.33	0.42	0.56	0.70	0.80
		V_f	8,960	10,050	10,530	10,640	11,090	11,200	11,200	10,530
Tool Steels HRC25~35	0.8	n	18,000	11,700	8,800	7,000	5,800	4,400	3,500	2,900
		f_z	0.10	0.17	0.24	0.30	0.38	0.51	0.64	0.73
		V_f	7,370	8,090	8,560	8,510	8,910	9,010	8,960	8,460
Pre-hardened Steels HRC35~45	0.7	n	16,000	10,600	8,000	6,400	5,300	4,000	3,200	2,700
		f_z	0.08	0.14	0.19	0.24	0.30	0.40	0.50	0.57
		V_f	5,120	5,720	6,080	6,080	6,360	6,400	6,400	6,160
Hardened Steels HRC45~55	0.6	n	12,700	8,500	6,400	5,100	4,200	3,200	2,500	2,100
		f_z	0.08	0.14	0.19	0.24	0.30	0.40	0.50	0.57
		V_f	4,060	4,590	4,860	4,850	5,040	5,120	5,000	4,790
Hardened Steels HRC55~60	0.4	n	11,100	7,400	5,600	4,500	3,700	2,800	2,200	1,900
		f_z	0.03	0.05	0.08	0.10	0.12	0.16	0.20	0.23
		V_f	1,420	1,600	1,700	1,710	1,780	1,790	1,760	1,730

Ratio of Cutting Depth / ØD x L

Material	Ratio	OH	Factor	Ø2 CR 0.5		Ø3 CR 0.8		Ø4 CR 1		Ø5 CR 1.2		Ø6 CR 1.5		Ø8 CR 2		Ø10 CR 2		Ø12 CR 2	
				a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e
Cast Iron, Carbon Steels, Alloy Steels HB150~250	0.8	5 x Dia	0.3	0.120		0.192		0.240		0.288		0.360		0.480		0.480		0.480	
		8 x Dia	0.23	0.092	0.5	0.147	0.7	0.184	1	0.221	1.3	0.276	1.5	0.368	2	0.368	3	0.368	4
		10 x Dia	0.15	0.060		0.096		0.120		0.144		0.180		0.240		0.240		0.240	
Tool Steels HRC25~35	0.8	5 x Dia	0.3	0.120		0.192		0.240		0.288		0.360		0.480		0.480		0.480	
		8 x Dia	0.23	0.092	0.5	0.147	0.7	0.184	1	0.221	1.3	0.276	1.5	0.368	2	0.368	3	0.368	4
		10 x Dia	0.15	0.060		0.096		0.120		0.144		0.180		0.240		0.240		0.240	
Pre-hardened Steels HRC35~45	0.7	5 x Dia	0.3	0.105		0.168		0.210		0.252		0.315		0.420		0.420		0.420	
		8 x Dia	0.23	0.081	0.5	0.129	0.7	0.161	1	0.193	1.3	0.242	1.5	0.322	2	0.322	3	0.322	4
		10 x Dia	0.15	0.053		0.084		0.105		0.126		0.158		0.210		0.210		0.210	
Hardened Steels HRC45~55	0.6	5 x Dia	0.3	0.090		0.144		0.180		0.216		0.270		0.360		0.360		0.360	
		8 x Dia	0.23	0.069	0.5	0.110	0.7	0.138	1	0.166	1.3	0.207	1.5	0.276	2	0.276	3	0.276	4
		10 x Dia	0.15	0.045		0.072		0.090		0.108		0.135		0.180		0.180		0.180	
Hardened Steels HRC55~60	0.4	5 x Dia	0.3	0.060		0.096		0.120		0.144		0.180		0.240		0.240		0.240	
		8 x Dia	0.23	0.046	0.5	0.074	0.7	0.092	1	0.110	1.3	0.138	1.5	0.184	2	0.184	3	0.184	4
		10 x Dia	0.15	0.030		0.048		0.060		0.072		0.090		0.120		0.120		0.120	

NOTE

1. Usare macchine più rigide e precise possibili.
2. Queste condizioni sono per un uso generale; le condizioni di uso vanno calcolate tenendo in considerazione la macchina e le condizioni di lavoro.
3. Se il numero di giri a disposizione è più basso di quello richiesto si raccomanda di adeguare l'avanzamento di conseguenza.

OBSERVACIÓN

1. Usar la máquina mas rígida y precisa posible.
2. Estas condiciones son una indicación general y deben adaptarse de acuerdo a las características de la máquina y la geometría y amarre de la pieza en concreto.
3. Si las revoluciones disponibles son menores que las recomendadas ajustar también el avance proporcionalmente.

REMARQUES:

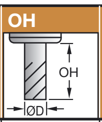
1. Utilisez une machine la plus rigide et précise possible.
2. Ces conditions sont indicatives; en conditions d'usinage réelles ajustez les paramètres selon l'état réel de vos machines et du travail à effectuer.
3. Si le nombre de tour par minute disponible est inférieur à celui recommandé, veuillez utiliser ce rapport pour réduire l'avance du même ratio.

4

High depth of cut Conditions · Low revolution, High depth of cut

Material	Ratio to standard depth of cut	Cutting Condition	Ø2	Ø3	Ø4	Ø5	Ø6	Ø8	Ø10	Ø12
			CR 0.5	CR 0.8	CR 1	CR 1.2	CR 1.5	CR 2	CR 2	CR 2
Cast Iron, Carbon Steels, Alloy Steels HB150~250	2	n	12,000	8,000	6,000	4,800	4,000	3,000	2,400	2,000
		f_z	0.05	0.09	0.12	0.15	0.19	0.26	0.32	0.36
		V_f	2,460	2,760	2,920	2,920	3,070	3,070	3,070	2,920
Tool Steels HRC25~35	1.8	n	11,000	7,400	5,600	4,500	3,700	2,800	2,200	1,900
		f_z	0.05	0.08	0.11	0.14	0.18	0.24	0.30	0.34
		V_f	2,110	2,400	2,550	2,570	2,660	2,690	2,640	2,600
Pre-hardened Steels HRC35~45	1.6	n	10,000	6,900	5,200	4,100	3,400	2,600	2,100	1,700
		f_z	0.04	0.07	0.10	0.12	0.15	0.20	0.25	0.29
		V_f	1,600	1,860	1,980	1,950	2,040	2,080	2,100	1,940
Hardened Steels HRC45~55	1.2	n	8,000	5,300	4,000	3,200	2,700	2,000	1,600	1,300
		f_z	0.04	0.07	0.10	0.12	0.15	0.20	0.25	0.29
		V_f	1,280	1,430	1,520	1,520	1,620	1,600	1,600	1,480
Hardened Steels HRC55~60	0.7	n	8,000	5,300	4,000	3,200	2,700	2,000	1,600	1,300
		f_z	0.02	0.03	0.05	0.06	0.07	0.10	0.12	0.14
		V_f	610	690	730	730	780	770	770	710

Ratio of Cutting Depth / ØD x L

Material	Ratio	OH	Factor	Ø2		Ø3		Ø4		Ø5		Ø6		Ø8		Ø10		Ø12	
				CR 0.5		CR 0.8		CR 1		CR 1.2		CR 1.5		CR 2		CR 2		CR 2	
				a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e
Cast Iron, Carbon Steels, Alloy Steels HB150~250	2	5 x Dia	0.3	0.300		0.480		0.600		0.720		0.900		1.200		1.200		1.200	
		8 x Dia	0.23	0.230	0.5	0.368	0.7	0.460	1	0.552	1.3	0.690	1.5	0.920	2	0.920	3	0.920	4
		10 x Dia	0.15	0.150		0.240		0.300		0.360		0.450		0.600		0.600		0.600	
Tool Steels HRC25~35	1.8	5 x Dia	0.3	0.270		0.432		0.540		0.648		0.810		1.080		1.080		1.080	
		8 x Dia	0.23	0.207	0.5	0.331	0.7	0.414	1	0.497	1.3	0.621	1.5	0.828	2	0.828	3	0.828	4
		10 x Dia	0.15	0.135		0.216		0.270		0.324		0.405		0.540		0.540		0.540	
Pre-hardened Steels HRC35~45	1.6	5 x Dia	0.3	0.240		0.384		0.480		0.576		0.720		0.960		0.960		0.960	
		8 x Dia	0.23	0.184	0.5	0.294	0.7	0.368	1	0.442	1.3	0.552	1.5	0.736	2	0.736	3	0.736	4
		10 x Dia	0.15	0.120		0.192		0.240		0.288		0.360		0.480		0.480		0.480	
Hardened Steels HRC45~55	1.2	5 x Dia	0.3	0.180		0.288		0.360		0.432		0.540		0.720		0.720		0.720	
		8 x Dia	0.23	0.138	0.5	0.221	0.7	0.276	1	0.331	1.3	0.414	1.5	0.552	2	0.552	3	0.552	4
		10 x Dia	0.15	0.090		0.144		0.180		0.216		0.270		0.360		0.360		0.360	
Hardened Steels HRC55~60	0.7	5 x Dia	0.3	0.105		0.168		0.210		0.252		0.315		0.420		0.420		0.420	
		8 x Dia	0.23	0.081	0.5	0.129	0.7	0.161	1	0.193	1.3	0.242	1.5	0.322	2	0.322	3	0.322	4
		10 x Dia	0.15	0.053		0.084		0.105		0.126		0.158		0.210		0.210		0.210	

NOTE

1. Use a highly rigid and accurate machine possible.
2. These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
3. If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

BEMERKUNG

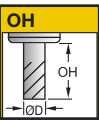
1. Nutzen Sie für die Bearbeitungen die Maschine mit der höchsten Genauigkeit und der höchsten Steifigkeit.
2. Die in der Tabelle angegebenen Schnittbedingungen stellen eine generelle Empfehlung dar. Die Werte sollten immer an die jeweilige Bearbeitung, deren Form und die verwendete Maschine angepasst werden.
3. Sollte die Ihnen verfügbare Drehzahl niedriger als der in der Tabelle angegebene Wert sein, sollte der Vorschub im gleichen Verhältnis reduziert werden.

4

Low load Conditions · Medium revolution, high feed

Material	Ratio to standard depth of cut	Cutting Condition	Ø2 CR 0.5	Ø3 CR 0.8	Ø4 CR 1	Ø5 CR 1.2	Ø6 CR 1.5	Ø8 CR 2	Ø10 CR 2	Ø12 CR 2
Cast Iron, Carbon Steels, Alloy Steels HB150~250	1	n	15,000	10,100	7,600	6,000	5,000	3,800	3,000	2,500
		f_z	0.09	0.15	0.21	0.26	0.32	0.43	0.54	0.62
		V_f	5,180	5,890	6,240	6,160	6,480	6,570	6,480	6,160
Tool Steels HRC25~35	1	n	14,000	9,500	7,200	5,700	4,800	3,600	2,900	2,400
		f_z	0.08	0.13	0.18	0.23	0.29	0.38	0.48	0.55
		V_f	4,300	4,920	5,250	5,200	5,530	5,530	5,570	5,250
Pre-hardened Steels HRC35~45	1	n	14,000	9,000	6,800	5,400	4,500	3,400	2,700	2,300
		f_z	0.06	0.10	0.14	0.18	0.23	0.30	0.38	0.43
		V_f	3,400	3,690	3,930	3,900	4,100	4,130	4,100	3,990
Hardened Steels HRC45~55	0.7	n	10,300	6,900	5,200	4,100	3,400	2,600	2,100	1,700
		f_z	0.06	0.09	0.13	0.17	0.21	0.28	0.35	0.40
		V_f	2,310	2,610	2,770	2,730	2,860	2,910	2,940	2,710
Hardened Steels HRC55~60	0.5	n	9,500	6,400	4,800	3,800	3,200	2,400	1,900	1,600
		f_z	0.02	0.04	0.06	0.07	0.09	0.12	0.15	0.17
		V_f	910	1,040	1,090	1,080	1,150	1,150	1,140	1,090

Ratio of Cutting Depth / ØD x L

Material	Ratio	OH	Factor	Ø2 CR 0.5		Ø3 CR 0.8		Ø4 CR 1		Ø5 CR 1.2		Ø6 CR 1.5		Ø8 CR 2		Ø10 CR 2		Ø12 CR 2	
				a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e	a_p	a_e
Cast Iron, Carbon Steels, Alloy Steels HB150~250	1	5 x Dia	0.3	0.150	0.5	0.240	0.7	0.300	1	0.360	1.3	0.450	1.5	0.600	2	0.600	3	0.600	4
		8 x Dia	0.23	0.115		0.184		0.230		0.276		0.345		0.460		0.460		0.460	
		10 x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Tool Steels HRC25~35	1	5 x Dia	0.3	0.150	0.5	0.240	0.7	0.300	1	0.360	1.3	0.450	1.5	0.600	2	0.600	3	0.600	4
		8 x Dia	0.23	0.115		0.184		0.230		0.276		0.345		0.460		0.460		0.460	
		10 x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Pre-hardened Steels HRC35~45	1	5 x Dia	0.3	0.150	0.5	0.240	0.7	0.300	1	0.360	1.3	0.450	1.5	0.600	2	0.600	3	0.600	4
		8 x Dia	0.23	0.115		0.184		0.230		0.276		0.345		0.460		0.460		0.460	
		10 x Dia	0.15	0.075		0.120		0.150		0.180		0.225		0.300		0.300		0.300	
Hardened Steels HRC45~55	0.7	5 x Dia	0.3	0.105	0.5	0.168	0.7	0.210	1	0.252	1.3	0.315	1.5	0.420	2	0.420	3	0.420	4
		8 x Dia	0.23	0.081		0.129		0.161		0.193		0.242		0.322		0.322		0.322	
		10 x Dia	0.15	0.053		0.084		0.105		0.126		0.158		0.210		0.210		0.210	
Hardened Steels HRC55~60	0.5	5 x Dia	0.3	0.075	0.5	0.120	0.7	0.150	1	0.180	1.3	0.225	1.5	0.300	2	0.300	3	0.300	4
		8 x Dia	0.23	0.058		0.092		0.115		0.138		0.173		0.230		0.230		0.230	
		10 x Dia	0.15	0.038		0.060		0.075		0.090		0.113		0.150		0.150		0.150	

NOTE

1. Usare macchine più rigide e precise possibili.
2. Queste condizioni sono per un uso generale; le condizioni di uso vanno calcolate tenendo in considerazione la macchina e le condizioni di lavoro.
3. Se il numero di giri a disposizione è più basso di quello richiesto si raccomanda di adeguare l'avanzamento di conseguenza.

OBSERVACIÓN

1. Usar la máquina mas rígida y precisa posible.
2. Estas condiciones son una indicación general y deben adaptarse de acuerdo a las características de la máquina y la geometría y amarre de la pieza en concreto.
3. Si las revoluciones disponibles son menores que las recomendadas ajustar también el avance proporcionalmente.

REMARQUES:

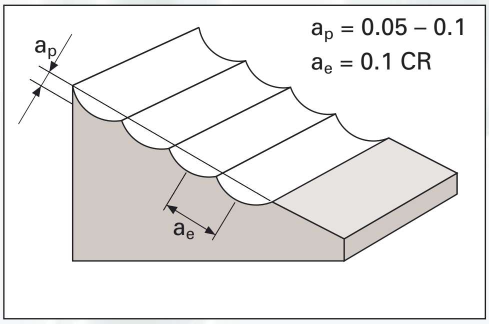
1. Utilisez une machine la plus rigide et précise possible.
2. Ces conditions sont indicatives; en conditions d'usinage réelles ajustez les paramètres selon l'état réel de vos machines et du travail à effectuer.
3. Si le nombre de tour par minute disponible est inférieur à celui recommandé, veuillez utiliser ce rapport pour réduire l'avance du même ratio.

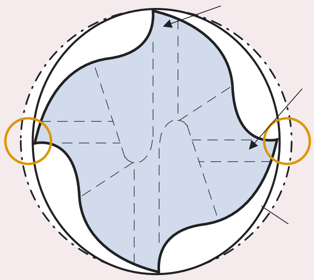
4

Finish Conditions

Material	Cutting Condition	Ø2 CR 0.5	Ø3 CR 0.8	Ø4 CR 1	Ø5 CR 1.2	Ø6 CR 1.5	Ø8 CR 2	Ø10 CR 2	Ø12 CR 2
Cast Iron, Carbon Steels, Alloy Steels HB150~250	n	29,000	19,100	14,300	11,500	9,500	7,200	5,700	4,800
	f_z	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.11
	V_f	1,860	2,060	2,170	2,190	2,280	2,300	2,280	2,190
Tool Steels HRC25~35	n	24,000	15,900	11,900	9,500	8,000	6,000	4,800	4,000
	f_z	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.09
	V_f	1,230	1,370	1,450	1,440	1,540	1,540	1,540	1,460
Pre-hardened Steels HRC35~45	n	19,000	12,700	9,500	7,600	6,400	4,800	3,800	3,200
	f_z	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07
	V_f	730	820	870	870	920	920	910	880
Hardened Steels HRC45~55	n	14,300	9,500	7,200	5,700	4,800	3,600	2,900	2,400
	f_z	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06
	V_f	460	510	550	540	580	580	580	550
Hardened Steels HRC55~60	n	11,100	7,400	5,600	4,500	3,700	2,800	2,200	1,900
	f_z	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05
	V_f	280	320	340	340	360	360	350	350

Depth of cut Finishing





ATTENTION

- Be careful of the newly developed flute shape when measuring tool diameter or oscillation.
- The bit is designed with a smaller outer diameter connected to end slave flutes.
- When measuring tool diameter or oscillation, measure the main flutes.

Product Range

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