



CARBIDE END MILLS

Caption .J2

Selection Guide .J6

G2 .J17

HF VH/UP .J85

MEF .J189

ALU .J203

MEX/MH .J235

UH/MH .J295

STOCK *		
●	 stock standard  stock standard	 Standard Lager  stock standard
⊙	 non-stock standard (no MOQ)  non-standard stock (no MOQ)	 Nicht-Lager-Standard (keine MOQ / Mindestbestellmenge)  non-standard stock (aucun MOQ/commande minimale)
○	 non-stock standard (MOQ)  non-standard stock (MOQ)	 Nicht-Lager-Standard (keine MOQ / Mindestbestellmenge)  non-standard stock (aucun MOQ/commande minimale)
▲	 upcoming product  prossima introduzione	 kommende Produkt  prochaine introduction
▽	 stock exhaustion  esaurimento stock	 Vorraterschöpfung  épuisement du stock

 APPLICATION GUIDELINES  INDICAZIONI PER L'APPLICAZIONE  LEITFADEN ZUR ANWENDUNG  INDICATIONS POUR L'APPLICATION		
★	 1st choice  1a scelta	 1. Wahl  1er choix
☆	 suitable  adatto	 geeignet  adapté

 SHANK  ATTACCO  SCHAF  QUEUE		
	 cylindrical shank  attacco cilindrico	 zylindrischer Schaft  queue cylindrique
	Weldon	

 MILLING STRATEGY  STRATEGIA DI FRESATURA  FRÄSSTRATEGIE  STRATÉGIES DE FRAISAGE		
	 slotting  fresatura di cave	 Nutfräsen  rainurage
 SIDE MILLING  SIDE MILLING	 side milling  contornatura	 Konturfräsen  contournage
	 3D machining  fresatura 3D	 3D-Bearbeitung  fraisage 3D
	 square rib  nervatura piana	 Flachrippen  rainurage
	 copying  copiatura	 Kopieren  copiage
	 round rib  nervatura raggiata	 Rundrippen  rainurage rayonné
	 helical  interpolazione elicoidale	 Helixinterpolation  interpolation hélicoïdale

*  The stock category of items in this catalogue may change without prior notice

 La categoria di stock dei prodotti a catalogo può variare senza preavviso

 La catégorie de stock des articles dans ce catalogue peut être modifiée sans préavis.

 Die Einstufung der Produkte kann sich jederzeit ändern

 MILLING STRATEGY  STRATEGIA DI FRESATURA  FRÄSSTRATEGIE  STRATÉGIES DE FRAISAGE		
	 ramping  entrata in rampa	 Rampen  entrée en ramping
	 vertical  fresatura assiale	 Vertikalfräsen  fraisage axial
	 drilling  foratura	 Bohren  perçage
	 trochoidal  fresatura trocoidale	 trochoidales Fräsen  fraisage trochoidal
	 chamfering  svasatura	 Ansenkung  chanfreiner
 GEOMETRY  GEOMETRIA  GEOMETRIE  GÉOMÉTRIE		
	 general purpose  uso generico	 allgemeine Anwendung  applications génériques
	 < 40 HRC variable helix and unequal pitch  < 40 HRC elica variabile e passo differenziato	 < 40 HRC ungleicher Teilung und Winkel  < 40 HRC hélice et pas décalé
	 30÷55 HRC unequal pitch  30÷55 HRC passo differenziato	 30÷55 HRC ungleicher Teilung  30÷55 HRC pas décalé
	 for stainless steel  per acciaio inossidabile	 für rostfreien Stahl  pour acier inoxydable
	 for aluminium  per alluminio	 für Aluminium  pour aluminium
	 unequal pitch (UP) for Aluminium  passo differenziato (UP) per alluminio	 ungleiche Teilung (UP) für Aluminium  pas décalé (UP) pour aluminium
	 30÷55 HRC general purpose and hardened steel  30÷55 HRC uso generico e acciaio temprato	 30÷55 HRC allgemeine Anwendung und gehärtete Stähle  30÷55 HRC utilisation générale et aciers trempés
	 30÷70 HRC general purpose and hardened steel  30÷70 HRC uso generico e acciaio temprato	 30÷70 HRC allgemeine Anwendung und gehärtete Stähle  30÷70 HRC utilisation générale et aciers trempés
	 < 70 HRC for hardened steel  < 70 HRC per acciai temprati	 < 70 HRC für Hartstahl  < 70 HRC pour acier trempé
 TYPE  TIPO  TYP  TYPE		
	 sharp corner  spigolo vivo	 scharfe Kante  arête vive
	 45° chamfer  smusso a 45°	 45° abgeschrägt  biseau à 45°

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H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

	✚ TYPE	🇮🇹 TIPO	🇩🇪 TYP	🇫🇷 TYPE
 RADIUS	✚ corner radius	🇮🇹 torica	🇩🇪 Eckradius	🇫🇷 torique
 BALL NOSE	✚ ball nose	🇮🇹 raggiata	🇩🇪 runder Stirn	🇫🇷 bout hémisphérique
 HIGH FEED	✚ high feed	🇮🇹 alto avanzamento	🇩🇪 hoher Vorschub	🇫🇷 haute vitesse
	✚ NR. OF FLUTES	🇮🇹 N. DI TAGLIENTI	🇩🇪 ANZAHL DER SCHNEIDEN	🇫🇷 NOMBRE DE DENTS
 ZEFP 1	✚ single flute	🇮🇹 monotagliante	🇩🇪 Einzelschneide	🇫🇷 monocoupe
 ZEFP 2	✚ 2 flutes	🇮🇹 2 taglianti	🇩🇪 2 Schneiden	🇫🇷 2 arêtes de coupe
 ZEFP 3	✚ 3 flutes	🇮🇹 3 taglianti	🇩🇪 3 Schneiden	🇫🇷 3 arêtes de coupe
 ZEFP 3 UP	✚ 3 flutes unequal pitch	🇮🇹 3 taglianti passo differenziato	🇩🇪 3 Schneiden ungleiche Teilung	🇫🇷 3 arêtes de coupe pas décalé
 ZEFP 4	✚ 4 flutes	🇮🇹 4 taglianti	🇩🇪 4 Schneiden	🇫🇷 4 arêtes de coupe
 ZEFP 4 UP	✚ 4 flutes unequal pitch	🇮🇹 4 taglianti passo differenziato	🇩🇪 4 Schneiden ungleiche Teilung	🇫🇷 4 arêtes de coupe pas décalé
 ZEFP 5	✚ 5 flutes	🇮🇹 5 taglianti	🇩🇪 5 Schneiden	🇫🇷 5 arêtes de coupe
 ZEFP 5 UP	✚ 5 flutes unequal pitch	🇮🇹 5 taglianti passo differenziato	🇩🇪 5 Schneiden ungleiche Teilung	🇫🇷 5 arêtes de coupe pas décalé
 ZEFP 6	✚ 6 flutes	🇮🇹 6 taglianti	🇩🇪 6 Schneiden	🇫🇷 6 arêtes de coupe
 ZEFP 8	✚ 8 flutes	🇮🇹 8 taglianti	🇩🇪 8 Schneiden	🇫🇷 8 arêtes de coupe
	✚ CHIPBREAKER STYLE	🇮🇹 TIPO DI ROMPITRUCIOLO	🇩🇪 SPÄNEBRECHER TYP	🇫🇷 TYPE DE BRISE-COPEAUX
 NR COARSE	✚ roughing coarse pitch	🇮🇹 sgrossare passo grosso	🇩🇪 Schrappfräser Regelprofil	🇫🇷 ébauche pas gros
 HR FINE	✚ roughing fine pitch	🇮🇹 sgrossare passo fine	🇩🇪 Schrappfräser Feinprofil	🇫🇷 ébauche pas fin

🇬🇧 MATERIAL 🇮🇹 MATERIALE 🇩🇪 WERKSTOFF 🇫🇷 MATIÈRE								
NMG ...	🇬🇧 nano micrograin 🇮🇹 nano micrograna	🇩🇪 nano Mikrokörnung 🇫🇷 nano micrograin						
UMG ...	🇬🇧 ultra fine micrograin 🇮🇹 micrograna ultra fine	🇩🇪 ultrafeine Mikrokörnung 🇫🇷 micrograin ultra-fin						
MG ...	🇬🇧 micrograin 🇮🇹 micrograna	🇩🇪 Mikrokörnung 🇫🇷 micrograin						
🇬🇧 SURFACE TREATMENT 🇮🇹 TRATTAMENTO SUPERFICIALE 🇩🇪 OBERFLÄCHENBEHANDLUNG 🇫🇷 TRAITEMENT DE SURFACE								
... BR	🇬🇧 uncoated 🇮🇹 non rivestito	🇩🇪 unbeschichtet 🇫🇷 non revêtu						
... POLISHED	🇬🇧 polished 🇮🇹 lappato	🇩🇪 geläppt 🇫🇷 poli						
🇬🇧 COATINGS 🇮🇹 RIVESTIMENTI 🇩🇪 BESCHICHTUNGEN 🇫🇷 REVÊTEMENTS								
		... PV200	... PV300	... PV500	... ENDLESS ORANGE	... MH COAT	... UH RED	... DLC
🇬🇧 hardness (HV) 🇮🇹 durezza (HV)	🇩🇪 Härte (HV) 🇫🇷 dureté (HV)	3300	3300	3300	3300	3600	3600	4000
🇬🇧 friction coefficient 🇮🇹 coefficiente d'attrito	🇩🇪 Reibungskoeffizient 🇫🇷 coefficient de frottement	0.3	0.3	0.3	0.35	0.3	0.35	0.1
🇬🇧 thickness (μ) 🇮🇹 spessore (μ)	🇩🇪 dicke (μ) 🇫🇷 épaisseur (μ)	3	2.5÷3.5	2.5÷3.5	2.5÷3.5	2.5÷3.5	2.5÷3.5	0.1÷0.5
🇬🇧 max working temperature (°C) 🇮🇹 temperatura max (°C)	🇩🇪 höchste Temperatur (°C) 🇫🇷 température maximale (°C)	950°	1100°	1100°	1000°	1300°	1200°	500°

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H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

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L - CARBIDE BURRS

	ITEM NO.	PAGE	
G2 general purpose, square	GB205	J19	
	GBL2	J21	
	G2CS2	J23	
	G2WS2	J25	
	G2210	J27	
	G2211	J29	
	G2212	J31	
	GB305	J33	
	G2CSH3	J35	
	G2WSH3	J37	
	G2310	J39	
	G2311	J41	
	G2312	J43	
	GB405	J45	
	GBL4	J47	
	G2CS4	J49	
	G2WS4	J51	
	G2410	J53	
	G2411	J55	
	G2412	J57	
	G2413	J59	
	G2CSHM	J61	
G2 general purpose, HR roughing	G2CSFR	J63	
	G2WSFR	J65	
G2 general purpose, corner radius	G2CS2R	J67	
	G2CS4R	J69	
	G2CL4R	J71	

RANGE	NORM	TYPE	MATERIAL / COATING	HRC	HELIX ANGLE	GEOMETRY	Z	ISO P	ISO M	ISO K	ISO N	ISO S	ISO H
1-12	OSAWA	N	MG BR	<45	30°	SQUARE	2	★	☆	★	☆		
3-12	OSAWA	N	MG BR	<45	30	SQUARE	2	★	☆	★	☆		
1-20	OSAWA	N	MG PV200	<45	30°	SQUARE	2	★	☆	★	☆		
3-20	OSAWA	N	MG PV200	<45	30°	SQUARE	2	★	☆	★	☆		
2-8	OSAWA	N	MG PV200	<45	30°	SQUARE	2	★	☆	★	☆		
5-12	OSAWA	N	MG PV200	<45	30°	SQUARE	2	★	☆	★	☆		
8-16	OSAWA	N	MG PV200	<45	30°	SQUARE	2	★	☆	★	☆		
1-12	OSAWA	N	MG BR	<45	45°	SQUARE	3	★	☆	★	☆		
1-20	OSAWA	N	MG PV200	<45	45°	SQUARE	3	★	☆	★	☆		
3-20	OSAWA	N	MG PV200	<45	45°	SQUARE	3	★	☆	★	☆		
2-6	OSAWA	N	MG PV200	<45	45°	SQUARE	3	★	☆	★	☆		
4-12	OSAWA	N	MG PV200	<45	45°	SQUARE	3	★	☆	★	☆		
8-20	OSAWA	N	MG PV200	<45	45°	SQUARE	3	★	☆	★	☆		
1-12	OSAWA	N	MG BR	<45	30°	SQUARE	4	★	☆	★	☆		
3-12	OSAWA	N	MG BR	<45	30	SQUARE	4	★	☆	★	☆		
1-25	OSAWA	N	MG PV200	<45	30°	SQUARE	4	★	☆	★	☆		
3-20	OSAWA	N	MG PV200	<45	30°	SQUARE	4	★	☆	★	☆		
2-8	OSAWA	N	MG PV200	<45	30°	SQUARE	4	★	☆	★	☆		
3-16	OSAWA	N	MG PV200	<45	30°	SQUARE	4	★	☆	★	☆		
6-20	OSAWA	N	MG PV200	<45	30°	SQUARE	4	★	☆	★	☆		
16-20	OSAWA	N	MG PV200	<45	30°	SQUARE	4	★	☆	★	☆		
6-20	OSAWA	N	MG PV200	<45	45°	SQUARE	6	★	☆	★	☆		
4-20	OSAWA	HR	MG PV200	<45	30°	SQUARE	3-4	★	☆	★	☆		
6-20	OSAWA	HR	MG PV200	<45	30°	SQUARE	3-4	★	☆	★	☆		
1-12	OSAWA	N	MG PV200	<45	30°	CORNER RADIUS	2	★	☆	★	☆		
1-12	OSAWA	N	MG PV200	<45	30°	CORNER RADIUS	4	★	☆	★	☆		
2-12	OSAWA	N	MG PV200	<45	30°	CORNER RADIUS	4	★	☆	★	☆		

★ 1st choice ☆ suitable

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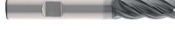
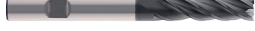
H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

	ITEM NO.	PAGE	
G2 general purpose, ball nose	GB255	J73	
	G2CSB2	J75	
	G2250	J77	
	G2251	J79	
	G2CSB4	J81	
G2 general purpose, chamfering	G2WC 90	J83	
HF UNI < 40 HRC, 45° chamfer	HF840	J89	
	HF440	J93	
	HF441	J98	
	HF6441	J104	
HF UNI < 40 HRC, HR roughing	HF844	J109	
	HF444	J113	
	HF445	J117	
HF UNI < 40 HRC, corner radius	HF342	J122	
	HF842	J125	
	HF442	J129	
	HF443	J134	
	HF542	J139	
	HF942	J142	
	HF943	J146	
	HF642	J150	
	HF643	J153	
	HF742	J156	
	HF743	J159	
	HF535T	J162	
HF SC <40HRC, 45° chamfer	HF471	J164	
HF HARD 30÷55 HRC, 45° chamfer	HF850	J169	
	HF450	J173	
	HF451	J177	

RANGE	NORM	TYPE	MATERIAL / COATING	HRC	HELIX ANGLE	GEOMETRY	Z	ISO P	ISO M	ISO K	ISO N	ISO S	ISO H
1-12	OSAWA	N	MG BR	<45	30°	BALL NOSE	2	★	☆	★	☆		
1-20	OSAWA	N	MG PV200	<45	30°	BALL NOSE	2	★	☆	★	☆		
1-12	OSAWA	N	MG PV200	<45	30°	BALL NOSE	2	★	☆	★	☆		
6-20	OSAWA	N	MG PV200	<45	30°	BALL NOSE	2	★	☆	★	☆		
1-20	OSAWA	N	MG PV200	<45	30°	BALL NOSE	4	★	☆	★	☆		
1-20	OSAWA	N	MG PV200	<45	-	-	3-4	★	☆	★	☆		
3-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CHAMFER 45°	4	★	★	★		★	
3-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CHAMFER 45°	4	★	★	★		★	
3-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CHAMFER 45°	4	★	★	★		★	
1-20	OSAWA	VH/UP	MG PV500	<40	36°-39°	CHAMFER 45°	4	★	★	★			
6-20	OSAWA	VH/UP – HR	MG PV300	<40	36°-39°	CHAMFER 45°	4	★	★	★		★	
6-20	OSAWA	VH/UP – HR	MG PV300	<40	36°-39°	CHAMFER 45°	4	★	★	★		★	
6-20	OSAWA	VH/UP – HR	MG PV300	<40	36°-39°	CHAMFER 45°	4	★	★	★		★	
3-12	OSAWA	VH/UP	MG PV300	<40	36°-39°	CORNER RADIUS	4	★	★	★		★	
4-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CORNER RADIUS	4	★	★	★		★	
3-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CORNER RADIUS	4	★	★	★		★	
3-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CORNER RADIUS	4	★	★	★		★	
6-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CORNER RADIUS	4	★	★	★		★	
4-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CORNER RADIUS	4	★	★	★		★	
4-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CORNER RADIUS	4	★	★	★		★	
4-20	OSAWA	VH	MG PV300	<40	36°-37°-38°	CORNER RADIUS	5	★	★	★		★	
4-20	OSAWA	VH	MG PV300	<40	36°-37°-38°	CORNER RADIUS	5	★	★	★		★	
6-20	OSAWA	VH	MG PV300	<40	36°-37°-38°	CORNER RADIUS	5	★	★	★		★	
6-20	OSAWA	VH	MG PV300	<40	36°-37°-38°	CORNER RADIUS	5	★	★	★		★	
10-20	OSAWA	VH/UP TROCH	MG PV300	<45	36°-37°-38°	CORNER RADIUS	5	★	☆	★		☆	
1-20	OSAWA	VH/UP	MG PV300	<40	36°-39°	CHAMFER 45°	4	★	★	★		★	
3-20	OSAWA	UP	MG PV300	35÷55	40°	CHAMFER 45°	4	★	★	★		★	★
3-20	OSAWA	UP	MG PV300	35÷55	40°	CHAMFER 45°	4	★	★	★		★	★
3-20	OSAWA	UP	MG PV300	35÷55	40°	CHAMFER 45°	4	★	★	★		★	★

★ 1st choice ☆ suitable

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

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L - CARBIDE BURRS

	ITEM NO.	PAGE	
HF HARD 30÷55 HRC, corner radius	HF852	J181	
	HF452	J185	
MEF stainless steel and super alloys, square	MEFCS2	J192	
	MEFCSH3	J194	
	MEFCS4	J196	
	MEF600	J198	
MEF stainless steel and super alloys, roughing	MEF901	J200	
ALU unequal pitch, square	HFAL4	J206	
ALU unequal pitch, corner radius	HFAL3	J209	
	HFA3D	J212	
	HFA53	J215	
ALU square	MDCSA1	J218	
	MDCSA2	J220	
	MDCSA3	J223	
	MDA310	J225	
	MDA311	J227	
	MDA312	J229	
	MDCSAM	J231	
ALU ball nose	MDCAB2	J233	
MEX 30÷55 HRC, square	MEXM2	J238	 
	MEXM2SC	J240	 
	MEXLN2	J242	 
	MEXCS2	J247	
	MEXCL2	J249	
	MEX400	J251	
	MEXCL4	J253	
	MEXCSHM	J255	
	MEXCLHM	J257	

RANGE	NORM	TYPE	MATERIAL / COATING	HRC	HELIX ANGLE	GEOMETRY	Z	ISO P	ISO M	ISO K	ISO N	ISO S	ISO H
4-20	OSAWA	UP	MG PV300	35÷55	40°	CORNER RADIUS	4	★	★	★		★	★
3-20	OSAWA	UP	MG PV300	35÷55	40°	CORNER RADIUS	4	★	★	★		★	★
1-16	OSAWA	VA	UMG ENDLESS	<45	35°	SQUARE	2	★	★			★	
6-20	OSAWA	VA	UMG ENDLESS	<45	50°	SQUARE	3	★	★			★	
2-20	OSAWA	VA	UMG ENDLESS	<45	35°	SQUARE	4	★	★			★	
6-20	OSAWA	VA	UMG ENDLESS	<45	50°	SQUARE	6-8	★	★			★	
4-20	OSAWA	VA - HR	UMG ENDLESS	<45	45°	SQUARE	3-6	★	★			★	
3-20	OSAWA	UP ALU	MG BR		40°	SQUARE	4				★		
1-20	OSAWA	UP ALU	MG POLISHED		30°	CORNER RADIUS	3				★		
1-20	OSAWA	UP ALU	MG DLC		30°	CORNER RADIUS	3				★		
3-20	OSAWA	UP ALU	MG BR		30°	CORNER RADIUS	3				★		
2-12	OSAWA	ALU	MG POLISHED		25°	SQUARE	1				★		
1-20	OSAWA	ALU	MG POLISHED		45°	SQUARE	2				★		
1-20	OSAWA	ALU	MG POLISHED		55°	SQUARE	3				★		
3-6	OSAWA	ALU	MG POLISHED		55°	SQUARE	3				★		
3-12	OSAWA	ALU	MG POLISHED		55°	SQUARE	3				★		
8-20	OSAWA	ALU	MG POLISHED		55°	SQUARE	3				★		
6-12	OSAWA	ALU	MG POLISHED		50°	SQUARE	6				★		
1-12	OSAWA	ALU	MG POLISHED		40°	BALL NOSE	2				★		
0.3-2	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	SQUARE	2	★		★			★
0.2-0.9	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	SQUARE	2	★		★			★
0.2-4	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	SQUARE	2	★		★			★
1-20	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	SQUARE	2	★		★			★
1-12	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	SQUARE	2	★		★			★
1-25	OSAWA	MEX UP	UMG ENDLESS ORANGE	<55	40°	SQUARE	4	★		★			★
2-25	OSAWA	MEX	UMG ENDLESS ORANGE	<55	30°-40°	SQUARE	4	★		★			★
3-20	OSAWA	MEX	UMG ENDLESS ORANGE	<55	50°	SQUARE	6-8	★		★			★
3-20	OSAWA	MEX	UMG ENDLESS ORANGE	<55	50°	SQUARE	6-8	★		★			★

★ 1st choice ☆ suitable

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K - HSS END MILLS

L - CARBIDE BURRS

	ITEM NO.	PAGE	
MEX 30÷55 HRC, corner radius	MEXLN2R	J259	
	MEXLS2R	J264	
	MEXCS4R	J266	
	MEX410R	J269	
	MEXLS4R	J271	
	MEX610R	J273	
	MEX611R	J275	
MEX 30÷55 HRC and MH 30÷70 HRC, ball nose	MHMB204	J277	
	MHMB206	J279	
	MHLNB2	J281	
	MHCRB2	J286	
	MEXCSB2	J288	
	MEXCLSB2	J290	
	MEX253	J292	
UH < 70 HRC, square	UHM204	J299	
	UHLN2	J301	
	UH600	J306	
	UH612	J308	
UH < 70 HRC, corner radius	UHM206	J310	
	UH211	J312	
	UH212	J314	
	UHCS2	J320	
	UHF4LN	J322	
	UHF-RT	J326	
	UHCS4	J328	
	UH410	J330	

RANGE	NORM	TYPE	MATERIAL / COATING	HRC	HELIX ANGLE	GEOMETRY	Z	ISO P	ISO M	ISO K	ISO N	ISO S	ISO H
0.3-4	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	CORNER RADIUS	2	★		★			★
2-16	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	CORNER RADIUS	2	★		★			★
1-20	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	CORNER RADIUS	4	★		★			★
2-12	OSAWA	MEX	UMG ENDLESS ORANGE	<55	30°	CORNER RADIUS	4	★		★			★
2-16	OSAWA	MEX	UMG ENDLESS ORANGE	<55	40°	CORNER RADIUS	4	★		★			★
6-12	OSAWA	MEX	UMG ENDLESS ORANGE	<55	45°	CORNER RADIUS	6	★		★			★
6-12	OSAWA	MEX	UMG ENDLESS ORANGE	<55	45°	CORNER RADIUS	6	★		★			★
0.2-2	OSAWA	MH	NMG MH COAT	30÷70	30°	BALL NOSE	2	★		★			★
0.2-0.8	OSAWA	MH	NMG MH COAT	30÷70	30°	BALL NOSE	2	★		★			★
0.2-4	OSAWA	MH	NMG MH COAT	30÷70	30°	BALL NOSE	2	★		★			★
0.5-2	OSAWA	MH	NMG MH COAT	30÷70	30°	BALL NOSE	2	★		★			★
1-20	OSAWA	MEX	UMG ENDLESS ORANGE	<55	30°	BALL NOSE	2	★		★			★
1-20	OSAWA	MEX	UMG ENDLESS ORANGE	<55	30°	BALL NOSE	2	★		★			★
1-20	OSAWA	MEX	UMG ENDLESS ORANGE	<55	30°	BALL NOSE	2	★		★			★
0.1-0.9	OSAWA	UH	NMG UH RED	<70	40°	SQUARE	2	☆		☆			★
0.2-4	OSAWA	UH	NMG UH RED	<70	40°	SQUARE	2	☆		☆			★
3-20	OSAWA	UH	NMG UH RED	<70	50°	SQUARE	6-8	☆		☆			★
3-20	OSAWA	UH	NMG UH RED	<70	50°	SQUARE	6-8	☆		☆			★
0.3-2	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	2	☆		☆			★
1-6	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	2	☆		☆			★
0.2-4	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	2	☆		☆			★
1-12	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	2	☆		☆			★
1-4	OSAWA	UP – UH	NMG UH RED	<70	25°	CORNER RADIUS	4	☆		☆			★
2-12	OSAWA	UH	NMG UH RED	<70	25°	CORNER RADIUS	4-6	☆		☆			★
1-12	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	4	☆		☆			★
1-20	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	4	☆		☆			★

★ 1st choice ☆ suitable

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

	ITEM NO.	PAGE	
UH < 70 HRC, corner radius	UH411	J332	
	UH412	J334	
	UH413	J336	
	UH610R	J338	
	UH611R	J340	
UH < 70 HRC and MH 30÷70 HRC, ball nose	MHMB204	J342	 
	MHMB206	J344	 
	MHLNB2	J346	 
	MHCRB2	J351	 
	UHCSB2	J353	
	UH250	J355	
	UH253	J357	

RANGE	NORM	TYPE	MATERIAL / COATING	HRC	HELIX ANGLE	GEOMETRY	Z	ISO P	ISO M	ISO K	ISO N	ISO S	ISO H
3-12	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	4	☆		☆			★
2-12	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	4	☆		☆			★
6-16	OSAWA	UH	NMG UH RED	<70	40°	CORNER RADIUS	4	☆		☆			★
6-12	OSAWA	UH	NMG UH RED	<70	50°	CORNER RADIUS	6	☆		☆			★
6-20	OSAWA	UH	NMG UH RED	<70	50°	CORNER RADIUS	6	☆		☆			★
0.2-0.8	OSAWA	MH	NMG MH COAT	30÷70	30°	BALL NOSE	2	☆		☆			★
0.4-0.8	OSAWA	MH	NMG MH COAT	30÷70	30°	BALL NOSE	2	☆		☆			★
0.2-4	OSAWA	MH	NMG MH COAT	30÷70	30°	BALL NOSE	2	☆		☆			★
0.5-2	OSAWA	MH	NMG MH COAT	30÷70	30°	BALL NOSE	2	☆		☆			★
1-20	OSAWA	UH	NMG UH RED	<70	30°	BALL NOSE	2	☆		☆			★
1-20	OSAWA	UH	NMG UH RED	<70	30°	BALL NOSE	2	☆		☆			★
1-20	OSAWA	UH	NMG UH RED	<70	30°	BALL NOSE	2	☆		☆			★

★ 1st choice ☆ suitable

SOLID

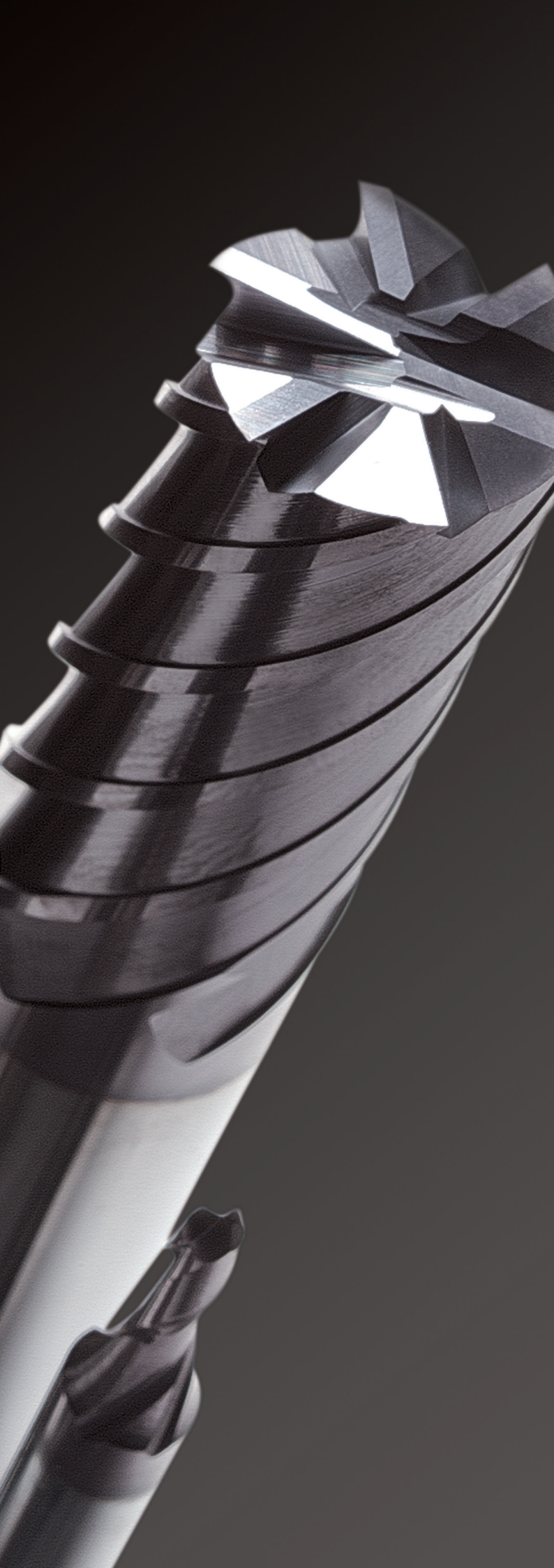
H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS



G2

GENERAL PURPOSE

🇬🇧 Range of general-purpose endmills, featuring new cutting geometries and innovative coatings for enhanced performance. The answer given by Osawa to the market demand for higher performance tools. Thanks to a fully optimized manufacturing process and to large production batches the G2 range excels in the cost-performance ratio.

🇮🇹 Gamma di frese per uso generico, dotate di geometria di taglio e rivestimenti innovativi per garantire prestazioni ancora più elevate. La risposta di Osawa ad un mercato che chiede utensili sempre più performanti e competitivi. L'innovazione nei processi produttivi consente alla gamma G2 di eccellere nel rapporto qualità-prezzo.

🇩🇪 Produktpalette von Fräser für allgemeine Anwendungen, ausgestattet mit einer Schnittgeometrie und innovativen Beschichtungen zur Gewährleistung noch höheren Leistungen. Die Antwort von Osawa auf einen Markt, der immer leistungsstärkere und wettbewerbsfähigere Werkzeuge fordert. Dank der Innovation der Produktionsprozesse zeichnet sich die Produktreihe G2 durch ein außergewöhnliches Preis-Leistungsverhältnis aus.

🇫🇷 Gamme de fraises pour un usage général, dotées de géométrie de coupe et de revêtements innovants pour garantir des prestations encore plus élevées. C'est la réponse d'Osawa à un marché qui nécessite d'outils de plus en plus performants et compétitifs. L'innovation des processus de production permet à la gamme G2 d'avoir un rapport qualité-prix excellent.

G2

For general machining

Features of G2 end mills



Features and Benefits

- End mills range featuring very competitive cost-performance ratio
- Edge design for long life and stable processing
- Substrate and coating specifically developed for combining toughness and wear resistance on a wide range of workpiece materials

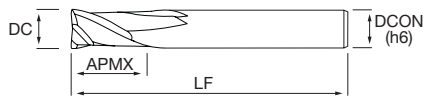
- Gamma caratterizzata da rapporto qualità-prezzo molto vantaggioso
- Geometria di taglio studiata per garantire lunga durata e processo stabile
- Substrato e rivestimento sviluppati per garantire elevata tenacità e resistenza all'usura su una grande varietà di materiali

- Das Angebot zeichnet sich durch ein sehr gutes Preis-Leistungs-Verhältnis aus
- Die Schneidegeometrie wurde für eine lange Standzeit und einen stabilen Prozess konzipiert
- Grundmaterial und Beschichtung wurden für hohe Robustheit und Verschleißfestigkeit bei einer Vielzahl von Materialien entwickelt

- Gamme caractérisée par un rapport qualité/prix très avantageux
- Géométrie de coupe conçue pour garantir longue durée et stabilité du processus
- Substrat et revêtement développés pour garantir grande solidité et haute résistance à l'usure sur une grande variété de matériaux

GB205

- Cylindrical shank
- 2 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
NORM

N

MG

BR

<45

HRC



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	4	h6	3	50	2	GB205010	●
1.5	0/-0.020	4	h6	4.5	50	2	GB205015	●
2	0/-0.020	4	h6	6	50	2	GB205020	●
3	0/-0.020	4	h6	8	50	2	GB205030	●
4	0/-0.020	4	h6	11	50	2	GB205040	●
5	0/-0.020	6	h6	13	50	2	GB205050	●
6	0/-0.020	6	h6	15	50	2	GB205060	●
8	0/-0.025	8	h6	20	60	2	GB205080	●
10	0/-0.025	10	h6	30	75	2	GB205100	●
12	0/-0.025	12	h6	30	75	2	GB205120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

GB205

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.5D x D
	Vc (m/min)	50÷60	30÷50	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.003	0.003	0.005
	2	0.007	0.006	0.005	0.009
	3	0.010	0.009	0.008	0.013
	4	0.014	0.012	0.011	0.018
	5	0.018	0.015	0.014	0.023
	6	0.023	0.020	0.017	0.030
	8	0.030	0.026	0.023	0.039
	10	0.038	0.032	0.029	0.049
	12	0.045	0.038	0.034	0.059

< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.2D	1.5D x 0.3D
	Vc (m/min)	50÷60	30÷50	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.004	0.003	0.006
	2	0.009	0.007	0.007	0.011
	3	0.013	0.011	0.009	0.016
	4	0.018	0.015	0.013	0.023
	5	0.023	0.019	0.017	0.029
	6	0.029	0.024	0.022	0.037
	8	0.038	0.032	0.028	0.049
	10	0.048	0.040	0.036	0.062
	12	0.056	0.048	0.042	0.073

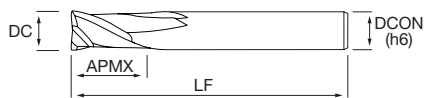
< D3 mm: ae = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	40÷50	30÷40	20÷30	60÷80
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.002	0.002	0.002	0.003
	2	0.004	0.004	0.003	0.006
	3	0.006	0.005	0.005	0.008
	4	0.009	0.007	0.007	0.011
	5	0.011	0.010	0.008	0.015
	6	0.014	0.012	0.011	0.019
	8	0.019	0.016	0.014	0.024
	10	0.024	0.020	0.018	0.031
	12	0.028	0.024	0.021	0.037

< D3 mm: ap = 0.5D

GBL2

- Cylindrical shank
- 2 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
BR
<45
HRC


DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.020	3	h6	30	75	2	GBL2030	●
4	0/-0.020	4	h6	30	75	2	GBL2040	●
5	0/-0.020	5	h6	40	100	2	GBL2050	●
6	0/-0.020	6	h6	60	150	2	GBL2060	●
8	0/-0.025	8	h6	60	150	2	GBL2080	●
10	0/-0.025	10	h6	75	150	2	GBL2100	●
12	0/-0.025	12	h6	75	150	2	GBL2120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

GBL2

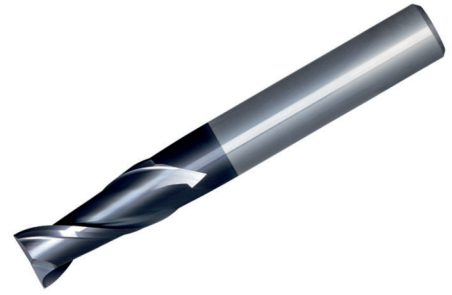
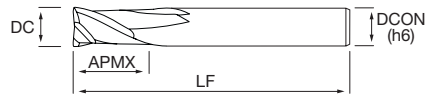
	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.3D x D	0.3D x D	0.3D x D	0.3D x D
	Vc (m/min)	40÷50	25÷35	20÷30	60÷80
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.010	0.008	0.007	0.011
	4	0.013	0.011	0.010	0.014
	5	0.016	0.014	0.012	0.018
	6	0.020	0.017	0.015	0.022
	8	0.026	0.022	0.019	0.033
	10	0.030	0.026	0.023	0.040
	12	0.036	0.031	0.027	0.047

< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.2D	1.5D x 0.3D
	Vc (m/min)	45÷55	30÷40	25÷35	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.012	0.010	0.009	0.013
	4	0.015	0.013	0.012	0.017
	5	0.019	0.016	0.014	0.021
	6	0.024	0.020	0.018	0.027
	8	0.031	0.026	0.023	0.040
	10	0.036	0.031	0.027	0.047
	12	0.043	0.037	0.032	0.056

G2CS2

- Cylindrical shank
- 2 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA NORM	N	MG PV200	<45 HRC	FHA 30°	SQUARE	ZEFP 2	SLOTING	SIDE MILLING	DRILLING
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DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	4	h6	3	50	2	G2CS2010	●
1.5	0/-0.020	4	h6	4.5	50	2	G2CS2015	●
2	0/-0.020	2	h6	8	50	2	G2CS2020S02	●
2	0/-0.020	4	h6	6	50	2	G2CS2020	●
2.5	0/-0.020	4	h6	7	50	2	G2CS2025	●
3	0/-0.020	3	h6	9	50	2	G2CS2030S03	●
3	0/-0.020	4	h6	8	50	2	G2CS2030	●
3.5	0/-0.020	4	h6	10	50	2	G2CS2035	●
4	0/-0.020	4	h6	11	50	2	G2CS2040	●
4.5	0/-0.020	6	h6	13	50	2	G2CS2045	●
5	0/-0.020	6	h6	13	50	2	G2CS2050	●
5.5	0/-0.020	6	h6	13	50	2	G2CS2055	●
6	0/-0.020	6	h6	15	50	2	G2CS2060	●
6.5	0/-0.025	8	h6	17	60	2	G2CS2065	●
7	0/-0.025	8	h6	17	60	2	G2CS2070	●
7.5	0/-0.025	8	h6	17	60	2	G2CS2075	●
8	0/-0.025	8	h6	20	60	2	G2CS2080	●
8.5	0/-0.025	10	h6	23	75	2	G2CS2085	●
9	0/-0.025	10	h6	23	75	2	G2CS2090	●
10	0/-0.025	10	h6	30	75	2	G2CS2100	●
10.5	0/-0.025	12	h6	25	75	2	G2CS2105	●
11	0/-0.025	12	h6	28	75	2	G2CS2110	●
12	0/-0.025	12	h6	30	75	2	G2CS2120	●
13	0/-0.030	16	h6	33	100	2	G2CS2130	●
14	0/-0.030	14	h6	26	83	2	G2CS2140	●
15	0/-0.030	16	h6	40	100	2	G2CS2150	●
16	0/-0.030	16	h6	32	92	2	G2CS2160	●
17	0/-0.030	20	h6	40	100	2	G2CS2170	●
18	0/-0.030	20	h6	40	100	2	G2CS2180	●
20	0/-0.030	20	h6	40	100	2	G2CS2200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CS2

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	1	0.004	0.003	0.003	0.005
	2	0.008	0.007	0.006	0.010
	3	0.012	0.010	0.009	0.016
	4	0.016	0.014	0.012	0.021
	5	0.020	0.017	0.015	0.026
	6	0.025	0.021	0.019	0.033
	8	0.032	0.027	0.024	0.042
	10	0.038	0.032	0.029	0.049
	12	0.045	0.038	0.034	0.059
	14	0.052	0.044	0.039	0.068
	16	0.060	0.051	0.045	0.078
	18	0.070	0.060	0.053	0.091
	20	0.080	0.068	0.060	0.104

< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.005	0.004	0.004	0.006
	2	0.010	0.008	0.007	0.012
	3	0.014	0.012	0.011	0.019
	4	0.019	0.016	0.014	0.025
	5	0.024	0.020	0.018	0.031
	6	0.030	0.026	0.023	0.039
	8	0.038	0.033	0.029	0.050
	10	0.046	0.039	0.034	0.059
	12	0.054	0.046	0.041	0.070
	14	0.062	0.053	0.047	0.081
	16	0.072	0.061	0.054	0.094
	18	0.084	0.071	0.063	0.109
	20	0.096	0.082	0.072	0.125

< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	70÷90	40÷60	25÷35	80÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.002	0.002	0.002	0.003
	2	0.005	0.004	0.004	0.006
	3	0.007	0.006	0.005	0.009
	4	0.010	0.008	0.007	0.012
	5	0.012	0.010	0.009	0.016
	6	0.015	0.013	0.011	0.020
	8	0.019	0.016	0.014	0.025
	10	0.023	0.019	0.017	0.030
	12	0.027	0.023	0.020	0.035
	14	0.031	0.027	0.023	0.041
	16	0.036	0.031	0.027	0.047
	18	0.042	0.036	0.032	0.055
	20	0.048	0.041	0.036	0.062

< D3 mm: ap = 0.5D

G2WS2

- Weldon shank
- 2 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 30°

SQUARE

ZEFP 2

SLOTING

SIDE MILLING

DRILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.020	6	h6	8	57	2	G2WS2030	●
4	0/-0.020	6	h6	11	57	2	G2WS2040	●
5	0/-0.020	6	h6	13	57	2	G2WS2050	●
6	0/-0.020	6	h6	13	57	2	G2WS2060	●
8	0/-0.025	8	h6	19	63	2	G2WS2080	●
10	0/-0.025	10	h6	22	72	2	G2WS2100	●
12	0/-0.025	12	h6	26	83	2	G2WS2120	●
14	0/-0.030	14	h6	26	83	2	G2WS2140	●
16	0/-0.030	16	h6	32	92	2	G2WS2160	●
20	0/-0.030	20	h6	38	104	2	G2WS2200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2WS2

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.012	0.010	0.009	0.016
	4	0.016	0.014	0.012	0.021
	5	0.020	0.017	0.015	0.026
	6	0.025	0.021	0.019	0.033
	8	0.032	0.027	0.024	0.042
	10	0.038	0.032	0.029	0.049
	12	0.045	0.038	0.034	0.059
	14	0.052	0.044	0.039	0.068
	16	0.060	0.051	0.045	0.078
	18	0.070	0.060	0.053	0.091
	20	0.080	0.068	0.060	0.104

< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.014	0.012	0.011	0.019
	4	0.019	0.016	0.014	0.025
	5	0.024	0.020	0.018	0.031
	6	0.030	0.026	0.023	0.039
	8	0.038	0.033	0.029	0.050
	10	0.046	0.039	0.034	0.059
	12	0.054	0.046	0.041	0.070
	14	0.062	0.053	0.047	0.081
	16	0.072	0.061	0.054	0.094
	18	0.084	0.071	0.063	0.109
	20	0.096	0.082	0.072	0.125

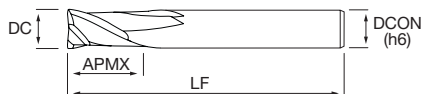
< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	70÷90	40÷60	25÷35	80÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	3	0.007	0.006	0.005	0.009
	4	0.010	0.008	0.007	0.012
	5	0.012	0.010	0.009	0.016
	6	0.015	0.013	0.011	0.020
	8	0.019	0.016	0.014	0.025
	10	0.023	0.019	0.017	0.030
	12	0.027	0.023	0.020	0.035
	14	0.031	0.027	0.023	0.041
	16	0.036	0.031	0.027	0.047
	18	0.042	0.036	0.032	0.055
	20	0.048	0.041	0.036	0.062

< D3 mm: ap = 0.2D

G2210

- Cylindrical shank
- 2 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 30°

SQUARE

ZEFP 2

SLOTING

SIDE MILLING

DRILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
2	0/-0.030	4	h6	9	75	2	G2210020	●
3	0/-0.030	3	h6	25	75	2	G2210030CL25	●
3	0/-0.030	4	h6	15	75	2	G2210030	●
4	0/-0.030	3	h6	30	75	2	G2210040CL30	●
4	0/-0.030	4	h6	20	75	2	G2210040	●
5	0/-0.030	5	h6	30	75	2	G2210050S05	●
5	0/-0.030	6	h6	25	75	2	G2210050	●
6	0/-0.030	6	h6	25	75	2	G2210060	●
6	0/-0.030	6	h6	35	75	2	G2210060CL35	●
8	0/-0.030	8	h6	30	75	2	G2210080	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2210

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	70÷90	45÷65	30÷50	80÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.007	0.006	0.005	0.009
	3	0.010	0.009	0.008	0.013
	4	0.014	0.012	0.011	0.018
	5	0.018	0.015	0.014	0.023
	6	0.023	0.019	0.017	0.029
	8	0.030	0.026	0.023	0.039

< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
	Vc (m/min)	70÷90	45÷65	30÷50	80÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	2	0.008	0.007	0.006	0.011
	3	0.012	0.010	0.009	0.016
	4	0.017	0.014	0.013	0.022
	5	0.022	0.018	0.016	0.028
	6	0.027	0.023	0.020	0.035
	8	0.036	0.031	0.027	0.047

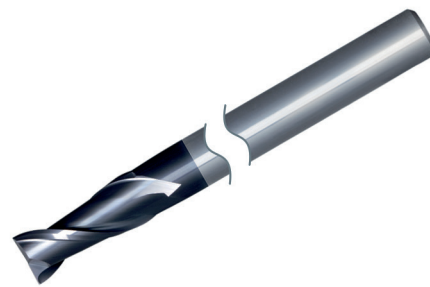
< D3 mm: ae = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	60÷80	40÷60	25÷35	70÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	2	0.004	0.004	0.003	0.005
	3	0.006	0.005	0.005	0.008
	4	0.008	0.007	0.006	0.011
	5	0.011	0.009	0.008	0.014
	6	0.014	0.011	0.010	0.018
	8	0.018	0.015	0.014	0.023

< D3 mm: ap = 0.5D

G2211

- Cylindrical shank
- 2 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 30°

SQUARE

ZEFP 2

SLOTING

SIDE MILLING

DRILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
5	0/-0.030	6	h6	30	100	2	G2211050	●
6	0/-0.030	6	h6	30	100	2	G2211060	●
8	0/-0.035	8	h6	35	100	2	G2211080	●
10	0/-0.035	10	h6	40	100	2	G2211100	●
12	0/-0.035	12	h6	45	100	2	G2211120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2211

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	70÷90	45÷65	30÷50	80÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	5	0.018	0.015	0.014	0.023
	6	0.023	0.019	0.017	0.029
	8	0.030	0.026	0.023	0.039
	10	0.035	0.030	0.026	0.046
	12	0.041	0.035	0.031	0.053

< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
	Vc (m/min)	70÷90	45÷65	30÷50	80÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	5	0.022	0.018	0.016	0.028
	6	0.027	0.023	0.020	0.035
	8	0.036	0.031	0.027	0.047
	10	0.042	0.036	0.032	0.055
	12	0.049	0.042	0.037	0.064

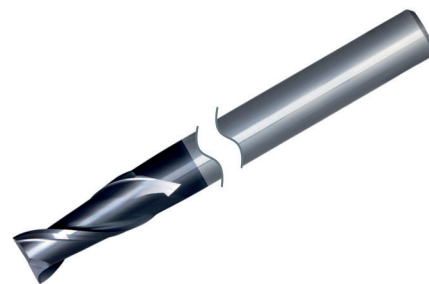
< D3 mm: ae = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	60÷80	40÷60	25÷35	70÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	5	0.011	0.009	0.008	0.014
	6	0.014	0.011	0.010	0.018
	8	0.018	0.015	0.014	0.023
	10	0.021	0.018	0.016	0.027
	12	0.025	0.021	0.018	0.032

< D3 mm: ap = 0.5D

G2212

- Cylindrical shank
- 2 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 30°

SQUARE

ZEFP 2

SLOTING

SIDE MILLING

DRILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
8	0/-0.035	8	h6	40	150	2	G2212080	●
10	0/-0.035	10	h6	50	150	2	G2212100	●
12	0/-0.035	12	h6	50	150	2	G2212120	●
16	0/-0.040	16	h6	70	150	2	G2212160	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2212

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.3D x D	0.3D x D	0.3D x D	0.3D x D
	Vc (m/min)	55÷75	40÷60	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.026	0.022	0.020	0.034
	10	0.032	0.027	0.024	0.042
	12	0.036	0.031	0.027	0.047
	14	0.042	0.036	0.032	0.055
	16	0.048	0.041	0.036	0.062

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D
	Vc (m/min)	55÷75	40÷60	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.031	0.027	0.023	0.041
	10	0.038	0.033	0.029	0.050
	12	0.043	0.037	0.032	0.056
	14	0.050	0.043	0.038	0.066
	16	0.058	0.049	0.043	0.075

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	50÷70	35÷55	20÷30	60÷80
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.016	0.013	0.012	0.020
	10	0.019	0.016	0.014	0.025
	12	0.022	0.018	0.016	0.028
	14	0.025	0.021	0.019	0.033
	16	0.029	0.024	0.022	0.037

GB305

- Cylindrical shank
- 3 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
BR
<45
HRC


DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	4	h6	3	50	3	GB305010	●
1.5	0/-0.020	4	h6	4.5	50	3	GB305015	●
2	0/-0.020	4	h6	6	50	3	GB305020	●
3	0/-0.020	4	h6	8	50	3	GB305030	●
4	0/-0.020	4	h6	11	50	3	GB305040	●
5	0/-0.020	6	h6	13	50	3	GB305050	●
6	0/-0.020	6	h6	15	50	3	GB305060	●
8	0/-0.025	8	h6	20	60	3	GB305080	●
10	0/-0.025	10	h6	30	75	3	GB305100	●
12	0/-0.025	12	h6	30	75	3	GB305120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

GB305

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	50÷60	30÷50	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.003	0.003	0.002	0.004
	2	0.006	0.005	0.004	0.008
	3	0.009	0.007	0.006	0.011
	4	0.012	0.010	0.009	0.016
	5	0.015	0.013	0.012	0.020
	6	0.020	0.017	0.015	0.026
	8	0.026	0.022	0.019	0.033
	10	0.032	0.028	0.024	0.042
	12	0.038	0.033	0.029	0.050

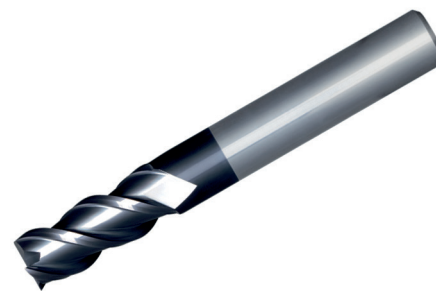
< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D
	Vc (m/min)	50÷70	40÷60	20÷40	80÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.003	0.003	0.005
	2	0.007	0.006	0.005	0.009
	3	0.010	0.009	0.008	0.013
	4	0.014	0.012	0.011	0.019
	5	0.018	0.016	0.014	0.024
	6	0.024	0.020	0.018	0.031
	8	0.031	0.026	0.023	0.040
	10	0.039	0.033	0.029	0.051
	12	0.046	0.039	0.035	0.060

< D3 mm: ae = 0.1D

G2CSH3

- Cylindrical shank
- 3 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 45°

SQUARE

ZEFP 3

SLOTING

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	4	h6	3	50	3	G2CSH3010	●
1.5	0/-0.020	4	h6	4.5	50	3	G2CSH3015	●
2	0/-0.020	4	h6	6	50	3	G2CSH3020	●
2.5	0/-0.020	4	h6	7	50	3	G2CSH3025	●
3	0/-0.020	3	h6	9	50	3	G2CSH3030S03	●
3	0/-0.020	4	h6	8	50	3	G2CSH3030	●
3.5	0/-0.020	4	h6	10	50	3	G2CSH3035	●
4	0/-0.020	4	h6	11	50	3	G2CSH3040	●
4.5	0/-0.020	6	h6	13	50	3	G2CSH3045	●
5	0/-0.020	6	h6	13	50	3	G2CSH3050	●
5.5	0/-0.020	6	h6	13	50	3	G2CSH3055	●
6	0/-0.020	6	h6	15	50	3	G2CSH3060	●
6.5	0/-0.025	8	h6	17	60	3	G2CSH3065	●
7	0/-0.025	8	h6	17	60	3	G2CSH3070	●
7.5	0/-0.025	8	h6	17	60	3	G2CSH3075	●
8	0/-0.025	8	h6	20	60	3	G2CSH3080	●
8.5	0/-0.025	10	h6	23	75	3	G2CSH3085	●
9	0/-0.025	10	h6	23	75	3	G2CSH3090	●
10	0/-0.025	10	h6	30	75	3	G2CSH3100	●
11	0/-0.025	12	h6	28	75	3	G2CSH3110	●
12	0/-0.025	12	h6	30	75	3	G2CSH3120	●
14	0/-0.030	14	h6	26	83	3	G2CSH3140	●
16	0/-0.030	16	h6	32	92	3	G2CSH3160	●
18	0/-0.030	20	h6	40	100	3	G2CSH3180	●
20	0/-0.030	20	h6	40	100	3	G2CSH3200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CSH3

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	80÷100	50÷70	30÷50	80÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.003	0.003	0.002	0.004
	2	0.006	0.005	0.005	0.008
	3	0.009	0.008	0.007	0.012
	4	0.013	0.011	0.009	0.016
	5	0.016	0.013	0.012	0.020
	6	0.019	0.016	0.014	0.024
	8	0.025	0.021	0.019	0.033
	10	0.031	0.027	0.023	0.041
	12	0.040	0.034	0.030	0.052
	14	0.046	0.039	0.035	0.060
	16	0.056	0.048	0.042	0.073
	18	0.065	0.055	0.049	0.085
	20	0.075	0.064	0.056	0.098

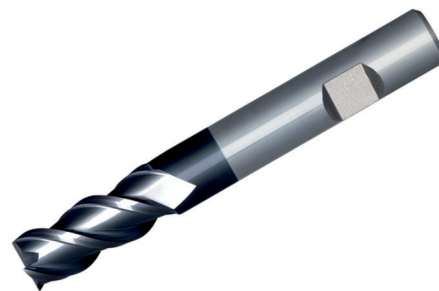
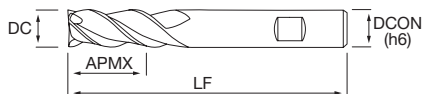
< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D
	Vc (m/min)	90÷110	60÷80	40÷60	110÷130
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.003	0.003	0.005
	2	0.008	0.006	0.006	0.010
	3	0.011	0.010	0.008	0.015
	4	0.015	0.013	0.011	0.020
	5	0.019	0.016	0.014	0.024
	6	0.023	0.019	0.017	0.029
	8	0.030	0.026	0.023	0.039
	10	0.038	0.032	0.028	0.049
	12	0.048	0.041	0.036	0.062
	14	0.056	0.047	0.042	0.072
	16	0.068	0.057	0.051	0.088
	18	0.078	0.066	0.059	0.101
	20	0.090	0.077	0.068	0.117

< D3 mm: ae = 0.1D

G2WSH3

- Weldon shank
- 3 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 45°

SQUARE

ZEFP 3

SLOTING

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.020	6	h6	8	57	3	G2WSH3030	●
4	0/-0.020	6	h6	11	57	3	G2WSH3040	●
5	0/-0.020	6	h6	13	57	3	G2WSH3050	●
6	0/-0.020	6	h6	13	57	3	G2WSH3060	●
8	0/-0.025	8	h6	19	63	3	G2WSH3080	●
10	0/-0.025	10	h6	22	72	3	G2WSH3100	●
12	0/-0.025	12	h6	26	83	3	G2WSH3120	●
14	0/-0.030	14	h6	26	83	3	G2WSH3140	●
16	0/-0.030	16	h6	32	92	3	G2WSH3160	●
20	0/-0.030	20	h6	38	104	3	G2WSH3200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2WSH3

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	80÷100	50÷70	30÷50	80÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.009	0.008	0.007	0.012
	4	0.013	0.011	0.009	0.016
	5	0.016	0.013	0.012	0.020
	6	0.019	0.016	0.014	0.024
	8	0.025	0.021	0.019	0.033
	10	0.031	0.027	0.023	0.041
	12	0.040	0.034	0.030	0.052
	14	0.046	0.039	0.035	0.060
	16	0.056	0.048	0.042	0.073
	18	0.065	0.055	0.049	0.085
	20	0.075	0.064	0.056	0.098

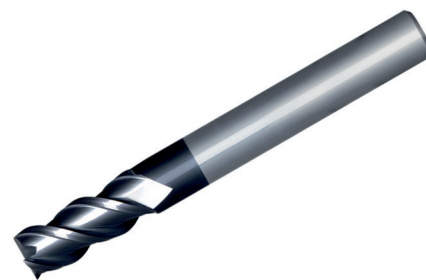
< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D
	Vc (m/min)	90÷110	60÷80	40÷60	110÷130
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.011	0.010	0.008	0.015
	4	0.015	0.013	0.011	0.020
	5	0.019	0.016	0.014	0.024
	6	0.023	0.019	0.017	0.029
	8	0.030	0.026	0.023	0.039
	10	0.038	0.032	0.028	0.049
	12	0.048	0.041	0.036	0.062
	14	0.056	0.047	0.042	0.072
	16	0.068	0.057	0.051	0.088
	18	0.078	0.066	0.059	0.101
	20	0.090	0.077	0.068	0.117

< D3 mm: ae = 0.1D

G2310

- Cylindrical shank
- 3 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 45°

SQUARE

ZEFP 3

SLOTING

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
2	0/-0.030	4	h6	9	75	3	G2310020	●
3	0/-0.030	4	h6	15	75	3	G2310030	●
4	0/-0.030	4	h6	20	75	3	G2310040	●
5	0/-0.030	6	h6	25	75	3	G2310050	●
6	0/-0.030	6	h6	25	75	3	G2310060	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2310

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	60÷80	35÷55	25÷35	80÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.006	0.005	0.004	0.007
	3	0.008	0.007	0.006	0.011
	4	0.011	0.010	0.008	0.015
	5	0.014	0.012	0.011	0.018
	6	0.017	0.014	0.013	0.022

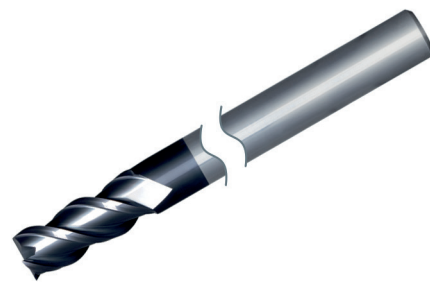
< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D
	Vc (m/min)	70÷90	45÷65	30÷50	80÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.007	0.006	0.005	0.009
	3	0.011	0.009	0.008	0.014
	4	0.014	0.012	0.011	0.018
	5	0.018	0.015	0.013	0.023
	6	0.021	0.018	0.016	0.027

< D3 mm: ae = 0.1D

G2311

- Cylindrical shank
- 3 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 45°

SQUARE

ZEFP 3

SLOTING

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.030	6	h6	25	100	3	G2311040	●
5	0/-0.030	6	h6	30	100	3	G2311050	●
6	0/-0.030	6	h6	30	100	3	G2311060	●
7	0/-0.030	8	h6	35	100	3	G2311070	●
8	0/-0.035	8	h6	35	100	3	G2311080	●
9	0/-0.035	10	h6	40	100	3	G2311090	●
10	0/-0.035	10	h6	40	100	3	G2311100	●
11	0/-0.035	12	h6	45	100	3	G2311110	●
12	0/-0.035	12	h6	45	100	3	G2311120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2311

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	60÷80	35÷55	25÷35	80÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.011	0.010	0.008	0.015
	5	0.014	0.012	0.011	0.018
	6	0.017	0.014	0.013	0.022
	8	0.023	0.019	0.017	0.029
	10	0.028	0.024	0.021	0.037
	12	0.036	0.031	0.027	0.047

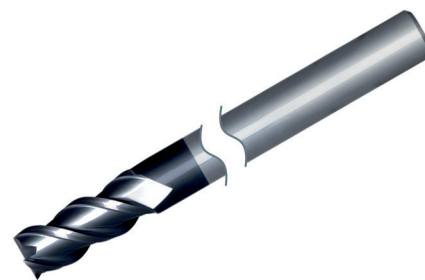
< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D
	Vc (m/min)	70÷90	45÷65	30÷50	80÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.014	0.012	0.011	0.018
	5	0.018	0.015	0.013	0.023
	6	0.021	0.018	0.016	0.027
	8	0.028	0.024	0.021	0.037
	10	0.035	0.030	0.026	0.046
	12	0.045	0.038	0.034	0.059

< D3 mm: ae = 0.1D

G2312

- Cylindrical shank
- 3 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 45°

SQUARE

ZEFP 3

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
8	0/-0.035	8	h6	40	150	3	G2312080	●
10	0/-0.035	10	h6	50	150	3	G2312100	●
12	0/-0.035	12	h6	50	150	3	G2312120	●
16	0/-0.040	16	h6	70	150	3	G2312160	●
20	0/-0.040	20	h6	80	150	3	G2312200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2312

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D
	Vc (m/min)	55÷75	40÷60	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.020	0.017	0.015	0.026
	10	0.025	0.021	0.019	0.033
	12	0.032	0.027	0.024	0.042
	14	0.037	0.031	0.028	0.048
	16	0.045	0.038	0.034	0.059
	20	0.060	0.051	0.045	0.078

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

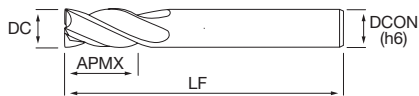
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

GB405

- Cylindrical shank
- 4 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
NORM

N

MG
BR<45
HRC

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	4	h6	3	50	4	GB405010	●
1.5	0/-0.020	4	h6	4.5	50	4	GB405015	●
2	0/-0.020	4	h6	6	50	4	GB405020	●
3	0/-0.020	4	h6	8	50	4	GB405030	●
4	0/-0.020	4	h6	11	50	4	GB405040	●
5	0/-0.020	6	h6	13	50	4	GB405050	●
6	0/-0.020	6	h6	15	50	4	GB405060	●
8	0/-0.025	8	h6	20	60	4	GB405080	●
10	0/-0.025	10	h6	30	75	4	GB405100	●
12	0/-0.025	12	h6	30	75	4	GB405120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

GB405

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D
	Vc (m/min)	50÷70	40÷50	20÷40	80÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.003	0.003	0.002	0.004
	2	0.006	0.006	0.005	0.008
	3	0.010	0.008	0.007	0.013
	4	0.013	0.011	0.010	0.017
	5	0.016	0.014	0.012	0.021
	6	0.020	0.017	0.015	0.026
	8	0.026	0.022	0.019	0.034
	10	0.031	0.026	0.023	0.040
	12	0.036	0.031	0.027	0.047

< D3 mm: ae = 0.1D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

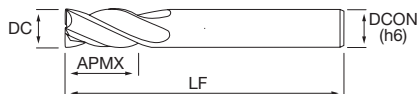
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

GBL4

- Cylindrical shank
- 4 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
NORM

N

MG
BR<45
HRC

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.020	3	h6	30	75	4	GBL4030	●
4	0/-0.020	4	h6	30	75	4	GBL4040	●
5	0/-0.020	5	h6	40	100	4	GBL4050	●
6	0/-0.020	6	h6	60	150	4	GBL4060	●
8	0/-0.025	8	h6	60	150	4	GBL4080	●
10	0/-0.025	10	h6	75	150	4	GBL4100	●
12	0/-0.025	12	h6	75	150	4	GBL4120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

GBL4

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	45÷55	30÷40	25÷35	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.008	0.007	0.006	0.009
	4	0.010	0.009	0.008	0.011
	5	0.013	0.011	0.010	0.014
	6	0.015	0.013	0.011	0.017
	8	0.020	0.017	0.015	0.026
	10	0.026	0.022	0.019	0.033
	12	0.032	0.027	0.024	0.042

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

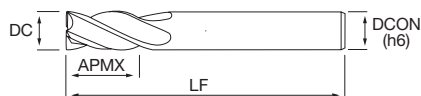
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2CS4

- Cylindrical shank
- 4 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N

MG
 PV200

 <45
 HRC


 FHA 30°


 SQUARE


 ZEFP 4


 SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	4	h6	3	50	4	G2CS4010	●
1.5	0/-0.020	4	h6	4.5	50	4	G2CS4015	●
2	0/-0.020	2	h6	8	50	4	G2CS4020S02	●
2	0/-0.020	4	h6	6	50	4	G2CS4020	●
2.5	0/-0.020	4	h6	7	50	4	G2CS4025	●
3	0/-0.020	3	h6	9	50	4	G2CS4030S03	●
3	0/-0.020	4	h6	8	50	4	G2CS4030	●
3.5	0/-0.020	4	h6	10	50	4	G2CS4035	●
4	0/-0.020	4	h6	11	50	4	G2CS4040	●
4.5	0/-0.020	6	h6	13	50	4	G2CS4045	●
5	0/-0.020	6	h6	13	50	4	G2CS4050	●
5.5	0/-0.020	6	h6	13	50	4	G2CS4055	●
6	0/-0.020	6	h6	15	50	4	G2CS4060	●
6.5	0/-0.025	8	h6	17	60	4	G2CS4065	●
7	0/-0.025	8	h6	17	60	4	G2CS4070	●
7.5	0/-0.025	8	h6	17	60	4	G2CS4075	●
8	0/-0.025	8	h6	20	60	4	G2CS4080	●
8.5	0/-0.025	10	h6	23	75	4	G2CS4085	●
9	0/-0.025	10	h6	23	75	4	G2CS4090	●
9.5	0/-0.025	10	h6	25	75	4	G2CS4095	●
10	0/-0.025	10	h6	30	75	4	G2CS4100	●
10.5	0/-0.025	12	h6	25	75	4	G2CS4105	●
11	0/-0.025	12	h6	30	75	4	G2CS4110	●
11.5	0/-0.025	12	h6	28	75	4	G2CS4115	●
12	0/-0.025	12	h6	30	75	4	G2CS4120	●
12.5	0/-0.030	14	h6	26	83	4	G2CS4125	●
13	0/-0.030	14	h6	26	83	4	G2CS4130	●
13.5	0/-0.030	14	h6	26	83	4	G2CS4135	●
14	0/-0.030	14	h6	26	83	4	G2CS4140	●
14.5	0/-0.030	16	h6	32	92	4	G2CS4145	●
15	0/-0.030	16	h6	32	92	4	G2CS4150	●
15.5	0/-0.030	16	h6	32	92	4	G2CS4155	●
16	0/-0.030	16	h6	32	92	4	G2CS4160	●
17	0/-0.030	20	h6	40	100	4	G2CS4170	●
18	0/-0.030	20	h6	40	100	4	G2CS4180	●
19	0/-0.030	20	h6	40	100	4	G2CS4190	●
20	0/-0.030	20	h6	40	100	4	G2CS4200	●
22	0/-0.030	25	h6	40	100	4	G2CS4220	●
25	0/-0.030	25	h6	40	100	4	G2CS4250	●

★ 1st choice, ☆ suitable, ● stock standard, ○ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CS4

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	$\leq 700 \text{ N/mm}^2$	$600 \div 1000 \text{ N/mm}^2$	$\leq 35 \text{ HRC}$	
	ap x ae	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.003	0.003	0.005
	2	0.007	0.006	0.005	0.009
	3	0.010	0.009	0.008	0.013
	4	0.013	0.011	0.010	0.017
	5	0.016	0.014	0.012	0.021
	6	0.019	0.016	0.014	0.025
	8	0.025	0.021	0.019	0.033
	10	0.032	0.027	0.024	0.042
	12	0.040	0.034	0.030	0.052
	14	0.047	0.040	0.035	0.061
	16	0.054	0.046	0.041	0.070
	18	0.060	0.051	0.045	0.078
	20	0.065	0.055	0.049	0.085
	22	0.073	0.062	0.055	0.095
	25	0.083	0.071	0.062	0.108

< D3 mm: ae = 0.1D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

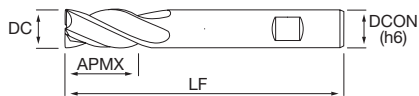
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2WS4

- Weldon shank
- 4 flutes



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 30°

SQUARE

ZEFP 4

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.020	6	h6	8	57	4	G2WS4030	●
4	0/-0.020	6	h6	11	57	4	G2WS4040	●
5	0/-0.020	6	h6	13	57	4	G2WS4050	●
6	0/-0.020	6	h6	13	57	4	G2WS4060	●
8	0/-0.025	8	h6	19	63	4	G2WS4080	●
10	0/-0.025	10	h6	22	72	4	G2WS4100	●
12	0/-0.025	12	h6	26	83	4	G2WS4120	●
14	0/-0.030	14	h6	26	83	4	G2WS4140	●
16	0/-0.030	16	h6	32	92	4	G2WS4160	●
20	0/-0.030	20	h6	38	104	4	G2WS4200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2WS4

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.010	0.009	0.008	0.013
	4	0.013	0.011	0.010	0.017
	5	0.016	0.014	0.012	0.021
	6	0.019	0.016	0.014	0.025
	8	0.025	0.021	0.019	0.033
	10	0.032	0.027	0.024	0.042
	12	0.040	0.034	0.030	0.052
	14	0.047	0.040	0.035	0.061
	16	0.054	0.046	0.041	0.070
	18	0.060	0.051	0.045	0.078
	20	0.065	0.055	0.049	0.085

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

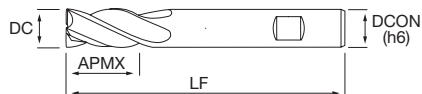
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2410

- Cylindrical shank
- 4 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N

MG
 PV200

<45
 HRC


FHA 30°

SQUARE

ZEFP 4

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
2	0/-0.030	4	h6	9	75	4	G2410020	●
2.5	0/-0.030	4	h6	10	75	4	G2410025	●
3	0/-0.030	4	h6	15	75	4	G2410030	●
3	0/-0.030	3	h6	25	75	4	G2410030CL25	●
3.5	0/-0.030	4	h6	15	75	4	G2410035	●
4	0/-0.030	4	h6	20	75	4	G2410040	●
4	0/-0.030	4	h6	30	75	4	G2410040CL30	●
4.5	0/-0.030	6	h6	20	75	4	G2410045	●
5	0/-0.030	6	h6	25	75	4	G2410050	●
5	0/-0.030	5	h6	30	75	4	G2410050S05	●
6	0/-0.030	6	h6	25	75	4	G2410060	●
6	0/-0.030	6	h6	35	75	4	G2410060CL35	●
8	0/-0.030	8	h6	30	75	4	G2410080	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2410

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	70÷90	45÷65	30÷50	80÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.006	0.005	0.005	0.008
	3	0.009	0.008	0.007	0.012
	4	0.012	0.010	0.009	0.015
	5	0.014	0.012	0.011	0.019
	6	0.017	0.015	0.013	0.022
	8	0.023	0.019	0.017	0.029

< D3 mm: ae = 0.1D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

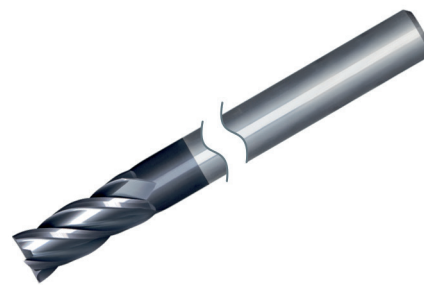
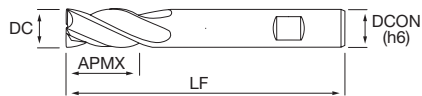
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2411

- Cylindrical shank
- 4 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 30°

SQUARE

ZEFP 4

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.030	6	h6	15	100	4	G2411030	●
4	0/-0.030	6	h6	25	100	4	G2411040	●
5	0/-0.030	6	h6	30	100	4	G2411050	●
6	0/-0.030	6	h6	30	100	4	G2411060	●
7	0/-0.030	8	h6	35	100	4	G2411070	●
8	0/-0.035	8	h6	35	100	4	G2411080	●
9	0/-0.035	10	h6	40	100	4	G2411090	●
10	0/-0.035	10	h6	40	100	4	G2411100	●
11	0/-0.035	12	h6	45	100	4	G2411110	●
12	0/-0.035	12	h6	45	100	4	G2411120	●
14	0/-0.035	14	h6	45	100	4	G2411140	●
16	0/-0.035	16	h6	45	100	4	G2411160	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2411

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	70÷90	45÷65	30÷50	80÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.009	0.008	0.007	0.012
	4	0.012	0.010	0.009	0.015
	5	0.014	0.012	0.011	0.019
	6	0.017	0.015	0.013	0.022
	8	0.023	0.019	0.017	0.029
	10	0.029	0.024	0.022	0.037
	12	0.036	0.031	0.027	0.047
	16	0.048	0.041	0.036	0.062

< D3 mm: ae = 0.1D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

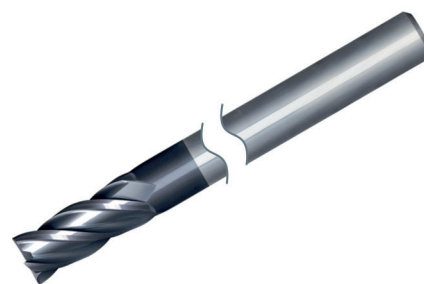
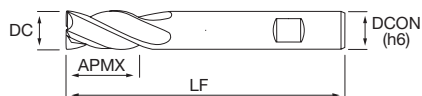
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2412

- Cylindrical shank
- 4 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


 FHA 30°


 SQUARE


 ZEFP 4


 SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.035	6	h6	40	150	4	G2412060CL40	●
6	0/-0.035	6	h6	60	150	4	G2412060CL60	●
8	0/-0.035	8	h6	40	150	4	G2412080	●
8	0/-0.035	8	h6	60	150	4	G2412080CL60	●
10	0/-0.035	10	h6	50	150	4	G2412100	●
10	0/-0.035	10	h6	75	150	4	G2412100CL75	●
12	0/-0.035	12	h6	50	150	4	G2412120	●
12	0/-0.035	12	h6	75	150	4	G2412120CL75	●
16	0/-0.040	16	h6	70	150	4	G2412160	●
18	0/-0.040	20	h6	80	150	4	G2412180	●
20	0/-0.040	20	h6	80	150	4	G2412200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2412

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	$\leq 700 \text{ N/mm}^2$	$600 \div 1000 \text{ N/mm}^2$	$\leq 35 \text{ HRC}$	
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	55÷75	40÷60	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.023	0.019	0.017	0.025
	8	0.020	0.017	0.015	0.026
	10	0.026	0.022	0.019	0.033
	12	0.032	0.027	0.024	0.042
	14	0.038	0.032	0.028	0.049
	16	0.043	0.037	0.032	0.056
	20	0.065	0.055	0.049	0.085

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

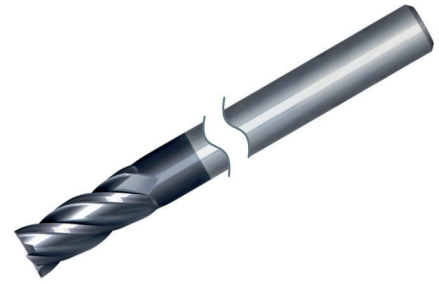
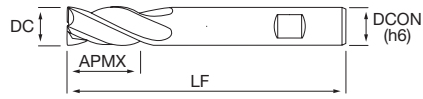
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2413

- Cylindrical shank
- 4 flutes
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA NORM	N	MG PV200	<45 HRC	FHA 30°	SQUARE	ZEFP 4	SIDE MILLING
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DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
16	0/-0.040	16	h6	40	200	4	G2413160	●
20	0/-0.040	20	h6	40	200	4	G2413200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2413

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	55÷75	40÷60	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.020	0.017	0.015	0.026
	10	0.026	0.022	0.019	0.033
	12	0.032	0.027	0.024	0.042
	14	0.038	0.032	0.028	0.049
	16	0.043	0.037	0.032	0.056
	20	0.065	0.055	0.049	0.085

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2CSHM

- Cylindrical shank
- Multi flute



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 45°

SQUARE

ZEFP 6

SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.020	6	h6	15	50	6	G2CSHM060	●
8	0/-0.025	8	h6	20	60	6	G2CSHM080	●
10	0/-0.025	10	h6	30	75	6	G2CSHM100	●
12	0/-0.025	12	h6	30	75	6	G2CSHM120	●
14	0/-0.030	14	h6	30	83	6	G2CSHM140	●
16	0/-0.030	16	h6	35	92	6	G2CSHM160	●
20	0/-0.030	20	h6	40	100	6	G2CSHM200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CSHM

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	
	Vc (m/min)	100÷120	70÷90	50÷70	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	6	0.016	0.014	0.012	
	8	0.020	0.017	0.015	
	10	0.026	0.022	0.019	
	12	0.032	0.027	0.024	
	14	0.038	0.032	0.028	
	16	0.043	0.037	0.032	
	16	0.043	0.037	0.032	
	20	0.065	0.055	0.049	

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

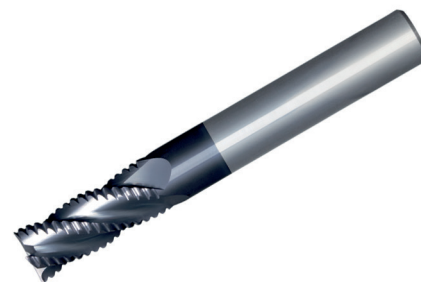
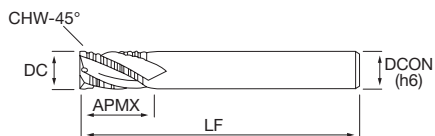
K - HSS END MILLS

L - CARBIDE BURRS

G2CSFR

- Cylindrical shank
- Roughing HR

P	M	K	N	S	H
★	☆	★	☆		



OSAWA
NORM

N

MG
PV200

<45
HRC

FHA 30°

CH-45°

HR
FINE

ZEFP 3-4

L
SIDE MILLING

DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.070	0.28	±0.020	6	h6	11	50	3	G2CSFR040	●
5	0/-0.070	0.35	±0.020	6	h6	13	50	3	G2CSFR050	●
6	0/-0.070	0.42	±0.020	6	h6	15	50	3	G2CSFR060	●
7	0/-0.070	0.49	±0.020	8	h6	20	60	3	G2CSFR070	●
8	0/-0.070	0.56	±0.020	8	h6	20	60	3	G2CSFR080	●
9	0/-0.070	0.63	±0.020	10	h6	25	75	3	G2CSFR090	●
10	0/-0.070	0.7	±0.020	10	h6	30	75	4	G2CSFR100	●
11	0/-0.070	0.77	±0.020	12	h6	30	75	4	G2CSFR110	●
12	0/-0.070	0.84	±0.020	12	h6	30	75	4	G2CSFR120	●
13	0/-0.070	0.91	±0.020	14	h6	30	83	4	G2CSFR130	●
14	0/-0.070	0.98	±0.020	14	h6	30	83	4	G2CSFR140	●
15	0/-0.070	1.05	±0.020	16	h6	30	92	4	G2CSFR150	●
16	0/-0.070	1.12	±0.020	16	h6	35	92	4	G2CSFR160	●
20	0/-0.070	1.4	±0.020	20	h6	40	100	4	G2CSFR200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CSFR

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	
	Vc (m/min)	70÷90	50÷70	30÷50	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	6	0.016	0.012	0.010	
	6	0.030	0.026	0.023	
	8	0.045	0.038	0.034	
	10	0.060	0.051	0.045	
	12	0.072	0.061	0.054	
	14	0.085	0.072	0.064	
	16	0.096	0.082	0.072	
	20	0.120	0.102	0.090	

D6-8: Z3 ; D10-20: Z4

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

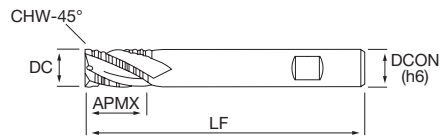
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2WSFR

- Weldon shank
- Roughing HR



P	M	K	N	S	H
★	☆	★	☆		

OSAWA NORM	N	MG PV200	<45 HRC	 FHA 30°	 CH-45°	 HR FINE	 ZEFP 3-4	 SIDE MILLING
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DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.070	0.42	±0.020	6	h6	13	57	3	G2WSFR060	●
8	0/-0.070	0.56	±0.020	8	h6	19	63	3	G2WSFR080	●
10	0/-0.070	0.7	±0.020	10	h6	22	72	4	G2WSFR100	●
12	0/-0.070	0.84	±0.020	12	h6	26	83	4	G2WSFR120	●
14	0/-0.070	0.98	±0.020	14	h6	26	83	4	G2WSFR140	●
16	0/-0.070	1.12	±0.020	16	h6	32	92	4	G2WSFR160	●
20	0/-0.070	1.4	±0.020	20	h6	38	104	4	G2WSFR200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2WSFR

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	
	Vc (m/min)	70÷90	50÷70	30÷50	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	6	0.030	0.026	0.023	
	8	0.045	0.038	0.034	
	10	0.060	0.051	0.045	
	12	0.072	0.061	0.054	
	14	0.085	0.072	0.064	
	16	0.096	0.082	0.072	
	20	0.120	0.102	0.090	

D6-8: Z3; D10-20: Z4

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

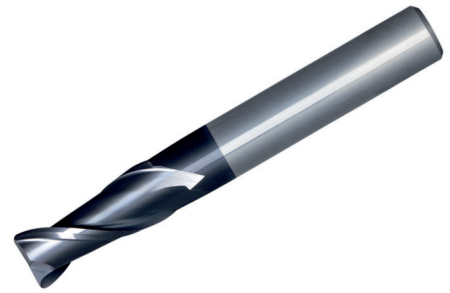
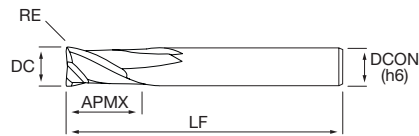
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2CS2R

- Cylindrical shank
- 2 flutes
- Corner radius



P	M	K	N	S	H
★	☆	★	☆		

OSAWA NORM	N	MG PV200	<45 HRC	 FHA 30°	 RADIUS	 ZEFP 2	 SLOTING	 SIDE MILLING	 DRILLING
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DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	0.2	±0.010	4	h6	2	50	2	G2CS2R02010	●
1.5	0/-0.020	0.2	±0.010	4	h6	3	50	2	G2CS2R02015	●
1.5	0/-0.020	0.5	±0.010	4	h6	3	50	2	G2CS2R05015	●
2	0/-0.020	0.2	±0.010	4	h6	4	50	2	G2CS2R02020	●
2	0/-0.020	0.5	±0.010	4	h6	4	50	2	G2CS2R05020	●
2.5	0/-0.020	0.2	±0.010	4	h6	5	50	2	G2CS2R02025	●
2.5	0/-0.020	0.5	±0.010	4	h6	5	50	2	G2CS2R05025	●
3	0/-0.020	0.2	±0.010	4	h6	6	50	2	G2CS2R02030	●
3	0/-0.020	0.5	±0.010	4	h6	6	50	2	G2CS2R05030	●
3	0/-0.020	1	±0.010	4	h6	6	50	2	G2CS2R10030	●
4	0/-0.020	0.2	±0.010	4	h6	8	50	2	G2CS2R02040	●
4	0/-0.020	0.5	±0.010	4	h6	8	50	2	G2CS2R05040	●
4	0/-0.020	1	±0.010	4	h6	8	50	2	G2CS2R10040	●
5	0/-0.020	0.5	±0.010	6	h6	10	50	2	G2CS2R05050	●
5	0/-0.020	1	±0.010	6	h6	10	50	2	G2CS2R10050	●
6	0/-0.020	0.2	±0.010	6	h6	12	50	2	G2CS2R02060	●
6	0/-0.020	0.5	±0.010	6	h6	12	50	2	G2CS2R05060	●
6	0/-0.020	1	±0.010	6	h6	12	50	2	G2CS2R10060	●
6	0/-0.020	1.5	±0.010	6	h6	12	50	2	G2CS2R15060	●
6	0/-0.020	2	±0.010	6	h6	12	50	2	G2CS2R20060	●
8	0/-0.025	0.5	±0.010	8	h6	16	60	2	G2CS2R05080	●
8	0/-0.025	1	±0.010	8	h6	16	60	2	G2CS2R10080	●
8	0/-0.025	1.5	±0.010	8	h6	16	60	2	G2CS2R15080	●
8	0/-0.025	2	±0.010	8	h6	16	60	2	G2CS2R20080	●
10	0/-0.025	0.5	±0.010	10	h6	20	75	2	G2CS2R05100	●
10	0/-0.025	1	±0.010	10	h6	20	75	2	G2CS2R10100	●
10	0/-0.025	1.5	±0.010	10	h6	20	75	2	G2CS2R15100	●
10	0/-0.025	2	±0.010	10	h6	20	75	2	G2CS2R20100	●
12	0/-0.025	0.5	±0.010	12	h6	24	75	2	G2CS2R05120	●
12	0/-0.025	1	±0.010	12	h6	24	75	2	G2CS2R10120	●
12	0/-0.025	1.5	±0.010	12	h6	24	75	2	G2CS2R15120	●
12	0/-0.025	2	±0.010	12	h6	24	75	2	G2CS2R20120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CS2R

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.003	0.003	0.005
	2	0.008	0.007	0.006	0.010
	3	0.012	0.010	0.009	0.016
	4	0.016	0.014	0.012	0.021
	5	0.020	0.017	0.015	0.026
	6	0.025	0.021	0.019	0.033
	8	0.032	0.027	0.024	0.042
	10	0.038	0.032	0.029	0.049
	12	0.045	0.038	0.034	0.059

< D3 mm: ap = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	1	0.005	0.004	0.004	0.006
	2	0.010	0.008	0.007	0.012
	3	0.014	0.012	0.011	0.019
	4	0.019	0.016	0.014	0.025
	5	0.024	0.020	0.018	0.031
	6	0.030	0.026	0.023	0.039
	8	0.038	0.033	0.029	0.050
	10	0.046	0.039	0.034	0.059
	12	0.054	0.046	0.041	0.070

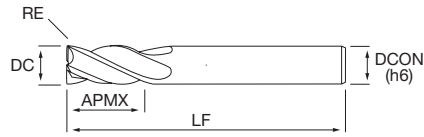
< D3 mm: ae = 0.2D

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	70÷90	40÷60	25÷35	70÷100
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	1	0.002	0.002	0.002	0.003
	2	0.005	0.004	0.004	0.006
	3	0.007	0.006	0.005	0.009
	4	0.010	0.008	0.007	0.012
	5	0.012	0.010	0.009	0.016
	6	0.015	0.013	0.011	0.020
	8	0.019	0.016	0.014	0.025
	10	0.023	0.019	0.017	0.030
	12	0.027	0.023	0.020	0.035

< D3 mm: ap = 0.5D

G2CS4R

- Cylindrical shank
- 4 flutes
- Corner radius



P	M	K	N	S	H
★	☆	★	☆		

OSAWA NORM	N	MG PV200	<45 HRC	FHA 30°	RADIUS	ZEFP 4	SIDE MILLING
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DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	0.2	±0.010	4	h6	2	50	4	G2CS4R02010	●
1.5	0/-0.020	0.2	±0.010	4	h6	3	50	4	G2CS4R02015	●
1.5	0/-0.020	0.5	±0.010	4	h6	3	50	4	G2CS4R05015	●
2	0/-0.020	0.2	±0.010	4	h6	4	50	4	G2CS4R02020	●
2	0/-0.020	0.5	±0.010	4	h6	4	50	4	G2CS4R05020	●
2.5	0/-0.020	0.2	±0.010	4	h6	5	50	4	G2CS4R02025	●
2.5	0/-0.020	0.5	±0.010	4	h6	5	50	4	G2CS4R05025	●
3	0/-0.020	0.2	±0.010	4	h6	6	50	4	G2CS4R02030	●
3	0/-0.020	0.5	±0.010	4	h6	6	50	4	G2CS4R05030	●
3	0/-0.020	1	±0.010	4	h6	6	50	4	G2CS4R10030	●
4	0/-0.020	0.2	±0.010	4	h6	8	50	4	G2CS4R02040	●
4	0/-0.020	0.5	±0.010	4	h6	8	50	4	G2CS4R05040	●
4	0/-0.020	1	±0.010	4	h6	8	50	4	G2CS4R10040	●
5	0/-0.020	0.5	±0.010	6	h6	10	50	4	G2CS4R05050	●
5	0/-0.020	1	±0.010	6	h6	10	50	4	G2CS4R10050	●
6	0/-0.020	0.2	±0.010	6	h6	12	50	4	G2CS4R02060	●
6	0/-0.020	0.5	±0.010	6	h6	12	50	4	G2CS4R05060	●
6	0/-0.020	1	±0.010	6	h6	12	50	4	G2CS4R10060	●
6	0/-0.020	1.5	±0.010	6	h6	12	50	4	G2CS4R15060	●
6	0/-0.020	2	±0.010	6	h6	12	50	4	G2CS4R20060	●
8	0/-0.025	0.5	±0.010	8	h6	16	60	4	G2CS4R05080	●
8	0/-0.025	1	±0.010	8	h6	16	60	4	G2CS4R10080	●
8	0/-0.025	1.5	±0.010	8	h6	16	60	4	G2CS4R15080	●
8	0/-0.025	2	±0.010	8	h6	16	60	4	G2CS4R20080	●
10	0/-0.025	0.5	±0.010	10	h6	20	75	4	G2CS4R05100	●
10	0/-0.025	1	±0.010	10	h6	20	75	4	G2CS4R10100	●
10	0/-0.025	1.5	±0.010	10	h6	20	75	4	G2CS4R15100	●
10	0/-0.025	2	±0.010	10	h6	20	75	4	G2CS4R20100	●
10	0/-0.025	2.5	±0.010	10	h6	20	75	4	G2CS4R25100	●
10	0/-0.025	3	±0.010	10	h6	20	75	4	G2CS4R30100	●
12	0/-0.025	0.5	±0.010	12	h6	24	75	4	G2CS4R05120	●
12	0/-0.025	1	±0.010	12	h6	24	75	4	G2CS4R10120	●
12	0/-0.025	1.5	±0.010	12	h6	24	75	4	G2CS4R15120	●
12	0/-0.025	2	±0.010	12	h6	24	75	4	G2CS4R20120	●
12	0/-0.025	2.5	±0.010	12	h6	24	75	4	G2CS4R25120	●
12	0/-0.025	3	±0.010	12	h6	24	75	4	G2CS4R30120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CS4R

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.003	0.003	0.005
	2	0.007	0.006	0.005	0.009
	3	0.010	0.009	0.008	0.013
	4	0.013	0.011	0.010	0.017
	5	0.016	0.014	0.012	0.021
	6	0.019	0.016	0.014	0.025
	8	0.025	0.021	0.019	0.033
	10	0.032	0.027	0.024	0.042
	12	0.040	0.034	0.030	0.052

< D3 mm: ae = 0.1D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

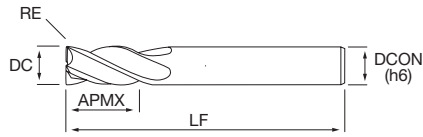
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2CL4R

- Cylindrical shank
- 4 flutes
- Long
- Corner radius



P	M	K	N	S	H
★	☆	★	☆		

OSAWA NORM	N	MG PV200	<45 HRC	 FHA 30°	 RADIUS	 ZEFP 4	 SIDE MILLING
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DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
2	0/-0.030	0.2	±0.010	4	h6	4	75	4	G2CL4R02020	●
2	0/-0.030	0.5	±0.010	4	h6	4	75	4	G2CL4R05020	●
3	0/-0.030	0.2	±0.010	4	h6	6	75	4	G2CL4R02030	●
3	0/-0.030	0.5	±0.010	4	h6	6	75	4	G2CL4R05030	●
3	0/-0.030	1	±0.010	4	h6	6	75	4	G2CL4R10030	●
4	0/-0.030	0.2	±0.010	4	h6	8	75	4	G2CL4R02040	●
4	0/-0.030	0.5	±0.010	4	h6	8	75	4	G2CL4R05040	●
4	0/-0.030	1	±0.010	4	h6	8	75	4	G2CL4R10040	●
5	0/-0.030	0.5	±0.010	6	h6	10	75	4	G2CL4R05050	●
5	0/-0.030	1	±0.010	6	h6	10	75	4	G2CL4R10050	●
6	0/-0.030	0.5	±0.010	6	h6	12	75	4	G2CL4R05060	●
6	0/-0.030	1	±0.010	6	h6	12	75	4	G2CL4R10060	●
8	0/-0.035	0.5	±0.010	8	h6	16	100	4	G2CL4R05080	●
8	0/-0.035	1	±0.010	8	h6	16	100	4	G2CL4R10080	●
8	0/-0.035	2	±0.010	8	h6	16	100	4	G2CL4R20080	●
10	0/-0.035	0.5	±0.010	10	h6	20	100	4	G2CL4R05100	●
10	0/-0.035	1	±0.010	10	h6	20	100	4	G2CL4R10100	●
10	0/-0.035	2	±0.010	10	h6	20	100	4	G2CL4R20100	●
12	0/-0.035	0.5	±0.010	12	h6	24	100	4	G2CL4R05120	●
12	0/-0.035	1	±0.010	12	h6	24	100	4	G2CL4R10120	●
12	0/-0.035	2	±0.010	12	h6	24	100	4	G2CL4R20120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CL4R

	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D	1.5D x 0.2D
	Vc (m/min)	55÷75	40÷60	20÷40	70÷90
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.006	0.005	0.005	0.007
	3	0.009	0.008	0.007	0.010
	4	0.012	0.010	0.009	0.013
	5	0.015	0.013	0.011	0.017
	6	0.017	0.014	0.013	0.019
	8	0.023	0.020	0.017	0.030
	10	0.029	0.025	0.022	0.038
	12	0.036	0.031	0.027	0.047

< D3 mm: ae = 0.1D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

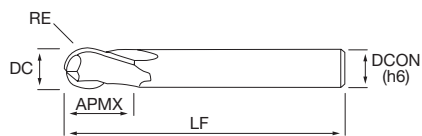
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

GB255

- Cylindrical shank
- 2 flutes ball nose



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
NORM

N

MG

BR

<45
HRC

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	0.5	±0.015	4	h6	2	50	2	GB255010	●
1.5	0/-0.020	0.75	±0.015	4	h6	3	50	2	GB255015	●
2	0/-0.020	1	±0.015	4	h6	4	50	2	GB255020	●
3	0/-0.020	1.5	±0.015	4	h6	6	50	2	GB255030	●
4	0/-0.020	2	±0.015	4	h6	8	50	2	GB255040	●
5	0/-0.020	2.5	±0.015	6	h6	10	50	2	GB255050	●
6	0/-0.020	3	±0.015	6	h6	12	50	2	GB255060	●
8	0/-0.025	4	±0.015	8	h6	16	60	2	GB255080	●
10	0/-0.025	5	±0.015	10	h6	20	75	2	GB255100	●
12	0/-0.025	6	±0.015	12	h6	24	75	2	GB255120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

GB255

	Material Group ISO 513		P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm		≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae		0.1D x 0.1D	0.1D x 0.1D	0.1D x 0.1D	0.1D x 0.1D
	Vc (m/min)		50÷70	35÷55	20÷40	80÷120
	DC (mm)	DC(eff.) (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.60	0.030	0.023	0.021	0.036
	2	1.20	0.040	0.030	0.028	0.048
	3	1.80	0.050	0.038	0.035	0.060
	4	2.40	0.060	0.045	0.042	0.072
	5	3.00	0.070	0.053	0.049	0.084
	6	3.60	0.080	0.060	0.056	0.096
	8	4.80	0.090	0.068	0.063	0.108
	10	6.00	0.105	0.079	0.074	0.126
	12	7.20	0.120	0.090	0.084	0.144

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

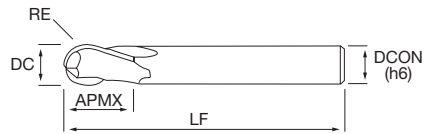
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2CSB2

- Cylindrical shank
- 2 flutes ball nose



P	M	K	N	S	H
★	☆	★	☆		

OSAWA NORM	N	MG PV200	<45 HRC	FHA 30°	BALL NOSE	ZEFP 2 BALL	COPYING
---------------	---	-------------	------------	---------	-----------	-------------	---------

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	0.5	±0.015	3	h6	3	50	2	G2CSB2010S03	●
1	0/-0.020	0.5	±0.015	4	h6	2	50	2	G2CSB2010	●
1.5	0/-0.020	0.75	±0.015	3	h6	5	50	2	G2CSB2015S03	●
1.5	0/-0.020	0.75	±0.015	4	h6	3	50	2	G2CSB2015	●
2	0/-0.020	1	±0.015	3	h6	7	50	2	G2CSB2020S03	●
2	0/-0.020	1	±0.015	4	h6	4	50	2	G2CSB2020	●
2.5	0/-0.020	1.25	±0.015	3	h6	8	50	2	G2CSB2025S03	●
2.5	0/-0.020	1.25	±0.015	4	h6	5	50	2	G2CSB2025	●
3	0/-0.020	1.5	±0.015	3	h6	9	50	2	G2CSB2030S03	●
3	0/-0.020	1.5	±0.015	4	h6	6	50	2	G2CSB2030	●
3.5	0/-0.020	1.75	±0.015	4	h6	7	50	2	G2CSB2035	●
4	0/-0.020	2	±0.015	4	h6	8	50	2	G2CSB2040	●
4.5	0/-0.020	2.25	±0.015	6	h6	9	50	2	G2CSB2045	●
5	0/-0.020	2.5	±0.015	5	h6	10	50	2	G2CSB2050S05	●
5	0/-0.020	2.5	±0.015	6	h6	10	50	2	G2CSB2050	●
5.5	0/-0.020	2.75	±0.015	6	h6	11	50	2	G2CSB2055	●
6	0/-0.020	3	±0.015	6	h6	12	50	2	G2CSB2060	●
6.5	0/-0.025	3.25	±0.015	8	h6	13	60	2	G2CSB2065	●
7	0/-0.025	3.5	±0.015	8	h6	14	60	2	G2CSB2070	●
8	0/-0.025	4	±0.015	8	h6	16	60	2	G2CSB2080	●
9	0/-0.025	4.5	±0.015	10	h6	18	75	2	G2CSB2090	●
10	0/-0.025	5	±0.015	10	h6	20	75	2	G2CSB2100	●
12	0/-0.025	6	±0.015	12	h6	24	75	2	G2CSB2120	●
16	0/-0.030	8	±0.015	16	h6	30	92	2	G2CSB2160	●
20	0/-0.030	10	±0.015	20	h6	30	100	2	G2CSB2200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CSB2

	Material Group ISO 513		P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm		≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae		0.1D x 0.1D	0.1D x 0.1D	0.1D x 0.1D	0.1D x 0.1D
	Vc (m/min)		80÷100	60÷80	40÷60	110÷130
	DC (mm)	DC(eff.) (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.60	0.030	0.023	0.021	0.036
	2	1.20	0.040	0.030	0.028	0.048
	3	1.80	0.050	0.038	0.035	0.060
	4	2.40	0.060	0.045	0.042	0.072
	5	3.00	0.070	0.053	0.049	0.084
I - HSS DRILLS	6	3.60	0.080	0.060	0.056	0.096
	8	4.80	0.090	0.068	0.063	0.108
	10	6.00	0.105	0.079	0.074	0.126
	12	7.20	0.120	0.090	0.084	0.144
	16	9.60	0.150	0.113	0.105	0.180
	20	12.00	0.180	0.135	0.126	0.216

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

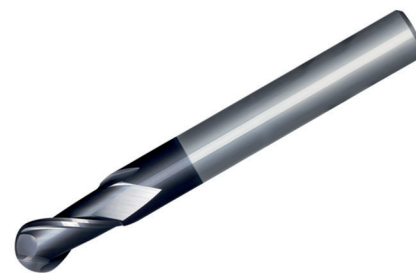
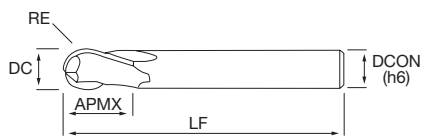
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2250

- Cylindrical shank
- 2 flutes ball nose
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
NORM

N

MG
PV200

<45
HRC

FHA 30°

BALL NOSE

ZEFP 2 BALL

COPYING

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.025	0.5	±0.015	4	h6	2	75	2	G2250010	●
1.5	0/-0.025	0.75	±0.015	4	h6	3	75	2	G2250015	●
2	0/-0.025	1	±0.015	4	h6	4	75	2	G2250020	●
3	0/-0.025	1.5	±0.015	3	h6	6	75	2	G2250030S03	●
3	0/-0.025	1.5	±0.015	4	h6	6	75	2	G2250030	●
4	0/-0.025	2	±0.015	4	h6	8	75	2	G2250040	●
5	0/-0.025	2.5	±0.015	5	h6	8	75	2	G2250050S05	●
5	0/-0.025	2.5	±0.015	6	h6	10	75	2	G2250050	●
6	0/-0.025	3	±0.015	6	h6	12	100	2	G2250060	●
8	0/-0.030	4	±0.015	8	h6	16	100	2	G2250080	●
10	0/-0.030	5	±0.015	10	h6	20	100	2	G2250100	●
12	0/-0.030	6	±0.015	12	h6	24	100	2	G2250120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2250

	Material Group ISO 513		P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm		≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae		0.1D x 0.1D	0.1D x 0.1D	0.1D x 0.1D	0.1D x 0.1D
	Vc (m/min)		70÷90	50÷70	40÷50	100÷120
	DC (mm)	DC(eff.) (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.60	0.027	0.020	0.019	0.032
	2	1.20	0.036	0.027	0.025	0.043
	3	1.80	0.045	0.034	0.032	0.054
	4	2.40	0.054	0.041	0.038	0.065
	5	3.00	0.063	0.047	0.044	0.076
	6	3.60	0.072	0.054	0.050	0.086
	8	4.80	0.081	0.061	0.057	0.097
	10	6.00	0.095	0.071	0.066	0.113
	12	7.20	0.108	0.081	0.076	0.130

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

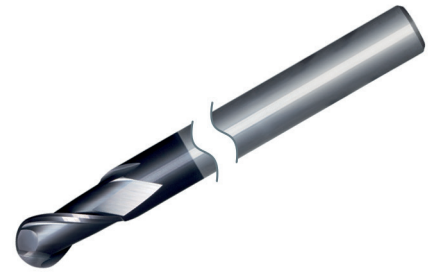
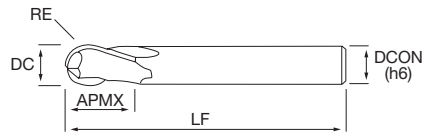
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2251

- Cylindrical shank
- 2 flutes ball nose
- Long



P	M	K	N	S	H
★	☆	★	☆		

OSAWA NORM	N	MG PV200	<45 HRC	FHA 30°	BALL NOSE	ZEFP 2 BALL	COPYING
---------------	---	-------------	------------	---------	-----------	-------------	---------

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.025	3	±0.015	6	h6	12	150	2	G2251060	●
8	0/-0.030	4	±0.015	8	h6	16	150	2	G2251080	●
10	0/-0.030	5	±0.015	10	h6	20	150	2	G2251100	●
12	0/-0.030	6	±0.015	12	h6	24	150	2	G2251120	●
16	0/-0.035	8	±0.015	16	h6	30	150	2	G2251160	●
20	0/-0.035	10	±0.015	20	h6	30	150	2	G2251200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2251

	Material Group ISO 513		P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm		≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae		0.1D x 0.1D	0.1D x 0.1D	0.1D x 0.1D	0.1D x 0.1D
	Vc (m/min)		60÷80	40÷60	35÷45	90÷110
	DC (mm)	DC(eff.) (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	3.60	0.058	0.044	0.041	0.070
	8	4.80	0.066	0.049	0.046	0.079
	10	6.00	0.077	0.057	0.054	0.092
	12	7.20	0.087	0.066	0.061	0.105
	16	9.60	0.122	0.092	0.085	0.146
	20	12.00	0.146	0.110	0.102	0.175

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

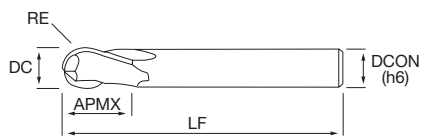
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

G2CSB4

- Cylindrical shank
- 4 flutes ball nose



P	M	K	N	S	H
★	☆	★	☆		

OSAWA
 NORM

N
MG
 PV200

<45
 HRC


FHA 30°

BALL NOSE

ZEFP 4 BALL

COPYING

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	0.5	±0.015	4	h6	2	50	4	G2CSB4010	●
1.5	0/-0.020	0.75	±0.015	4	h6	3	50	4	G2CSB4015	●
2	0/-0.020	1	±0.015	4	h6	4	50	4	G2CSB4020	●
3	0/-0.020	1.5	±0.015	4	h6	6	50	4	G2CSB4030	●
4	0/-0.020	2	±0.015	4	h6	8	50	4	G2CSB4040	●
5	0/-0.020	2.5	±0.015	6	h6	10	50	4	G2CSB4050	●
6	0/-0.020	3	±0.015	6	h6	12	50	4	G2CSB4060	●
8	0/-0.025	4	±0.015	8	h6	16	60	4	G2CSB4080	●
10	0/-0.025	5	±0.015	10	h6	20	75	4	G2CSB4100	●
12	0/-0.025	6	±0.015	12	h6	24	75	4	G2CSB4120	●
16	0/-0.030	8	±0.015	16	h6	30	92	4	G2CSB4160	●
20	0/-0.030	10	±0.015	20	h6	30	100	4	G2CSB4200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

G2CSB4

	Material Group ISO 513		P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm		≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae		0.1D x 0.3D	0.1D x 0.3D	0.1D x 0.3D	0.1D x 0.3D
	Vc (m/min)		80÷100	60÷80	40÷60	110÷130
	DC (mm)	DC(eff.) (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.60	0.030	0.023	0.021	0.036
	2	1.20	0.040	0.030	0.028	0.048
	3	1.80	0.050	0.038	0.035	0.060
	4	2.40	0.060	0.045	0.042	0.072
	5	3.00	0.070	0.053	0.049	0.084
	6	3.60	0.080	0.060	0.056	0.096
	8	4.80	0.090	0.068	0.063	0.108
	10	6.00	0.105	0.079	0.074	0.126
	12	7.20	0.120	0.090	0.084	0.144
	16	9.60	0.150	0.113	0.105	0.180
	20	12.00	0.180	0.135	0.126	0.216

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

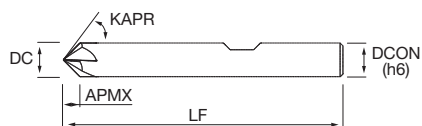
K - HSS END MILLS

L - CARBIDE BURRS

G2WC 90

- Chamfering and deburring
- Sharp point
- Weldon shank

P	M	K	N	S	H
★	☆	★	☆		

OSAWA
NORM

N

MG
PV200<45
HRC

SIG 90°

ZEFP 3

ZEFP 4

90°

DC	DC tol.	KAPR	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	-	45	3	h6	0.5	50	3	G2WC01090	●
2	-	45	3	h6	1	50	3	G2WC02090	●
3	-	45	3	h6	1.5	50	4	G2WC03090	●
4	-	45	4	h6	2	50	4	G2WC04090	●
6	-	45	6	h6	3	50	4	G2WC06090	●
8	-	45	8	h6	4	60	4	G2WC08090	●
10	-	45	10	h6	5	75	4	G2WC10090	●
12	-	45	12	h6	6	75	4	G2WC12090	●
16	-	45	16	h6	8	100	4	G2WC16090	●
20	-	45	20	h6	10	100	4	G2WC20090	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

G2WC 90

 CHAMFERING	Material Group ISO 513	P1 P2 K1	P3 P4 P7 M1 K2	P5 M2 K3	N1 N2 N3 N4
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	-	-	-	-
	Vc (m/min)	80÷100	50÷70	30÷50	100÷120
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.003	0.003	0.005
	2	0.007	0.006	0.005	0.009
	3	0.010	0.009	0.008	0.013
	4	0.013	0.011	0.010	0.017
	5	0.016	0.014	0.012	0.021
	6	0.019	0.016	0.014	0.025
	8	0.025	0.021	0.019	0.033
	10	0.032	0.027	0.024	0.042
	12	0.040	0.034	0.030	0.052
	16	0.054	0.046	0.041	0.070
	20	0.065	0.055	0.049	0.085



HF

VARIABLE HELIX AND UNEQUAL PITCH -
UNIVERSAL APPLICATION

✚ HF EVOLution is the Osawa family of micrograin carbide endmills for universal application with coatings and cutting edges specifically designed for high performance machining of all ISO materials. The HF EVOLution endmills are available in a broad range of types, lengths and radii. They are the ideal tools for both mass production and small batch manufacturing, thanks to the outstanding performance delivered and the universal applicability.

🇮🇹 HF EVOLution è la linea Osawa di frese universali in metallo duro micrograna con spoglie e rivestimenti specifici per la lavorazione ad alto rendimento di tutti i materiali della scala ISO. Le frese HF EVOLution sono disponibili in un'ampia gamma di tipologie, lunghezze e raggi torici. Sono gli utensili ideali sia per le produzioni di serie che per la produzione di piccoli lotti, grazie all'eccellenza del rendimento e all'universalità d'impiego.

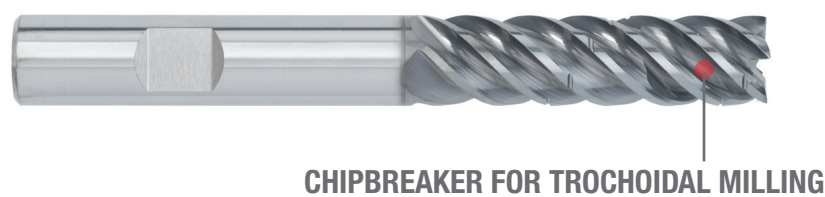
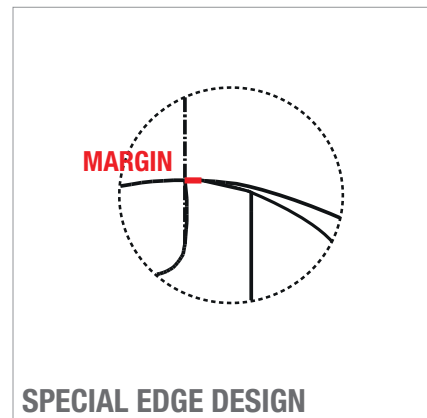
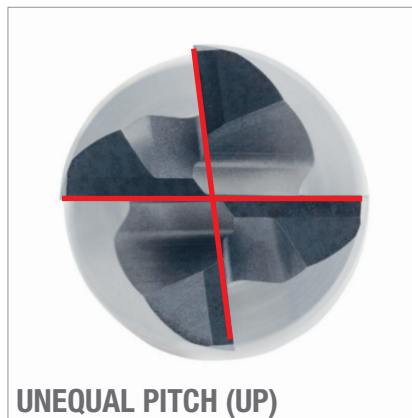
🇩🇪 HF EVOLution heißt die Linie der Universalfräser aus mikrokörnigem Hartmetall von Osawa, mit Schneidekanten und spezifischen Beschichtungen zur Hochleistungsbearbeitung von allen Materialien der ISO-Skala. Die Fräser HF EVOLution sind in einer reichen Auswahl an Typologien, Längen und Torusradien erhältlich. Mit ihren ausgezeichneten Leistungen und dem universellen Einsatz sind sie die idealen Werkzeuge, sowohl für die Serienproduktion großer Mengen als auch für die Herstellung kleiner Lose.

🇫🇷 HF EVOLution est la ligne Osawa de fraises universelles en carbure micrograin avec dépouilles et revêtements spécifiques pour l'usinage de haute performance de tous les matériaux de l'échelle ISO. Les fraises HF EVOLution sont disponibles dans une large gamme, longueurs et rayons. Ce sont des outils aussi bien pour les grandes séries que pour la production de prototypes, grâce à leur excellence de rendement et leur polyvalence.

HF

Variable Helix (VH) and Unequal Pitch (UP) - universal application

Features of HF VH/UP end mills



HF

Variable Helix (VH) and Unequal Pitch (UP) - universal application

Features and Benefits

- Variable helix VH and unequal pitch UP design reduces vibrations, allows higher productivity and longer life
 - Highly sophisticated cutting edge preparation for an excellent surface finishing
 - Microngrain carbide and PV300 coating provide high wear resistance allowing long and stable tool life.
 - Chipbreakers for roughing process significantly improve the metal removal rate, reduce cutting force and deliver faster heat dissipation
 - Chipbreakers for trochoidal milling generate small chips for quick ejection under deep pocket milling.
- La geometria con elica variabile (VH) e passo differenziato (UP) riduce le vibrazioni garantendo elevata produttività e lunga durata
 - Preparazione del tagliente altamente sofisticata per un'eccellente finitura superficiale
 - Il metallo duro micrograna e il rivestimento PV300 offrono un'elevata resistenza all'usura consentendo una durata lunga e stabile.
 - I rompitrucioli per il processo di sgrossatura consentono l'aumento del volume di truciolo asportato, riducono la forza di taglio e garantiscono una rapida dissipazione del calore
 - I rompitrucioli per la fresatura trocoidale generano piccoli trucioli per una rapida espulsione durante la fresatura di tasche profonde.

- Die Geometrie mit variablem Helix (VH) und differenzierter Steigung (UP) sorgt für weniger Vibrationen und damit für hohe Produktivität und lange Standzeit
- Ausgereifte Schneidkantenpräparation für eine hervorragende Oberflächenqualität
- Das mikrokörnige Hartmetall und die PV300-Beschichtung bieten eine hohe Verschleißfestigkeit und ermöglichen eine lange und stabile Standzeit.
- Die Spanteiler für den Schrappprozess erhöhen das Volumen der abgetragenen Späne, reduzieren die Schneidkraft und sorgen für eine schnelle Wärmeableitung
- Die Spanteiler für das Schaftfräsen erzeugen kleine Späne für eine schnelle Abfuhr beim Fräsen tiefer Taschen.

- La géométrie à hélice variable (VH) et pas décalé (UP) réduit les vibrations, assurant ainsi une productivité élevée et une longue durée
- Préparation du tranchant hautement sophistiquée gage d'excellente finition superficielle
- Le carbure à micro-grains et le revêtement PV300 offrent une haute résistance à l'usure qui garantit longue durée de vie et stabilité.
- Les brise-copeaux pour le processus de dégrossissage augmentent le volume de copeau éliminé, réduisent la force de coupe et assurent une dissipation rapide de la chaleur.
- Les brise-copeaux de fraisage trochoïdal génèrent de petits copeaux gage d'expulsion rapide lors du fraisage de poches profondes.

Use case

Tool Type	HF840
Workpiece	W.-Nr 1.6510 39NiCrMo3
Parameters	Vc 130 m/min, fz 0,04 mm/t, ap 25 mm, ae 3 mm
Diameter	12 mm
Machining time:	
OSAWA	+60%
Competitor A	
Competitor B	

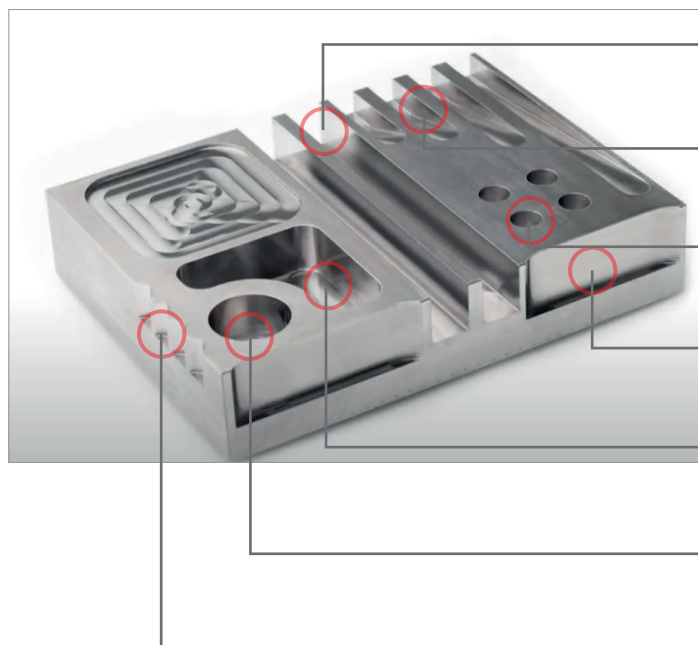
HF

Variable Helix (VH) and Unequal Pitch (UP) - universal application

Multi purpose for all milling strategies



WATCH
THE VIDEO



**HIGH EFFICIENCY
SLOTING UP TO 2XD**



UP TO 45°



HIGH VERSATILITY



SUPERIOR FINISHING



REDUCE CYCLE TIME SIGNIFICANTLY



EFFICIENT POCKET MILLING



STABLE Z-AXIS OPERATION

Universal application



- 2 families of tools with application-specific geometries.
- HF UNI (VH+UP), designed for milling of materials with hardness up to 40 HRC: steel (ISO P), stainless steel (ISO M), cast iron (ISO K) and super alloys (ISO S), such as Inconel or Titanium. The HF UNI range is now extended with the new HF535T for trochoidal milling which allows small chips and high feed thanks to the optimized chipbreaker, becoming the optimal choice for high metal removal rate application.
- HF HARD (UP) for steel (ISO P), stainless steel (ISO M), cast iron (ISO K), super alloys (ISO S), hardened steel (ISO H) milling, with hardness up to 55 HRC.

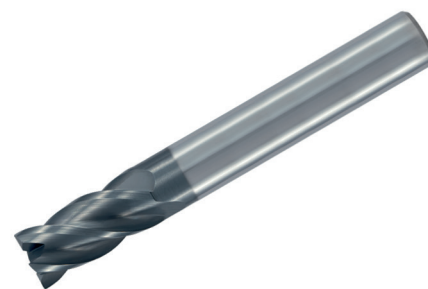
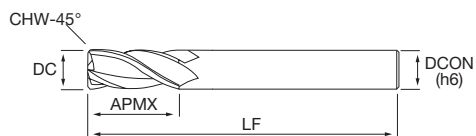
- 2 Werkzeugfamilien mit spezifischen Geometrien
- HF UNI (VH+UP), zum Fräsen von Materialien mit einer Härte bis zu 40HRC: Stahl (ISO P), korrosionsbeständiger Stahl (ISO M), Gusseisen (ISO K) und Superlegierungen (ISO S) wie Inconel oder Titan. Die HF UNI-Produktpalette wird mit dem neuen HF535T Fräser für Trochoidalfräsen bereichert, der sehr kleine Späne erzeugt und dank des optimierten Spanbrechers hohe Vorschübe ermöglicht, wodurch er zur besten Wahl für hohe Abtragsraten wird.
- HF HARD (UP) für das Fräsen von Stahl (ISO P), korrosionsbeständigem Stahl (ISO M), Gusseisen (ISO K), Superlegierungen (ISO S), gehärtetem Stahl (ISO H) mit einer Härten bis zu 55HRC.

- 2 famiglie di utensili con geometrie specifiche.
- HF UNI (VH+UP), per fresatura di materiali con durezza sino a 40 HRC: acciaio (ISO P), acciaio inossidabile (ISO M), ghisa (ISO K) e super leghe (ISO S), quali Inconel o titanio. La gamma HF UNI si arricchisce della nuova HF535T per fresatura trocoidale che favorisce la formazione di trucioli piccoli e consente elevati avanzamenti grazie al rompitrucciolo ottimizzato, diventando così la migliore scelta per elevate asportazioni.
- HF HARD (UP) per fresatura di acciaio (ISO P), acciaio inossidabile (ISO M), ghisa (ISO K), super leghe (ISO S), acciaio temprato (ISO H), con durezza sino a 55 HRC.

- 2 familles d'outils avec des géométries spécifiques
- HF UNI (VH+UP), pour fraisage de matériaux dont la dureté peut atteindre 40HRC : acier (ISO P), acier inoxydable (ISO M), fonte (ISO K) et super alliages (ISO S), tels que l' inconel ou titane. La gamme HF UNI s'étend désormais avec le nouveau HF535T pour le fraisage trochoïdal qui permet de petits copeaux et une avance élevée grâce au brise-copeaux optimisé, devenant ainsi le choix optimal pour les applications à taux d'enlèvement de copeaux élevé.
- HF HARD (UP), pour fraisage d'acier (ISO P), acier inoxydable (ISO M), fonte (ISO K) et super alliages (ISO S), acier trempé (ISO H), dont la dureté peut atteindre 55HRC.

HF840

- Cylindrical shank
- 45° chamfer



P	M	K	N	S	H
★	★	★		★	

OSAWA
NORM

MG
PV300

<40
HRC



DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.020	0.1	±0.020	6	h6	9	57	4	HF840030	●
4	0/-0.020	0.1	±0.020	6	h6	11	57	4	HF840040	●
5	0/-0.020	0.1	±0.020	6	h6	13	57	4	HF840050	●
6	0/-0.020	0.1	±0.020	6	h6	13	57	4	HF840060	●
8	0/-0.020	0.2	±0.020	8	h6	20	64	4	HF840080	●
10	0/-0.020	0.2	±0.020	10	h6	22	72	4	HF840100	●
12	0/-0.020	0.2	±0.020	12	h6	26	83	4	HF840120	●
14	0/-0.020	0.3	±0.020	14	h6	26	83	4	HF840140	●
16	0/-0.020	0.3	±0.020	16	h6	32	92	4	HF840160	●
18	0/-0.020	0.3	±0.020	18	h6	32	92	4	HF840180	●
20	0/-0.020	0.4	±0.020	20	h6	38	104	4	HF840200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF840



Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
ap x ae	D x D	D x D	D x D	D x D
Vc (m/min)	130÷150	70÷90	50÷70	30÷50
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.014	0.013	0.011	0.010
4	0.019	0.017	0.014	0.013
5	0.023	0.021	0.017	0.016
6	0.027	0.024	0.020	0.019
8	0.035	0.032	0.026	0.025
10	0.042	0.038	0.032	0.029
12	0.048	0.043	0.036	0.034
14	0.054	0.049	0.041	0.038
16	0.060	0.054	0.045	0.042
18	0.066	0.059	0.050	0.046
20	0.073	0.066	0.055	0.051
ap x ae	≤ D5	0.5D x D	0.25D x D	0.25D x D



Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
Vc (m/min)	160÷180	100÷120	70÷90	40÷60
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.017	0.015	0.013	0.018
4	0.022	0.020	0.018	0.024
5	0.028	0.025	0.022	0.030
6	0.032	0.029	0.026	0.036
8	0.042	0.038	0.034	0.046
10	0.050	0.045	0.040	0.055
12	0.058	0.052	0.046	0.063
14	0.065	0.058	0.052	0.071
16	0.072	0.065	0.058	0.079
18	0.079	0.071	0.063	0.087
20	0.088	0.079	0.070	0.096
ap x ae	≤ D5	1.5D x 0.25D	1.2D x 0.1D	1.2D x 0.1D



Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	3° x 0.4D
Vc (m/min)	130÷150	80÷100	60÷80	30÷50
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.010	0.010	0.008	0.008
4	0.013	0.013	0.011	0.010
5	0.017	0.016	0.014	0.013
6	0.020	0.018	0.016	0.015
8	0.025	0.024	0.021	0.020
10	0.031	0.029	0.025	0.024
12	0.035	0.033	0.029	0.027
14	0.039	0.037	0.032	0.030
16	0.044	0.041	0.036	0.034
18	0.048	0.045	0.040	0.037
20	0.053	0.050	0.044	0.041
α° x ae	≤ D5	2° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF840

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.022	0.020	0.019	0.026
	8	0.028	0.026	0.024	0.034
	10	0.034	0.031	0.029	0.040
	12	0.038	0.035	0.034	0.046
	14	0.043	0.040	0.038	0.052
	16	0.048	0.044	0.042	0.058
	18	0.053	0.048	0.046	0.063
	20	0.058	0.054	0.051	0.070

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.027	0.024	0.020	0.019
	8	0.035	0.032	0.026	0.025
	10	0.042	0.038	0.032	0.029
	12	0.048	0.043	0.036	0.034
	14	0.054	0.049	0.041	0.038
	16	0.060	0.054	0.045	0.042
	18	0.066	0.059	0.050	0.046
	20	0.073	0.066	0.055	0.051

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	100÷120	60÷80	45÷65	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.007	0.006	0.006	0.008
	4	0.009	0.008	0.007	0.010
	5	0.012	0.010	0.009	0.013
	6	0.014	0.012	0.011	0.015
	8	0.018	0.016	0.014	0.019
	10	0.021	0.019	0.017	0.023
	12	0.024	0.022	0.019	0.026
	14	0.027	0.024	0.022	0.030
	16	0.030	0.027	0.024	0.033
	18	0.033	0.030	0.026	0.036
	20	0.037	0.033	0.029	0.040

ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D
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Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF840

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	190÷230	130÷150	100÷120	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.035	0.032	0.028	0.039
	4	0.046	0.042	0.037	0.051
	5	0.058	0.052	0.046	0.063
	6	0.068	0.061	0.054	0.074
	8	0.088	0.079	0.070	0.096
	10	0.105	0.095	0.084	0.116
	12	0.120	0.108	0.096	0.132
	14	0.135	0.122	0.108	0.149
	16	0.150	0.135	0.120	0.165
	18	0.165	0.149	0.132	0.182
	20	0.183	0.164	0.146	0.201
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D		

NOTES:

Down milling CNC programming is required.

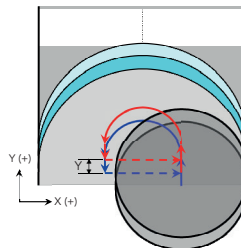
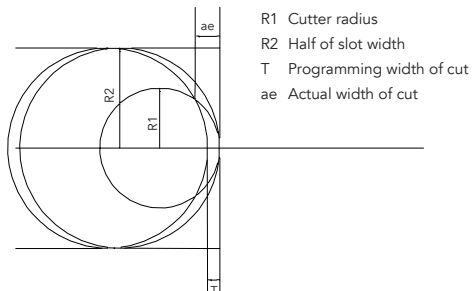
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

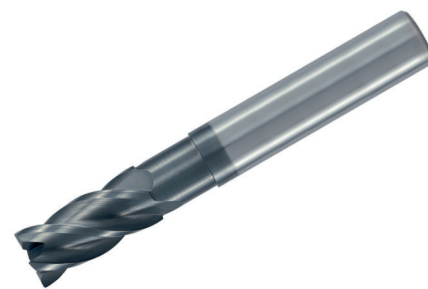
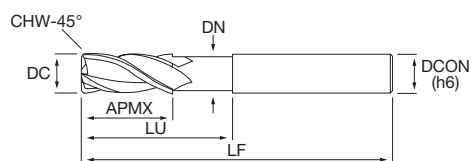
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF440

- Cylindrical shank and reduced neck
- 45° chamfer



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

MG
PV300

<40
HRC

FHA VH 36°/39°

CH-45°

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

DRILLING

TROCHOIDAL

DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.1	±0.020	6	h6	9	15	2.8	57	4	HF440030	●
4	0/-0.030	0.1	±0.020	6	h6	11	18	3.8	57	4	HF440040	●
5	0/-0.030	0.1	±0.020	6	h6	13	19	4.8	57	4	HF440050	●
6	0/-0.030	0.1	±0.020	6	h6	13	20	5.8	57	4	HF440060	●
8	0/-0.030	0.2	±0.020	8	h6	20	26	7.8	64	4	HF440080	●
10	0/-0.030	0.2	±0.020	10	h6	22	30	9.8	72	4	HF440100	●
12	0/-0.030	0.2	±0.020	12	h6	26	36	11.8	83	4	HF440120	●
14	0/-0.030	0.2	±0.020	14	h6	26	36	13.7	83	4	HF440140	●
16	0/-0.030	0.3	±0.020	16	h6	32	42	15.7	92	4	HF440160	●
20	0/-0.030	0.4	±0.020	20	h6	38	50	19.7	104	4	HF440200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF440

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.013	0.011	0.009	0.009
	4	0.017	0.015	0.012	0.012
	5	0.021	0.019	0.016	0.014
	6	0.024	0.022	0.018	0.017
	8	0.032	0.028	0.024	0.022
	10	0.038	0.034	0.028	0.026
	12	0.043	0.039	0.032	0.030
	14	0.049	0.044	0.036	0.034
	16	0.054	0.049	0.041	0.038
	20	0.066	0.059	0.049	0.046
ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	ap x ae	1.5D x D	1.5D x D		
	Vc (m/min)	85÷105	55÷75		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	8	0.025	0.023		
	10	0.030	0.027		
	12	0.035	0.031		
	14	0.039	0.035		
	16	0.043	0.039		
	20	0.053	0.047		

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	130÷150	90÷110	60÷80	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.015	0.014	0.012	0.017
	4	0.020	0.018	0.016	0.022
	5	0.025	0.022	0.020	0.027
	6	0.029	0.026	0.023	0.032
	8	0.038	0.034	0.030	0.042
	10	0.045	0.041	0.036	0.050
	12	0.052	0.047	0.041	0.057
	14	0.058	0.052	0.047	0.064
	16	0.065	0.058	0.052	0.071
	20	0.079	0.071	0.063	0.087
ap x ae	≤ D5	1.5D x 0.25D	1.5D x 0.25D	1.2D x 0.1D	1.2D x 0.1D

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF440

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x 0.4D	5° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.009	0.009	0.008	0.007
	4	0.012	0.011	0.010	0.009
	5	0.015	0.014	0.012	0.012
	6	0.018	0.016	0.015	0.014
	8	0.023	0.021	0.019	0.018
	10	0.028	0.026	0.023	0.021
	12	0.031	0.029	0.026	0.024
	14	0.035	0.033	0.029	0.027
	16	0.039	0.037	0.032	0.030
	20	0.048	0.045	0.039	0.037
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.019	0.018	0.017	0.023
	8	0.025	0.023	0.022	0.030
	10	0.030	0.028	0.026	0.036
	12	0.034	0.032	0.030	0.042
	14	0.039	0.036	0.034	0.047
	16	0.043	0.040	0.038	0.052
	20	0.052	0.048	0.046	0.063

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	α° x ae	30° x D	15° x D		
	Vc (m/min)	80÷100	50÷70		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	10	0.025	0.023		
	12	0.028	0.026		
	14	0.032	0.029		
	16	0.035	0.032		
	20	0.043	0.039		

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF440

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.024	0.022	0.018	0.017
	8	0.032	0.028	0.024	0.022
	10	0.038	0.034	0.028	0.026
	12	0.043	0.039	0.032	0.030
	14	0.049	0.044	0.036	0.034
	16	0.054	0.049	0.041	0.038
	20	0.066	0.059	0.049	0.046

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	85÷105	55÷75	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.006	0.006	0.005	0.007
	4	0.008	0.007	0.007	0.009
	5	0.010	0.009	0.008	0.011
	6	0.012	0.011	0.010	0.013
	8	0.016	0.014	0.013	0.017
	10	0.019	0.017	0.015	0.021
	12	0.022	0.019	0.017	0.024
	14	0.024	0.022	0.019	0.027
	16	0.027	0.024	0.022	0.030
	20	0.033	0.030	0.026	0.036

ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D
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Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF440

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.2D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	160÷200	110÷130	80÷100	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.032	0.028	0.025	0.035
	4	0.042	0.037	0.033	0.046
	5	0.052	0.047	0.041	0.057
	6	0.061	0.055	0.049	0.067
	8	0.079	0.071	0.063	0.087
	10	0.095	0.085	0.076	0.104
	12	0.108	0.097	0.086	0.119
	14	0.122	0.109	0.097	0.134
	16	0.135	0.122	0.108	0.149
	20	0.164	0.148	0.131	0.181
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D		

NOTES:

Down milling CNC programming is required.

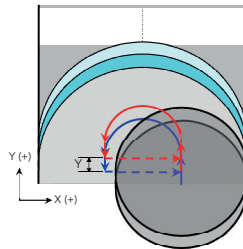
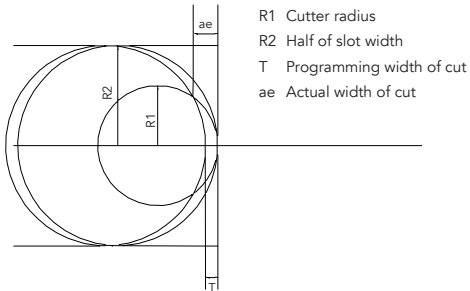
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

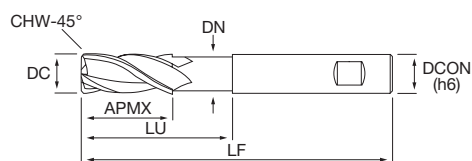
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF441

- Weldon shank and reduced neck
- 45° chamfer



P	M	K	N	S	H
★	★	★		★	

OSAWA
NORM

MG
PV300

<40
HRC



DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.1	±0.020	6	h6	9	15	2.8	57	4	HF441030	●
4	0/-0.030	0.1	±0.020	6	h6	11	18	3.8	57	4	HF441040	●
5	0/-0.030	0.1	±0.020	6	h6	13	19	4.8	57	4	HF441050	●
6	0/-0.030	0.1	±0.020	6	h6	13	20	5.8	57	4	HF441060	●
8	0/-0.030	0.2	±0.020	8	h6	20	26	7.8	64	4	HF441080	●
10	0/-0.030	0.2	±0.020	10	h6	22	30	9.8	72	4	HF441100	●
12	0/-0.030	0.2	±0.020	12	h6	26	36	11.8	83	4	HF441120	●
14	0/-0.030	0.2	±0.020	14	h6	26	36	13.7	83	4	HF441140	●
16	0/-0.030	0.3	±0.020	16	h6	32	42	15.7	92	4	HF441160	●
18	0/-0.030	0.3	±0.020	18	h6	32	42	17.7	92	4	HF441180	●
20	0/-0.030	0.4	±0.020	20	h6	38	50	19.7	104	4	HF441200	●

★ 1st choice, ☆ suitable, ● stock standard, ○ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.013	0.011	0.009	0.009
	4	0.017	0.015	0.012	0.012
	5	0.021	0.019	0.016	0.014
	6	0.024	0.022	0.018	0.017
	8	0.032	0.028	0.024	0.022
	10	0.038	0.034	0.028	0.026
	12	0.043	0.039	0.032	0.030
	14	0.049	0.044	0.036	0.034
	16	0.054	0.049	0.041	0.038
	18	0.059	0.053	0.045	0.042
	20	0.066	0.059	0.049	0.046
ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	ap x ae	1.5D x D	1.5D x D		
	Vc (m/min)	85÷105	55÷75		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	8	0.025	0.023		
	10	0.030	0.027		
	12	0.035	0.031		
	14	0.039	0.035		
	16	0.043	0.039		
	18	0.048	0.043		
	20	0.053	0.047		

	Material Group ISO 513	P1 P2 P7 K1			
	Hardness/Rm	≤700 N/mm ²			
	ap x ae	2D x D			
	Vc (m/min)	60÷80			
	DC (mm)	fz (mm/z)			
	10	0.023			
	12	0.026			
	14	0.029			
	16	0.032			
	18	0.036			
	20	0.039			

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	130÷150	90÷110	60÷80	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.015	0.014	0.012	0.017
	4	0.020	0.018	0.016	0.022
	5	0.025	0.022	0.020	0.027
	6	0.029	0.026	0.023	0.032
	8	0.038	0.034	0.030	0.042
	10	0.045	0.041	0.036	0.050
	12	0.052	0.047	0.041	0.057
	14	0.058	0.052	0.047	0.064
	16	0.065	0.058	0.052	0.071
	18	0.071	0.064	0.057	0.078
	20	0.079	0.071	0.063	0.087
ap x ae	≤ D5	1.5D x 0.25D	1.5D x 0.25D	1.2D x 0.1D	1.2D x 0.1D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.009	0.009	0.008	0.007
	4	0.012	0.011	0.010	0.009
	5	0.015	0.014	0.012	0.012
	6	0.018	0.016	0.015	0.014
	8	0.023	0.021	0.019	0.018
	10	0.028	0.026	0.023	0.021
	12	0.031	0.029	0.026	0.024
	14	0.035	0.033	0.029	0.027
	16	0.039	0.037	0.032	0.030
	18	0.043	0.040	0.036	0.033
	20	0.048	0.045	0.039	0.037
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D
Parameters suggested with high precision weldon chuck and stable machining condition. For application on high power milling chuck, please refer to HF440 parameters.					

Cutting Parameters

HF441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.019	0.018	0.017	0.023
	8	0.025	0.023	0.022	0.030
	10	0.030	0.028	0.026	0.036
	12	0.034	0.032	0.030	0.042
	14	0.039	0.036	0.034	0.047
	16	0.043	0.040	0.038	0.052
	18	0.047	0.044	0.042	0.057
	20	0.052	0.048	0.046	0.063

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	α° x ae	30° x D	15° x D		
	Vc (m/min)	80÷100	50÷70		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	10	0.025	0.023		
	12	0.028	0.026		
	14	0.032	0.029		
	16	0.035	0.032		
	18	0.039	0.036		
	20	0.043	0.039		

	Material Group ISO 513	P1 P2 P7 K1			
	Hardness/Rm	≤700 N/mm ²			
	α° x ae	45° x D			
	Vc (m/min)	60÷80			
	DC (mm)	fz (mm/z)			
	10	0.024			
	12	0.028			
	14	0.031			
	16	0.035			
	18	0.038			
	20	0.042			

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.024	0.022	0.018	0.017
	8	0.032	0.028	0.024	0.022
	10	0.038	0.034	0.028	0.026
	12	0.043	0.039	0.032	0.030
	14	0.049	0.044	0.036	0.034
	16	0.054	0.049	0.041	0.038
	18	0.059	0.053	0.045	0.042
	20	0.066	0.059	0.049	0.046

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	85÷105	55÷75	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.006	0.006	0.005	0.007
	4	0.008	0.007	0.007	0.009
	5	0.010	0.009	0.008	0.011
	6	0.012	0.011	0.010	0.013
	8	0.016	0.014	0.013	0.017
	10	0.019	0.017	0.015	0.021
	12	0.022	0.019	0.017	0.024
	14	0.024	0.022	0.019	0.027
	16	0.027	0.024	0.022	0.030
	18	0.030	0.027	0.024	0.033
	20	0.033	0.030	0.026	0.036
ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

Cutting Parameters

HF441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	160÷200	110÷130	80÷100	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.032	0.028	0.025	0.035
	4	0.042	0.037	0.033	0.046
	5	0.052	0.047	0.041	0.057
	6	0.061	0.055	0.049	0.067
	8	0.079	0.071	0.063	0.087
	10	0.095	0.085	0.076	0.104
	12	0.108	0.097	0.086	0.119
	14	0.122	0.109	0.097	0.134
	16	0.135	0.122	0.108	0.149
	18	0.149	0.134	0.119	0.163
	20	0.164	0.148	0.131	0.181
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D		

NOTES:

Down milling CNC programming is required.

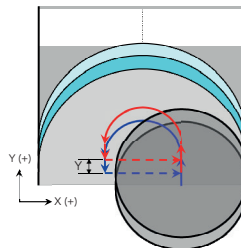
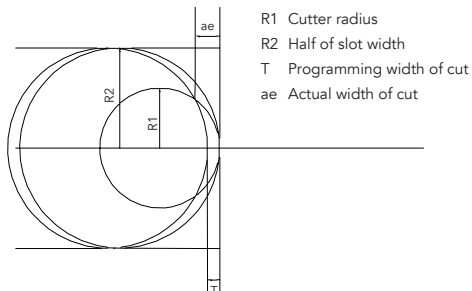
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

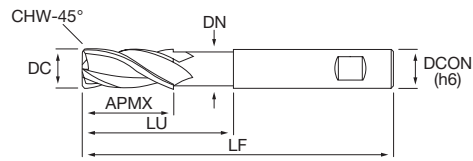
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

HF6441

- Weldon shank and reduced neck
- 45° chamfer



P	M	K	N	S	H
★	★	★			

OSAWA NORM	MG PV500	<40 HRC	FHA VH 36°/39°	CH-45°	ZEFP 4 UP	SLOTING	SIDE MILLING	HELICAL	RAMPING	VERTICAL	DRILLING	TROCHOIDAL
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DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
1	0/-0.02	0.1	±0.020	4	h6	3	-	-	50	4	HF6441010N	●
1.5	0/-0.02	0.1	±0.020	4	h6	4.5	-	-	50	4	HF6441015N	●
2	0/-0.02	0.1	±0.020	4	h6	6.5	-	-	50	4	HF6441020N	●
2.5	0/-0.02	0.1	±0.020	4	h6	6.5	-	-	50	4	HF6441025N	●
3	0/-0.02	0.1	±0.020	6	h6	9	15	2.8	57	4	HF6441030N	●
3.5	0/-0.02	0.15	±0.020	6	h6	11	18	3.3	57	4	HF6441035N	●
4	0/-0.02	0.15	±0.020	6	h6	11	18	3.8	57	4	HF6441040N	●
4.5	0/-0.02	0.15	±0.020	6	h6	13	19	4.3	57	4	HF6441045N	●
5	0/-0.02	0.15	±0.020	6	h6	13	19	4.8	57	4	HF6441050N	●
5.5	0/-0.02	0.15	±0.020	6	h6	13	21	5.3	57	4	HF6441055N	●
6	0/-0.02	0.2	±0.020	6	h6	13	21	5.8	57	4	HF6441060N	●
6.5	0/-0.02	0.2	±0.020	8	h6	20	27	6.3	63	4	HF6441065N	●
7	0/-0.02	0.2	±0.020	8	h6	20	27	6.8	63	4	HF6441070N	●
7.5	0/-0.02	0.2	±0.020	8	h6	20	27	7.3	63	4	HF6441075N	●
8	0/-0.02	0.2	±0.020	8	h6	20	27	7.8	63	4	HF6441080N	●
8.5	0/-0.02	0.2	±0.020	10	h6	22	32	8.3	72	4	HF6441085N	●
9	0/-0.02	0.2	±0.020	10	h6	22	32	8.8	72	4	HF6441090N	●
9.5	0/-0.03	0.3	±0.020	10	h6	22	32	9.3	72	4	HF6441095N	●
10	0/-0.03	0.3	±0.020	10	h6	22	32	9.8	72	4	HF6441100N	●
10.5	0/-0.03	0.3	±0.020	12	h6	26	38	10.2	83	4	HF6441105N	●
11	0/-0.03	0.3	±0.020	12	h6	26	38	10.7	83	4	HF6441110N	●
11.5	0/-0.03	0.35	±0.020	12	h6	26	38	11.2	83	4	HF6441115N	●
12	0/-0.03	0.35	±0.020	12	h6	26	38	11.7	83	4	HF6441120N	●
13	0/-0.03	0.35	±0.020	14	h6	26	38	12.7	83	4	HF6441130N	●
14	0/-0.03	0.4	±0.020	14	h6	26	38	13.7	83	4	HF6441140N	●
15	0/-0.03	0.4	±0.020	16	h6	32	44	14.7	92	4	HF6441150N	●
16	0/-0.03	0.4	±0.020	16	h6	32	44	15.7	92	4	HF6441160N	●
17	0/-0.03	0.5	±0.020	18	h6	32	44	16.7	92	4	HF6441170N	●
18	0/-0.03	0.5	±0.020	18	h6	32	44	17.7	92	4	HF6441180N	●
19	0/-0.03	0.5	±0.020	20	h6	38	54	18.7	104	4	HF6441190N	●
20	0/-0.03	0.5	±0.020	20	h6	38	54	19.7	104	4	HF6441200N	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF6441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	D x D	
	Vc (m/min)	180÷220	120÷140	90÷110	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	1	0.004	0.004	0.004	
	2	0.008	0.008	0.008	
	3	0.013	0.012	0.012	
	4	0.017	0.016	0.016	
	5	0.021	0.020	0.020	
	6	0.025	0.024	0.023	
	8	0.036	0.033	0.033	
	10	0.047	0.044	0.044	
	12	0.060	0.056	0.056	
	14	0.068	0.063	0.063	
	16	0.076	0.071	0.069	
	20	0.089	0.083	0.080	
ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	
	Vc (m/min)	240÷280	160÷200	100÷140	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	1	0.005	0.004	0.005	
	2	0.010	0.008	0.010	
	3	0.014	0.013	0.015	
	4	0.019	0.018	0.021	
	5	0.025	0.023	0.026	
	6	0.030	0.028	0.032	
	8	0.043	0.040	0.044	
	10	0.056	0.052	0.057	
	12	0.071	0.065	0.070	
	14	0.081	0.075	0.079	
	16	0.091	0.084	0.088	
	20	0.110	0.100	0.103	
ap x ae	≤ D5	1.5D x 0.12D	1.5D x 0.12D	1.5D x 0.1D	

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

HF6441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	α° x ae	5° x 0.4D	4° x 0.4D	4° x 0.4D	
	Vc (m/min)	180÷220	120÷140	90÷110	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	1	0.004	0.003	0.003	
	2	0.007	0.006	0.006	
	3	0.009	0.009	0.009	
	4	0.012	0.012	0.012	
	5	0.015	0.015	0.015	
	6	0.018	0.018	0.017	
	8	0.026	0.025	0.025	
	10	0.034	0.033	0.033	
	12	0.044	0.042	0.042	
	14	0.050	0.047	0.047	
	16	0.055	0.053	0.052	
	20	0.065	0.062	0.060	
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	α° x ae	15° x D	10° x D	10° x D	
	Vc (m/min)	160÷200	100÷120	80÷100	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	6	0.010	0.010	0.010	
	8	0.014	0.013	0.013	
	10	0.017	0.016	0.016	
	12	0.020	0.019	0.018	
	14	0.029	0.026	0.026	
	16	0.038	0.035	0.035	
	20	0.048	0.045	0.045	

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	α° x ae	30° x D	15° x D	10° x D	
	Vc (m/min)	140÷180	90÷110	70÷90	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	10	0.014	0.013	0.013	
	12	0.016	0.016	0.015	
	14	0.024	0.022	0.022	
	16	0.031	0.029	0.029	
	20	0.039	0.037	0.037	

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

Cutting Parameters

HF6441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x 0.4D	D x 0.4D	D x 0.4D	
	Vc (m/min)	160÷200	100÷120	80÷100	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	6	0.025	0.024	0.023	
	8	0.036	0.033	0.033	
	10	0.047	0.044	0.044	
	12	0.060	0.056	0.056	
	14	0.068	0.063	0.063	
	16	0.076	0.071	0.069	
	20	0.089	0.083	0.080	

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	D x D	D x D	0.5D x D	
	Vc (m/min)	85÷105	55÷75	40÷60	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	1	0.002	0.002	0.002	
	2	0.004	0.004	0.004	
	3	0.007	0.006	0.006	
	4	0.009	0.008	0.008	
	5	0.011	0.010	0.010	
	6	0.013	0.012	0.012	
	8	0.018	0.017	0.017	
	10	0.024	0.022	0.022	
	12	0.030	0.028	0.028	
	14	0.034	0.032	0.032	
	16	0.038	0.036	0.035	
	20	0.045	0.042	0.040	
	ap x ae	≤ D5	0.5D x D	0.5D x D	0.5D x D

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

HF6441

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	
	Vc (m/min)	260÷300	170÷210	100÷150	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	1	0.011	0.01	0.01	
	2	0.022	0.02	0.02	
	3	0.033	0.030	0.030	
	4	0.043	0.040	0.040	
	5	0.053	0.050	0.050	
	6	0.063	0.060	0.058	
	8	0.090	0.083	0.083	
	10	0.118	0.110	0.110	
	12	0.150	0.140	0.140	
	14	0.170	0.158	0.158	
	16	0.190	0.178	0.173	
	20	0.223	0.208	0.200	
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	

NOTES:

Down milling CNC programming is required.

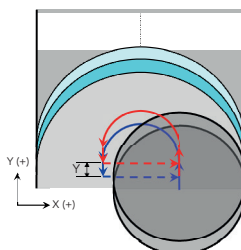
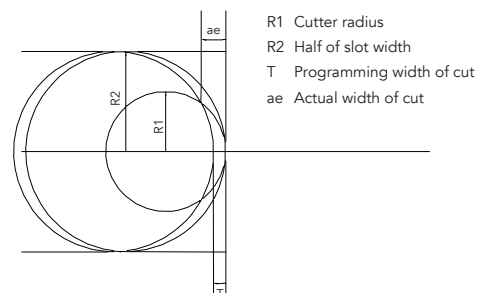
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.

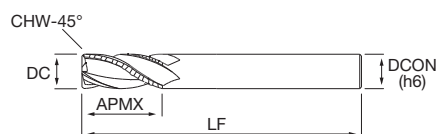


Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

HF844

- Cylindrical shank
- 45° chamfer
- Roughing HR

P	M	K	N	S	H
★	★	★		★	



DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.020	0.1	±0.020	6	h6	16	57	4	HF844060	●
8	0/-0.020	0.2	±0.020	8	h6	20	64	4	HF844080	●
10	0/-0.020	0.2	±0.020	10	h6	22	72	4	HF844100	●
12	0/-0.020	0.2	±0.020	12	h6	26	83	4	HF844120	●
14	0/-0.020	0.2	±0.020	14	h6	26	83	4	HF844140	●
16	0/-0.020	0.3	±0.020	16	h6	32	92	4	HF844160	●
18	0/-0.020	0.3	±0.020	18	h6	32	92	4	HF844180	●
20	0/-0.020	0.4	±0.020	20	h6	38	104	4	HF844200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF844

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.029	0.026	0.022	0.020
	8	0.038	0.034	0.028	0.026
	10	0.045	0.041	0.034	0.032
	12	0.052	0.047	0.039	0.036
	14	0.058	0.052	0.044	0.041
	16	0.065	0.058	0.049	0.045
	20	0.079	0.071	0.059	0.055

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	ap x ae	1.5D x D	1.5D x D		
	Vc (m/min)	85÷105	55÷75		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	8	0.030	0.027		
	10	0.036	0.033		
	12	0.041	0.037		
	14	0.047	0.042		
	16	0.052	0.047		
	20	0.063	0.057		

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	130÷150	90÷110	60÷80	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.035	0.031	0.028	0.038
	8	0.045	0.041	0.036	0.050
	10	0.054	0.049	0.044	0.060
	12	0.062	0.056	0.050	0.068
	14	0.070	0.063	0.056	0.077
	16	0.078	0.070	0.062	0.086
	20	0.095	0.085	0.076	0.104

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF844

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	8° x 0.4D	6° x 0.4D	4° x 0.4D	3° x 0.4D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.020	0.019	0.016	0.016
	8	0.026	0.024	0.021	0.021
	10	0.031	0.029	0.026	0.025
	12	0.036	0.033	0.029	0.029
	14	0.040	0.037	0.033	0.033
	16	0.045	0.041	0.037	0.036
	20	0.055	0.050	0.045	0.044

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.030	0.028	0.026	0.036
	10	0.036	0.033	0.032	0.044
	12	0.041	0.038	0.036	0.050
	14	0.047	0.043	0.041	0.056
	16	0.052	0.048	0.045	0.062
	20	0.063	0.058	0.055	0.076

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	α° x ae	30° x D	15° x D		
	Vc (m/min)	85÷105	45÷65		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	10	0.030	0.027		
	12	0.034	0.031		
	14	0.038	0.035		
	16	0.042	0.039		
	20	0.051	0.047		

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

HF844

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.029	0.026	0.022	0.020
	8	0.038	0.034	0.028	0.026
	10	0.045	0.041	0.034	0.032
	12	0.052	0.047	0.039	0.036
	14	0.058	0.052	0.044	0.041
	16	0.065	0.058	0.049	0.045
	20	0.079	0.071	0.059	0.055

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	160÷200	110÷130	80÷100	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.073	0.066	0.058	0.080
	8	0.095	0.085	0.076	0.104
	10	0.113	0.102	0.091	0.125
	12	0.130	0.117	0.104	0.143
	14	0.146	0.131	0.117	0.160
	16	0.162	0.146	0.130	0.178
	20	0.197	0.177	0.158	0.217

NOTES:

Down milling CNC programming is required.

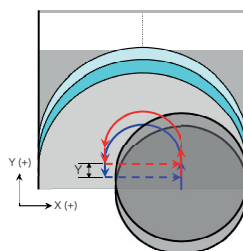
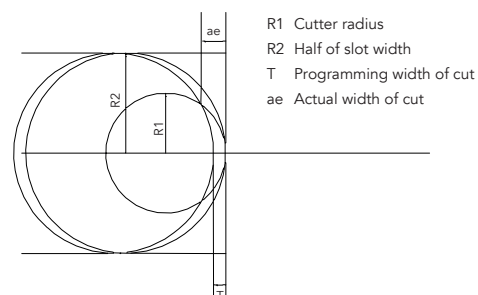
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.

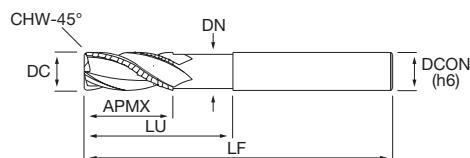


Parameters suggested with high power milling chuck and stable machining condition

HF444

- Cylindrical shank and reduced neck
- 45° chamfer
- Roughing HR

P	M	K	N	S	H
★	★	★	★	★	★



DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
6	0/-0.050	0.1	±0.020	6	h6	13	20	5.8	57	4	HF444060	●
8	0/-0.050	0.2	±0.020	8	h6	20	26	7.8	64	4	HF444080	●
10	0/-0.050	0.2	±0.020	10	h6	22	30	9.8	72	4	HF444100	●
12	0/-0.050	0.2	±0.020	12	h6	26	36	11.8	83	4	HF444120	●
14	0/-0.050	0.2	±0.020	14	h6	26	36	13.7	83	4	HF444140	●
16	0/-0.050	0.3	±0.020	16	h6	32	42	15.7	92	4	HF444160	●
20	0/-0.050	0.4	±0.020	20	h6	38	50	19.7	104	4	HF444200	●

★ 1st choice, ☆ suitable, ● stock standard, ○ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF444

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.026	0.024	0.020	0.018
	8	0.034	0.031	0.026	0.024
	10	0.041	0.037	0.031	0.029
	12	0.047	0.042	0.035	0.033
	14	0.052	0.047	0.039	0.037
	16	0.058	0.052	0.044	0.041
	20	0.071	0.064	0.053	0.050

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	ap x ae	1.5D x D	1.5D x D		
	Vc (m/min)	85÷105	55÷75		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	8	0.027	0.024		
	10	0.033	0.029		
	12	0.037	0.034		
	14	0.042	0.038		
	16	0.047	0.042		
	20	0.057	0.051		

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	130÷150	90÷110	60÷80	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.031	0.028	0.025	0.035
	8	0.041	0.037	0.033	0.045
	10	0.049	0.044	0.039	0.054
	12	0.056	0.050	0.045	0.062
	14	0.063	0.057	0.050	0.069
	16	0.070	0.063	0.056	0.077
	20	0.085	0.077	0.068	0.094

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF444

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	7° x 0.4D	5° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.018	0.017	0.016	0.015
	8	0.024	0.022	0.020	0.019
	10	0.029	0.027	0.025	0.023
	12	0.033	0.031	0.028	0.026
	14	0.037	0.034	0.032	0.029
	16	0.041	0.038	0.035	0.033
	20	0.050	0.046	0.043	0.040

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.027	0.025	0.024	0.033
	10	0.033	0.030	0.029	0.039
	12	0.037	0.034	0.033	0.045
	14	0.042	0.039	0.037	0.050
	16	0.047	0.043	0.041	0.056
	20	0.057	0.052	0.050	0.068

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	α° x ae	30° x D	15° x D		
	Vc (m/min)	80÷100	50÷70		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	10	0.027	0.024		
	12	0.030	0.028		
	14	0.034	0.031		
	16	0.038	0.035		
	20	0.046	0.042		

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF444

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.026	0.024	0.020	0.018
	8	0.034	0.031	0.026	0.024
	10	0.041	0.037	0.031	0.029
	12	0.047	0.042	0.035	0.033
	14	0.052	0.047	0.039	0.037
	16	0.058	0.052	0.044	0.041
	20	0.071	0.064	0.053	0.050

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	160÷200	110÷130	80÷100	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.066	0.059	0.052	0.072
	8	0.085	0.077	0.068	0.094
	10	0.102	0.092	0.082	0.112
	12	0.117	0.105	0.093	0.128
	14	0.131	0.118	0.105	0.144
	16	0.146	0.131	0.117	0.160
	20	0.177	0.160	0.142	0.195

NOTES:

Down milling CNC programming is required.

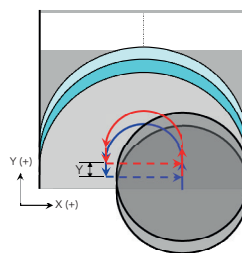
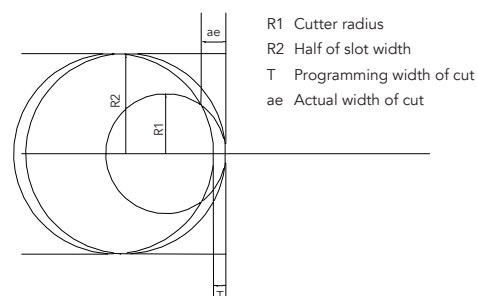
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

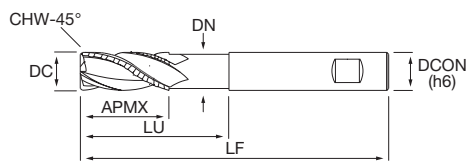
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF445

- Weldon shank and reduced neck
- 45° chamfer
- Roughing HR



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

MG
PV300

<40
HRC

FHA VH 36°/39°

CH-45°

HR
FINE

ZEFP 4 UP

1.5D
SLOTING

L
SIDE MILLING

HEXAGONAL

RAMPING

VERTICAL

TROCHOIDAL

DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
6	0/-0.050	0.1	±0.020	6	h6	13	20	5.8	57	4	HF445060	●
8	0/-0.050	0.2	±0.020	8	h6	20	26	7.8	64	4	HF445080	●
10	0/-0.050	0.2	±0.020	10	h6	22	30	9.8	72	4	HF445100	●
12	0/-0.050	0.2	±0.020	12	h6	26	36	11.8	83	4	HF445120	●
14	0/-0.050	0.2	±0.020	14	h6	26	36	13.7	83	4	HF445140	●
16	0/-0.050	0.3	±0.020	16	h6	32	42	15.7	92	4	HF445160	●
20	0/-0.050	0.4	±0.020	20	h6	38	50	19.7	104	4	HF445200	●

★ 1st choice, ☆ suitable, ● stock standard, ○ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF445

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.026	0.024	0.020	0.018
	8	0.034	0.031	0.026	0.024
	10	0.041	0.037	0.031	0.029
	12	0.047	0.042	0.035	0.033
	14	0.052	0.047	0.039	0.037
	16	0.058	0.052	0.044	0.041
	20	0.071	0.064	0.053	0.050

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	ap x ae	1.5D x D	1.5D x D		
	Vc (m/min)	85÷105	55÷75		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	8	0.027	0.024		
	10	0.033	0.029		
	12	0.037	0.034		
	14	0.042	0.038		
	16	0.047	0.042		
	20	0.057	0.051		

	Material Group ISO 513	P1 P2 P7 K1			
	Hardness/Rm	≤700 N/mm ²			
	ap x ae	2D x D			
	Vc (m/min)	60÷80			
	DC (mm)	fz (mm/z)			
	10	0.024			
	12	0.028			
	14	0.031			
	16	0.035			
	20	0.043			

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

Cutting Parameters

HF445

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	130÷150	90÷110	60÷80	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.031	0.028	0.025	0.035
	8	0.041	0.037	0.033	0.045
	10	0.049	0.044	0.039	0.054
	12	0.056	0.050	0.045	0.062
	14	0.063	0.057	0.050	0.069
	16	0.070	0.063	0.056	0.077
	20	0.085	0.077	0.068	0.094

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	7° x 0.4D	5° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.018	0.017	0.016	0.015
	8	0.024	0.022	0.020	0.019
	10	0.029	0.027	0.025	0.023
	12	0.033	0.031	0.028	0.026
	14	0.037	0.034	0.032	0.029
	16	0.041	0.038	0.035	0.033
	20	0.050	0.046	0.043	0.040

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.027	0.025	0.024	0.033
	10	0.033	0.030	0.029	0.039
	12	0.037	0.034	0.033	0.045
	14	0.042	0.039	0.037	0.050
	16	0.047	0.043	0.041	0.056
	20	0.057	0.052	0.050	0.068

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF445

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	α° x ae	30° x D	15° x D		
	Vc (m/min)	80÷100	50÷70		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	10	0.027	0.024		
	12	0.030	0.028		
	14	0.034	0.031		
	16	0.038	0.035		
	20	0.046	0.042		

	Material Group ISO 513	P1 P2 P7 K1			
	Hardness/Rm	≤700 N/mm ²			
	α° x ae	45° x D			
	Vc (m/min)	60÷80			
	DC (mm)	fz (mm/z)			
	10	0.026			
	12	0.030			
	14	0.034			
	16	0.038			
	20	0.046			

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.026	0.024	0.020	0.018
	8	0.034	0.031	0.026	0.024
	10	0.041	0.037	0.031	0.029
	12	0.047	0.042	0.035	0.033
	14	0.052	0.047	0.039	0.037
	16	0.058	0.052	0.044	0.041
	20	0.071	0.064	0.053	0.050

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

Cutting Parameters

HF445

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	160÷200	110÷130	80÷100	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.066	0.059	0.052	0.072
	8	0.085	0.077	0.068	0.094
	10	0.102	0.092	0.082	0.112
	12	0.117	0.105	0.093	0.128
	14	0.131	0.118	0.105	0.144
	16	0.146	0.131	0.117	0.160
	20	0.177	0.160	0.142	0.195

NOTES:

Down milling CNC programming is required.

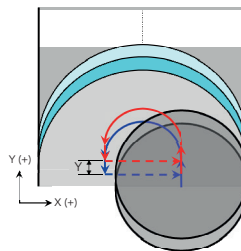
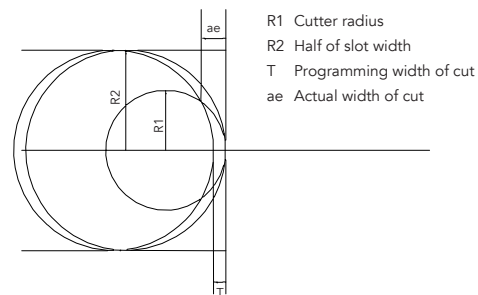
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

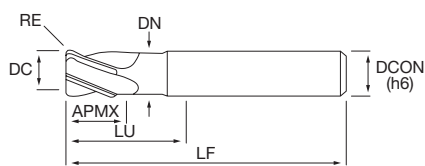
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF440 parameters.

HF342

- Cylindrical shank and reduced neck
- Extra short
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

MG
PV300

<40
HRC

FHA VH 36°/39°

RADIUS

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

DRILLING

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.2	±0.010	6	h6	5	9	2.8	50	4	HF34202030	●
4	0/-0.030	0.2	±0.010	6	h6	6	12	3.8	50	4	HF34202040	●
5	0/-0.030	0.2	±0.010	6	h6	8	14	4.8	50	4	HF34202050	●
6	0/-0.030	0.3	±0.010	6	h6	9	18	5.8	55	4	HF34203060	●
8	0/-0.030	0.5	±0.010	8	h6	12	24	7.8	60	4	HF34205080	●
10	0/-0.030	1	±0.010	10	h6	15	30	9.8	70	4	HF34210100	●
12	0/-0.030	1	±0.010	12	h6	18	35	11.8	80	4	HF34210120	●

★ 1st choice, ☆ suitable, ● stock standard, ○ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF342

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.014	0.013	0.011	0.010
	4	0.019	0.017	0.014	0.013
	5	0.023	0.021	0.017	0.016
	6	0.027	0.024	0.020	0.019
	8	0.035	0.032	0.026	0.025
	10	0.042	0.038	0.032	0.029
	12	0.048	0.043	0.036	0.034
ap x ae		≤ D5	0.5D x D	0.25D x D	0.25D x D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	160÷180	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.017	0.015	0.013	0.018
	4	0.022	0.020	0.018	0.024
	5	0.028	0.025	0.022	0.030
	6	0.032	0.029	0.026	0.036
	8	0.042	0.038	0.034	0.046
	10	0.050	0.045	0.040	0.055
	12	0.058	0.052	0.046	0.063
ap x ae		≤ D5	1.2D x 0.3D	D x 0.2D	D x 0.2D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.010	0.010	0.008	0.008
	4	0.013	0.013	0.011	0.010
	5	0.017	0.016	0.014	0.013
	6	0.020	0.018	0.016	0.015
	8	0.025	0.024	0.021	0.020
	10	0.031	0.029	0.025	0.024
	12	0.035	0.033	0.029	0.027
α° x ae		≤ D5	2° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF342

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	120÷140	70÷90	55÷75	25÷45
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.022	0.020	0.019	0.026
	8	0.028	0.026	0.024	0.034
	10	0.034	0.031	0.029	0.040
	12	0.038	0.035	0.034	0.046

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	120÷140	70÷90	55÷75	25÷45
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.027	0.024	0.020	0.019
	8	0.035	0.032	0.026	0.025
	10	0.042	0.038	0.032	0.029
	12	0.048	0.043	0.036	0.034

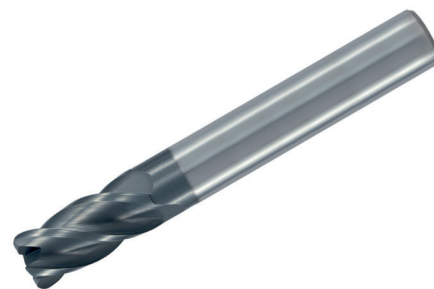
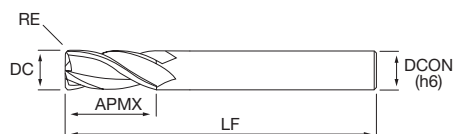
	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	100÷120	60÷80	45÷65	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.007	0.006	0.006	0.008
	4	0.009	0.008	0.007	0.010
	5	0.012	0.010	0.009	0.013
	6	0.014	0.012	0.011	0.015
	8	0.018	0.016	0.014	0.019
	10	0.021	0.019	0.017	0.023
	12	0.024	0.022	0.019	0.026

ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D
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Parameters suggested with high power milling chuck and stable machining condition

HF842

- Cylindrical shank
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

MG
PV300

<40
HRC

FHA VH 36°/39°

RADIUS

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

DRILLING

TROCHOIDAL

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.025	0.3	±0.015	6	h6	11	57	4	HF84203040	●
4	0/-0.025	0.5	±0.015	6	h6	11	57	4	HF84205040	●
5	0/-0.025	0.3	±0.015	6	h6	13	57	4	HF84203050	●
5	0/-0.025	0.5	±0.015	6	h6	13	57	4	HF84205050	●
6	0/-0.025	0.3	±0.015	6	h6	13	57	4	HF84203060	●
6	0/-0.025	0.5	±0.015	6	h6	13	57	4	HF84205060	●
6	0/-0.025	1	±0.015	6	h6	13	57	4	HF84210060	●
8	0/-0.030	0.5	±0.015	8	h6	20	64	4	HF84205080	●
8	0/-0.030	1	±0.015	8	h6	20	64	4	HF84210080	●
10	0/-0.030	0.5	±0.020	10	h6	22	72	4	HF84205100	●
10	0/-0.030	1	±0.020	10	h6	22	72	4	HF84210100	●
12	0/-0.030	0.5	±0.020	12	h6	26	83	4	HF84205120	●
12	0/-0.030	1	±0.020	12	h6	26	83	4	HF84210120	●
12	0/-0.030	2	±0.020	12	h6	26	83	4	HF84220120	●
12	0/-0.030	3	±0.020	12	h6	26	83	4	HF84230120	●
14	0/-0.030	1	±0.020	14	h6	26	83	4	HF84210140	●
16	0/-0.030	1	±0.020	16	h6	32	92	4	HF84210160	●
16	0/-0.030	2	±0.020	16	h6	32	92	4	HF84220160	●
16	0/-0.030	3	±0.020	16	h6	32	92	4	HF84230160	●
18	0/-0.030	1	±0.020	18	h6	32	92	4	HF84210180	●
20	0/-0.030	1	±0.020	20	h6	38	104	4	HF84210200	●
20	0/-0.030	2	±0.020	20	h6	38	104	4	HF84220200	●
20	0/-0.030	3	±0.020	20	h6	38	104	4	HF84230200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF842



Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
ap x ae	D x D	D x D	0.5D x D	0.5D x D
Vc (m/min)	130÷150	70÷90	50÷70	30÷50
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.014	0.013	0.011	0.010
4	0.019	0.017	0.014	0.013
5	0.023	0.021	0.017	0.016
6	0.027	0.024	0.020	0.019
8	0.035	0.032	0.026	0.025
10	0.042	0.038	0.032	0.029
12	0.048	0.043	0.036	0.034
14	0.054	0.049	0.041	0.038
16	0.060	0.054	0.045	0.042
18	0.066	0.059	0.050	0.046
20	0.073	0.066	0.055	0.051
ap x ae	≤ D5	0.5D x D	0.25D x D	0.25D x D



Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
ap x ae	D x D	D x D	0.5D x D	0.5D x D
Vc (m/min)	160÷180	100÷120	70÷90	40÷60
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.017	0.015	0.013	0.018
4	0.022	0.020	0.018	0.024
5	0.028	0.025	0.022	0.030
6	0.032	0.029	0.026	0.036
8	0.042	0.038	0.034	0.046
10	0.050	0.045	0.040	0.055
12	0.058	0.052	0.046	0.063
14	0.065	0.058	0.052	0.071
16	0.072	0.065	0.058	0.079
18	0.079	0.071	0.063	0.087
20	0.088	0.079	0.070	0.096
ap x ae	≤ D5	1.5D x 0.25D	1.2D x 0.1D	1.2D x 0.1D



Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	3° x 0.4D
Vc (m/min)	130÷150	80÷100	60÷80	30÷50
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.010	0.010	0.008	0.008
4	0.013	0.013	0.011	0.010
5	0.017	0.016	0.014	0.013
6	0.020	0.018	0.016	0.015
5	0.017	0.016	0.014	0.013
6	0.020	0.018	0.016	0.015
5	0.017	0.016	0.014	0.013
6	0.020	0.018	0.016	0.015
8	0.025	0.024	0.021	0.020
10	0.031	0.029	0.025	0.024
12	0.035	0.033	0.029	0.027
α° x ae	≤ D5	2° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF842

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.022	0.020	0.019	0.026
	8	0.028	0.026	0.024	0.034
	10	0.034	0.031	0.029	0.040
	12	0.038	0.035	0.034	0.046
	14	0.043	0.040	0.038	0.052
	16	0.048	0.044	0.042	0.058
	18	0.053	0.048	0.046	0.063
	20	0.058	0.054	0.051	0.070

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.027	0.024	0.020	0.019
	8	0.035	0.032	0.026	0.025
	10	0.042	0.038	0.032	0.029
	12	0.048	0.043	0.036	0.034
	14	0.054	0.049	0.041	0.038
	16	0.060	0.054	0.045	0.042
	18	0.066	0.059	0.050	0.046
	20	0.073	0.066	0.055	0.051

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	100÷120	60÷80	45÷65	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.007	0.006	0.006	0.008
	4	0.009	0.008	0.007	0.010
	5	0.012	0.010	0.009	0.013
	6	0.014	0.012	0.011	0.015
	8	0.018	0.016	0.014	0.019
	10	0.021	0.019	0.017	0.023
	12	0.024	0.022	0.019	0.026
	14	0.027	0.024	0.022	0.030
	16	0.030	0.027	0.024	0.033
	18	0.033	0.030	0.026	0.036
	20	0.037	0.033	0.029	0.040

ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D
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Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF842

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	190÷230	130÷150	100÷120	50÷70
	D (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.035	0.032	0.028	0.039
	4	0.046	0.042	0.037	0.051
	5	0.058	0.052	0.046	0.063
	6	0.068	0.061	0.054	0.074
	8	0.088	0.079	0.070	0.096
	10	0.105	0.095	0.084	0.116
	12	0.120	0.108	0.096	0.132
	14	0.135	0.122	0.108	0.149
	16	0.150	0.135	0.120	0.165
	18	0.165	0.149	0.132	0.182
	20	0.183	0.164	0.146	0.201
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D		

NOTES:

Down milling CNC programming is required.

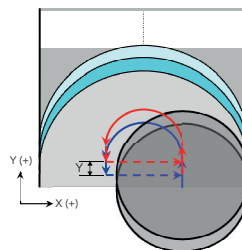
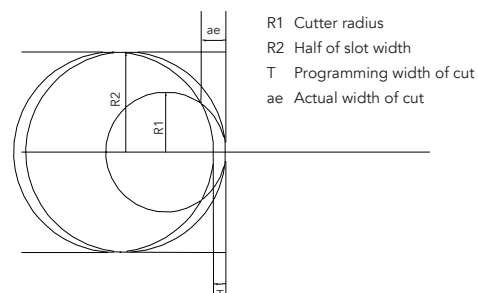
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

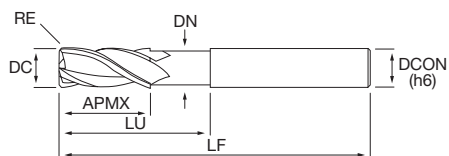
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF442

- Cylindrical shank and reduced neck
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

MG
PV300

<40
HRC

FHA VH 36°/39°

RADIUS

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

DRILLING

TROCHOIDAL

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.3	±0.020	6	h6	9	15	2.8	57	4	HF44203030	●
3	0/-0.030	0.5	±0.020	6	h6	9	15	2.8	57	4	HF44205030	●
4	0/-0.030	0.3	±0.020	6	h6	11	18	3.8	57	4	HF44203040	●
4	0/-0.030	0.5	±0.020	6	h6	11	18	3.8	57	4	HF44205040	●
5	0/-0.030	0.3	±0.020	6	h6	13	19	4.8	57	4	HF44203050	●
5	0/-0.030	0.5	±0.020	6	h6	13	19	4.8	57	4	HF44205050	●
6	0/-0.030	0.3	±0.020	6	h6	13	20	5.8	57	4	HF44203060	●
6	0/-0.030	0.5	±0.020	6	h6	13	20	5.8	57	4	HF44205060	●
6	0/-0.030	1	±0.020	6	h6	13	20	5.8	57	4	HF44210060	●
8	0/-0.030	0.5	±0.020	8	h6	20	26	7.8	64	4	HF44205080	●
8	0/-0.030	1	±0.020	8	h6	20	26	7.8	64	4	HF44210080	●
10	0/-0.030	0.5	±0.020	10	h6	22	30	9.8	72	4	HF44205100	●
10	0/-0.030	1	±0.020	10	h6	22	30	9.8	72	4	HF44210100	●
12	0/-0.030	0.5	±0.020	12	h6	26	36	11.8	83	4	HF44205120	●
12	0/-0.030	1	±0.020	12	h6	26	36	11.8	83	4	HF44210120	●
14	0/-0.030	1	±0.020	14	h6	26	36	13.7	83	4	HF44210140	●
16	0/-0.030	1	±0.020	16	h6	32	42	15.7	92	4	HF44210160	●
16	0/-0.030	2	±0.020	16	h6	32	42	15.7	92	4	HF44220160	●
20	0/-0.030	1	±0.020	20	h6	38	50	19.7	104	4	HF44210200	●
20	0/-0.030	2	±0.020	20	h6	38	50	19.7	104	4	HF44220200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF442

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.013	0.011	0.009	0.009
	4	0.017	0.015	0.012	0.012
	5	0.021	0.019	0.016	0.014
	6	0.024	0.022	0.018	0.017
	8	0.032	0.028	0.024	0.022
	10	0.038	0.034	0.028	0.026
	12	0.043	0.039	0.032	0.030
	14	0.049	0.044	0.036	0.034
	16	0.054	0.049	0.041	0.038
	20	0.066	0.059	0.049	0.046
ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	ap x ae	1.5D x D	1.5D x D		
	Vc (m/min)	85÷105	55÷75		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	8	0.025	0.023		
	10	0.030	0.027		
	12	0.035	0.031		
	14	0.039	0.035		
	16	0.043	0.039		
	20	0.053	0.047		

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	130÷150	90÷140	60÷80	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.015	0.014	0.012	0.017
	4	0.020	0.018	0.016	0.022
	5	0.025	0.022	0.020	0.027
	6	0.029	0.026	0.023	0.032
	8	0.038	0.034	0.030	0.042
	10	0.045	0.041	0.036	0.050
	12	0.052	0.047	0.041	0.057
	14	0.058	0.052	0.047	0.064
	16	0.065	0.058	0.052	0.071
	20	0.079	0.071	0.063	0.087
ap x ae	≤ D5	1.5D x 0.25D	1.5D x 0.25D	1.2D x 0.1D	1.2D x 0.1D

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF442

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.009	0.009	0.008	0.007
	4	0.012	0.011	0.010	0.009
	5	0.015	0.014	0.012	0.012
	6	0.018	0.016	0.015	0.014
	8	0.023	0.021	0.019	0.018
	10	0.028	0.026	0.023	0.021
	12	0.031	0.029	0.026	0.024
	14	0.035	0.033	0.029	0.027
	16	0.039	0.037	0.032	0.030
	20	0.048	0.045	0.039	0.037
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.019	0.018	0.017	0.023
	8	0.025	0.023	0.022	0.030
	10	0.030	0.028	0.026	0.036
	12	0.034	0.032	0.030	0.042
	14	0.039	0.036	0.034	0.047
	16	0.043	0.040	0.038	0.052
	20	0.052	0.048	0.046	0.063

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	α° x ae	30° x D	15° x D		
	Vc (m/min)	80÷100	50÷70		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	10	0.025	0.023		
	12	0.028	0.026		
	14	0.032	0.029		
	16	0.035	0.032		
	20	0.043	0.039		

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF442

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.024	0.022	0.018	0.017
	8	0.032	0.028	0.024	0.022
	10	0.038	0.034	0.028	0.026
	12	0.043	0.039	0.032	0.030
	14	0.049	0.044	0.036	0.034
	16	0.054	0.049	0.041	0.038
	20	0.066	0.059	0.049	0.046

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	85÷105	55÷75	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.006	0.006	0.005	0.007
	4	0.008	0.007	0.007	0.009
	5	0.010	0.009	0.008	0.011
	6	0.012	0.011	0.010	0.013
	8	0.016	0.014	0.013	0.017
	10	0.019	0.017	0.015	0.021
	12	0.022	0.019	0.017	0.024
	14	0.024	0.022	0.019	0.027
	16	0.027	0.024	0.022	0.030
	20	0.033	0.030	0.026	0.036

ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D
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Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF442

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	160÷200	110÷130	80÷100	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.032	0.028	0.025	0.035
	4	0.042	0.037	0.033	0.046
	5	0.052	0.047	0.041	0.057
	6	0.061	0.055	0.049	0.067
	8	0.079	0.071	0.063	0.087
	10	0.095	0.085	0.076	0.104
	12	0.108	0.097	0.086	0.119
	14	0.122	0.109	0.097	0.134
	16	0.135	0.122	0.108	0.149
	20	0.164	0.148	0.131	0.181
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D		

NOTES:

Down milling CNC programming is required.

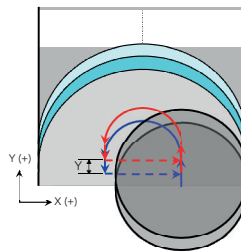
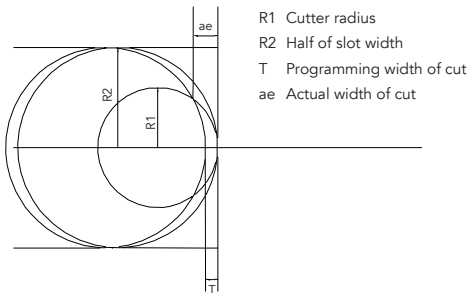
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

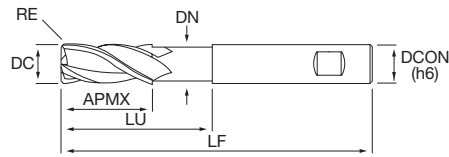
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



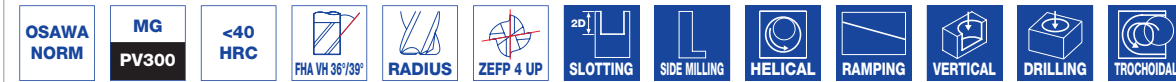
Parameters suggested with high power milling chuck and stable machining condition

HF443

- Weldon shank and reduced neck
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★



DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.3	±0.020	6	h6	9	15	2.8	57	4	HF44303030	●
3	0/-0.030	0.5	±0.020	6	h6	9	15	2.8	57	4	HF44305030	●
4	0/-0.030	0.3	±0.020	6	h6	11	18	3.8	57	4	HF44303040	●
4	0/-0.030	0.5	±0.020	6	h6	11	18	3.8	57	4	HF44305040	●
5	0/-0.030	0.5	±0.020	6	h6	13	19	4.8	57	4	HF44305050	●
6	0/-0.030	0.5	±0.020	6	h6	13	20	5.8	57	4	HF44305060	●
6	0/-0.030	1	±0.020	6	h6	13	20	5.8	57	4	HF44310060	●
8	0/-0.030	0.5	±0.020	8	h6	20	26	7.8	64	4	HF44305080	●
8	0/-0.030	1	±0.020	8	h6	20	26	7.8	64	4	HF44310080	●
10	0/-0.030	0.5	±0.020	10	h6	22	30	9.8	72	4	HF44305100	●
10	0/-0.030	1	±0.020	10	h6	22	30	9.8	72	4	HF44310100	●
12	0/-0.030	0.5	±0.020	12	h6	26	36	11.8	83	4	HF44305120	●
12	0/-0.030	1	±0.020	12	h6	26	36	11.8	83	4	HF44310120	●
14	0/-0.030	1	±0.020	14	h6	26	36	13.7	83	4	HF44310140	●
16	0/-0.030	1	±0.020	16	h6	32	42	15.7	92	4	HF44310160	●
20	0/-0.030	1	±0.020	20	h6	38	50	19.7	104	4	HF44310200	●

★ 1st choice, ☆ suitable, ● stock standard, ○ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF443

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.013	0.011	0.009	0.009
	4	0.017	0.015	0.012	0.012
	5	0.021	0.019	0.016	0.014
	6	0.024	0.022	0.018	0.017
	8	0.032	0.028	0.024	0.022
	10	0.038	0.034	0.028	0.026
	12	0.043	0.039	0.032	0.030
	14	0.049	0.044	0.036	0.034
	16	0.054	0.049	0.041	0.038
	18	0.059	0.053	0.045	0.042
	20	0.066	0.059	0.049	0.046
ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	ap x ae	1.5D x D	1.5D x D		
	Vc (m/min)	85÷105	55÷75		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	8	0.025	0.023		
	10	0.030	0.027		
	12	0.035	0.031		
	14	0.039	0.035		
	16	0.043	0.039		
	18	0.048	0.043		
	20	0.053	0.047		

	Material Group ISO 513	P1 P2 P7 K1			
	Hardness/Rm	≤700 N/mm ²			
	ap x ae	1.5D x D			
	Vc (m/min)	85÷105			
	DC (mm)	fz (mm/z)			
	10	0.023			
	12	0.026			
	14	0.029			
	16	0.032			
	18	0.036			
	20	0.039			

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF442 parameters.

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF443

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	130÷150	90÷110	60÷80	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.015	0.014	0.012	0.017
	4	0.020	0.018	0.016	0.022
	5	0.025	0.022	0.020	0.027
	6	0.029	0.026	0.023	0.032
	8	0.038	0.034	0.030	0.042
	10	0.045	0.041	0.036	0.050
	12	0.052	0.047	0.041	0.057
	14	0.058	0.052	0.047	0.064
	16	0.065	0.058	0.052	0.071
	18	0.071	0.064	0.057	0.078
	20	0.079	0.071	0.063	0.087
ap x ae	≤ D5	1.5D x 0.25D	1.5D x 0.25D	1.2D x 0.1D	1.2D x 0.1D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.009	0.009	0.008	0.007
	4	0.012	0.011	0.010	0.009
	5	0.015	0.014	0.012	0.012
	6	0.018	0.016	0.015	0.014
	8	0.023	0.021	0.019	0.018
	10	0.028	0.026	0.023	0.021
	12	0.031	0.029	0.026	0.024
	14	0.035	0.033	0.029	0.027
	16	0.039	0.037	0.032	0.030
	18	0.043	0.040	0.036	0.033
	20	0.048	0.045	0.039	0.037
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.019	0.018	0.017	0.023
	8	0.025	0.023	0.022	0.030
	10	0.030	0.028	0.026	0.036
	12	0.034	0.032	0.030	0.042
	14	0.039	0.036	0.034	0.047
	16	0.043	0.040	0.038	0.052
	18	0.047	0.044	0.042	0.057
	20	0.052	0.048	0.046	0.063

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF442 parameters.

Cutting Parameters

HF443

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	α° x ae	30° x D	15° x D		
	Vc (m/min)	80÷100	50÷70		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	10	0.025	0.023		
	12	0.028	0.026		
	14	0.032	0.029		
	16	0.035	0.032		
	18	0.039	0.036		
	20	0.043	0.039		

	Material Group ISO 513	P1 P2 P7 K1			
	Hardness/Rm	≤700 N/mm ²			
	α° x ae	45° x D			
	Vc (m/min)	60÷80			
	DC (mm)	fz (mm/z)			
	10	0.024			
	12	0.028			
	14	0.031			
	16	0.035			
	18	0.038			
	20	0.042			

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	100÷120	60÷80	45÷65	30÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.024	0.022	0.018	0.017
	8	0.032	0.028	0.024	0.022
	10	0.038	0.034	0.028	0.026
	12	0.043	0.039	0.032	0.030
	14	0.049	0.044	0.036	0.034
	16	0.054	0.049	0.041	0.038
	18	0.059	0.053	0.045	0.042
	20	0.066	0.059	0.049	0.046

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF442 parameters.

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF443

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	85÷105	55÷75	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.006	0.006	0.005	0.007
	4	0.008	0.007	0.007	0.009
	5	0.010	0.009	0.008	0.011
	6	0.012	0.011	0.010	0.013
	8	0.016	0.014	0.013	0.017
	10	0.019	0.017	0.015	0.021
	12	0.022	0.019	0.017	0.024
	14	0.024	0.022	0.019	0.027
	16	0.027	0.024	0.022	0.030
	18	0.030	0.027	0.024	0.033
	20	0.033	0.030	0.026	0.036
ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	160÷200	110÷130	80÷100	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	5	0.052	0.047	0.041	0.057
	6	0.061	0.055	0.049	0.067
	8	0.079	0.071	0.063	0.087
	10	0.095	0.085	0.076	0.104
	12	0.108	0.097	0.086	0.119
	14	0.122	0.109	0.097	0.134
	16	0.135	0.122	0.108	0.149
	18	0.149	0.134	0.119	0.163
	20	0.164	0.148	0.131	0.181
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D		

NOTES:

Down milling CNC programming is required.

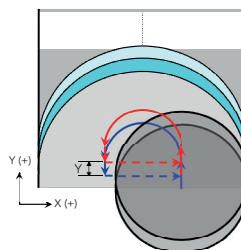
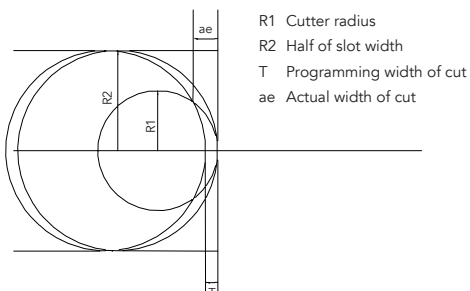
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

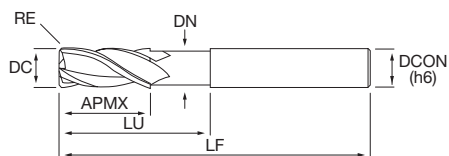
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF442 parameters.

HF542

- Cylindrical shank and reduced neck
- Long reach
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

MG
PV300

<40
HRC

FHA VH 36°/39°

RADIUS

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

DRILLING

TROCHOIDAL

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
6	0/-0.030	0.3	±0.020	6	h6	12	30	5.8	75	4	HF5420306075	●
6	0/-0.030	0.3	±0.020	6	h6	12	30	5.8	100	4	HF54203060100	●
6	0/-0.030	0.5	±0.020	6	h6	12	30	5.8	75	4	HF5420506075	●
6	0/-0.030	0.5	±0.020	6	h6	12	30	5.8	100	4	HF54205060100	●
6	0/-0.030	1	±0.020	6	h6	12	30	5.8	75	4	HF5421006075	●
6	0/-0.030	1	±0.020	6	h6	12	30	5.8	100	4	HF54210060100	●
8	0/-0.030	0.5	±0.020	8	h6	16	40	7.8	100	4	HF54205080100	●
8	0/-0.030	1	±0.020	8	h6	16	40	7.8	100	4	HF54210080100	●
8	0/-0.030	2	±0.020	8	h6	16	40	7.8	100	4	HF54220080100	●
10	0/-0.030	0.5	±0.020	10	h6	20	50	9.8	125	4	HF54205100125	●
10	0/-0.030	1	±0.020	10	h6	20	50	9.8	125	4	HF54210100125	●
10	0/-0.030	2	±0.020	10	h6	20	50	9.8	125	4	HF54220100125	●
12	0/-0.030	0.5	±0.020	12	h6	24	60	11.8	125	4	HF54205120125	●
12	0/-0.030	0.5	±0.020	12	h6	24	60	11.8	150	4	HF54205120150	●
12	0/-0.030	1	±0.020	12	h6	24	60	11.8	125	4	HF54210120125	●
12	0/-0.030	1	±0.020	12	h6	24	60	11.8	150	4	HF54210120150	●
12	0/-0.030	2	±0.020	12	h6	24	60	11.8	125	4	HF54220120125	●
12	0/-0.030	2	±0.020	12	h6	24	60	11.8	150	4	HF54220120150	●
12	0/-0.030	3	±0.020	12	h6	24	60	11.8	125	4	HF54230120125	●
12	0/-0.030	3	±0.020	12	h6	24	60	11.8	150	4	HF54230120150	●
16	0/-0.030	0.5	±0.020	16	h6	32	80	15.7	150	4	HF54205160150	●
16	0/-0.030	1	±0.020	16	h6	32	80	15.7	150	4	HF54210160150	●
16	0/-0.030	2	±0.020	16	h6	32	80	15.7	150	4	HF54220160150	●
16	0/-0.030	3	±0.020	16	h6	32	80	15.7	150	4	HF54230160150	●
16	0/-0.030	4	±0.020	16	h6	32	80	15.7	150	4	HF54240160150	○
20	0/-0.030	0.5	±0.020	20	h6	40	100	19.7	150	4	HF54205200150	●
20	0/-0.030	1	±0.020	20	h6	40	100	19.7	150	4	HF54210200150	●
20	0/-0.030	2	±0.020	20	h6	40	100	19.7	150	4	HF54220200150	●
20	0/-0.030	3	±0.020	20	h6	40	100	19.7	150	4	HF54230200150	●
20	0/-0.030	4	±0.020	20	h6	40	100	19.7	150	4	HF54240200150	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF542

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	0.5D x D	0.3D x D	0.2D x D	0.2D x D
	Vc (m/min)	90÷110	60÷80	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.019	0.017	0.015	0.014
	8	0.025	0.023	0.019	0.018
	10	0.030	0.027	0.023	0.021
	12	0.035	0.031	0.026	0.024
	14	0.039	0.035	0.029	0.027
	16	0.043	0.039	0.032	0.030
	20	0.053	0.047	0.039	0.037

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.2D x 0.2D	1.2D x 0.2D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.023	0.021	0.019	0.026
	8	0.030	0.027	0.024	0.033
	10	0.036	0.033	0.029	0.040
	12	0.041	0.037	0.033	0.046
	14	0.047	0.042	0.037	0.051
	16	0.052	0.047	0.041	0.057
	20	0.063	0.057	0.050	0.069

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	4° x 0.4D	3° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	90÷110	60÷80	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.015	0.014	0.012	0.012
	8	0.019	0.018	0.015	0.016
	10	0.023	0.022	0.018	0.019
	12	0.026	0.025	0.021	0.022
	14	0.029	0.028	0.023	0.025
	16	0.033	0.031	0.026	0.027
	20	0.040	0.038	0.032	0.033

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	7° x D	5° x D	3° x D	3° x D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.016	0.015	0.015	0.021
	8	0.021	0.020	0.019	0.027
	10	0.025	0.024	0.023	0.032
	12	0.029	0.027	0.027	0.037
	14	0.033	0.031	0.030	0.041
	16	0.036	0.034	0.033	0.046
	20	0.044	0.041	0.040	0.056

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF542

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	80÷100	50÷70	45÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.019	0.017	0.015	0.014
	8	0.025	0.023	0.019	0.018
	10	0.030	0.027	0.023	0.021
	12	0.035	0.031	0.026	0.024
	14	0.039	0.035	0.029	0.027
	16	0.043	0.039	0.032	0.030
	20	0.053	0.047	0.039	0.037

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	70÷90	50÷60	35÷45	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.010	0.009	0.008	0.011
	8	0.013	0.011	0.010	0.014
	10	0.015	0.014	0.012	0.017
	12	0.017	0.016	0.014	0.019
	14	0.019	0.017	0.016	0.021
	16	0.022	0.019	0.017	0.024
	20	0.026	0.024	0.021	0.029

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

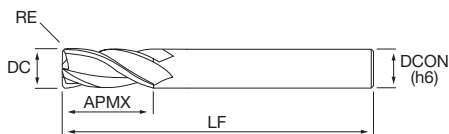
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

HF942

- Cylindrical shank
- Long cutting edge ideal for trochoidal milling
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★



DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.030	0.1	0/-0.015	6	h6	19	75	4	HF9420104075	●
5	0/-0.030	0.1	0/-0.015	6	h6	19	75	4	HF9420105075	●
6	0/-0.030	0.1	0/-0.015	6	h6	25	75	4	HF9420106075	●
8	0/-0.030	0.2	0/-0.015	8	h6	30	75	4	HF9420208075	●
10	0/-0.035	0.2	0/-0.020	10	h6	40	100	4	HF94202100100	●
12	0/-0.035	0.3	0/-0.020	12	h6	45	100	4	HF94203120100	●
16	0/-0.035	0.3	0/-0.020	16	h6	65	125	4	HF94203160125	●
20	0/-0.035	0.3	0/-0.020	20	h6	65	125	4	HF94203200125	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF942

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.2D x 0.2D	1.2D x 0.2D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.016	0.015	0.013	0.018
	5	0.021	0.019	0.017	0.023
	6	0.026	0.023	0.021	0.029
	8	0.031	0.028	0.025	0.034
	10	0.036	0.033	0.029	0.040
	12	0.041	0.037	0.033	0.045
	16	0.047	0.042	0.038	0.052
	20	0.063	0.057	0.051	0.070
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D	1.2D x 0.1D	1.2D x 0.1D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	4° x 0.4D	3° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	90÷110	60÷80	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.010	0.010	0.008	0.009
	5	0.013	0.013	0.011	0.011
	6	0.016	0.016	0.013	0.014
	8	0.019	0.018	0.015	0.016
	10	0.023	0.022	0.018	0.019
	12	0.026	0.025	0.021	0.022
	16	0.030	0.028	0.024	0.025
	20	0.040	0.038	0.032	0.033
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D
Parameters suggested with high power milling chuck and stable machining condition					

Cutting Parameters

HF942

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x D	5° x D	3° x D	3° x D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.012	0.011	0.010	0.014
	5	0.015	0.014	0.014	0.019
	6	0.019	0.017	0.017	0.023
	8	0.022	0.020	0.020	0.027
	10	0.027	0.024	0.023	0.032
	12	0.030	0.027	0.026	0.036
	16	0.034	0.031	0.030	0.041
	20	0.046	0.042	0.041	0.056

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.014	0.012	0.010	0.010
	5	0.018	0.016	0.013	0.012
	6	0.022	0.019	0.016	0.015
	8	0.026	0.023	0.019	0.018
	10	0.030	0.027	0.023	0.021
	12	0.034	0.031	0.026	0.024
	16	0.039	0.035	0.029	0.027
	20	0.053	0.048	0.040	0.037

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	D x 0.5D	D x 0.5D
	Vc (m/min)	70÷90	50÷60	35÷45	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.007	0.006	0.005	0.007
	5	0.009	0.008	0.007	0.010
	6	0.011	0.010	0.009	0.012
	8	0.013	0.012	0.010	0.014
	10	0.015	0.014	0.012	0.017
	12	0.017	0.015	0.014	0.019
	16	0.020	0.018	0.016	0.022
	20	0.026	0.024	0.021	0.029

ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D
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Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF942

	Material Group ISO 513	P1P2P7K1	P3P4M1K2K3	P5M2M3K4S1S4	S2S3S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.1D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	140÷160	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.034	0.031	0.027	0.037
	5	0.044	0.040	0.035	0.048
	6	0.054	0.049	0.043	0.059
	8	0.064	0.058	0.051	0.070
	10	0.076	0.068	0.061	0.084
	12	0.086	0.077	0.069	0.095
	16	0.098	0.088	0.078	0.108
	20	0.132	0.119	0.106	0.145
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D	1.2D x 0.05D	1.2D x 0.05D

NOTES:

Down milling CNC programming is required.

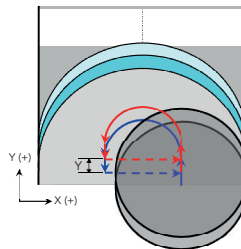
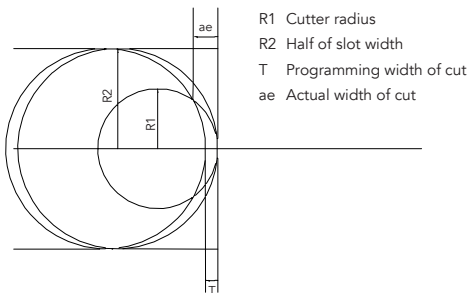
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

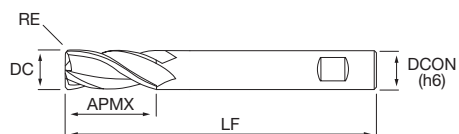
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF943

- Weldon shank
- Long cutting edge ideal for trochoidal milling
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★



DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.030	0.1	0/-0.015	6	h6	19	75	4	HF9430104075	●
5	0/-0.030	0.1	0/-0.015	6	h6	19	75	4	HF9430105075	●
6	0/-0.030	0.1	0/-0.015	6	h6	25	75	4	HF9430106075	●
8	0/-0.030	0.2	0/-0.015	8	h6	30	75	4	HF9430208075	●
10	0/-0.035	0.2	0/-0.020	10	h6	40	100	4	HF94302100100	●
12	0/-0.035	0.3	0/-0.020	12	h6	45	100	4	HF94303120100	●
16	0/-0.035	0.3	0/-0.020	16	h6	65	125	4	HF94303160125	●
20	0/-0.035	0.3	0/-0.020	20	h6	65	125	4	HF94303200125	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF943

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.2D x 0.2D	1.2D x 0.2D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.016	0.015	0.013	0.018
	5	0.021	0.019	0.017	0.023
	6	0.026	0.023	0.021	0.029
	8	0.031	0.028	0.025	0.034
	10	0.036	0.033	0.029	0.040
	12	0.041	0.037	0.033	0.045
	16	0.047	0.042	0.038	0.052
	20	0.063	0.057	0.051	0.070
ap x ae	≤ D5	1.5D x 0.1D	1.5D x 0.1D	1.2D x 0.1D	1.2D x 0.1D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	4° x 0.4D	3° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	90÷110	60÷80	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.010	0.010	0.008	0.009
	5	0.013	0.013	0.011	0.011
	6	0.016	0.016	0.013	0.014
	8	0.019	0.018	0.015	0.016
	10	0.023	0.022	0.018	0.019
	12	0.026	0.025	0.021	0.022
	16	0.030	0.028	0.024	0.025
	20	0.040	0.038	0.032	0.033
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D
Parameters suggested with high power milling chuck and stable machining condition					

Cutting Parameters

HF943

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	a° x ae	5° x D	5° x D	3° x D	3° x D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.012	0.011	0.010	0.014
	5	0.015	0.014	0.014	0.019
	6	0.019	0.017	0.017	0.023
	8	0.022	0.020	0.020	0.027
	10	0.027	0.024	0.023	0.032
	12	0.030	0.027	0.026	0.036
	16	0.034	0.031	0.030	0.041
	20	0.046	0.042	0.041	0.056

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.014	0.012	0.010	0.010
	5	0.018	0.016	0.013	0.012
	6	0.022	0.019	0.016	0.015
	8	0.026	0.023	0.019	0.018
	10	0.030	0.027	0.023	0.021
	12	0.034	0.031	0.026	0.024
	16	0.039	0.035	0.029	0.027
	20	0.053	0.048	0.040	0.037

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	D x 0.5D	D x 0.5D
	Vc (m/min)	70÷90	50÷60	35÷45	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.007	0.006	0.005	0.007
	5	0.009	0.008	0.007	0.010
	6	0.011	0.010	0.009	0.012
	8	0.013	0.012	0.010	0.014
	10	0.015	0.014	0.012	0.017
	12	0.017	0.015	0.014	0.019
	16	0.020	0.018	0.016	0.022
	20	0.026	0.024	0.021	0.029

ap x ae	≤ D5	0.5D x D	0.5D x D	0.25D x D	0.25D x D
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Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF943

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.1D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	140÷160	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.034	0.031	0.027	0.037
	5	0.044	0.040	0.035	0.048
	6	0.054	0.049	0.043	0.059
	8	0.064	0.058	0.051	0.070
	10	0.076	0.068	0.061	0.084
	12	0.086	0.077	0.069	0.095
	16	0.098	0.088	0.078	0.108
	20	0.132	0.119	0.106	0.145
ap x ae		≤ D5	1.5D x 0.1D	1.5D x 0.1D	1.2D x 0.05D

NOTES:

Down milling CNC programming is required.

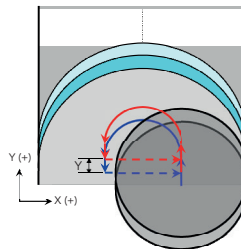
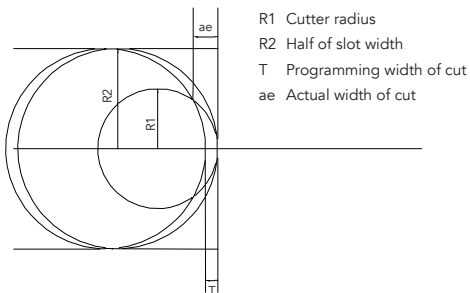
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

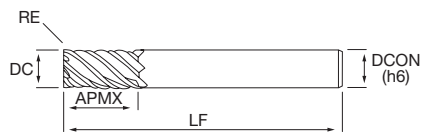
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF642

- Cylindrical shank
- 5F ideal for trochoidal milling
- Corner radius



P	M	K	N	S	H
★	★	★		★	



DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.020	0.1	0/-0.015	6	h6	12	57	5	HF64201040	●
5	0/-0.020	0.1	0/-0.015	6	h6	13	57	5	HF64201050	●
6	0/-0.020	0.1	0/-0.015	6	h6	13	57	5	HF64201060	●
8	0/-0.020	0.2	0/-0.015	8	h6	20	64	5	HF64202080	●
10	0/-0.020	0.2	0/-0.020	10	h6	22	72	5	HF64202100	●
12	0/-0.020	0.3	0/-0.020	12	h6	26	83	5	HF64203120	●
16	0/-0.020	0.3	0/-0.020	16	h6	32	92	5	HF64203160	●
20	0/-0.020	0.3	0/-0.020	20	h6	38	104	5	HF64203200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF642

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	160÷180	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.019	0.017	0.015	0.021
	5	0.023	0.021	0.019	0.026
	6	0.028	0.025	0.022	0.030
	8	0.036	0.032	0.029	0.039
	10	0.043	0.039	0.034	0.047
	12	0.049	0.044	0.039	0.054
	14	0.055	0.050	0.044	0.061
	16	0.061	0.055	0.049	0.067
	20	0.074	0.067	0.060	0.082
ap x ae	≤ D5	1.5D x 0.3D	1.5D x 0.3D	1.2D x 0.2D	1.2D x 0.2D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.011	0.011	0.009	0.009
	5	0.014	0.013	0.012	0.011
	6	0.017	0.016	0.014	0.013
	8	0.022	0.020	0.018	0.017
	10	0.026	0.024	0.021	0.020
	12	0.030	0.028	0.024	0.023
	14	0.033	0.031	0.028	0.026
	16	0.037	0.035	0.031	0.029
	20	0.045	0.042	0.037	0.035
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.018	0.017	0.016	0.022
	8	0.024	0.022	0.021	0.029
	10	0.028	0.026	0.025	0.034
	12	0.033	0.030	0.029	0.039
	14	0.037	0.034	0.032	0.044
	16	0.041	0.037	0.036	0.049
	20	0.050	0.046	0.043	0.060
	20	0.046	0.042	0.041	0.056

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF642

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.023	0.021	0.017	0.016
	8	0.030	0.027	0.022	0.021
	10	0.036	0.032	0.027	0.025
	12	0.041	0.037	0.031	0.029
	14	0.046	0.041	0.034	0.032
	16	0.051	0.046	0.038	0.036
	20	0.062	0.056	0.047	0.043

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	190÷230	130÷150	100÷120	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.039	0.035	0.031	0.043
	5	0.049	0.044	0.039	0.054
	6	0.057	0.052	0.046	0.063
	8	0.074	0.067	0.060	0.082
	10	0.089	0.080	0.071	0.098
	12	0.102	0.092	0.082	0.112
	14	0.115	0.103	0.092	0.126
	16	0.128	0.115	0.102	0.140
	20	0.155	0.140	0.124	0.171
ap x ae		≤ D5	1.5D x 0.1D	1.5D x 0.1D	D x 0.1D

NOTES:

Down milling CNC programming is required.

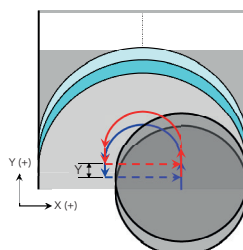
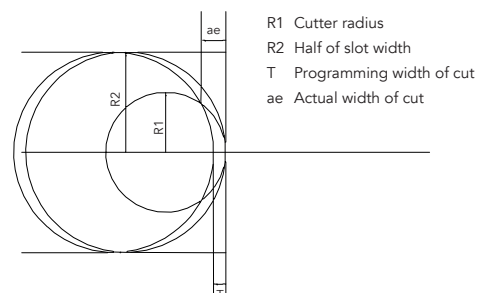
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

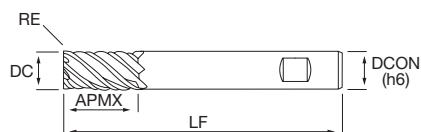
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF643

- Weldon shank
- 5 flutes ideal for trochoidal milling
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★



DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.020	0.1	0/-0.015	6	h6	12	57	5	HF64301040	●
5	0/-0.020	0.1	0/-0.015	6	h6	13	57	5	HF64301050	●
6	0/-0.020	0.1	0/-0.015	6	h6	13	57	5	HF64301060	●
8	0/-0.020	0.2	0/-0.015	8	h6	20	64	5	HF64302080	●
10	0/-0.020	0.2	0/-0.020	10	h6	22	72	5	HF64302100	●
12	0/-0.020	0.3	0/-0.020	12	h6	26	83	5	HF64303120	●
16	0/-0.020	0.3	0/-0.020	16	h6	32	92	5	HF64303160	●
20	0/-0.020	0.3	0/-0.020	20	h6	38	104	5	HF64303200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF643

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	160÷180	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.019	0.017	0.015	0.021
	5	0.023	0.021	0.019	0.026
	6	0.028	0.025	0.022	0.030
	8	0.036	0.032	0.029	0.039
	10	0.043	0.039	0.034	0.047
	12	0.049	0.044	0.039	0.054
	14	0.055	0.050	0.044	0.061
	16	0.061	0.055	0.049	0.067
	20	0.074	0.067	0.060	0.082
ap x ae	≤ D5	1.5D x 0.3D	1.5D x 0.3D	1.2D x 0.2D	1.2D x 0.2D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.011	0.011	0.009	0.009
	5	0.014	0.013	0.012	0.011
	6	0.017	0.016	0.014	0.013
	8	0.022	0.020	0.018	0.017
	10	0.026	0.024	0.021	0.020
	12	0.030	0.028	0.024	0.023
	14	0.033	0.031	0.028	0.026
	16	0.037	0.035	0.031	0.029
	20	0.045	0.042	0.037	0.035
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.018	0.017	0.016	0.022
	8	0.024	0.022	0.021	0.029
	10	0.028	0.026	0.025	0.034
	12	0.033	0.030	0.029	0.039
	14	0.037	0.034	0.032	0.044
	16	0.041	0.037	0.036	0.049
	20	0.050	0.046	0.043	0.060
	20	0.046	0.042	0.041	0.056

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF642 parameters.

Cutting Parameters

HF643

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.023	0.021	0.017	0.016
	8	0.030	0.027	0.022	0.021
	10	0.036	0.032	0.027	0.025
	12	0.041	0.037	0.031	0.029
	14	0.046	0.041	0.034	0.032
	16	0.051	0.046	0.038	0.036
	20	0.062	0.056	0.047	0.043

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	190÷230	130÷150	100÷120	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.039	0.035	0.031	0.043
	5	0.049	0.044	0.039	0.054
	6	0.057	0.052	0.046	0.063
	8	0.074	0.067	0.060	0.082
	10	0.089	0.080	0.071	0.098
	12	0.102	0.092	0.082	0.112
	14	0.115	0.103	0.092	0.126
	16	0.128	0.115	0.102	0.140
	20	0.155	0.140	0.124	0.171
ap x ae		≤ D5	1.5D x 0.1D	1.5D x 0.1D	D x 0.1D

NOTES:

Down milling CNC programming is required.

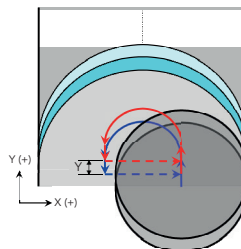
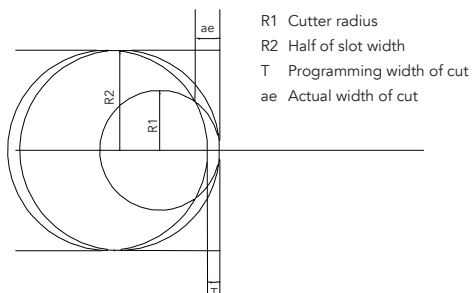
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

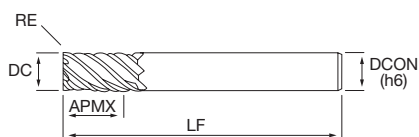
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF642 parameters.

HF742

- Cylindrical shank
- Long 5 flutes ideal for trochoidal milling
- Corner radius



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

MG
PV300

<40
HRC

VH 36°/37°/38°

RADIUS

ZEFP 5

SIDE MILLING

HELICAL

RAMPING

VERTICAL

TROCHOIDAL

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.030	0.1	0/-0.015	6	h6	25	75	5	HF7420106075	●
8	0/-0.030	0.2	0/-0.015	8	h6	25	75	5	HF7420208075	●
10	0/-0.035	0.2	0/-0.020	10	h6	38	100	5	HF74202100100	●
-	-	-	-	-	-	-	-	-	HF7420306075	○
12	0/-0.035	0.3	0/-0.020	12	h6	45	100	5	HF74203120100	●
16	0/-0.035	0.3	0/-0.020	16	h6	55	125	5	HF74203160125	●
20	0/-0.035	0.3	0/-0.020	20	h6	65	125	5	HF74203200125	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF742

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.2D x 0.2D	1.2D x 0.2D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.023	0.021	0.019	0.026
	8	0.028	0.025	0.022	0.030
	10	0.033	0.030	0.026	0.036
	12	0.037	0.033	0.030	0.041
	16	0.042	0.038	0.034	0.047
	20	0.057	0.051	0.046	0.063

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	4° x 0.4D	3° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	90÷110	60÷80	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.016	0.016	0.013	0.014
	8	0.019	0.018	0.015	0.016
	10	0.023	0.022	0.018	0.019
	12	0.026	0.025	0.021	0.022
	16	0.030	0.028	0.024	0.025
	20	0.040	0.038	0.032	0.033

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x D	4° x D	3° x D	3° x D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.017	0.016	0.015	0.021
	8	0.020	0.019	0.018	0.024
	10	0.024	0.022	0.021	0.029
	12	0.027	0.025	0.024	0.033
	16	0.031	0.029	0.027	0.037
	20	0.042	0.039	0.037	0.050

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF742

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.022	0.019	0.016	0.015
	8	0.026	0.023	0.019	0.018
	10	0.030	0.027	0.023	0.021
	12	0.034	0.031	0.026	0.024
	16	0.039	0.035	0.029	0.027
	20	0.053	0.048	0.040	0.037

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	3D x 0.1D	3D x 0.1D	2D x 0.1D	2D x 0.1D
	Vc (m/min)	130÷170	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.054	0.049	0.043	0.059
	8	0.064	0.058	0.051	0.070
	10	0.076	0.068	0.061	0.084
	12	0.086	0.077	0.069	0.095
	16	0.098	0.088	0.078	0.108
	20	0.132	0.119	0.106	0.145

NOTES:

Down milling CNC programming is required.

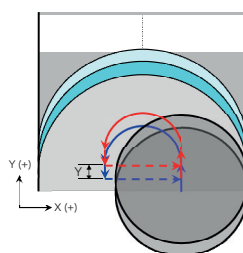
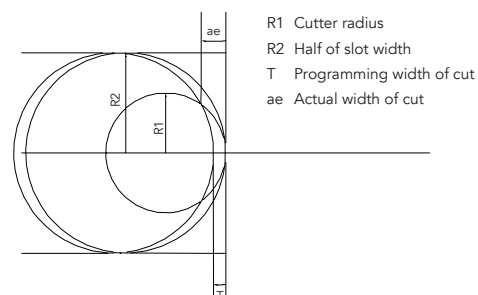
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.

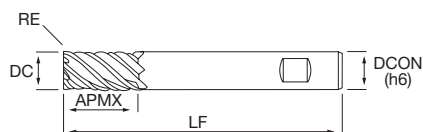


Parameters suggested with high power milling chuck and stable machining condition

HF743

- Weldon shank
- Long 5 flutes ideal for trochoidal milling
- Corner radius

P	M	K	N	S	H
★	★	★		★	



DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.030	0.1	0/-0.015	6	h6	25	75	5	HF7430106075	●
8	0/-0.030	0.2	0/-0.015	8	h6	25	75	5	HF7430208075	●
10	0/-0.035	0.2	0/-0.020	10	h6	38	100	5	HF74302100100	●
12	0/-0.035	0.3	0/-0.020	12	h6	45	100	5	HF74303120100	●
16	0/-0.035	0.3	0/-0.020	16	h6	55	125	5	HF74303160125	●
20	0/-0.035	0.3	0/-0.020	20	h6	65	125	5	HF74303200125	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HF743

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.2D x 0.2D	1.2D x 0.2D
	Vc (m/min)	110÷130	70÷90	50÷70	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.023	0.021	0.019	0.026
	8	0.028	0.025	0.022	0.030
	10	0.033	0.030	0.026	0.036
	12	0.037	0.033	0.030	0.041
	16	0.042	0.038	0.034	0.047
	20	0.057	0.051	0.046	0.063

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	4° x 0.4D	3° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	90÷110	60÷80	40÷60	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.016	0.016	0.013	0.014
	8	0.019	0.018	0.015	0.016
	10	0.023	0.022	0.018	0.019
	12	0.026	0.025	0.021	0.022
	16	0.030	0.028	0.024	0.025
	20	0.040	0.038	0.032	0.033

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x D	4° x D	3° x D	3° x D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.017	0.016	0.015	0.021
	8	0.020	0.019	0.018	0.024
	10	0.024	0.022	0.021	0.029
	12	0.027	0.025	0.024	0.033
	16	0.031	0.029	0.027	0.037
	20	0.042	0.039	0.037	0.050

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF742 parameters.

Cutting Parameters

HF743

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	80÷100	50÷70	35÷55	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.022	0.019	0.016	0.015
	8	0.026	0.023	0.019	0.018
	10	0.030	0.027	0.023	0.021
	12	0.034	0.031	0.026	0.024
	16	0.039	0.035	0.029	0.027
	20	0.053	0.048	0.040	0.037

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	3D x 0.1D	3D x 0.1D	2D x 0.1D	2D x 0.1D
	Vc (m/min)	130÷170	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.054	0.049	0.043	0.059
	8	0.064	0.058	0.051	0.070
	10	0.076	0.068	0.061	0.084
	12	0.086	0.077	0.069	0.095
	16	0.098	0.088	0.078	0.108
	20	0.132	0.119	0.106	0.145

NOTES:

Down milling CNC programming is required.

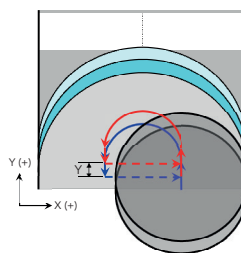
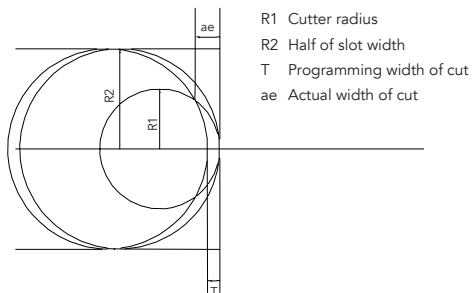
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

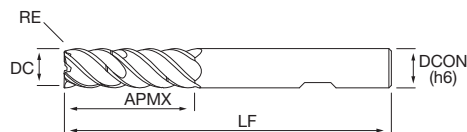
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF742 parameters.

HF535T

- Weldon shank
- 5 flutes
- Chipbreaker
- Corner radius
- Different core diameter
- Trochoidal milling



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

MG
PV300

<45
HRC

VH 36°/37°/38°

RADIUS

ZEFP 5 UP

CB

CD

L
SIDE MILLING

TROCHOIDAL

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
10	0/-0.040	0.1	0/-0.020	10	h6	35	90	5	HF535T010100	●
12	0/-0.050	0.12	0/-0.020	12	h6	45	100	5	HF535T012120	●
16	0/-0.050	0.15	0/-0.020	16	h6	55	115	5	HF535T015160	●
20	0/-0.050	0.2	0/-0.020	20	h6	70	131	5	HF535T020200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF535T

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 P6 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	3.5D x 0.05D	3.5D x 0.05D	3.5D x 0.05D	3.5D x 0.05D
	Vc (m/min)	170÷190	100÷120	80÷100	60÷80
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	10	0.100	0.100	0.080	0.072
	12	0.120	0.120	0.100	0.090
	16	0.150	0.150	0.130	0.117
	20	0.150	0.150	0.150	0.135

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 P6 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	3.5D x 0.05D	3.5D x 0.05D	3.5D x 0.05D	3.5D x 0.05D
	Vc (m/min)	170÷190	100÷120	80÷100	60÷80
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	10	0.100	0.100	0.080	0.072
	12	0.120	0.120	0.100	0.090
	16	0.150	0.150	0.130	0.117
	20	0.150	0.150	0.150	0.135

High speed cutting conditions (A highly rigidity CNC machine is required)

	Material Group ISO 513	P1 P2 P7	P3 P4	P5 P6	
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	
	ap x ae	3.5D x 0.05D	3.5D x 0.05D	3.5D x 0.05D	
	Vc (m/min)	220÷260	120÷160	100÷140	
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	
	10	0.100	0.100	0.080	
	12	0.120	0.120	0.100	
	16	0.150	0.150	0.130	
	20	0.150	0.150	0.150	

High speed cutting conditions is only suggested for material groups ISO P.

NOTES:

Down milling CNC programming is required.

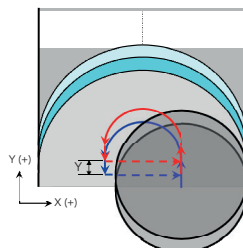
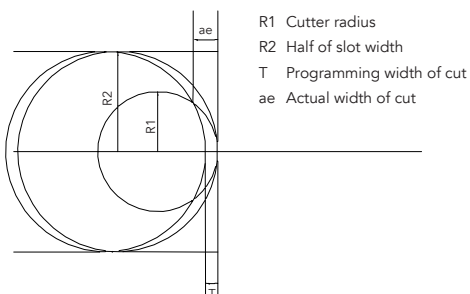
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

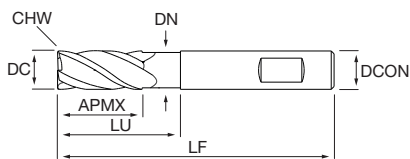
With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



HF471

- Weldon shank
- SC smooth cut for low cutting force
- 45° chamfer
- ▽ rank items will be available until stock is exhausted and will be replaced by HF6441 page J104



P	M	K	N	S	H
★	★	★		★	



DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
1	0/-0.020	0.1	0/-0.02	4	h6	3	-	-	50	4	HF471010	▽
1.5	0/-0.020	0.1	0/-0.03	4	h6	4.5	-	-	50	4	HF471015	▽
2	0/-0.020	0.1	0/-0.04	4	h6	6.5	-	-	50	4	HF471020	▽
2.5	0/-0.020	0.1	0/-0.05	4	h6	6.5	-	-	50	4	HF471025	▽
3	0/-0.020	0.1	0/-0.06	6	h6	9	15	2.8	57	4	HF471030	●
3.5	0/-0.020	0.1	0/-0.07	6	h6	11	20	3.3	57	4	HF471035	▽
4	0/-0.020	0.1	0/-0.08	6	h6	11	20	3.7	57	4	HF471040	●
4.5	0/-0.020	0.1	0/-0.09	6	h6	13	20	4.2	57	4	HF471045	▽
5	0/-0.020	0.1	0/-0.10	6	h6	13	20	4.6	57	4	HF471050	●
5.5	0/-0.020	0.1	0/-0.11	6	h6	13	20	5.1	57	4	HF471055	▽
6	0/-0.020	0.1	0/-0.12	6	h6	13	20	5.5	57	4	HF471060	●
7	0/-0.020	0.2	0/-0.13	8	h6	20	26	6.5	64	4	HF471070	▽
8	0/-0.020	0.2	0/-0.14	8	h6	20	26	7.4	64	4	HF471080	●
9	0/-0.020	0.2	0/-0.15	10	h6	22	32	8.4	72	4	HF471090	▽
10	0/-0.020	0.2	0/-0.16	10	h6	22	32	9.2	72	4	HF471100	●
11	0/-0.020	0.2	0/-0.17	12	h6	26	37	10.2	83	4	HF471110	▽
12	0/-0.020	0.2	0/-0.18	12	h6	26	37	11	83	4	HF471120	●
13	0/-0.020	0.2	0/-0.19	14	h6	26	37	12	83	4	HF471130	▽
14	0/-0.020	0.2	0/-0.20	14	h6	26	37	13	83	4	HF471140	●
16	0/-0.020	0.2	0/-0.22	16	h6	32	42	15	92	4	HF471160	●
18	0/-0.020	0.2	0/-0.23	18	h6	32	42	17	92	4	HF471180	▽
20	0/-0.020	0.2	0/-0.24	20	h6	38	50	19	104	4	HF471200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF471

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.005	0.005	0.004	0.004
	2	0.010	0.009	0.008	0.007
	3	0.014	0.013	0.011	0.010
	4	0.019	0.017	0.014	0.013
	5	0.023	0.021	0.017	0.016
	6	0.027	0.024	0.020	0.019
	8	0.035	0.032	0.026	0.025
	10	0.042	0.038	0.032	0.029
	12	0.048	0.043	0.036	0.034
	14	0.054	0.049	0.041	0.038
	16	0.060	0.054	0.045	0.042
	18	0.066	0.059	0.050	0.046
	20	0.073	0.066	0.055	0.051
ap x ae	D1	0.25D x D	0.25D x D	0.2D x D	0.2D x D
ap x ae	≤ D3	0.5D x D	0.5D x D	0.25D x D	0.25D x D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	ap x ae	1.5D x D	1.5D x D		
	Vc (m/min)	100÷120	60÷80		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	8	0.028	0.025		
	10	0.034	0.030		
	12	0.038	0.035		
	14	0.043	0.039		
	16	0.048	0.043		
	18	0.053	0.048		
	20	0.058	0.053		

	Material Group ISO 513	P1 P2 P7 K1			
	Hardness/Rm	≤700 N/mm ²			
	ap x ae	1.5D x D			
	Vc (m/min)	100÷120			
	DC (mm)	fz (mm/z)			
	8	0.028			
	10	0.034			
	12	0.038			
	14	0.043			
	16	0.048			
	18	0.053			
	20	0.058			

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF840 parameters

Cutting Parameters

HF471

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.2D x 0.3D	1.2D x 0.3D
	Vc (m/min)	160÷180	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.006	0.005	0.005	0.007
	2	0.012	0.011	0.010	0.013
	3	0.017	0.015	0.013	0.018
	4	0.022	0.020	0.018	0.024
	5	0.028	0.025	0.022	0.030
	6	0.032	0.029	0.026	0.036
	8	0.042	0.038	0.034	0.046
	10	0.050	0.045	0.040	0.055
	12	0.058	0.052	0.046	0.063
	14	0.065	0.058	0.052	0.071
	16	0.072	0.065	0.058	0.079
	18	0.079	0.071	0.063	0.087
	20	0.088	0.079	0.070	0.096
ap x ae	≤ D3	1.5D x 0.1D	1.5D x 0.1D	1.2D x 0.1D	1.2D x 0.1D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	3° x 0.4D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.004	0.003	0.003	0.003
	2	0.007	0.007	0.006	0.006
	3	0.010	0.010	0.008	0.008
	4	0.013	0.013	0.011	0.010
	5	0.017	0.016	0.014	0.013
	6	0.020	0.018	0.016	0.015
	8	0.025	0.024	0.021	0.020
	10	0.031	0.029	0.025	0.024
	12	0.035	0.033	0.029	0.027
	14	0.039	0.037	0.032	0.030
	16	0.044	0.041	0.036	0.034
	18	0.048	0.045	0.040	0.037
	20	0.053	0.050	0.044	0.041
α° x ae	≤ D3	1° x 0.4D	1° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF840 parameters

Cutting Parameters

HF471

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	α° x ae	15° x D	10° x D	5° x D	5° x D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.022	0.020	0.019	0.026
	8	0.028	0.026	0.024	0.034
	10	0.034	0.031	0.029	0.040
	12	0.038	0.035	0.034	0.046
	14	0.043	0.040	0.038	0.052
	16	0.048	0.044	0.042	0.058
	18	0.053	0.048	0.046	0.063
	20	0.058	0.054	0.051	0.070

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3		
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²		
	α° x ae	30° x D	15° x D		
	Vc (m/min)	80÷100	60÷80		
	DC (mm)	fz (mm/z)	fz (mm/z)		
	10	0.025	0.023		
	12	0.028	0.026		
	14	0.032	0.029		
	16	0.035	0.032		
	18	0.039	0.036		
	20	0.043	0.039		

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	130÷150	80÷100	60÷80	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.027	0.024	0.020	0.019
	8	0.035	0.032	0.026	0.025
	10	0.042	0.038	0.032	0.029
	12	0.048	0.043	0.036	0.034
	14	0.054	0.049	0.041	0.038
	16	0.060	0.054	0.045	0.042
	18	0.066	0.059	0.050	0.046
	20	0.073	0.066	0.055	0.051

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF840 parameters

HF471

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	100÷120	60÷80	45÷65	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.003	0.002	0.002	0.003
	2	0.005	0.005	0.004	0.006
	3	0.007	0.006	0.006	0.008
	4	0.009	0.008	0.007	0.010
	5	0.012	0.010	0.009	0.013
	6	0.014	0.012	0.011	0.015
	8	0.018	0.016	0.014	0.019
	10	0.021	0.019	0.017	0.023
	12	0.024	0.022	0.019	0.026
	14	0.027	0.024	0.022	0.030
	16	0.030	0.027	0.024	0.033
	18	0.033	0.030	0.026	0.036
	20	0.037	0.033	0.029	0.040
ap x ae	≤ D3	0.5D x D	0.5D x D	0.25D x D	0.25D x D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	600÷1000 N/mm ²	≤35 HRC	≤40 HRC
	ap x ae	2D x 0.2D	2D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	130÷170	100÷120	70÷90	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.013	0.011	0.010	0.014
	2	0.025	0.023	0.020	0.028
	3	0.035	0.032	0.028	0.039
	4	0.046	0.042	0.037	0.051
	5	0.058	0.052	0.046	0.063
	6	0.068	0.061	0.054	0.074
	8	0.088	0.079	0.070	0.096
	10	0.105	0.095	0.084	0.116
	12	0.120	0.108	0.096	0.132
	14	0.135	0.122	0.108	0.149
	16	0.150	0.135	0.120	0.165
	18	0.165	0.149	0.132	0.182
	20	0.183	0.164	0.146	0.201
ap x ae	D1	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
ap x ae	≤ D3	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D

NOTES:

Down milling CNC programming is required.

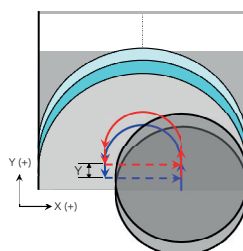
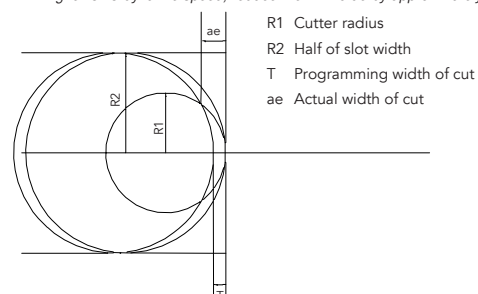
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

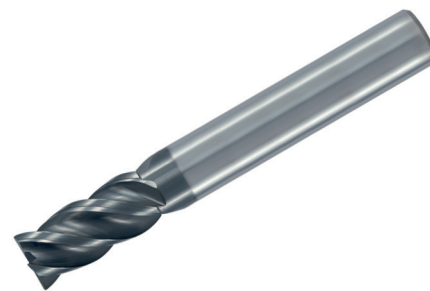
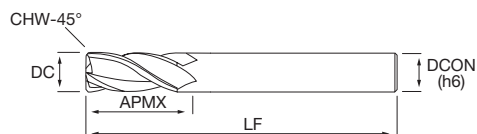
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF840 parameters

HF850

- Cylindrical shank
- 45° chamfer



P	M	K	N	S	H
★	★	★	★	★	★

OSAWA
NORM

HF
HARD

MG
PV300

30±55
HRC

FHA 40°

CH-45°

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

TROCHOIDAL

DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.1	±0.020	6	h6	9	57	4	HF850030	●
4	0/-0.030	0.1	±0.020	6	h6	11	57	4	HF850040	●
5	0/-0.030	0.1	±0.020	6	h6	13	57	4	HF850050	●
6	0/-0.030	0.1	±0.020	6	h6	13	57	4	HF850060	●
8	0/-0.030	0.2	±0.020	8	h6	20	64	4	HF850080	●
10	0/-0.030	0.2	±0.020	10	h6	22	72	4	HF850100	●
12	0/-0.030	0.2	±0.020	12	h6	26	83	4	HF850120	●
14	0/-0.030	0.3	±0.020	14	h6	26	90	4	HF850140	●
16	0/-0.030	0.3	±0.020	16	h6	32	92	4	HF850160	●
20	0/-0.030	0.4	±0.020	20	h6	38	104	4	HF850200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF850

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.2D x D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.012	0.011	0.009	0.008
	4	0.016	0.014	0.012	0.011
	5	0.020	0.018	0.015	0.014
	6	0.023	0.021	0.017	0.016
	8	0.030	0.027	0.022	0.021
	10	0.036	0.032	0.027	0.025
	12	0.041	0.037	0.031	0.029
	14	0.046	0.041	0.034	0.032
	16	0.051	0.046	0.038	0.036
	20	0.062	0.056	0.047	0.043
ap x ae	≤ D5	0.3D x D	0.3D x D	0.2D x D	0.1D x D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.2D	1.2D x 0.2D	D x 0.1D
	Vc (m/min)	100÷120	70÷90	50÷70	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.014	0.013	0.011	0.016
	4	0.019	0.017	0.015	0.021
	5	0.023	0.021	0.019	0.026
	6	0.028	0.025	0.022	0.030
	8	0.036	0.032	0.029	0.039
	10	0.043	0.039	0.034	0.047
	12	0.049	0.044	0.039	0.054
	14	0.055	0.050	0.044	0.061
	16	0.061	0.055	0.049	0.067
	20	0.074	0.067	0.060	0.082
ap x ae	≤ D5	1.2D x 0.2D	1.2D x 0.1D	D x 0.1D	D x 0.05D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.009	0.008	0.007	0.008
	4	0.011	0.011	0.009	0.010
	5	0.014	0.013	0.012	0.012
	6	0.017	0.016	0.014	0.015
	8	0.022	0.020	0.018	0.019
	10	0.026	0.024	0.021	0.023
	12	0.030	0.028	0.024	0.026
	14	0.033	0.031	0.028	0.029
	16	0.037	0.035	0.031	0.032
	20	0.045	0.042	0.037	0.039
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF850

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x D	4° x D	3° x D	2° x D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.020	0.019	0.018	0.027
	8	0.026	0.024	0.023	0.035
	10	0.031	0.029	0.027	0.043
	12	0.036	0.033	0.031	0.049
	14	0.040	0.037	0.035	0.055
	16	0.045	0.042	0.039	0.061
	20	0.054	0.051	0.048	0.074

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.023	0.021	0.017	0.016
	8	0.030	0.027	0.022	0.021
	10	0.036	0.032	0.027	0.025
	12	0.041	0.037	0.031	0.029
	14	0.046	0.041	0.034	0.032
	16	0.051	0.046	0.038	0.036
	20	0.062	0.056	0.047	0.043

Parameters suggested with high power milling chuck and stable machining condition

HF850

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1-5D x 0.1D	1-5D x 0.1D	D x 0.1D	D x 0.1D
	Vc (m/min)	130÷150	100÷120	60÷80	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.027	0.024	0.021	0.029
	4	0.035	0.032	0.028	0.039
	5	0.044	0.040	0.035	0.048
	6	0.052	0.046	0.041	0.057
	8	0.067	0.060	0.054	0.074
	10	0.080	0.072	0.064	0.088
	12	0.092	0.083	0.073	0.101
	14	0.103	0.093	0.083	0.114
	16	0.115	0.103	0.092	0.126
	20	0.140	0.126	0.112	0.154

NOTES:

Down milling CNC programming is required.

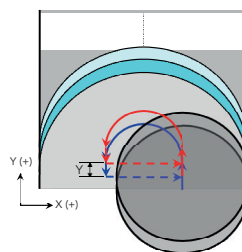
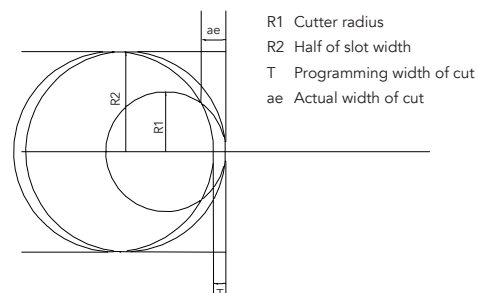
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

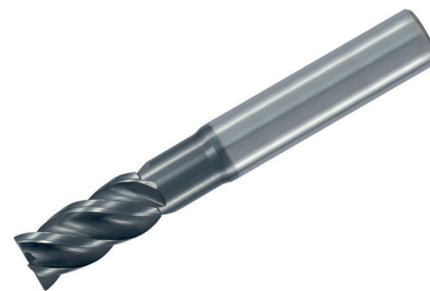
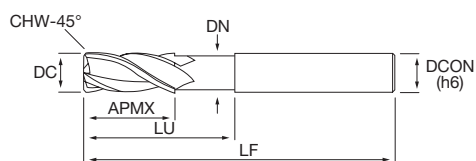
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF450

- Cylindrical shank and reduced neck
- 45° chamfer



P	M	K	N	S	H
★	★	★		★	★

OSAWA
NORM

HF
HARD

MG
PV300

30±5
HRC

FHA 40°

CH-45°

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

TROCHOIDAL

DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.1	±0.020	6	h6	9	15	2.8	57	4	HF450030	●
4	0/-0.030	0.1	±0.020	6	h6	11	18	3.8	57	4	HF450040	●
5	0/-0.030	0.1	±0.020	6	h6	13	19	4.8	57	4	HF450050	●
6	0/-0.030	0.1	±0.020	6	h6	13	20	5.8	57	4	HF450060	●
8	0/-0.030	0.2	±0.020	8	h6	20	26	7.8	64	4	HF450080	●
10	0/-0.030	0.2	±0.020	10	h6	22	30	9.8	72	4	HF450100	●
12	0/-0.030	0.2	±0.020	12	h6	26	36	11.8	83	4	HF450120	●
14	0/-0.030	0.2	±0.020	14	h6	26	36	13.7	83	4	HF450140	●
16	0/-0.030	0.3	±0.020	16	h6	32	42	15.7	92	4	HF450160	●
20	0/-0.030	0.4	±0.020	20	h6	38	50	19.7	104	4	HF450200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF450

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.2D x D
	Vc (m/min)	70÷90	50÷70	30÷50	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.011	0.010	0.008	0.007
	4	0.014	0.013	0.011	0.010
	5	0.018	0.016	0.013	0.012
	6	0.021	0.019	0.015	0.014
	8	0.027	0.024	0.020	0.019
	10	0.032	0.029	0.024	0.022
	12	0.037	0.033	0.028	0.026
	14	0.041	0.037	0.031	0.029
	16	0.046	0.041	0.034	0.032
	20	0.056	0.050	0.042	0.03
ap x ae	≤ D5	0.3D x D	0.3D x D	0.2D x D	0.1D x D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.2D	1.2D x 0.2D	D x 0.1D
	Vc (m/min)	90÷110	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.013	0.012	0.010	0.014
	4	0.017	0.015	0.014	0.019
	5	0.021	0.019	0.017	0.023
	6	0.025	0.022	0.020	0.027
	8	0.032	0.029	0.026	0.035
	10	0.039	0.035	0.031	0.042
	12	0.044	0.040	0.035	0.048
	14	0.050	0.045	0.040	0.055
	16	0.055	0.050	0.044	0.061
	20	0.067	0.060	0.054	0.074
ap x ae	≤ D5	1.2D x 0.2D	1.2D x 0.2D	D x 0.1D	D x 0.05D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	70÷90	50÷70	30÷50	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.008	0.007	0.006	0.007
	4	0.010	0.010	0.008	0.009
	5	0.013	0.012	0.011	0.011
	6	0.015	0.014	0.012	0.013
	8	0.019	0.018	0.016	0.017
	10	0.023	0.022	0.019	0.020
	12	0.027	0.025	0.022	0.023
	14	0.030	0.028	0.025	0.026
	16	0.033	0.031	0.028	0.029
	20	0.041	0.038	0.034	0.035
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF450

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x D	4° x D	3° x D	2° x D
	Vc (m/min)	60÷80	50÷60	30÷40	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.020	0.019	0.018	0.027
	8	0.026	0.024	0.023	0.035
	10	0.031	0.029	0.027	0.043
	12	0.036	0.033	0.031	0.049
	14	0.040	0.037	0.035	0.055
	16	0.045	0.042	0.039	0.061
	20	0.054	0.051	0.048	0.074

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	60÷80	50÷60	30÷40	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.021	0.019	0.015	0.014
	8	0.027	0.024	0.020	0.019
	10	0.032	0.029	0.024	0.022
	12	0.037	0.033	0.028	0.026
	14	0.041	0.037	0.031	0.029
	16	0.046	0.041	0.034	0.032
	20	0.056	0.050	0.042	0.039

Parameters suggested with high power milling chuck and stable machining condition

HF450

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	D x 0.1D	D x 0.1D
	Vc (m/min)	110÷130	80÷100	50÷70	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.027	0.024	0.021	0.029
	4	0.035	0.032	0.028	0.039
	5	0.044	0.040	0.035	0.048
	6	0.052	0.046	0.041	0.057
	8	0.067	0.060	0.054	0.074
	10	0.080	0.072	0.064	0.088
	12	0.092	0.083	0.073	0.101
	14	0.103	0.093	0.083	0.114
	16	0.115	0.103	0.092	0.126
	20	0.140	0.126	0.112	0.154

NOTES:

Down milling CNC programming is required.

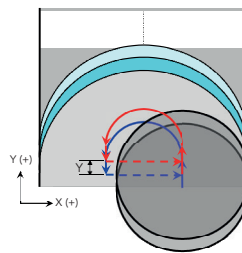
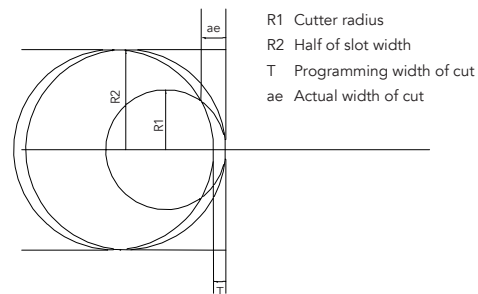
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

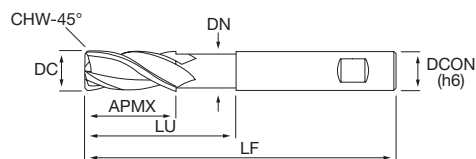
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF451

- Weldon shank and reduced neck
- 45° chamfer



P	M	K	N	S	H
★	★	★		★	★



DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.1	±0.020	6	h6	9	15	2.8	57	4	HF451030	●
4	0/-0.030	0.1	±0.020	6	h6	11	18	3.8	57	4	HF451040	●
5	0/-0.030	0.1	±0.020	6	h6	13	19	4.8	57	4	HF451050	●
6	0/-0.030	0.1	±0.020	6	h6	13	20	5.8	57	4	HF451060	●
8	0/-0.030	0.2	±0.020	8	h6	20	26	7.8	64	4	HF451080	●
10	0/-0.030	0.2	±0.020	10	h6	22	30	9.8	72	4	HF451100	●
12	0/-0.030	0.2	±0.020	12	h6	26	36	11.8	83	4	HF451120	●
14	0/-0.030	0.2	±0.020	14	h6	26	36	13.7	83	4	HF451140	●
16	0/-0.030	0.3	±0.020	16	h6	32	42	15.7	92	4	HF451160	●
20	0/-0.030	0.4	±0.020	20	h6	38	50	19.7	104	4	HF451200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF451

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.2D x D
	Vc (m/min)	70÷90	50÷70	30÷50	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.011	0.010	0.008	0.007
	4	0.014	0.013	0.011	0.010
	5	0.018	0.016	0.013	0.012
	6	0.021	0.019	0.015	0.014
	8	0.027	0.024	0.020	0.019
	10	0.032	0.029	0.024	0.022
	12	0.037	0.033	0.028	0.026
	14	0.041	0.037	0.031	0.029
	16	0.046	0.041	0.034	0.032
	20	0.056	0.050	0.042	0.039
ap x ae	≤ D5	0.3D x D	0.3D x D	0.2D x D	0.1D x D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.2D	1.2D x 0.2D	D x 0.1D
	Vc (m/min)	90÷110	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.013	0.012	0.010	0.014
	4	0.017	0.015	0.014	0.019
	5	0.021	0.019	0.017	0.023
	6	0.025	0.022	0.020	0.027
	8	0.032	0.029	0.026	0.035
	10	0.039	0.035	0.031	0.042
	12	0.044	0.040	0.035	0.048
	14	0.050	0.045	0.040	0.055
	16	0.055	0.050	0.044	0.061
	20	0.067	0.060	0.054	0.074
ap x ae	≤ D5	1.2D x 0.2D	1.2D x 0.1D	D x 0.1D	D x 0.05D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	70÷90	50÷70	30÷50	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.008	0.007	0.006	0.007
	4	0.010	0.010	0.008	0.009
	5	0.013	0.012	0.011	0.011
	6	0.015	0.014	0.012	0.013
	8	0.019	0.018	0.016	0.017
	10	0.023	0.022	0.019	0.020
	12	0.027	0.025	0.022	0.023
	14	0.030	0.028	0.025	0.026
	16	0.033	0.031	0.028	0.029
	20	0.041	0.038	0.034	0.035
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF450 parameters.

Cutting Parameters

HF451

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x D	4° x D	3° x D	2° x D
	Vc (m/min)	60÷80	50÷60	30÷40	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.018	0.017	0.016	0.025
	8	0.023	0.022	0.021	0.032
	10	0.028	0.026	0.025	0.038
	12	0.032	0.030	0.028	0.044
	14	0.036	0.034	0.032	0.049
	16	0.040	0.037	0.035	0.055
	20	0.049	0.045	0.043	0.067

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	60÷80	50÷60	30÷40	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.021	0.019	0.015	0.014
	8	0.027	0.024	0.020	0.019
	10	0.032	0.029	0.024	0.022
	12	0.037	0.033	0.028	0.026
	14	0.041	0.037	0.031	0.029
	16	0.046	0.041	0.034	0.032
	20	0.056	0.050	0.042	0.039

Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF450 parameters.

HF451

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	D x 0.1D	D x 0.1D
	Vc (m/min)	110÷130	80÷100	50÷70	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.027	0.024	0.021	0.029
	4	0.035	0.032	0.028	0.039
	5	0.044	0.040	0.035	0.048
	6	0.052	0.046	0.041	0.057
	8	0.067	0.060	0.054	0.074
	10	0.080	0.072	0.064	0.088
	12	0.092	0.083	0.073	0.101
	14	0.103	0.093	0.083	0.114
	16	0.115	0.103	0.092	0.126
	20	0.140	0.126	0.112	0.154

NOTES:

Down milling CNC programming is required.

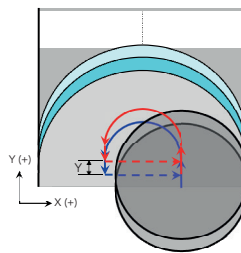
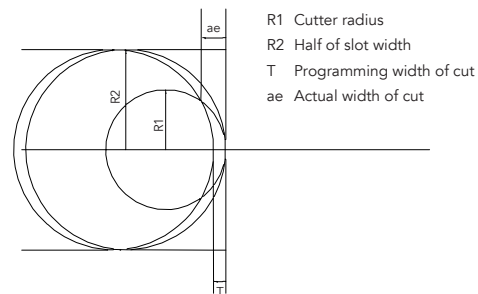
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

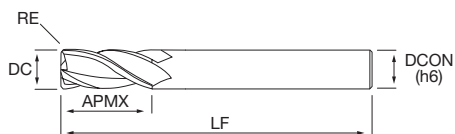
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high precision weldon chuck and stable machining condition.
For application on high power milling chuck, please refer to HF450 parameters.

HF852

- Cylindrical shank
- Corner radius



P	M	K	N	S	H
★	★	★		★	★

OSAWA
NORM

HF
HARD

MG
PV300

30±55
HRC

FHA 40°

RADIUS

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

TROCHOIDAL

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.020	0.3	±0.015	6	h6	12	57	4	HF85203040	●
4	0/-0.020	0.5	±0.015	6	h6	12	57	4	HF85205040	●
5	0/-0.020	0.3	±0.015	6	h6	15	57	4	HF85203050	●
5	0/-0.020	0.5	±0.015	6	h6	15	57	4	HF85205050	●
6	0/-0.020	0.3	±0.015	6	h6	16	57	4	HF85203060	●
6	0/-0.020	0.5	±0.015	6	h6	16	57	4	HF85205060	●
6	0/-0.020	1	±0.015	6	h6	16	57	4	HF85210060	●
8	0/-0.020	0.5	±0.015	8	h6	20	64	4	HF85205080	●
8	0/-0.020	1	±0.015	8	h6	20	64	4	HF85210080	●
10	0/-0.020	0.5	±0.020	10	h6	22	72	4	HF85205100	●
10	0/-0.020	1	±0.020	10	h6	22	72	4	HF85210100	●
12	0/-0.020	0.5	±0.020	12	h6	26	83	4	HF85205120	●
12	0/-0.020	1	±0.020	12	h6	26	83	4	HF85210120	●
12	0/-0.020	2	±0.020	12	h6	26	83	4	HF85220120	●
12	0/-0.020	3	±0.020	12	h6	26	83	4	HF85230120	●
14	0/-0.020	1	±0.020	14	h6	32	83	4	HF85210140	●
16	0/-0.020	1	±0.020	16	h6	32	92	4	HF85210160	●
16	0/-0.020	2	±0.020	16	h6	32	92	4	HF85220160	●
20	0/-0.020	1	±0.020	20	h6	38	104	4	HF85210200	⊙
20	0/-0.020	2	±0.020	20	h6	38	104	4	HF85220200	●

★ 1st choice, ☆ suitable, ● stock standard, ⊙ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF852

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.2D x D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.012	0.011	0.009	0.008
	4	0.016	0.014	0.012	0.011
	5	0.020	0.018	0.015	0.014
	6	0.023	0.021	0.017	0.016
	8	0.030	0.027	0.022	0.021
	10	0.036	0.032	0.027	0.025
	12	0.041	0.037	0.031	0.029
	14	0.046	0.041	0.034	0.032
	16	0.051	0.046	0.038	0.036
	20	0.062	0.056	0.047	0.043
ap x ae	≤ D5	0.3D x D	0.3D x D	0.2D x D	0.1D x D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.2D	1.2D x 0.2D	D x 0.1D
	Vc (m/min)	100÷120	70÷90	50÷70	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.014	0.013	0.011	0.016
	4	0.019	0.017	0.015	0.021
	5	0.023	0.021	0.019	0.026
	6	0.028	0.025	0.022	0.030
	8	0.036	0.032	0.029	0.039
	10	0.043	0.039	0.034	0.047
	12	0.049	0.044	0.039	0.054
	14	0.055	0.050	0.044	0.061
	16	0.061	0.055	0.049	0.067
	20	0.074	0.067	0.060	0.082
ap x ae	≤ D5	1.2D x 0.2D	1.2D x 0.2D	D x 0.1D	D x 0.05D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.009	0.008	0.007	0.008
	4	0.011	0.011	0.009	0.010
	5	0.014	0.013	0.012	0.012
	6	0.017	0.016	0.014	0.015
	8	0.022	0.020	0.018	0.019
	10	0.026	0.024	0.021	0.023
	12	0.030	0.028	0.024	0.026
	14	0.033	0.031	0.028	0.029
	16	0.037	0.035	0.031	0.032
	20	0.045	0.042	0.037	0.039
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF852

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x D	4° x D	3° x D	2° x D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.020	0.019	0.018	0.027
	8	0.026	0.024	0.023	0.035
	10	0.031	0.029	0.027	0.043
	12	0.036	0.033	0.031	0.049
	14	0.040	0.037	0.035	0.055
	16	0.045	0.042	0.039	0.061
	20	0.054	0.051	0.048	0.074

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.023	0.021	0.017	0.016
	8	0.030	0.027	0.022	0.021
	10	0.036	0.032	0.027	0.025
	12	0.041	0.037	0.031	0.029
	14	0.046	0.041	0.034	0.032
	16	0.051	0.046	0.038	0.036
	20	0.062	0.056	0.047	0.043

Parameters suggested with high power milling chuck and stable machining condition

HF852

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	D x 0.1D	D x 0.1D
	Vc (m/min)	130÷150	100÷120	60÷80	50÷70
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.027	0.024	0.021	0.029
	4	0.035	0.032	0.028	0.039
	5	0.044	0.040	0.035	0.048
	6	0.052	0.046	0.041	0.057
	8	0.067	0.060	0.054	0.074
	10	0.080	0.072	0.064	0.088
	12	0.092	0.083	0.073	0.101
	14	0.103	0.093	0.083	0.114
	16	0.115	0.103	0.092	0.126
	20	0.140	0.126	0.112	0.154

NOTES:

Down milling CNC programming is required.

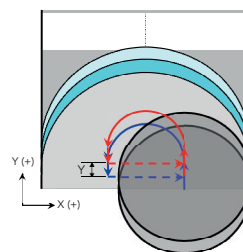
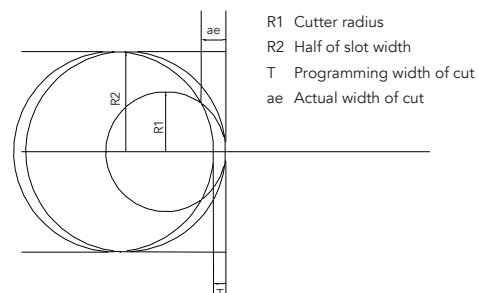
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

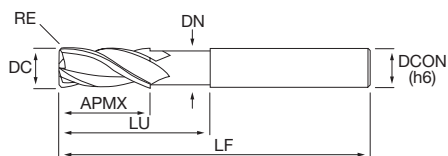
With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition

HF452

- Cylindrical shank and reduced neck
- Corner radius



P	M	K	N	S	H
★	★	★		★	★

OSAWA
NORM

HF
HARD

MG
PV300

30±55
HRC

FHA 40°

RADIUS

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

TROCHOIDAL

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.3	±0.020	6	h6	9	15	2.8	57	4	HF45203030	●
3	0/-0.030	0.5	±0.020	6	h6	9	15	2.8	57	4	HF45205030	●
4	0/-0.030	0.3	±0.020	6	h6	11	18	3.8	57	4	HF45203040	●
4	0/-0.030	0.5	±0.020	6	h6	11	18	3.8	57	4	HF45205040	●
5	0/-0.030	0.5	±0.020	6	h6	13	19	4.8	57	4	HF45205050	●
6	0/-0.030	0.5	±0.020	6	h6	13	20	5.8	57	4	HF45205060	●
6	0/-0.030	1	±0.020	6	h6	13	20	5.8	57	4	HF45210060	●
8	0/-0.030	0.5	±0.020	8	h6	20	26	7.8	64	4	HF45205080	●
8	0/-0.030	1	±0.020	8	h6	20	26	7.8	64	4	HF45210080	●
10	0/-0.030	0.5	±0.020	10	h6	22	30	9.8	72	4	HF45205100	●
10	0/-0.030	1	±0.020	10	h6	22	30	9.8	72	4	HF45210100	●
12	0/-0.030	0.5	±0.020	12	h6	26	36	11.8	83	4	HF45205120	●
12	0/-0.030	1	±0.020	12	h6	26	36	11.8	83	4	HF45210120	●
16	0/-0.030	1	±0.020	16	h6	32	42	15.7	92	4	HF45210160	●
16	0/-0.030	2	±0.020	16	h6	32	42	15.7	92	4	HF45220160	●
20	0/-0.030	1	±0.020	20	h6	38	50	19.7	104	4	HF45210200	●
20	0/-0.030	2	±0.020	20	h6	38	50	19.7	104	4	HF45220200	●

★ 1st choice, ☆ suitable, ● stock standard, ○ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HF452

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.2D x D
	Vc (m/min)	70÷90	50÷70	30÷50	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.011	0.010	0.008	0.007
	4	0.014	0.013	0.011	0.010
	5	0.018	0.016	0.013	0.012
	6	0.021	0.019	0.015	0.014
	8	0.027	0.024	0.020	0.019
	10	0.032	0.029	0.024	0.022
	12	0.037	0.033	0.028	0.026
	14	0.041	0.037	0.031	0.029
	16	0.046	0.041	0.034	0.032
	20	0.056	0.050	0.042	0.039
ap x ae	≤ D5	0.3D x D	0.3D x D	0.2D x D	0.1D x D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.2D	1.2D x 0.2D	D x 0.1D
	Vc (m/min)	90÷110	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.013	0.012	0.010	0.014
	4	0.017	0.015	0.014	0.019
	5	0.021	0.019	0.017	0.023
	6	0.025	0.022	0.020	0.027
	8	0.032	0.029	0.026	0.035
	10	0.039	0.035	0.031	0.042
	12	0.044	0.040	0.035	0.048
	14	0.050	0.045	0.040	0.055
	16	0.055	0.050	0.044	0.061
	20	0.067	0.060	0.054	0.074
ap x ae	≤ D5	1.2D x 0.2D	1.2D x 0.1D	D x 0.1D	D x 0.05D

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x 0.4D	4° x 0.4D	3° x 0.4D	2° x 0.4D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.008	0.007	0.006	0.007
	4	0.010	0.010	0.008	0.009
	5	0.013	0.012	0.011	0.011
	6	0.015	0.014	0.012	0.013
	8	0.019	0.018	0.016	0.017
	10	0.023	0.022	0.019	0.020
	12	0.027	0.025	0.022	0.023
	14	0.030	0.028	0.025	0.026
	16	0.033	0.031	0.028	0.029
	20	0.041	0.038	0.034	0.035
α° x ae	≤ D5	2° x 0.4D	2° x 0.4D	1° x 0.4D	1° x 0.4D

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HF452

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	α° x ae	5° x D	4° x D	3° x D	2° x D
	Vc (m/min)	60÷80	50÷60	30÷40	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.018	0.017	0.016	0.025
	8	0.023	0.022	0.021	0.032
	10	0.028	0.026	0.025	0.038
	12	0.032	0.030	0.028	0.044
	14	0.036	0.034	0.032	0.049
	16	0.040	0.037	0.035	0.055
	20	0.049	0.045	0.043	0.067

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	D x 0.4D	D x 0.4D	D x 0.25D	D x 0.25D
	Vc (m/min)	60÷80	50÷60	30÷40	20÷30
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.021	0.019	0.015	0.014
	8	0.027	0.024	0.020	0.019
	10	0.032	0.029	0.024	0.022
	12	0.037	0.033	0.028	0.026
	14	0.041	0.037	0.031	0.029
	16	0.046	0.041	0.034	0.032
	20	0.056	0.050	0.042	0.039

Parameters suggested with high power milling chuck and stable machining condition

HF452

	Material Group ISO 513	P4 M3 K4	P4 P5 P8 M3 K4 S1	P5 P8 P8 K4 S2 S3	H1 H4 H5
	Hardness/Rm	800÷1000 N/mm ²	900÷1200 N/mm ²	35÷45 HRC	≤55 HRC
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	D x 0.1D	D x 0.1D
	Vc (m/min)	110÷130	80÷100	50÷70	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.027	0.024	0.021	0.029
	4	0.035	0.032	0.028	0.039
	5	0.044	0.040	0.035	0.048
	6	0.052	0.046	0.041	0.057
	8	0.067	0.060	0.054	0.074
	10	0.080	0.072	0.064	0.088
	12	0.092	0.083	0.073	0.101
	14	0.103	0.093	0.083	0.114
	16	0.115	0.103	0.092	0.126
	20	0.140	0.126	0.112	0.154

NOTES:

Down milling CNC programming is required.

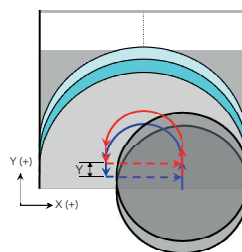
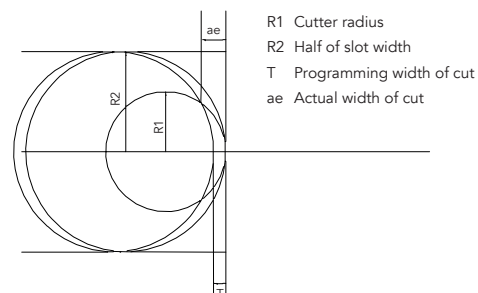
"ae" value max 0.2xD - "T" value max 0.1xD.

The use of end mill with diameter 30-40% smaller than the width of the slot is recommended.

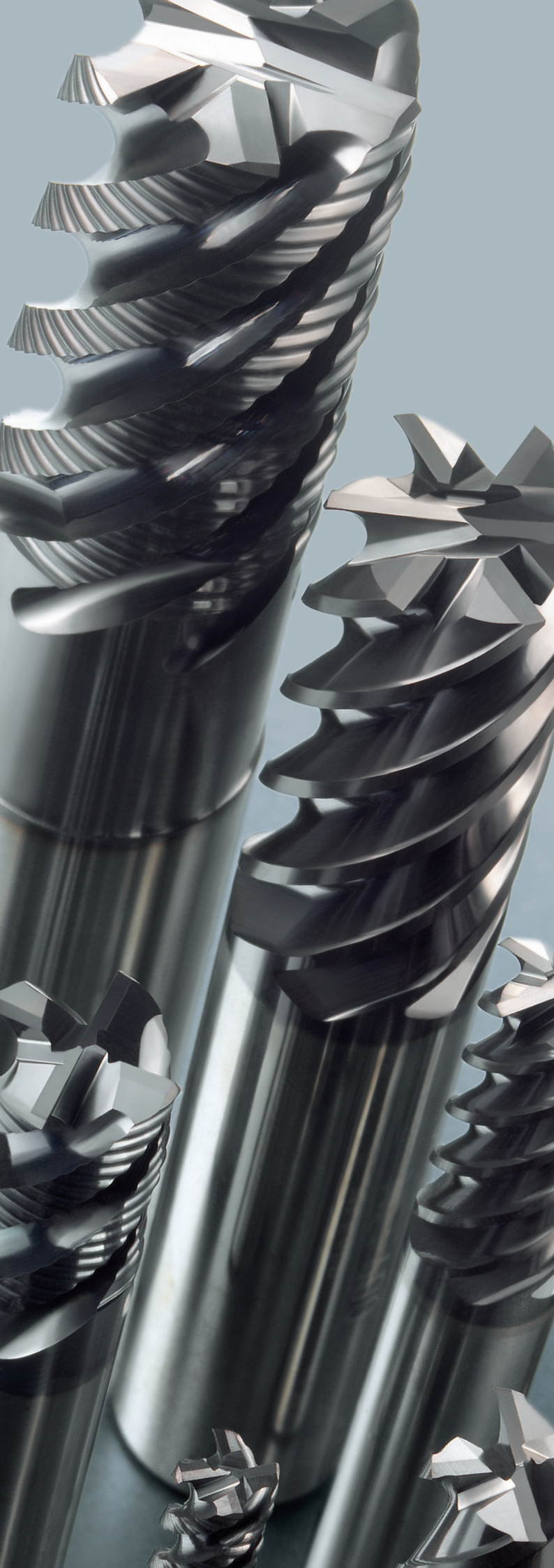
The cutting conditions are based on CNC programming with medium dynamic speed.

With lower CNC dynamic speed, use the same cutting conditions or reduce the cutting speed Vc.

With higher CNC dynamic speed, reduce the "T" value by approximately -30 -50% and apply the maximum available cutting speed Vc.



Parameters suggested with high power milling chuck and stable machining condition



MEF

STAINLESS STEEL AND SUPER ALLOYS

🇪🇺 Ultra-fine micrograin and Endless Black coating for high performance machining on stainless steel, HRSA and titanium alloy, carbon and low alloy steel. The unique design of the cutting geometry and the Endless Black coating are specifically developed to control the cutting friction delivering longer tool life through the reduction of the heat generation.

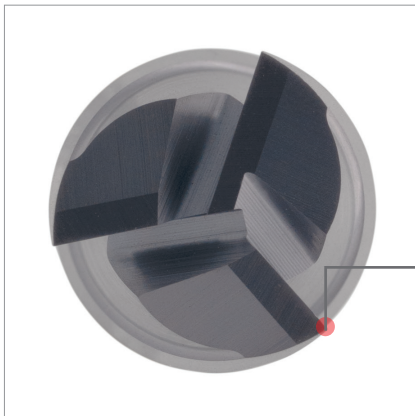
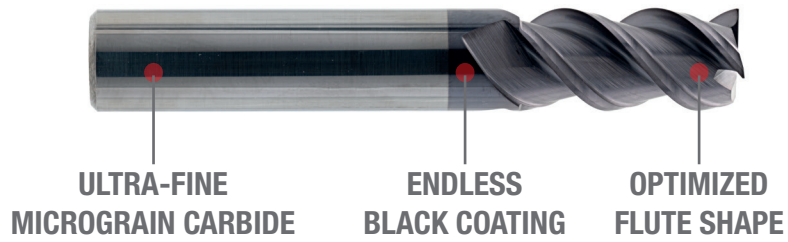
🇮🇹 Micrograna ultrafine e rivestimento Endless Black per la lavorazione ad alto rendimento di acciai al carbonio, acciai inossidabili, HRSA e leghe di titanio. La geometria e il rivestimento specifici consentono di generare bassi sforzi di taglio e l'abbassamento del coefficiente di attrito, garantendo una riduzione dello sviluppo del calore con conseguente rallentamento del processo di usura del tagliente.

🇩🇪 Besonders feine Mikrokörnung und Beschichtung Endless Black für Hochleistungsbearbeitungen von Kohlenstoffstahl, Edelstahl, HRSA und Titanlegierungen. Dank der speziellen Geometrie und der spezifischen Beschichtung wird ein niedriger Schneiddruck erzeugt und der Reibungsfaktor gesenkt, wodurch die Hitzeentwicklung reduziert und in Folge die Abnutzung der Schneidkante verzögert werden.

🇫🇷 Ultra Micrograin et revêtement Endless Black pour l'usinage à haute performance pour les aciers au carbone, aciers inoxydables, HRSA et alliages de titane. La géométrie et le revêtement spécifiques permettent de générer peu d'efforts de coupe et de réduire le coefficient de frottement, en garantissant une diminution du développement de la chaleur et le ralentissement consécutif du processus d'usure de l'arête.

MEF

Features of MEF end mills



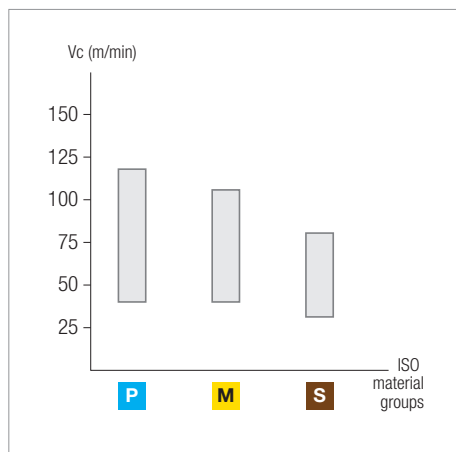
MEF

Features and Benefits

- Optimized flutes design for fast chip ejection.
 - Reinforced cutting edge design for chipping protection.
 - Ultra-fine micrograin delivers high wear resistance and reliable long tool life.
 - Endless Black coating provides lower cutting friction
 - Chipbreaker design reduces cutting force and allows quick heat dissipation
- Optimiertes Nutendesign für eine schnelle Spanabfuhr
 - Verstärkte Schneidkanten geometrie zum Schutz vor Ausbrüchen.
 - Ultrafeine Mikrostruktur sorgt für hohe Verschleißfestigkeit und eine lange, zuverlässige Werkzeuglebensdauer
 - Endless Black-Beschichtung reduziert die Schnittreibung
 - Spanbrecherdesign verringert die Schnittkräfte und ermöglicht eine schnelle Wärmeableitung.
- Particolare design delle gole per migliorare l'evacuazione dei trucioli
 - Taglienti rinforzati per ridurre i problemi di scheggiatura
 - Micrograna ultra-fine per maggiore resistenza all'usura, lunga durata e affidabilità
 - Rivestimento Endless Black per riduzione del coefficiente di attrito
 - Tipologie con rompitrucciolo per minor sforzo di taglio e maggiore dissipazione del calore
- Conception optimisée des goujures pour une évacuation rapide des copeaux.
 - Conception renforcée des arêtes de coupe pour une protection contre l'écaillage.
 - Micrograins ultra-fins offrant une résistance élevée à l'usure et une durée de vie prolongée de l'outil.
 - Revêtement Endless Black réduisant les frottements lors de la coupe.
 - Conception avec brise-copeaux réduisant la force de coupe et permettant une dissipation rapide de la chaleur.

Application range - ISO 513

P M S



Use case

Tool Type	MEF901
Workpiece	W.-Nr 1.4435 AISI 316L
Parameters	Vc 60 m/min, fz 0,036 mm/t, ap 15 mm, ae 2 mm
Diameter	12 mm
Machining time:	
 OSAWA	+50%
Competitor A	
Competitor B	

MEFCS2

- Cylindrical shank
- 2 flutes



P	M	K	N	S	H
★	★			★	



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.030	4	h6	2.5	40	2	MEFCS2010	●
1.5	0/-0.030	4	h6	4	40	2	MEFCS2015	●
2	0/-0.030	4	h6	6	40	2	MEFCS2020	●
2.5	0/-0.030	4	h6	8	40	2	MEFCS2025	●
3	0/-0.030	6	h6	8	45	2	MEFCS2030	●
4	0/-0.030	6	h6	11	45	2	MEFCS2040	●
5	0/-0.030	6	h6	13	50	2	MEFCS2050	●
6	0/-0.030	6	h6	13	50	2	MEFCS2060	●
8	0/-0.030	8	h6	19	60	2	MEFCS2080	●
10	0/-0.030	10	h6	22	70	2	MEFCS2100	●
12	0/-0.030	12	h6	26	75	2	MEFCS2120	●
14	0/-0.030	16	h6	26	85	2	MEFCS2140	●
16	0/-0.030	16	h6	32	100	2	MEFCS2160	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

MEFCS2

	Material Group ISO 513	P1 P2 P3	P4 P7 M1	P5 M2 M3 S1 S2 S4	P8 S3 S5
	Hardness/Rm	≤700 N/mm ²	700÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.2D x D
	Vc (m/min)	90÷110	50÷70	30÷50	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.005	0.004	0.004	0.004
	2	0.009	0.008	0.007	0.007
	3	0.012	0.010	0.009	0.009
	4	0.017	0.015	0.014	0.014
	5	0.023	0.020	0.018	0.018
	6	0.029	0.024	0.023	0.023
	8	0.035	0.029	0.028	0.028
	10	0.040	0.034	0.032	0.032
	12	0.046	0.039	0.037	0.037
	14	0.052	0.044	0.041	0.041
	16	0.058	0.049	0.046	0.046

< D3 mm: ap = 0.1D ÷ 0.2D

	Material Group ISO 513	P1 P2 P3	P4 P7 M1	P5 M2 M3 S1 S2 S4	P8 S3 S5
	Hardness/Rm	≤700 N/mm ²	700÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	D x 0.3D	D x 0.1D
	Vc (m/min)	90÷110	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.006	0.005	0.004	0.004
	2	0.011	0.009	0.009	0.009
	3	0.014	0.012	0.011	0.011
	4	0.021	0.018	0.017	0.017
	5	0.028	0.023	0.022	0.022
	6	0.035	0.029	0.028	0.028
	8	0.041	0.035	0.033	0.033
	10	0.048	0.041	0.039	0.039
	12	0.055	0.047	0.044	0.044
	14	0.062	0.053	0.050	0.050
	16	0.069	0.059	0.055	0.055

< D3 mm: ap = 0.1D ÷ 0.2D

	Material Group ISO 513	P1 P2 P7 K1	P3 P4 M1 K2 K3	P5 M2 M3 K4 S1 S4	S2 S3 S5
	Hardness/Rm	≤700 N/mm ²	700÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	D x D	D x D	0.5D x D	0.2D x D
	Vc (m/min)	90÷110	50÷70	30÷50	20÷40
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.003	0.002	0.002	0.002
	2	0.006	0.005	0.004	0.004
	3	0.007	0.006	0.006	0.006
	4	0.010	0.009	0.008	0.008
	5	0.014	0.012	0.011	0.011
	6	0.017	0.015	0.014	0.014
	8	0.021	0.018	0.017	0.017
	10	0.024	0.021	0.019	0.019
	12	0.028	0.023	0.022	0.022
	14	0.031	0.026	0.025	0.025
	16	0.035	0.029	0.028	0.028

< D3 mm: ap = 0.1D ÷ 0.2D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

MEFCSH3

- Cylindrical shank
- 3 flutes



P	M	K	N	S	H
★	★			★	



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.030	6	h6	13	50	3	MEFCSH3060	●
8	0/-0.030	8	h6	19	60	3	MEFCSH3080	●
10	0/-0.030	10	h6	22	70	3	MEFCSH3100	●
12	0/-0.030	12	h6	26	75	3	MEFCSH3120	●
16	0/-0.030	16	h6	32	100	3	MEFCSH3160	●
18	0/-0.030	18	h6	32	90	3	MEFCSH3180	▽

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

MEFCSH3

	Material Group ISO 513	P1 P2 P3	P4 P7 M1	P5 M2 M3 S1 S2 S4	P8 S3 S5
	Hardness/Rm	≤700 N/mm ²	700÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.2D x D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.022	0.013	0.012	0.012
	8	0.029	0.017	0.015	0.016
	10	0.036	0.021	0.019	0.020
	12	0.046	0.027	0.024	0.026
	14	0.053	0.031	0.028	0.030
	16	0.065	0.038	0.034	0.036
	18	0.075	0.044	0.039	0.042

	Material Group ISO 513	P1 P2 P3	P4 P7 M1	P5 M2 M3 S1 S2 S4	P8 S3 S5
	Hardness/Rm	≤700 N/mm ²	700÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	0.5D x D	0.5D x D	0.3D x D	0.2D x D
	Vc (m/min)	80÷100	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.026	0.015	0.014	0.014
	8	0.035	0.020	0.019	0.019
	10	0.043	0.026	0.024	0.024
	12	0.055	0.033	0.031	0.031
	14	0.064	0.038	0.036	0.036
	16	0.078	0.046	0.043	0.043
	18	0.090	0.053	0.050	0.050

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

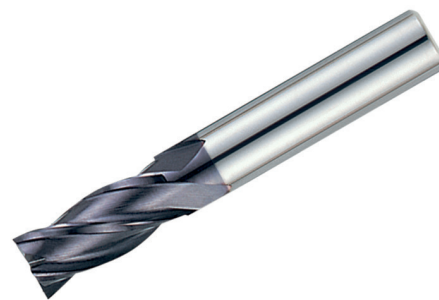
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

MEFCS4

- Cylindrical shank
- 4 flutes



P	M	K	N	S	H
★	★			★	



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
2	0/-0.030	4	h6	6	40	4	MEFCS4020	●
2.5	0/-0.030	4	h6	8	40	4	MEFCS4025	●
3	0/-0.030	6	h6	8	45	4	MEFCS4030	●
4	0/-0.030	6	h6	11	45	4	MEFCS4040	●
5	0/-0.030	6	h6	13	50	4	MEFCS4050	●
6	0/-0.030	6	h6	13	50	4	MEFCS4060	●
8	0/-0.030	8	h6	19	60	4	MEFCS4080	●
10	0/-0.030	10	h6	22	70	4	MEFCS4100	●
12	0/-0.030	12	h6	26	75	4	MEFCS4120	●
14	0/-0.030	16	h6	26	85	4	MEFCS4140	●
16	0/-0.030	16	h6	32	100	4	MEFCS4160	●
20	0/-0.030	20	h6	38	105	4	MEFCS4200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

MEFCS4

	Material Group ISO 513	P1 P2 P3	P4 P7 M1	P5 M2 M3 S1 S2 S4	P8 S3 S5
	Hardness/Rm	≤700 N/mm ²	700÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	90÷110	60÷80	40÷60	30÷50
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.012	0.010	0.010	0.010
	4	0.015	0.013	0.012	0.012
	5	0.018	0.015	0.014	0.014
	6	0.023	0.020	0.018	0.018
	8	0.030	0.026	0.024	0.024
	10	0.038	0.032	0.030	0.030
	12	0.045	0.038	0.036	0.036
	14	0.052	0.044	0.042	0.042
	16	0.058	0.049	0.046	0.046
	18	0.066	0.056	0.053	0.053
	20	0.075	0.064	0.060	0.060

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

MEF600

- Cylindrical shank
- Multi flute



P	M	K	N	S	H
★	★			★	



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.030	6	h6	13	57	6	MEF600060	●
8	0/-0.030	8	h6	19	63	6	MEF600080	●
10	0/-0.030	10	h6	22	72	6	MEF600100	●
12	0/-0.030	12	h6	26	83	6	MEF600120	●
16	0/-0.030	16	h6	32	92	6	MEF600160	●
20	0/-0.030	20	h6	38	104	8	MEF600200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

MEF600

	Material Group ISO 513	P1 P2 P3	P4 P7 M1	P5 M2 M3 S1 S2 S4	P8 S3 S5
	Hardness/Rm	≤700 N/mm ²	700÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	D x 0.1D	D x 0.05D
	Vc (m/min)	100÷140	70÷110	50÷80	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.015	0.013	0.012	0.012
	8	0.020	0.017	0.016	0.016
	10	0.025	0.021	0.020	0.020
	12	0.030	0.026	0.024	0.024
	14	0.035	0.030	0.028	0.028
	16	0.040	0.034	0.032	0.032
	20	0.050	0.043	0.040	0.040

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

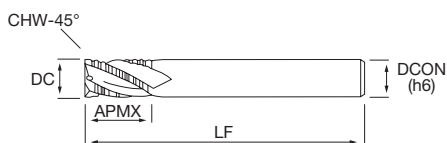
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

MEF901

- Cylindrical shank
- Roughing



P	M	K	N	S	H
★	★			★	

OSAWA
 NORM

VA
UMG
 ENDLESS

<45
 HRC


FHA 45°

CH-45°

HR FINE

ZEFP 3-6

SIDE MILLING

DC	DC tol.	CHW	CHW tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
4	0/-0.048	0.1	±0.020	6	h6	11	57	3	MEF901040	●
5	0/-0.048	0.1	±0.020	6	h6	13	57	4	MEF901050	●
6	0/-0.048	0.15	±0.020	6	h6	16	57	4	MEF901060	●
8	0/-0.058	0.2	±0.020	8	h6	16	63	4	MEF901080	●
10	0/-0.058	0.2	±0.020	10	h6	22	72	4	MEF901100	●
12	0/-0.070	0.2	±0.020	12	h6	26	83	4	MEF901120	●
14	0/-0.070	0.2	±0.020	14	h6	26	83	5	MEF901140	●
16	0/-0.070	0.2	±0.020	16	h6	32	92	5	MEF901160	●
20	0/-0.084	0.2	±0.020	20	h6	38	104	6	MEF901200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

MEF901

	Material Group ISO 513	P1 P2 P3	P4 P7 M1	P5 M2 M3 S1 S2 S4	P8 S3 S5
	Hardness/Rm	≤700 N/mm ²	700÷1000 N/mm ²	≤35 HRC	≤45 HRC
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.2D	D x 0.1D
	Vc (m/min)	100÷140	70÷90	50÷70	40÷60
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	4	0.018	0.015	0.014	0.014
	5	0.022	0.019	0.018	0.018
	6	0.028	0.024	0.022	0.022
	8	0.035	0.030	0.028	0.028
	10	0.040	0.034	0.032	0.032
	12	0.045	0.038	0.036	0.036
	14	0.050	0.043	0.040	0.040
	16	0.057	0.048	0.046	0.046
	20	0.073	0.062	0.058	0.058

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS



ALU

NON-FERROUS MATERIALS

✚ Uncoated micrograin carbide and cutting geometry specifically developed for non-ferrous machining. Polished and unique flutes design for low cutting forces, smooth chip ejection and outstanding finishing quality. Also available in the HF ALU version with unequal pitch (UP) with a specific design allowing mirror finishing and DxD machining, even in the 4-flutes version.

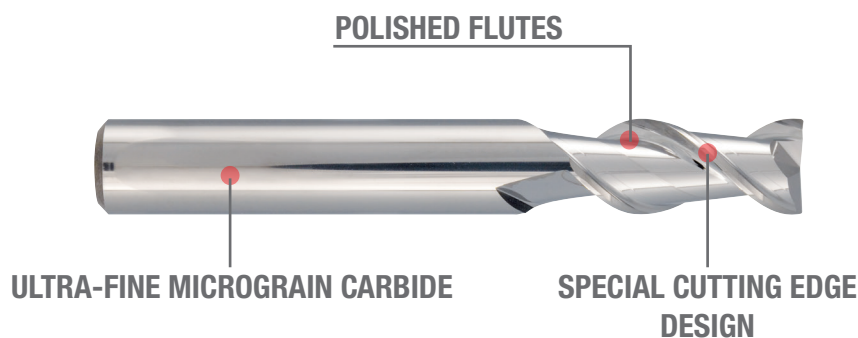
🇮🇹 Micrograna non rivestita e geometria di taglio sviluppata specificamente per la lavorazione di materiali non-ferrosi. Taglienti lappati e particolare profilo del vano truciolo per bassi sforzi di taglio e un'eccellente finitura superficiale. Disponibile anche la versione HF Alu con passo differenziato (UP) con un particolare design che permette finiture a specchio e lavorazioni DxD, anche nella versione a 4 taglienti.

🇩🇪 Unbeschichtete Mikrokörnung und eigens für die Bearbeitung von NE-Metallen entwickelte Schnittgeometrie. Dank der geläpften Schneiden und der besonderen Form der Nuten ist die aufzubringende Schnittkraft gering, bei gleichzeitig ausgezeichnetem Oberflächenfinish. Auch in der Version HF Alu mit ungleicher Teilung (UP) und besonderer Form erhältlich, die auch in der Version mit 4 Schneiden ein spiegelblankes Oberflächenfinish und DxD-Bearbeitungen ermöglicht.

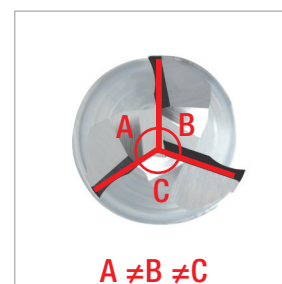
🇫🇷 Micrograin non revêtu et géométrie de coupe développée spécifiquement pour l'usinage de matériaux non ferreux. Arêtes de coupe polies et profil particulier de la goujure pour de faibles efforts de coupe et une excellente finition superficielle. Également disponible la version HF Alu à pas décalé(UP), avec un design particulier qui permet des finitions glacées et des usinages DxD, aussi dans la version à 4 arêtes de coupe.

ALU

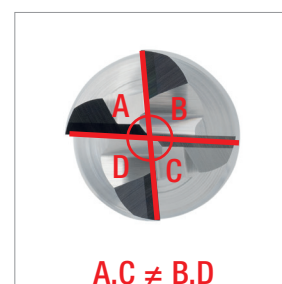
Features of ALU end mills



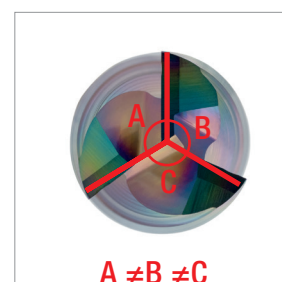
3FL - unequal pitch design



4FL - unequal pitch design



3FL - unequal pitch design with innovative DLC coating

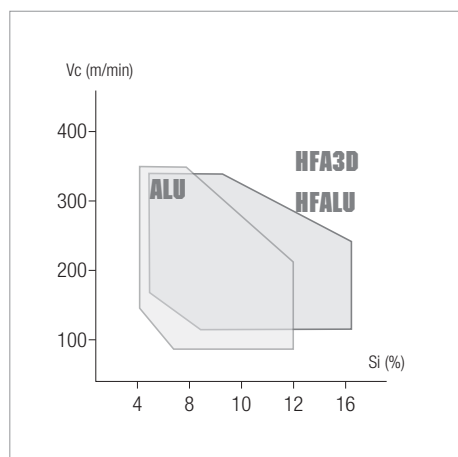


ALU

Features and Benefits

- Mirror finishing surface thanks to the special cutting edge design
 - Polished flutes for smoother chip ejection
 - High wear resistance and longer durability thanks to the ultra micrograin carbide composition
 - HF ALU 3-flutes and 4-flutes with Unequal Pitch(UP) design allow large Ae x Ap while minimizing vibrations
 - New DLC coating allows higher cutting speed and lower cutting force
- Hochglanzoberfläche dank spezieller Schneidkantenkonstruktion
 - Polierte Nuten für bessere Spanabfuhr
 - Mikrokörniges Hartmetall für hohe Verschleißfestigkeit
 - HF ALU mit 3 und 4 Schneiden ermöglichen dank dem ungleichen Winkel (UP) eine drastische Reduzierung der Vibrationen und hohe Ae x Ap
 - Die neue DLC-Beschichtung ermöglicht eine geringere Schneidkraft und höhere Geschwindigkeit
- Finitura a specchio grazie allo speciale design del tagliente
 - Scanalature lappate per una migliore espulsione del truciolo
 - Metallo duro micrograna per garantire elevata resistenza all'usura
 - Le HF ALU a 3 e 4 taglienti grazie al passo differenziato (UP) che riduce drasticamente le vibrazioni, consentono elevati Ae x Ap
 - Il nuovo rivestimento DLC permette la riduzione dello sforzo di taglio e l'aumento della velocità
- Finition miroir grâce à un design spécial du tranchant
 - Goujures rodées gage de meilleure expulsion du copeau
 - Carbure micro-grain pour assurer une haute résistance à l'usure
 - Les HF ALU à 3 et 4 tranchants, grâce au pas décalé (UP) qui réduit considérablement les vibrations, assurent de hautes valeurs de Ae x Ap
 - Le nouveau revêtement DLC permet de réduire l'effort de coupe et d'augmenter la vitesse

Cutting speed Vc range

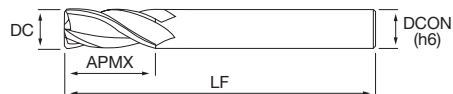


Use case

Tool Type	HFAL4
Workpiece	W.-Nr 3.3523 AlMg2.5(ASTM 5052)
Parameters	Vc 375 m/min, fz 0,1 mm/t, ap 6 mm, ae 12 mm
Diameter	12 mm
Machining time:	
 OSAWA	+68%
Competitor A	
Competitor B	

HFAL4

- Cylindrical shank
- 4 flutes



P	M	K	N	S	H
			★		

OSAWA
NORM

HF
ALU

MG
BR

FHA 40°

SQUARE

ZEFP 4 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

DRILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.025	6	h6	9	57	4	HFAL4030	●
4	0/-0.025	6	h6	12	57	4	HFAL4040	●
5	0/-0.025	6	h6	13	57	4	HFAL4050	●
6	0/-0.025	6	h6	13	57	4	HFAL4060	●
8	0/-0.030	8	h6	20	64	4	HFAL4080	●
10	0/-0.030	10	h6	22	72	4	HFAL4100	●
12	0/-0.030	12	h6	26	83	4	HFAL4120	●
14	0/-0.030	14	h6	32	90	4	HFAL4140	●
16	0/-0.030	16	h6	32	92	4	HFAL4160	●
20	0/-0.030	20	h6	38	104	4	HFAL4200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HFAL4

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.030	0.025	0.021	0.033
	4	0.040	0.034	0.028	0.044
	5	0.050	0.042	0.035	0.054
	6	0.059	0.050	0.041	0.064
	8	0.077	0.066	0.054	0.085
	10	0.095	0.080	0.066	0.104
	12	0.108	0.092	0.076	0.119
	14	0.126	0.107	0.088	0.139
	16	0.144	0.122	0.101	0.158
	18	0.158	0.135	0.111	0.174
	20	0.176	0.149	0.123	0.19

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
	Vc (m/min)	300÷600	200÷500	200÷400	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.036	0.032	0.029	0.039
	4	0.048	0.043	0.038	0.052
	5	0.059	0.053	0.048	0.065
	6	0.070	0.063	0.056	0.077
	8	0.093	0.084	0.074	0.102
	10	0.113	0.102	0.091	0.125
	12	0.130	0.117	0.104	0.143
	14	0.151	0.136	0.121	0.166
	16	0.173	0.156	0.138	0.190
	18	0.190	0.171	0.152	0.209
	20	0.211	0.190	0.168	0.232

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	α° x ae	8° x 0.5D	5° x 0.5D	5° x 0.5D	8° x 0.5D
	Vc (m/min)	300÷600	200÷500	200÷400	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.021	0.018	0.015	0.023
	4	0.027	0.025	0.020	0.030
	5	0.034	0.031	0.025	0.038
	6	0.040	0.036	0.030	0.044
	8	0.054	0.048	0.039	0.059
	10	0.065	0.058	0.048	0.072
	12	0.075	0.067	0.055	0.082
	14	0.087	0.078	0.064	0.096
	16	0.100	0.089	0.073	0.110
	18	0.110	0.098	0.081	0.120
	20	0.121	0.109	0.089	0.133

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HFAL4

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	$\alpha^\circ \times ae$	15° x D	10° x D	7° x D	15° x D
	Vc (m/min)	300÷500	200÷400	200÷300	600÷10
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.020	0.017	0.015	0.022
	4	0.026	0.023	0.019	0.029
	5	0.033	0.029	0.024	0.036
	6	0.039	0.034	0.029	0.043
	8	0.051	0.045	0.038	0.057
	10	0.063	0.055	0.046	0.069
	12	0.072	0.062	0.053	0.079
	14	0.084	0.073	0.062	0.092
	16	0.096	0.083	0.071	0.105
	18	0.105	0.092	0.078	0.116
	20	0.117	0.101	0.086	0.128

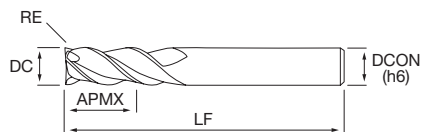
	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x 0.4D	D x 0.4D	D x 0.4D	D x 0.4D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.030	0.027	0.024	0.033
	4	0.040	0.036	0.032	0.044
	5	0.050	0.045	0.040	0.054
	6	0.059	0.053	0.047	0.064
	8	0.077	0.070	0.062	0.085
	10	0.095	0.085	0.076	0.104
	12	0.108	0.097	0.086	0.119
	14	0.126	0.113	0.101	0.139
	16	0.144	0.130	0.115	0.158
	18	0.158	0.143	0.127	0.174
	20	0.176	0.158	0.140	0.193

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.015	0.013	0.012	0.016
	4	0.020	0.018	0.016	0.022
	5	0.025	0.022	0.020	0.027
	6	0.029	0.026	0.023	0.032
	8	0.039	0.035	0.031	0.043
	10	0.047	0.043	0.038	0.052
	12	0.054	0.049	0.043	0.059
	14	0.063	0.057	0.050	0.069
	16	0.072	0.065	0.058	0.079
	18	0.079	0.071	0.063	0.087
	20	0.088	0.079	0.070	0.097

Parameters suggested with high power milling chuck and stable machining condition

HFAL3

- Cylindrical shank
- 3 flutes
- Corner radius
- Polished



P M K N S H

OSAWA
NORM

HF
ALU

MG
POLISHED

FHA 30°

RADIUS

ZEFP 3 UP

SLOTING

SIDE MILLING

HELICAL

RAMPING

VERTICAL

DRILLING

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.015	0.1	0/-0.010	6	h6	3	50	3	HFAL301010030	●
1	0/-0.015	0.1	0/-0.010	6	h6	5	50	3	HFAL301010050	●
1.5	0/-0.015	0.1	0/-0.010	6	h6	4.5	50	3	HFAL301015045	●
1.5	0/-0.015	0.1	0/-0.010	6	h6	6	50	3	HFAL301015060	●
1.5	0/-0.015	0.1	0/-0.010	6	h6	8	50	3	HFAL301015080	●
2	0/-0.020	0.1	±0.020	6	h6	3	50	3	HFAL301020030	●
2	0/-0.020	0.1	±0.020	6	h6	5	50	3	HFAL301020050	●
2	0/-0.020	0.1	±0.020	6	h6	6.5	50	3	HFAL301020	●
2	0/-0.020	0.1	±0.020	6	h6	8	50	3	HFAL301020080	●
2	0/-0.020	0.1	±0.020	6	h6	10	50	3	HFAL301020100	●
3	0/-0.020	0.1	±0.020	6	h6	6	50	3	HFAL301030060	●
3	0/-0.020	0.1	±0.020	6	h6	9	50	3	HFAL301030	●
3	0/-0.020	0.1	±0.020	6	h6	12	50	3	HFAL301030120	●
4	0/-0.020	0.1	±0.020	6	h6	12	50	3	HFAL301040	●
5	0/-0.020	0.1	±0.020	6	h6	15	50	3	HFAL301050	●
6	0/-0.020	0.1	±0.020	6	h6	20	60	3	HFAL301060	●
8	0/-0.020	0.1	±0.020	8	h6	20	64	3	HFAL301080	●
10	0/-0.020	0.1	±0.020	10	h6	22	75	3	HFAL301100	●
12	0/-0.020	0.1	±0.020	12	h6	25	75	3	HFAL301120	●
14	0/-0.020	0.1	±0.020	14	h6	32	90	3	HFAL301140	●
16	0/-0.020	0.1	±0.020	16	h6	32	90	3	HFAL301160	●
20	0/-0.020	0.1	±0.020	20	h6	38	100	3	HFAL301200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HFAL3

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.011	0.009	0.008	0.012
	2	0.022	0.019	0.015	0.024
	3	0.033	0.028	0.023	0.036
	4	0.044	0.037	0.031	0.048
	5	0.055	0.047	0.039	0.061
	6	0.065	0.055	0.046	0.072
	8	0.086	0.073	0.060	0.095
	10	0.105	0.089	0.074	0.116
	12	0.120	0.102	0.084	0.132
	14	0.140	0.119	0.098	0.154
	16	0.160	0.136	0.112	0.176
	18	0.176	0.150	0.123	0.194
	20	0.195	0.166	0.137	0.215

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
	Vc (m/min)	300÷600	200÷500	200÷400	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.013	0.012	0.011	0.015
	2	0.026	0.024	0.021	0.029
	3	0.040	0.036	0.032	0.044
	4	0.053	0.048	0.042	0.058
	5	0.066	0.059	0.053	0.073
	6	0.078	0.070	0.062	0.086
	8	0.103	0.093	0.083	0.114
	10	0.126	0.113	0.101	0.139
	12	0.144	0.130	0.115	0.158
	14	0.168	0.151	0.134	0.185
	16	0.192	0.173	0.154	0.211
	18	0.211	0.190	0.169	0.232
	20	0.234	0.211	0.187	0.257

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	α° x ae	8° x 0.5D	5° x 0.5D	5° x 0.5D	8° x 0.5D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.008	0.007	0.006	0.008
	2	0.015	0.014	0.011	0.017
	3	0.023	0.020	0.017	0.025
	4	0.030	0.027	0.022	0.033
	5	0.038	0.034	0.028	0.042
	6	0.045	0.040	0.033	0.049
	8	0.059	0.053	0.044	0.065
	10	0.073	0.065	0.054	0.080
	12	0.083	0.074	0.061	0.091
	14	0.097	0.087	0.071	0.106
	16	0.111	0.099	0.082	0.122
	18	0.122	0.109	0.090	0.134
	20	0.135	0.121	0.099	0.148

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HFAL3

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	$\alpha^\circ \times ae$	15° x D	10° x D	7° x D	15° x D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.007	0.006	0.005	0.008
	2	0.015	0.013	0.011	0.016
	3	0.022	0.019	0.016	0.024
	4	0.029	0.025	0.022	0.032
	5	0.037	0.032	0.027	0.040
	6	0.043	0.038	0.032	0.048
	8	0.057	0.050	0.042	0.063
	10	0.070	0.061	0.051	0.077
	12	0.080	0.069	0.059	0.088
	14	0.093	0.081	0.069	0.102
	16	0.106	0.092	0.078	0.117
	18	0.117	0.102	0.086	0.129
	20	0.130	0.113	0.096	0.143

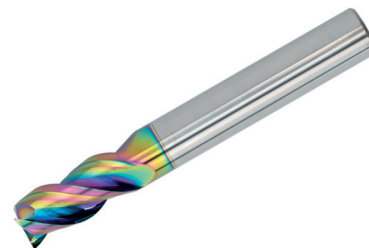
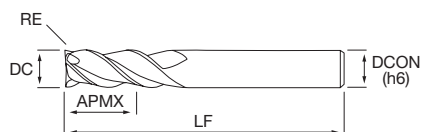
	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x 0.4D	D x 0.4D	D x 0.4D	D x 0.4D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.011	0.010	0.009	0.012
	4	0.022	0.020	0.018	0.024
	3	0.033	0.030	0.026	0.036
	4	0.044	0.040	0.035	0.048
	5	0.055	0.050	0.044	0.061
	6	0.065	0.059	0.052	0.072
	8	0.086	0.077	0.069	0.095
	10	0.105	0.095	0.084	0.116
	12	0.120	0.108	0.096	0.132
	14	0.140	0.126	0.112	0.154
	16	0.160	0.144	0.128	0.176
	18	0.176	0.158	0.141	0.194
	20	0.195	0.176	0.156	0.215

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	270÷370	190÷290	150÷250	500÷700
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.011	0.010	0.009	0.012
	4	0.022	0.020	0.018	0.024
	3	0.017	0.015	0.013	0.018
	4	0.022	0.020	0.018	0.024
	5	0.028	0.025	0.022	0.030
	6	0.033	0.029	0.026	0.036
	8	0.043	0.039	0.034	0.047
	10	0.053	0.047	0.042	0.058
	12	0.060	0.054	0.048	0.066
	14	0.070	0.063	0.056	0.077
	16	0.080	0.072	0.064	0.088
	18	0.088	0.079	0.070	0.097
	20	0.098	0.088	0.078	0.107

Parameters suggested with high power milling chuck and stable machining condition

HFA3D

- Cylindrical shank
- 3 flutes
- Corner radius



DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	0.1	±0.020	6	h6	3	50	3	HFA3D01010030	●
1	0/-0.020	0.1	±0.020	6	h6	5	50	3	HFA3D01010050	●
1.5	0/-0.020	0.1	±0.020	6	h6	4.5	50	3	HFA3D01015045	●
1.5	0/-0.020	0.1	±0.020	6	h6	8	50	3	HFA3D01015080	●
1.5	0/-0.020	0.1	±0.020	6	h6	6	50	3	HFA3D01015060	●
2	0/-0.020	0.1	±0.020	6	h6	5	50	3	HFA3D01020050	●
2	0/-0.020	0.1	±0.020	6	h6	6.5	50	3	HFA3D01020065	●
2	0/-0.020	0.1	±0.020	6	h6	8	50	3	HFA3D01020080	●
3	0/-0.020	0.1	±0.020	6	h6	6	50	3	HFA3D01030060	●
3	0/-0.020	0.1	±0.020	6	h6	9	50	3	HFA3D01030090	●
3	0/-0.020	0.1	±0.020	6	h6	12	50	3	HFA3D01030120	●
4	0/-0.020	0.1	±0.020	6	h6	12	50	3	HFA3D01040120	●
5	0/-0.020	0.1	±0.020	6	h6	15	60	3	HFA3D01050150	●
6	0/-0.020	0.1	±0.020	6	h6	20	60	3	HFA3D01060	●
8	0/-0.020	0.1	±0.020	8	h6	20	64	3	HFA3D01080	●
10	0/-0.020	0.1	±0.020	10	h6	22	75	3	HFA3D01100	●
12	0/-0.020	0.1	±0.020	12	h6	25	75	3	HFA3D01120	●
16	0/-0.020	0.1	±0.020	16	h6	32	90	3	HFA3D01160	●
20	0/-0.020	0.1	±0.020	20	h6	38	100	3	HFA3D01200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HFA3D

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x D	D x D	D x D	D x D
	Vc (m/min)	350÷600	250÷480	180÷400	700÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.011	0.009	0.008	0.012
	2	0.022	0.019	0.015	0.024
	3	0.033	0.028	0.023	0.036
	4	0.044	0.037	0.031	0.048
	5	0.055	0.047	0.039	0.061
	6	0.065	0.055	0.046	0.072
	8	0.086	0.073	0.060	0.095
	10	0.105	0.089	0.074	0.116
	12	0.120	0.102	0.084	0.132
	16	0.160	0.136	0.112	0.176
	20	0.195	0.166	0.137	0.215

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
	Vc (m/min)	300÷600	200÷500	200÷400	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.013	0.012	0.011	0.015
	2	0.026	0.024	0.021	0.029
	3	0.040	0.036	0.032	0.044
	4	0.053	0.048	0.042	0.058
	5	0.066	0.059	0.053	0.073
	6	0.078	0.070	0.062	0.086
	8	0.103	0.093	0.083	0.114
	10	0.126	0.113	0.101	0.139
	12	0.144	0.130	0.115	0.158
	16	0.192	0.173	0.154	0.211
	20	0.234	0.211	0.187	0.257

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	α° x ae	8° x 0.5D	5° x 0.5D	5° x 0.5D	8° x 0.5D
	Vc (m/min)	350÷600	250÷480	180÷400	700÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.007	0.006	0.005	0.008
	2	0.015	0.013	0.011	0.016
	3	0.022	0.019	0.016	0.024
	4	0.029	0.025	0.022	0.032
	5	0.037	0.032	0.027	0.040
	6	0.043	0.038	0.032	0.048
	8	0.057	0.050	0.042	0.063
	10	0.070	0.061	0.051	0.077
	12	0.083	0.074	0.061	0.091
	16	0.111	0.099	0.082	0.122
	20	0.135	0.121	0.099	0.148

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

HFA3D

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	$\alpha^\circ \times ae$	15° x D	10° x D	7° x D	15° x D
	Vc (m/min)	350÷600	250÷480	180÷400	700÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.011	0.010	0.009	0.012
	2	0.022	0.020	0.018	0.024
	3	0.033	0.030	0.026	0.036
	4	0.044	0.040	0.035	0.048
	5	0.055	0.050	0.044	0.061
	6	0.065	0.059	0.052	0.072
	8	0.086	0.077	0.069	0.095
	10	0.105	0.095	0.084	0.116
	12	0.080	0.069	0.059	0.088
	16	0.106	0.092	0.078	0.117
	20	0.130	0.113	0.096	0.143

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x 0.4D	D x 0.4D	D x 0.4D	D x 0.4D
	Vc (m/min)	350÷600	250÷480	180÷400	700÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.011	0.010	0.009	0.012
	2	0.022	0.020	0.018	0.024
	3	0.033	0.030	0.026	0.036
	4	0.044	0.040	0.035	0.048
	5	0.055	0.050	0.044	0.061
	6	0.065	0.059	0.052	0.072
	8	0.086	0.077	0.069	0.095
	10	0.105	0.095	0.084	0.116
	12	0.120	0.108	0.096	0.132
	16	0.160	0.144	0.128	0.176
	20	0.195	0.176	0.156	0.215

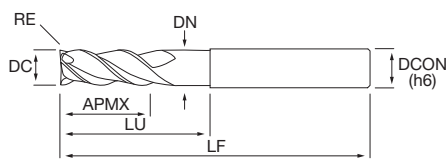
	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x D	D x D	0.5D x D	0.5D x D
	Vc (m/min)	300÷400	220÷350	180÷300	600÷800
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.006	0.005	0.004	0.006
	2	0.011	0.010	0.009	0.012
	3	0.017	0.015	0.013	0.018
	4	0.022	0.020	0.018	0.024
	5	0.028	0.025	0.022	0.030
	6	0.033	0.029	0.026	0.036
	8	0.043	0.039	0.034	0.047
	10	0.053	0.047	0.042	0.058
	12	0.060	0.054	0.048	0.066
	16	0.080	0.072	0.064	0.088
	20	0.098	0.088	0.078	0.107

Parameters suggested with high power milling chuck and stable machining condition

HFA53

- Cylindrical shank
- Reduced neck
- 3 edges
- Long reach
- Corner radius

P M K N S H



DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LU	DN	LF	ZEFP	EDP no.	Stock
3	0/-0.030	0.2	±0.010	6	h6	5	18	2.8	60	3	HFA5302030	●
3	0/-0.030	0.5	±0.010	6	h6	5	18	2.8	60	3	HFA5305030	●
4	0/-0.030	0.5	±0.010	6	h6	6	22	3.8	60	3	HFA5305040	●
4	0/-0.030	1	±0.010	6	h6	6	22	3.8	60	3	HFA5310040	●
5	0/-0.030	0.5	±0.010	6	h6	8	24	4.8	60	3	HFA5305050	●
5	0/-0.030	1	±0.010	6	h6	8	24	4.8	60	3	HFA5310050	●
6	0/-0.030	0.5	±0.010	6	h6	9	29	5.8	65	3	HFA5305060	●
6	0/-0.030	1	±0.010	6	h6	9	29	5.8	65	3	HFA5310060	●
6	0/-0.030	2	±0.010	6	h6	9	29	5.8	65	3	HFA5320060	●
8	0/-0.030	0.5	±0.010	8	h6	12	39	7.8	75	3	HFA5305080	●
8	0/-0.030	1	±0.010	8	h6	12	39	7.8	75	3	HFA5310080	●
8	0/-0.030	2	±0.010	8	h6	12	39	7.8	75	3	HFA5320080	●
8	0/-0.030	3	±0.010	8	h6	12	39	7.8	75	3	HFA5330080	●
10	0/-0.030	0.5	±0.010	10	h6	15	52	9.8	100	3	HFA5305100	●
10	0/-0.030	1	±0.010	10	h6	15	52	9.8	100	3	HFA5310100	●
10	0/-0.030	2	±0.010	10	h6	15	52	9.8	100	3	HFA5320100	●
10	0/-0.030	3	±0.010	10	h6	15	52	9.8	100	3	HFA5330100	●
10	0/-0.030	4	±0.010	10	h6	15	52	9.8	100	3	HFA5340100	●
12	0/-0.030	0.5	±0.010	12	h6	18	62	11.8	120	3	HFA5305120	●
12	0/-0.030	1	±0.010	12	h6	18	62	11.8	120	3	HFA5310120	●
12	0/-0.030	2	±0.010	12	h6	18	62	11.8	120	3	HFA5320120	●
12	0/-0.030	3	±0.010	12	h6	18	62	11.8	120	3	HFA5330120	●
12	0/-0.030	4	±0.010	12	h6	18	62	11.8	120	3	HFA5340120	●
16	0/-0.030	0.5	±0.010	16	h6	24	82	15.7	130	3	HFA5305160	●
16	0/-0.030	1	±0.010	16	h6	24	82	15.7	130	3	HFA5310160	●
16	0/-0.030	2	±0.010	16	h6	24	82	15.7	130	3	HFA5320160	●
16	0/-0.030	3	±0.010	16	h6	24	82	15.7	130	3	HFA5330160	●
16	0/-0.030	4	±0.010	16	h6	24	82	15.7	130	3	HFA5340160	●
20	0/-0.030	0.5	±0.010	20	h6	30	100	19.7	150	3	HFA5305200	●
20	0/-0.030	1	±0.010	20	h6	30	100	19.7	150	3	HFA5310200	●
20	0/-0.030	2	±0.010	20	h6	30	100	19.7	150	3	HFA5320200	●
20	0/-0.030	3	±0.010	20	h6	30	100	19.7	150	3	HFA5330200	●
20	0/-0.030	4	±0.010	20	h6	30	100	19.7	150	3	HFA5340200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

HFA53



Material Group ISO 513	N1	N2 N3	N4	N5
Hardness/Rm				
ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
Vc (m/min)	200÷500	150÷350	150÷250	500÷900
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.026	0.022	0.018	0.029
4	0.035	0.030	0.025	0.039
5	0.044	0.037	0.031	0.048
6	0.052	0.044	0.036	0.057
8	0.069	0.058	0.048	0.076
10	0.084	0.071	0.059	0.092
12	0.096	0.082	0.067	0.106
14	0.112	0.095	0.078	0.123
16	0.128	0.109	0.090	0.141
18	0.141	0.120	0.099	0.155
20	0.156	0.133	0.109	0.172



Material Group ISO 513	N1	N2 N3	N4	N5
Hardness/Rm				
ap x ae	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D	1.5D x 0.5D
Vc (m/min)	300÷500	200÷400	150÷350	600÷900
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.032	0.029	0.025	0.035
4	0.042	0.038	0.034	0.046
5	0.053	0.048	0.042	0.058
6	0.062	0.056	0.050	0.069
8	0.083	0.074	0.066	0.091
10	0.101	0.091	0.081	0.111
12	0.115	0.104	0.092	0.127
14	0.134	0.121	0.108	0.148
16	0.154	0.138	0.123	0.169
18	0.169	0.152	0.135	0.186
20	0.187	0.168	0.150	0.206



Material Group ISO 513	N1	N2 N3	N4	N5
Hardness/Rm				
α° x ae	8° x 0.5D	5° x 0.5D	5° x 0.5D	8° x 0.5D
Vc (m/min)	200÷500	150÷350	200÷400	500÷900
DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
3	0.018	0.016	0.013	0.020
4	0.024	0.022	0.018	0.027
5	0.030	0.027	0.022	0.033
6	0.036	0.032	0.027	0.040
8	0.048	0.043	0.035	0.052
10	0.058	0.052	0.043	0.064
12	0.066	0.059	0.049	0.073
14	0.077	0.069	0.057	0.085
16	0.088	0.079	0.065	0.097
18	0.097	0.087	0.072	0.107
20	0.108	0.097	0.080	0.119

Parameters suggested with high power milling chuck and stable machining condition

Cutting Parameters

HFA53

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	$\alpha^\circ \times ae$	15° x D	10° x D	7° x D	15° x D
	Vc (m/min)	200÷500	150÷350	200÷400	500÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.018	0.014	0.013	0.019
	4	0.023	0.018	0.017	0.026
	5	0.029	0.023	0.022	0.032
	6	0.035	0.027	0.025	0.038
	8	0.046	0.036	0.034	0.050
	10	0.056	0.044	0.041	0.061
	12	0.064	0.050	0.047	0.070
	14	0.074	0.058	0.055	0.082
	16	0.085	0.067	0.063	0.094
	18	0.094	0.073	0.069	0.103
	20	0.104	0.081	0.076	0.114

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x 0.4D	D x 0.4D	D x 0.4D	D x 0.4D
	Vc (m/min)	200÷500	150÷350	150÷250	500÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.026	0.024	0.021	0.029
	4	0.035	0.032	0.028	0.039
	5	0.044	0.040	0.035	0.048
	6	0.052	0.047	0.042	0.057
	8	0.069	0.062	0.055	0.076
	10	0.084	0.076	0.067	0.092
	12	0.096	0.086	0.077	0.106
	14	0.112	0.101	0.090	0.123
	16	0.128	0.115	0.102	0.141
	18	0.141	0.127	0.113	0.155
	20	0.156	0.140	0.125	0.172

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	230÷330	150÷250	110÷210	510÷610
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.013	0.012	0.011	0.015
	4	0.018	0.016	0.014	0.019
	5	0.022	0.020	0.018	0.024
	6	0.026	0.023	0.021	0.029
	8	0.034	0.031	0.028	0.038
	10	0.042	0.038	0.034	0.046
	12	0.048	0.043	0.038	0.053
	14	0.056	0.050	0.045	0.062
	16	0.064	0.058	0.051	0.070
	18	0.070	0.063	0.056	0.077
	20	0.078	0.070	0.062	0.086

Parameters suggested with high power milling chuck and stable machining condition

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

MDCSA1

- Cylindrical shank
- 1 flute
- Polished



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
2	0/-0.015	2	h6	10	40	1	MDCSA1020	●
3	0/-0.020	3	h6	12	40	1	MDCSA1030	●
4	0/-0.020	4	h6	15	50	1	MDCSA1040	●
5	0/-0.020	5	h6	16	50	1	MDCSA1050	●
6	0/-0.020	6	h6	20	60	1	MDCSA1060	●
8	0/-0.020	8	h6	22	63	1	MDCSA1080	●
10	0/-0.020	10	h6	25	72	1	MDCSA1100	●
12	0/-0.020	12	h6	30	83	1	MDCSA1120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

MDCSA1

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	300÷500	200÷400	150÷350	400÷600
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.023	0.019	0.016	0.023
	3	0.030	0.026	0.021	0.030
	4	0.039	0.033	0.027	0.039
	5	0.049	0.041	0.034	0.049
	6	0.058	0.049	0.040	0.058
	8	0.079	0.067	0.055	0.079
	10	0.098	0.083	0.068	0.098
	12	0.116	0.099	0.081	0.116

< D3 ap x ae D x 0.25D

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x 0.5D	D x 0.5D	D x 0.5D	D x 0.5D
	Vc (m/min)	300÷600	200÷500	200÷400	400÷800
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.030	0.026	0.021	0.030
	3	0.040	0.034	0.028	0.040
	4	0.052	0.044	0.036	0.052
	5	0.065	0.055	0.046	0.065
	6	0.077	0.065	0.054	0.077
	8	0.105	0.089	0.074	0.105
	10	0.130	0.111	0.091	0.130
	12	0.155	0.132	0.109	0.155

< D3 ap x ae D x 0.25D

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x D	D x D	D x D	0.5D x D
	Vc (m/min)	300÷400	150÷350	100÷300	300÷500
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	2	0.011	0.010	0.008	0.011
	3	0.015	0.013	0.011	0.015
	4	0.020	0.017	0.014	0.020
	5	0.024	0.021	0.017	0.024
	6	0.029	0.025	0.020	0.029
	8	0.039	0.033	0.028	0.039
	10	0.049	0.041	0.034	0.049
	12	0.058	0.049	0.041	0.058

< D3 ap x ae 0.5D x D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

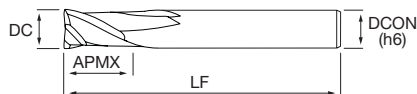
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

MDCSA2

- Cylindrical shank
- 2 flutes
- Polished



P	M	K	N	S	H
			★		



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.015	4	h6	3	40	2	MDCSA2010	●
1.5	0/-0.015	4	h6	4.5	40	2	MDCSA2015	●
2	0/-0.015	4	h6	6.5	40	2	MDCSA2020	●
2.5	0/-0.020	4	h6	6.5	40	2	MDCSA2025	●
3	0/-0.030	6	h6	8	57	2	MDCSA2030	●
4	0/-0.030	6	h6	11	57	2	MDCSA2040	●
5	0/-0.030	6	h6	13	57	2	MDCSA2050	●
6	0/-0.030	6	h6	13	57	2	MDCSA2060	●
8	0/-0.030	8	h6	19	63	2	MDCSA2080	●
10	0/-0.030	10	h6	22	72	2	MDCSA2100	●
12	0/-0.030	12	h6	26	83	2	MDCSA2120	●
14	0/-0.030	14	h6	26	83	2	MDCSA2140	●
16	0/-0.030	16	h6	32	92	2	MDCSA2160	●
18	0/-0.030	18	h6	32	92	2	MDCSA2180	●
20	0/-0.030	20	h6	38	104	2	MDCSA2200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

Cutting Parameters

MDCSA2

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	300÷600	150÷350	150÷250	500÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.011	0.010	0.008	0.011
	1.5	0.017	0.014	0.012	0.017
	2	0.022	0.019	0.016	0.022
	3	0.028	0.024	0.020	0.028
	4	0.038	0.032	0.026	0.038
	5	0.047	0.040	0.033	0.047
	6	0.056	0.048	0.039	0.056
	8	0.075	0.064	0.052	0.075
	10	0.094	0.080	0.066	0.094
	12	0.112	0.095	0.078	0.112
	14	0.130	0.111	0.091	0.130
	16	0.148	0.126	0.103	0.148
	18	0.166	0.141	0.116	0.166
	20	0.185	0.157	0.129	0.185

< D3 ap x ae 0.25D x D

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	D x 0.5D	D x 0.5D	D x 0.5D	D x 0.5D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.013	0.011	0.009	0.013
	1.5	0.020	0.017	0.014	0.020
	2	0.027	0.023	0.019	0.027
	3	0.034	0.029	0.024	0.034
	4	0.045	0.038	0.032	0.045
	5	0.056	0.048	0.040	0.056
	6	0.068	0.057	0.047	0.068
	8	0.090	0.076	0.063	0.090
	10	0.112	0.096	0.079	0.112
	12	0.134	0.114	0.094	0.134
	14	0.157	0.133	0.110	0.157
	16	0.177	0.151	0.124	0.177
	18	0.200	0.170	0.140	0.200
	20	0.222	0.188	0.155	0.222

< D3 ap x ae D x 0.25D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

MDCSA2

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	200÷400	150÷350	150÷350	500÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.006	0.005	0.004	0.006
	1.5	0.008	0.007	0.006	0.008
	2	0.011	0.010	0.008	0.011
	3	0.014	0.012	0.010	0.014
	4	0.019	0.016	0.013	0.019
	5	0.024	0.020	0.016	0.024
	6	0.028	0.024	0.020	0.028
	8	0.037	0.032	0.026	0.037
	10	0.047	0.040	0.033	0.047
	12	0.056	0.048	0.039	0.056
	14	0.065	0.055	0.046	0.065
	16	0.074	0.063	0.052	0.074
	18	0.083	0.071	0.058	0.083
	20	0.092	0.079	0.065	0.092

< D3 ap x ae 0.25D x D

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

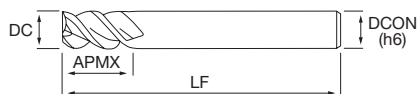
J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

MDCSA3

- Cylindrical shank
- 3 flutes
- Polished



P	M	K	N	S	H
			★		



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	4	h6	3	50	3	MDCSA3010	●
1.5	0/-0.020	4	h6	4.5	50	3	MDCSA3015	●
2	0/-0.020	4	h6	6	50	3	MDCSA3020	●
3	0/-0.020	4	h6	8	50	3	MDCSA3030	●
4	0/-0.020	4	h6	11	50	3	MDCSA3040	●
5	0/-0.020	6	h6	13	50	3	MDCSA3050	●
6	0/-0.020	6	h6	15	50	3	MDCSA3060	●
8	0/-0.025	8	h6	20	60	3	MDCSA3080	●
10	0/-0.025	10	h6	25	75	3	MDCSA3100	●
12	0/-0.025	12	h6	30	75	3	MDCSA3120	●
16	0/-0.030	16	h6	40	100	3	MDCSA3160	●
20	0/-0.030	20	h6	40	100	3	MDCSA3200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

MDCSA3

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	0.5D x D	0.5D x D	0.5D x D	0.5D x D
	Vc (m/min)	200÷600	150÷350	150÷250	500÷900
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.010	0.009	0.007	0.010
	1.5	0.015	0.013	0.011	0.015
	2	0.020	0.017	0.014	0.020
	3	0.025	0.022	0.018	0.025
	4	0.034	0.029	0.024	0.034
	5	0.042	0.036	0.030	0.042
	6	0.051	0.043	0.035	0.051
	8	0.067	0.057	0.047	0.067
	10	0.084	0.072	0.059	0.084
	12	0.101	0.086	0.071	0.101
	14	0.117	0.100	0.082	0.117
	16	0.133	0.113	0.093	0.133
	18	0.150	0.127	0.105	0.150
	20	0.166	0.141	0.116	0.166

< D3 ap x ae 0.25D x D

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D	1.5D x 0.3D
	Vc (m/min)	300÷500	200÷400	150÷350	600÷1000
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	1	0.012	0.010	0.008	0.012
	1.5	0.018	0.015	0.013	0.018
	2	0.024	0.021	0.017	0.024
	3	0.030	0.026	0.021	0.030
	4	0.041	0.034	0.028	0.041
	5	0.051	0.043	0.036	0.051
	6	0.061	0.052	0.043	0.061
	8	0.081	0.069	0.057	0.081
	10	0.101	0.086	0.071	0.101
	12	0.121	0.103	0.085	0.121
	14	0.141	0.120	0.099	0.141
	16	0.160	0.136	0.112	0.160
	18	0.180	0.153	0.126	0.180
	20	0.200	0.170	0.140	0.200

< D3 ap x ae D x 0.1D

MDA310

- Cylindrical shank
- 3 flutes polished
- Long



P	M	K	N	S	H
			★		



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.030	6	h6	12	75	3	MDA310030	●
4	0/-0.030	6	h6	16	75	3	MDA310040	●
5	0/-0.030	6	h6	20	75	3	MDA310050	●
6	0/-0.030	6	h6	25	75	3	MDA310060	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

MDA310

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	0.3D x D	0.3D x D	0.3D x D	0.3D x D
	Vc (m/min)	220÷340	150÷250	100÷200	400÷700
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.023	0.019	0.016	0.023
	4	0.030	0.026	0.021	0.030
	5	0.038	0.032	0.027	0.038
	6	0.046	0.039	0.032	0.046

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D	1.5D x 0.1D
	Vc (m/min)	270÷370	200÷300	150÷250	500÷800
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.027	0.023	0.019	0.027
	4	0.036	0.031	0.026	0.036
	5	0.046	0.039	0.032	0.046
	6	0.055	0.047	0.038	0.055

MDA311

- Cylindrical shank
- 3 flutes polished
- Long

P M K N S H


OSAWA
NORM
ALU
MG
POLISHED
FHA 55°
SQUARE
ZEFP 3
SLOTING
SIDE MILLING

DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
3	0/-0.030	6	h6	15	100	3	MDA311030	●
4	0/-0.030	6	h6	20	100	3	MDA311040	●
5	0/-0.030	6	h6	25	100	3	MDA311050	●
6	0/-0.030	6	h6	30	100	3	MDA311060	●
8	0/-0.035	8	h6	35	100	3	MDA311080	●
10	0/-0.035	10	h6	40	100	3	MDA311100	●
12	0/-0.035	12	h6	45	100	3	MDA311120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

MDA311

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	0.3D x D	0.3D x D	0.3D x D	0.3D x D
	Vc (m/min)	180÷280	110÷210	100÷160	350÷550
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.019	0.016	0.013	0.019
	4	0.025	0.022	0.018	0.025
	5	0.032	0.027	0.022	0.032
	6	0.038	0.032	0.027	0.038
	8	0.051	0.043	0.035	0.051
	10	0.063	0.054	0.044	0.063
	12	0.076	0.064	0.053	0.076

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	2D x0.05D	2D x0.05D	2D x0.05D	2D x0.05D
	Vc (m/min)	210÷310	150÷250	110÷210	420÷620
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	3	0.023	0.019	0.016	0.023
	4	0.030	0.026	0.021	0.030
	5	0.038	0.032	0.027	0.038
	6	0.046	0.039	0.032	0.046
	8	0.061	0.052	0.042	0.061
	10	0.076	0.064	0.053	0.076
	12	0.091	0.077	0.064	0.091

MDA312

- Cylindrical shank
- 3 flutes polished
- Long



P	M	K	N	S	H
			★		



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
8	0/-0.035	8	h6	40	150	3	MDA312080	●
10	0/-0.035	10	h6	50	150	3	MDA312100	●
12	0/-0.035	12	h6	50	150	3	MDA312120	●
16	0/-0.040	16	h6	70	150	3	MDA312160	●
20	0/-0.040	20	h6	80	150	3	MDA312200	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

MDA312

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	0.1D x D	0.1D x D	0.1D x D	0.1D x D
	Vc (m/min)	130÷230	100÷160	80÷120	250÷450
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.040	0.034	0.028	0.040
	10	0.051	0.043	0.035	0.051
	12	0.060	0.051	0.042	0.060
	16	0.080	0.068	0.056	0.080
	20	0.100	0.085	0.070	0.100

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	2.5D x 0.05D	2.5D x 0.05D	2.5D x 0.05D	2.5D x 0.05D
	Vc (m/min)	150÷250	100÷200	100÷160	300÷500
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	8	0.048	0.041	0.034	0.048
	10	0.061	0.052	0.042	0.061
	12	0.073	0.062	0.051	0.073
	16	0.096	0.081	0.067	0.096
	20	0.120	0.102	0.084	0.120

MDCSAM

- Cylindrical shank
- 6F
- Polished



P	M	K	N	S	H
			★		



DC	DC tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
6	0/-0.020	6	h6	15	57	6	MDCSAM060	●
8	0/-0.020	8	h6	20	64	6	MDCSAM080	●
10	0/-0.020	10	h6	22	75	6	MDCSAM100	●
12	0/-0.020	12	h6	25	75	6	MDCSAM120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

MDCSAM

	Material Group ISO 513	N1	N2 N3	N4	N5
	Hardness/Rm				
	ap x ae	1.5D x 0.05D	1.5D x 0.05D	1.5D x 0.05D	1.5D x 0.05D
	Vc (m/min)	600÷1000	400÷800	300÷700	900÷1300
	DC (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
	6	0.050	0.043	0.035	0.050
	8	0.067	0.057	0.047	0.067
	10	0.084	0.071	0.059	0.084
	12	0.100	0.085	0.070	0.100

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

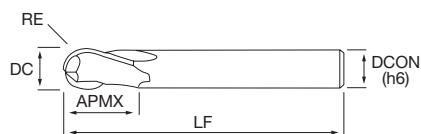
K - HSS END MILLS

L - CARBIDE BURRS

MDCAB2

- Cylindrical shank
- 2 flutes ball nose
- Polished

P M K N S H


OSAWA
NORM

ALU
MG
POLISHED

FHA 40°
BALL NOSE
ZEFP 2 BALL
COPYING

DC	DC tol.	RE	RE tol.	DCON	TCDCON	APMX	LF	ZEFP	EDP no.	Stock
1	0/-0.020	0.5	±0.010	4	h6	2	50	2	MDCAB2010	●
1.5	0/-0.020	0.75	±0.010	4	h6	3	50	2	MDCAB2015	●
2	0/-0.020	1	±0.010	4	h6	4	50	2	MDCAB2020	●
3	0/-0.020	1.5	±0.010	4	h6	6	50	2	MDCAB2030	●
4	0/-0.020	2	±0.010	4	h6	8	50	2	MDCAB2040	●
5	0/-0.020	2.5	±0.010	6	h6	10	50	2	MDCAB2050	●
6	0/-0.020	3	±0.010	6	h6	12	50	2	MDCAB2060	●
8	0/-0.025	4	±0.010	8	h6	16	60	2	MDCAB2080	●
10	0/-0.025	5	±0.010	10	h6	20	75	2	MDCAB2100	●
12	0/-0.025	6	±0.010	12	h6	24	75	2	MDCAB2120	●

★ 1st choice, ☆ suitable, ● stock standard, ◎ non-stock standard (no MOQ), ○ non-stock standard (MOQ), ▲ upcoming product, ▽ stock exhaustion

SOLID

H - CARBIDE DRILLS

I - HSS DRILLS

J - CARBIDE END MILLS

K - HSS END MILLS

L - CARBIDE BURRS

Cutting Parameters

MDCAB2

Material Group ISO 513		N1	N2 N3	N4	N5
Hardness/Rm					
ap x ae		0.2D x 0.4D	0.2D x 0.4D	0.2D x 0.4D	0.2D x 0.4D
Vc (m/min)		200÷600	250÷450	200÷400	600÷1000
DC (mm)	DC (eff.) (mm)	fz (mm/z)	fz (mm/z)	fz (mm/z)	fz (mm/z)
1	0.80	0.013	0.011	0.010	0.013
1.5	1.20	0.017	0.015	0.013	0.017
2	1.60	0.017	0.015	0.013	0.017
2.5	2.00	0.021	0.019	0.017	0.021
3	2.40	0.025	0.023	0.020	0.025
4	3.20	0.035	0.032	0.028	0.035
5	4.00	0.045	0.040	0.036	0.045
6	4.80	0.053	0.048	0.043	0.053
8	6.40	0.067	0.060	0.054	0.067
10	8.00	0.080	0.072	0.064	0.080
12	9.60	0.094	0.084	0.075	0.094





MEX AND MH

STEEL AND HARDENED STEEL

30÷55 HRC (MEX) AND 30÷70 HRC (MH)

🇬🇧 MEX: Ultra-fine micrograin and Endless Orange coating for high performance machining on 30÷55 HRC materials.

MH: Wide range of tools available for general milling, copying and super finishing (30÷70 HRC).

🇮🇹 MEX: Micrograna ultrafine e rivestimento Endless Orange per lavorazione ad alto rendimento di materiali con durezza compresa tra 30÷55 HRC.
MH: Ampia gamma per soddisfare applicazioni di copiatura e super finitura (30÷70 HRC).

🇩🇪 MEX: Besonders feine Mikrokörnung und Beschichtung Endless Orange für Hochleistungsbearbeitungen von Materialien mit einer Härte zwischen 30 und 55 HRC.
MH: Große Produktpalette für Anwendungen zum Fräsen im Allgemeinen, Kopierfräsen und Schlichtbearbeitung (30÷70 HRC).

🇫🇷 MEX: Ultra Micrograin et revêtement Endless Orange pour un usinage à rendement élevé de matériaux ayant une dureté comprise entre 30÷55 HRC.

MH: Une large gamme pour satisfaire les applications de fraisage général, copiage et super finition (30÷70 HRC).