

EPSM-CR-PN /-W-PN

Epoch Multi Series

Micro Grain Solid Carbide End Mill

D1mm ~ D20mm

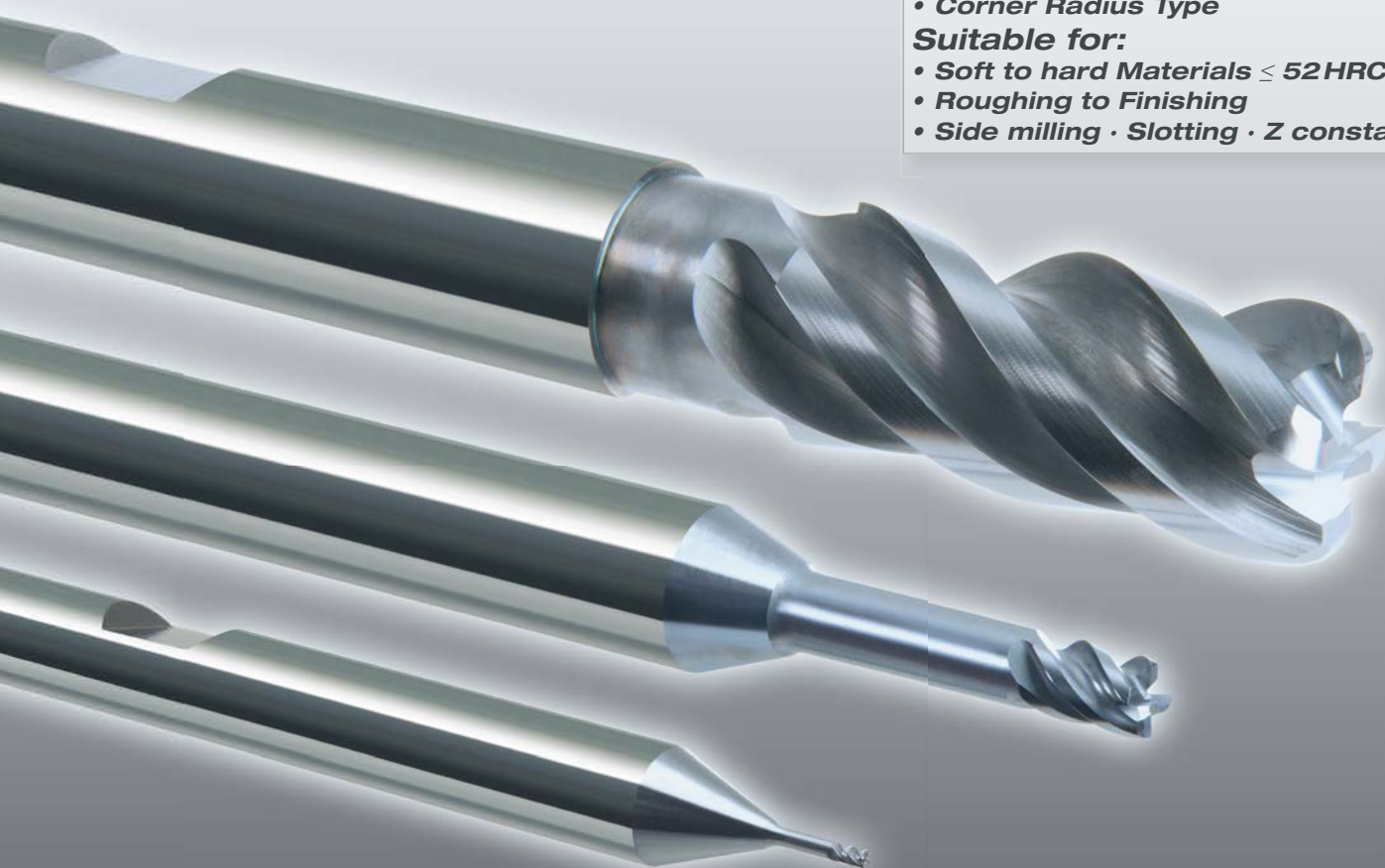
• Corner Radius Type

Suitable for:

• Soft to hard Materials $\leq 52\text{HRC}$

• Roughing to Finishing

• Side milling • Slotting • Z constant

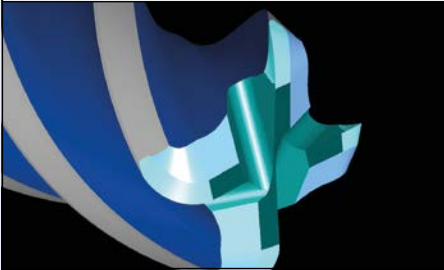


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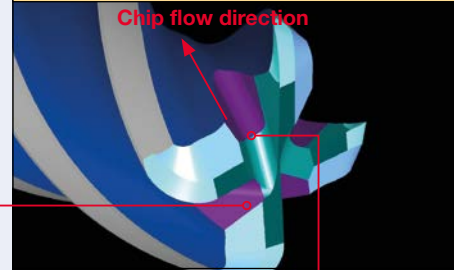
EPSM-CR-PN | Epoch Multi Series Corner Radius

Double Gash achieves perfect balance with rigidity and chip evacuation. It guarantees high performance in vertical and horizontal milling.

Conventional single gash type



EPSM-CR double gash



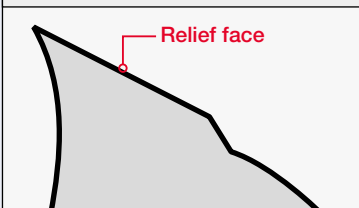
1st gash for high rigidity

2nd gash for stable chip evacuation

Double relief face avoids chipping even in aggressive cutting parameter

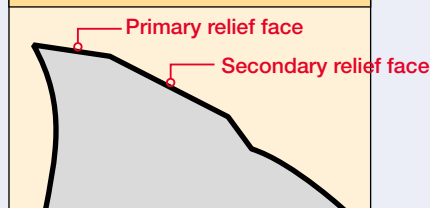
Strengthens cutting edge and avoids excessive contact between cutter and workpiece.
For higher efficiency and longer tool life

Conventional relief face



Cutting edge cross section

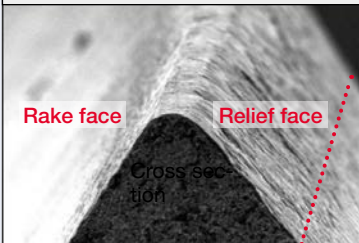
EPSM-CR double relief face



Cutting edge cross section

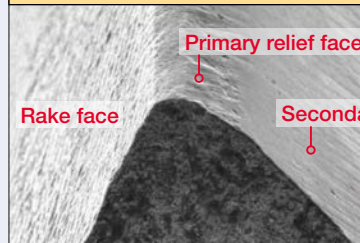
Cutting edge picture after steel cutting

Conventional relief face



Flank wear extended to the dotted line

EPSM-CR double relief face



Wear is restricted by first eccentric relief face

Rubbing only primary relief face

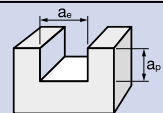
Optimized unequal pitch: Dramatically suppressing vibration by irregular frequency

For longer tool life and better surface quality, especially in thin wall machining

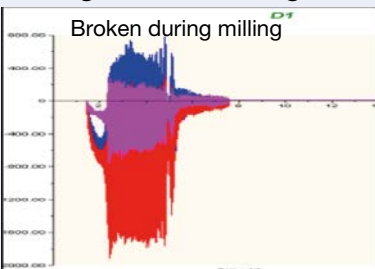
Testing tool size: D = 8 mm, Workpiece material: 1.4301

n = 2,100 min⁻¹, Feed rate V_f = 230 mm/min, a_p = 6.4 mm, a_e = 8 mm, Machine: Makino V33 (HSK63A)

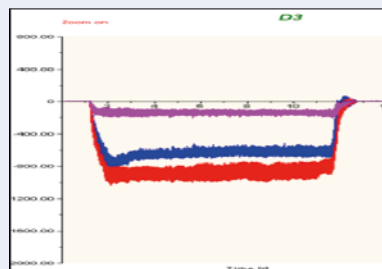
OH = 24 mm, Coolant: Wet, Work size: 100 × 50 × 50 mm



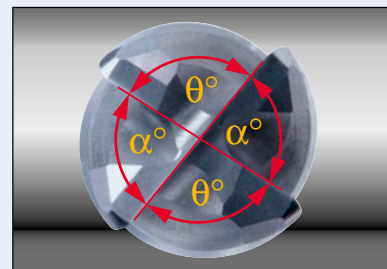
Cutting force in slotting



Conventional Equal pitch

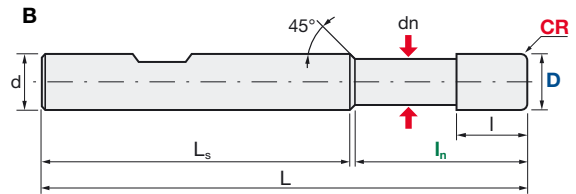
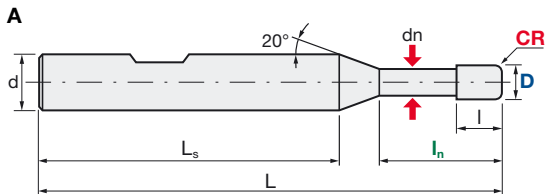
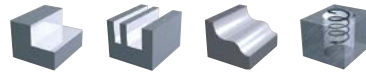


EPSM Unequal pitch



EPSM-CR-PN | Epoch Multi Series Corner Radius

V max High Speed	Q max High Efficient				HRC 55	No. of Teeth 4
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Type B: D16 and D20 without 45° phase at neck end

Carbide Micro Grain	PN PaNacea Coating	Rake Angle Positive
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Helix Angle	D Tol. [mm]	d Tol.
40°	D1~D6: 0/-0.015 D8~D20: 0/-0.02	D1~D12: h5 D16~D20: h6

EPSM Corner R (underneck 3xD) Weldon											
ID Code	Item Code	Z	D	CR	I _n	I	dn	L	L _s	d	Type
EP1563	EPSM-4010-3-R0.1-W-PN	4	1	0.1	3	2.2	0.96	56	46.08	6	A
EP1566	EPSM-4020-6-R0.2-W-PN		2	0.2	6	4.4	1.92		44.40		
EP1568	EPSM-4030-9-R0.2-W-PN		3		9	6.6	2.88		42.71		
EP1569	EPSM-4040-12-R0.5-W-PN		4	12	8.8	3.70	40.84				
EP1571	EPSM-4050-15-R0.5-W-PN		5	0.5	15	11.0	4.60		39.08		
EP1573	EPSM-4060-18-R0.5-W-PN		6		18	13.2	5.50	63	37.75		
EP1574	EPSM-4060-18-R1.0-W-PN			1							
EP1575	EPSM-4060-18-R1.5-W-PN		8	1.5	24	17.6	7.30	63	38.65	8	
EP1577	EPSM-4080-24-R0.5-W-PN			0.5							
EP1578	EPSM-4080-24-R1.0-W-PN		10	1	30	22.0	9.10	74	43.55	10	
EP1579	EPSM-4080-24-R2.0-W-PN			2							
EP1581	EPSM-4100-30-R0.5-W-PN		12	0.5	36	26.4	11.00	86	49.50	12	
EP1582	EPSM-4100-30-R1.0-W-PN			1							
EP1583	EPSM-4100-30-R2.0-W-PN		16	2	48	35.2	14.50	110	62.00	16	
EP1585	EPSM-4120-36-R0.5-W-PN			0.5							
EP1586	EPSM-4120-36-R1.0-W-PN		20	1	60	44.0	18.20	125	65.00	20	
EP1587	EPSM-4120-36-R2.0-W-PN			2							
EP1589	EPSM-4160-48-R1.0-W-PN		16	1	48	35.2	14.50	110	62.00	16	
EP1590	EPSM-4160-48-R3.0-W-PN			3							
EP1593	EPSM-4200-60-R1.0-W-PN		20	1	60	44.0	18.20	125	65.00	20	
EP1594	EPSM-4200-60-R3.0-W-PN			3							

EPSM Corner R (underneck 5xD) Weldon											
ID Code	Item Code	Z	D	CR	In	I	dn	L	Ls	d	Type
EP1564	EPSM-4010-5-R0.1-W-PN	4	1	0.1	5	2.2	0.96	56	44.08	6	A
EP1565	EPSM-4020-10-R0.2-W-PN		2	0.2	10	4.4	1.92		40.40		
EP1567	EPSM-4030-15-R0.2-W-PN		3	0.2	15	6.6	2.88		36.71		
EP1570	EPSM-4040-20-R0.5-W-PN		4	0.5	20	8.8	3.70	63	39.84	8	B
EP1572	EPSM-4050-25-R0.5-W-PN		5	0.5	25	11.0	4.60	68	41.08		
EP1576	EPSM-4060-30-R0.5-W-PN		6	0.5	30	13.2	5.50		37.75		
EP1580	EPSM-4080-40-R0.5-W-PN		8	1	40	17.6	7.30	80	39.65	10	B
EP1584	EPSM-4100-50-R1.0-W-PN		10	1	50	22.0	9.10	94	43.55		
EP1588	EPSM-4120-60-R1.0-W-PN		12	1	60	26.4	11.00	110	49.50		
EP1591	EPSM-4160-80-R1.0-W-PN		16	1	80	35.2	14.50	135	55.00	16	B
EP1592	EPSM-4200-100-R1.0-W-PN		20	1	100	44.0	18.20	155	55.00		

Cutting Conditions Schnittwerte Condizioni di taglio Condiciones de Corte Conditions de coupe Valores de corte:					
Side Milling: Page 6		Slot Milling: Page 7		Side Finishing: Page 8	
3D finishing: Page 9					

EPSM-CR-PN | Epoch Multi Series Corner Radius

V max
High Speed

Q max
High Efficient

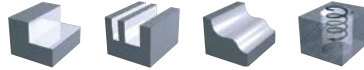
▽
Roughing

▽▽
Semi Finishing

▽▽▽
Finishing

HRC
55

No. of Teeth
4



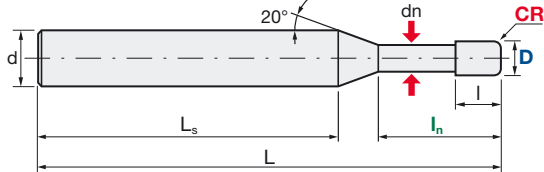
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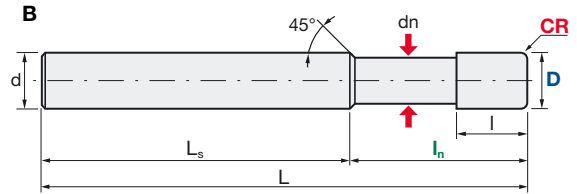
B



A



B



Type B: D16 and D20 without 45° phase at neck end

Carbide
Micro Grain

PN
PaNacea Coating

Rake Angle
Positive

Helix Angle	D Tol. [mm]	d Tol.
40°	D1~D6: 0/-0.015 D8~D20: 0/-0.02	D1~D12: h5 D16~D20: h6

EPSM Corner R (underneck 5xD)														
ID Code	Item Code	Z	D	CR	I _n	I	dn	L	L _s	d	Type			
EP1702	EPSM-4010-5-R0.1-PN	4	1	0.1	5	1.5	0.960	68	56.08	6	A			
EP1705	EPSM-4020-10-R0.1-PN		2	0.2	10	3	1.920		52.40					
EP1706	EPSM-4020-10-R0.2-PN		3		3	48.71								
EP1709	EPSM-4030-15-R0.2-PN			4	0.5		15		4.5			2.880		
EP1710	EPSM-4030-15-R0.5-PN		4		0.2	20	6		3.700			44.84		
EP1714	EPSM-4040-20-R0.2-PN			0.5										
EP1715	EPSM-4040-20-R0.5-PN		5	1	25	7.5	4.600		41.08					
EP1716	EPSM-4040-20-R1.0-PN			5					0.2			30	9	5.500
EP1719	EPSM-4050-25-R0.2-PN		6		0.5									
EP1720	EPSM-4050-25-R0.5-PN			6	0.3	40	12		7.300	80	40.00	8		
EP1725	EPSM-4060-30-R0.3-PN		8		0.5									
EP1726	EPSM-4060-30-R0.5-PN			8	1	50	15		9.100	94	44.00		10	
EP1727	EPSM-4060-30-R1.0-PN		10		1.5									
EP1728	EPSM-4060-30-R1.5-PN			10	0.3	60	18		11.000	110	50.00			12
EP1733	EPSM-4080-40-R0.3-PN		12		0.5									
EP1734	EPSM-4080-40-R0.5-PN			12	1	80	24		14.500	135	55.00			
EP1735	EPSM-4080-40-R1.0-PN		16		2									
EP1736	EPSM-4080-40-R2.0-PN			16	0.3	100	30		18.200	155	20			
EP1741	EPSM-4100-50-R0.3-PN		20		0.5									
EP1742	EPSM-4100-50-R0.5-PN			20	1									
EP1743	EPSM-4100-50-R1.0-PN		20		1.5									
EP1744	EPSM-4100-50-R2.0-PN			20	2									
EP1750	EPSM-4120-60-R0.3-PN		20		0.3									
EP1751	EPSM-4120-60-R0.5-PN			20	0.5									
EP1752	EPSM-4120-60-R1.0-PN		20		1									
EP1753	EPSM-4120-60-R1.5-PN			20	1.5									
EP1754	EPSM-4120-60-R2.0-PN		20		2									
EP1757	EPSM-4160-80-R0.5-PN			20	0.3									
EP1758	EPSM-4160-80-R1.0-PN		20		0.5									
EP1761	EPSM-4200-100-R0.5-PN			20	1									
EP1762	EPSM-4200-100-R1.0-PN		20		1									

EPSM-CR-PN | Epoch Multi Series Corner Radius

V max
High Speed

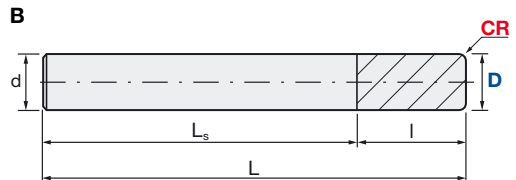
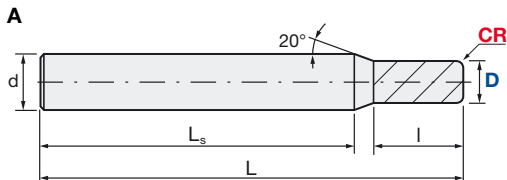
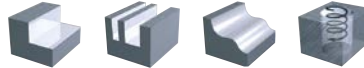
Q max
High Efficient


Roughing


Semi Finishing


Finishing

HRC
55

No. of Teeth
4

Carbide
Micro Grain

PN
PaNacea Coating

Rake Angle
Positive

Helix Angle	D Tol. [mm]	d Tol.
40°	D1~D6: 0/-0.015	D1~D12: h5
	D8~D20: 0/-0.02	D16~D20: h6

EPSM Corner R (no underneck)									
ID Code	Item Code	Z	D	CR	I	L	L _s	d	Type
EP1701	EPSM-4010-R0.1-PN	4	1	0.1	2.5	56	46.13	6	A
EP1703	EPSM-4020-R0.1-PN		2		5		44.51		
EP1704	EPSM-4020-R0.2-PN		3	0.2	7.5		43.38		
EP1707	EPSM-4030-R0.2-PN			0.5					
EP1708	EPSM-4030-R0.5-PN		4	0.2	10		42.25		
EP1711	EPSM-4040-R0.2-PN			0.5					
EP1712	EPSM-4040-R0.5-PN		5	1	12.5		41.13		
EP1713	EPSM-4040-R1.0-PN			0.2					
EP1717	EPSM-4050-R0.2-PN		6	0.5	15		41.00		
EP1718	EPSM-4050-R0.5-PN			1					
EP1721	EPSM-4060-R0.3-PN		8	0.3	20	63	43.00	8	
EP1722	EPSM-4060-R0.5-PN			0.5					
EP1723	EPSM-4060-R1.0-PN		10	1	25	74	49.00	10	
EP1724	EPSM-4060-R1.5-PN			1.5					
EP1729	EPSM-4080-R0.3-PN		12	0.3	30	86	56.00	12	
EP1730	EPSM-4080-R0.5-PN			0.5					
EP1731	EPSM-4080-R1.0-PN		16	1	40	110	70.00	16	
EP1732	EPSM-4080-R2.0-PN			2					
EP1737	EPSM-4100-R0.3-PN		20	0.3	50	125	75.00	20	
EP1738	EPSM-4100-R0.5-PN			0.5					
EP1739	EPSM-4100-R1.0-PN		12	1	30	86	56.00	12	
EP1740	EPSM-4100-R2.0-PN			2					
EP1745	EPSM-4120-R0.3-PN		16	0.3	40	110	70.00	16	
EP1746	EPSM-4120-R0.5-PN			0.5					
EP1747	EPSM-4120-R1.0-PN		20	1	50	125	75.00	20	
EP1748	EPSM-4120-R1.5-PN			1.5					
EP1749	EPSM-4120-R2.0-PN		16	2	40	110	70.00	16	
EP1755	EPSM-4160-R0.5-PN			0.5					
EP1756	EPSM-4160-R1.0-PN		20	1	50	125	75.00	20	
EP1759	EPSM-4200-R0.5-PN			0.5					
EP1760	EPSM-4200-R1.0-PN		20	1	50	125	75.00	20	

Cutting Conditions | Schnittwerte | Condizioni di taglio | Condiciones de Corte | Conditions de coupe | Valores de corte:

Side Milling: Page 6



Slot Milling: Page 7



Side Finishing: Page 8









3D finishing: Page 9



EPSM-CR-PN | Recommended Cutting Conditions Side Milling








Material group	Example	Tensile strength	Parameter	Tool Diameter (mm)											
				D 1	D 2	D 3	D 4	D 5	D 6	D 8	D 10	D 12	D 16	D 20	
Carbon Steels Alloy Steels Cast Irons EN-JL(GG) Ductile Cast Iron: EN-JS (GGG) (~300HB)			V _c m/min	160	160	160	160	160	160	160	160	160	160	160	
			n min ⁻¹	51000	25500	17000	12700	10200	8500	6400	5100	4200	3200	2500	
			f _z mm/tooth	0.006	0.012	0.019	0.027	0.036	0.042	0.057	0.070	0.074	0.098	0.115	
			V _f mm/min	1220	1220	1290	1370	1470	1430	1460	1430	1240	1250	1150	
			a _p mm	1	2	3	4	5	6	8	10	12	16	20	
			a _e mm	0.5	1	1.5	2	2.5	3	4	5	6	8	10	
			Q cm³/min	0.61	2.44	5.81	10.96	18.38	25.74	46.72	71.50	89.28	160.00	230.00	
Tool Steels Alloy Steels (35-45HRC)			V _c m/min	125	125	125	125	125	125	125	125	125	125	125	
			n min ⁻¹	39800	19900	13300	10000	8000	6600	5000	4000	3300	2500	2000	
			f _z mm/tooth	0.004	0.008	0.013	0.018	0.024	0.029	0.038	0.047	0.052	0.064	0.075	
			V _f mm/min	640	640	690	720	770	770	760	750	690	640	600	
			a _p mm	1	2	3	4	5	6	8	10	12	16	20	
			a _e mm	0.3	0.6	0.9	1.2	1.5	1.8	2.4	3.0	3.6	4.8	6.0	
			Q cm³/min	0.19	0.77	1.86	3.46	5.78	8.32	14.59	22.50	29.81	49.15	72.00	
Tool Steels Pre-Hardened Steels (45-55HRC)			V _c m/min	85	85	85	85	85	85	85	85	85	85	85	
			n min ⁻¹	27100	13500	9000	6800	5400	4500	3400	2700	2300	1700	1400	
			f _z mm/tooth	0.003	0.006	0.010	0.015	0.019	0.023	0.030	0.038	0.041	0.051	0.060	
			V _f mm/min	330	320	360	410	410	410	410	410	380	350	340	
			a _p mm	1	2	3	4	5	6	8	10	12	16	20	
			a _e mm	0.06	0.12	0.18	0.24	0.3	0.36	0.48	0.6	0.72	0.96	1.2	
			Q cm³/min	0.02	0.08	0.19	0.39	0.62	0.89	1.57	2.46	3.28	5.38	8.16	
Stainless Steel Ferritic, Martensitic	1.4034 (X46Cr13), 1.4021 (X20Cr13), 1.4112 (X90CrMoV18)	<750 N/mm²	V _c m/min	114	114	114	114	114	114	114	114	114	114	114	
			n min ⁻¹	36300	18200	12100	9100	7300	6100	4500	3600	3000	2300	1800	
			f _z mm/tooth	0.005	0.011	0.016	0.023	0.03	0.036	0.048	0.06	0.065	0.082	0.096	
			V _f mm/min	730	800	770	840	880	880	860	860	780	750	690	
			a _p mm	1	2	3	4	5	6	8	10	12	16	20	
			a _e mm	0.5	1	1.5	2	2.5	3	4	5	6	8	10	
			Q cm³/min	0.37	1.60	3.47	6.72	11.00	15.84	27.52	43.00	56.16	96.00	138.00	
Stainless Steel Austenitic	1.4301 (X5CrNi18-10), 1.4404 (X2CrNi-Mo17-12-2), 1.4571 (X6CrNiMo-Ti17-12-2)	750-850 N/mm²	V _c m/min	95	95	95	95	95	95	95	95	95	95	95	
			n min ⁻¹	30250	15130	10080	7560	6050	5040	3780	3030	2520	1890	1510	
			f _z mm/tooth	0.004	0.009	0.013	0.019	0.025	0.030	0.040	0.050	0.054	0.068	0.080	
			V _f mm/min	480	540	520	570	610	600	600	610	540	510	480	
			a _p mm	1	2	3	4	5	6	8	10	12	16	20	
			a _e mm	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	
			Q cm³/min	0.24	1.08	2.34	4.56	7.63	10.80	19.20	30.50	38.88	65.28	96.00	
Stainless Steel Duplex, Precipitation- hardenable	1.4542 (X5CrNi-CuNb16-4), 1.4501 (X2CrNiMoCu-WN25-7-4)	850-1100 N/mm²	V _c m/min	76	76	76	76	76	76	76	76	76	76	76	
			n min ⁻¹	24190	12100	8060	6050	4840	4030	3020	2420	2020	1510	1210	
			f _z mm/tooth	0.003	0.007	0.010	0.015	0.020	0.024	0.032	0.040	0.043	0.054	0.064	
			V _f mm/min	290	340	320	360	390	390	390	390	350	330	310	
			a _p mm	1	2	3	4	5	6	8	10	12	16	20	
			a _e mm	0.3	0.6	0.9	1.2	1.5	1.8	2.4	3	3.6	4.8	6	
			Q cm³/min	0.09	0.41	0.86	1.73	2.93	4.21	7.49	11.70	15.12	25.34	37.20	
Titanium, Ti alloys	3.7164 (TiAl6V4)	1100-1300 N/mm²	V _c m/min	60	60	60	60	60	60	60	60	60	60	60	
			n min ⁻¹	19100	9550	6370	4770	3820	3180	2390	1910	1590	1190	950	
			f _z mm/tooth	0.006	0.012	0.018	0.024	0.030	0.036	0.048	0.060	0.072	0.096	0.120	
			V _f mm/min	460	460	460	460	460	460	460	460	460	460	460	
			a _p mm	1	2	3	4	5	6	8	10	12	16	20	
			a _e mm	0.30	0.60	0.90	1.20	1.50	1.80	2.40	3.00	3.60	4.80	6.00	
			Q cm³/min	0.14	0.55	1.24	2.21	3.45	4.97	8.83	13.80	19.87	35.33	55.20	
Super alloy, Heat-resist- ance alloy	Inconel 718 Hastelloy	>1300 N/mm²	V _c m/min	25	25	25	25	25	25	25	25	25	25	25	
			n min ⁻¹	7960	3980	2650	1990	1590	1330	990	800	660	500	400	
			f _z mm/tooth	0.0035	0.007	0.0105	0.014	0.0175	0.021	0.028	0.035	0.042	0.056	0.07	
			V _f mm/min	110	110	110	110	110	110	110	110	110	110	110	
			a _p mm	0.5	1	1.5	2	2.5	3	4	5	6	8	10	
			a _e mm	0.3	0.6	0.9	1.2	1.5	1.8	2.4	3	3.6	4.8	6	
			Q cm³/min	0.020	0.07	0.15	0.26	0.41	0.59	1.06	1.65	2.38	4.22	6.60	


 In the case of 5xD underneck, please reduce V_c to 85% and keep 100% f_z , reduce 50% a_p and 50% a_e .
 Bei Auskraglängen von 5xD, reduzieren Sie bitte V_c auf 85% unter Beibehaltung von f_z , und reduzieren a_p & a_e auf jeweils 50%.
 In caso di tipologia 5xD, ridurre V_c ad 85% e tenere il 100% f_z , ridurre a_p 50% ed a_e 50%.
 En las fresas destalonadas 5xD, reduzca la V_c al 85% y mantenga el 100% de la f_z , reducir también el 50% tanto de la a_p como la a_e .
 Dans le cas de longueurs détalonnées de D5, veuillez baisser V_c à 85% en conservant f_z à 100%, réduire l' a_p et l' a_e de 50%.
 No caso de 5xD respigado, reduzir V_c para 85% e manter 100% f_z , reduzir 50% a_p e 50% a_e .


EPSM-CR-PN | Recommended Cutting Conditions Slot Milling





Material group	Example	Tensile strength	Parameter	Tool Diameter (mm)										
				D 1	D 2	D 3	D 4	D 5	D 6	D 8	D 10	D 12	D 16	D 20
Carbon Steels Alloy Steels Cast Irons EN-JL(GG) Ductile Cast Iron: EN-JS (GGG) (~300HB)			V_c m/min	80	80	80	80	80	80	80	80	80	80	80
			n min ⁻¹	25480	12740	8490	6370	5100	4250	3180	2550	2120	1590	1270
			f_z mm/tooth	0.007	0.013	0.018	0.025	0.032	0.034	0.049	0.061	0.069	0.087	0.096
			V_f mm/min	710	660	610	640	650	580	620	620	590	550	490
			a_p mm	1	2	3	4	5	6	8	10	12	16	20
			a_e mm	1	2	3	4	5	6	8	10	12	16	20
			Q cm ³ /min	0.7	2.6	5.5	10.2	16.3	20.9	39.7	62.0	85.0	140.8	196.0
Tool Steels Alloy Steels (35-45HRC)			V_c m/min	70	70	70	70	70	70	70	70	70	70	70
			n min ⁻¹	22290	11150	7430	5570	4460	3720	2790	2230	1860	1390	1110
			f_z mm/tooth	0.004	0.008	0.011	0.016	0.020	0.022	0.031	0.039	0.044	0.055	0.061
			V_f mm/min	360	360	330	360	360	330	350	350	330	310	270
			a_p mm	0.6	1.2	1.8	2.4	3	3.6	4.8	6	7.2	9.6	12
			a_e mm	1	2	3	4	5	6	8	10	12	16	20
			Q cm ³ /min	0.2	0.9	1.8	3.5	5.4	7.1	13.4	21.0	28.5	47.6	64.8
Stainless Steel Ferritic, Martensitic	1.4034 (X46Cr13), 1.4021 (X20Cr13), 1.4112 (X90CrMoV18)	<750 N/mm ²	V_c m/min	80	80	80	80	80	80	80	80	80	80	80
			n min ⁻¹	25500	12700	8500	6400	5100	4200	3200	2500	2100	1600	1300
			f_z mm/tooth	0.004	0.007	0.013	0.018	0.024	0.028	0.038	0.048	0.05	0.064	0.077
			V_f mm/min	410	360	440	460	490	470	490	480	420	410	400
			a_p mm	1	2	3	4	5	6	8	10	12	16	20
			a_e mm	1	2	3	4	5	6	8	10	12	16	20
			Q cm ³ /min	0.41	1.44	3.96	7.36	12.25	16.92	31.36	48	60.48	104.96	160
Stainless Steel Austenitic	1.4301 (X5CrNi18-10), 1.4404 (X2CrNi-Mo17-12-2), 1.4571 (X6CrNiMo-Ti17-12-2)	750-850 N/mm ²	V_c m/min	70	70	70	70	70	70	70	70	70	70	70
			n min ⁻¹	22280	11140	7430	5570	4460	3710	2790	2230	1860	1390	1110
			f_z mm/tooth	0.003	0.006	0.011	0.015	0.02	0.023	0.032	0.04	0.042	0.053	0.064
			V_f mm/min	270	270	330	330	360	340	360	360	310	290	280
			a_p mm	1	2	3	4	5	6	8	10	12	16	20
			a_e mm	1	2	3	4	5	6	8	10	12	16	20
			Q cm ³ /min	0.27	1.08	2.97	5.28	9	12.24	23.04	36	44.64	74.24	112
Stainless Steel Duplex, Precipitation- hardenable	1.4542 (X5CrNi-CuNb16-4), 1.4501 (X2CrNiMoCu-WN25-7-4)	850-1100 N/mm ²	V_c m/min	50	50	50	50	50	50	50	50	50	50	50
			n min ⁻¹	15920	7960	5310	3980	3180	2650	1990	1590	1330	990	800
			f_z mm/tooth	0.002	0.005	0.009	0.012	0.016	0.018	0.026	0.032	0.034	0.042	0.051
			V_f mm/min	130	160	190	190	200	190	210	200	180	170	160
			a_p mm	1	2	3	4	5	6	8	10	12	16	20
			a_e mm	1	2	3	4	5	6	8	10	12	16	20
			Q cm ³ /min	0.13	0.64	1.71	3.04	5	6.84	13.44	20	25.92	43.52	64
Titanium, Ti alloys	3.7164 (TiAl6V4)	1100-1300 N/mm ²	V_c m/min	50	50	50	50	50	50	50	50	50	50	50
			n min ⁻¹	15920	7960	5310	3980	3180	2650	1990	1590	1330	990	800
			f_z mm/tooth	0.004	0.008	0.012	0.016	0.02	0.024	0.032	0.04	0.048	0.064	0.08
			V_f mm/min	250	250	250	250	250	250	250	250	260	250	260
			a_p mm	1	2	3	4	5	6	8	10	12	16	20
			a_e mm	1	2	3	4	5	6	8	10	12	16	20
			Q cm ³ /min	0.25	1	2.25	4	6.25	9	16	25	37.44	64	104
Super alloy, Heat-resist- ance alloy	Inconel 718 Hastelloy	>1300 N/mm ²	V_c m/min	20	20	20	20	20	20	20	20	20	20	20
			n min ⁻¹	6400	3200	2100	1600	1300	1100	800	600	500	400	300
			f_z mm/tooth	0.0025	0.005	0.0075	0.01	0.0125	0.015	0.02	0.025	0.03	0.04	0.05
			V_f mm/min	60	60	60	60	70	70	60	60	60	60	60
			a_p mm	0.5	1	1.5	2	2.5	3	4	5	6	8	10
			a_e mm	1	2	3	4	5	6	8	10	12	16	20
			Q cm ³ /min	0.03	0.12	0.27	0.48	0.88	1.26	1.92	3	4.32	7.68	12


-  In the case of 5xD underneck, please reduce V_c to 85% and keep 100% f_z , reduce 50% a_p
-  Bei Auskraglängen von 5xD, reduzieren Sie bitte V_c auf 85% unter Beibehaltung von f_z , und reduzieren a_p auf 50%
-  In caso di tipologia 5xD, ridurre V_c ad 85% e tenere il 100% f_z , ridurre a_p 50%
-  En las fresas destalonadas 5xD, reduzca la V_c al 85% y mantenga el 100% de la f_z , reducir también el 50% tanto de la a_p
-  Dans le cas de longueurs détalonnées de D5, veuillez baisser V_c à 85% en conservant f_z à 100%, réduire l' a_p de 50%
-  No caso de 5xD respigado, reduzir V_c para 85% e manter 100% f_z , reduzir 50% a_p


 **Note:** For finishing and precise tool definition for the CAM system please download DXF data (QuickFinder), or contact your local MOLDINO Tool staff for more details.

 **Nota:** Per lavorazioni di finitura e per una precisa e corretta definizione del profilo dell'utensile per l'utilizzo CAM si prega di richiedere file DXF tramite QuickFinder o rivolgendosi al personale MOLDINO Tool.

 **Remarque :** Pour les opérations de finition et une définition précise de l'outil dans votre système FAO, demandez nous le fichier DXF des outils, téléchargez les via notre logiciel QuickFinder, ou contactez votre interlocuteur commercial pour plus de détails.







 **Achtung:** Bitte laden Sie sich für die Schlichtbearbeitung und die präzise Definition der Werkzeuge die DXF Daten herunter (QuickFinder) oder wenden Sie sich an Ihren MOLDINO Tool Anwendungstechniker.

 **Nota:** En procesos de acabado y para una más precisa definición de la herramienta en el sistema de CAM por favor solicite los ficheros DXF (QuickFinder), o póngase en contacto con MOLDINO Tool para obtener más detalles.

 **Nota:** Para o acabamento e precisão assim como melhor definição da ferramenta para o sistema CAM por favor solicitar dados DXF (QuickFinder), ou entre em contato com sua equipe de ferramentas MOLDINO Tool local para obter mais detalhes.

EPSM-CR-PN | Recommended Cutting Conditions Side Finishing


Material group	Example	Tensile strength	Parameter	Tool Diameter (mm)											
				D 1	D 2	D 3	D 4	D 5	D 6	D 8	D 10	D 12	D 16	D 20	
Carbon Steels Alloy Steels Cast Irons EN-JL(GG) Ductile Cast Iron: EN-JS (GGG) (~300HB)			V_c m/min	170	170	170	170	170	170	170	170	170	170	170	
			n min ⁻¹	54110	27060	18040	13530	10820	9020	6760	5410	4510	3380	2710	
			f_z mm/tooth	0.006	0.012	0.019	0.027	0.036	0.042	0.057	0.070	0.074	0.098	0.115	
			V_f mm/min	1300	1300	1370	1460	1560	1520	1540	1510	1330	1320	1250	
			a_p mm	1	2	3	4	5	6	8	10	12	16	20	
			a_e mm	0.02	0.04	0.06	0.08	0.1	0.12	0.16	0.2	0.24	0.32	0.4	
			Q cm³/min	0.03	0.10	0.25	0.47	0.78	1.09	1.97	3.02	3.83	6.76	10.00	
			Tool Steels Alloy Steels (35-45HRC)			V_c m/min	135	135	135	135	135	135	135	135	135
n min ⁻¹	42970	21490				14320	10740	8590	7160	5370	4300	3580	2690	2150	
f_z mm/tooth	0.004	0.008				0.013	0.018	0.024	0.029	0.038	0.047	0.052	0.064	0.075	
V_f mm/min	690	690				740	770	820	830	820	810	740	690	650	
a_p mm	1	2				3	4	5	6	8	10	12	16	20	
a_e mm	0.02	0.04				0.06	0.08	0.1	0.12	0.16	0.2	0.24	0.32	0.4	
Q cm³/min	0.01	0.06				0.13	0.25	0.41	0.60	1.05	1.62	2.13	3.53	5.20	
Tool Steels Pre-Hardened Steels (45-55HRC)						V_c m/min	95	95	95	95	95	95	95	95	95
			n min ⁻¹	30240	15120	10080	7560	6050	5040	3780	3020	2520	1890	1510	
			f_z mm/tooth	0.003	0.007	0.011	0.015	0.020	0.024	0.031	0.039	0.042	0.054	0.063	
			V_f mm/min	360	420	440	450	480	480	470	470	420	410	380	
			a_p mm	1	2	3	4	5	6	8	10	12	16	20	
			a_e mm	0.02	0.04	0.06	0.08	0.1	0.12	0.16	0.2	0.24	0.32	0.4	
			Q cm³/min	0.01	0.03	0.08	0.14	0.24	0.35	0.60	0.94	1.21	2.10	3.04	
			Stainless Steel Ferritic, Martensitic	1.4034 (X46Cr13), 1.4021 (X20Cr13), 1.4112 (X90CrMoV18)	<750 N/mm²	V_c m/min	120	120	120	120	120	120	120	120	120
n min ⁻¹	38200	19100				12730	9550	7640	6370	4770	3820	3180	2390	1910	
f_z mm/tooth	0.005	0.01				0.014	0.02	0.028	0.032	0.043	0.054	0.059	0.073	0.086	
V_f mm/min	760	760				710	760	860	820	820	830	750	700	660	
a_p mm	1	2				3	4	5	6	8	10	12	16	20	
a_e mm	0.02	0.04				0.06	0.08	0.1	0.12	0.16	0.2	0.24	0.32	0.4	
Q cm³/min	0.02	0.06				0.13	0.24	0.43	0.59	1.05	1.66	2.16	3.58	5.28	
Stainless Steel Austenitic	1.4301 (X5CrNi18-10), 1.4404 (X2CrNi- Mo17-12-2), 1.4571 (X6CrNiMo- Ti17-12-2)	750-850 N/mm²				V_c m/min	100	100	100	100	100	100	100	100	100
			n min ⁻¹	31830	15920	10610	7960	6370	5310	3980	3180	2650	1990	1590	
			f_z mm/tooth	0.004	0.008	0.012	0.017	0.023	0.027	0.036	0.045	0.049	0.061	0.072	
			V_f mm/min	510	510	510	540	590	570	570	570	520	490	460	
			a_p mm	1	2	3	4	5	6	8	10	12	16	20	
			a_e mm	0.02	0.04	0.06	0.08	0.1	0.12	0.16	0.2	0.24	0.32	0.4	
			Q cm³/min	0.01	0.04	0.09	0.17	0.30	0.41	0.73	1.14	1.50	2.51	3.68	
			Stainless Steel Duplex, Precipitation- hardenable	1.4542 (X5CrNi- CuNb16-4), 1.4501 (X2CrNiMoCu- WN25-7-4)	850-1100 N/mm²	V_c m/min	80	80	80	80	80	80	80	80	80
n min ⁻¹	25460	12730				8490	6370	5090	4240	3180	2550	2120	1590	1270	
f_z mm/tooth	0.003	0.006				0.01	0.014	0.018	0.022	0.029	0.036	0.039	0.049	0.058	
V_f mm/min	310	310				340	360	370	370	370	370	330	310	290	
a_p mm	1	2				3	4	5	6	8	10	12	16	20	
a_e mm	0.02	0.04				0.06	0.08	0.1	0.12	0.16	0.2	0.24	0.32	0.4	
Q cm³/min	0.01	0.02				0.06	0.12	0.19	0.27	0.47	0.74	0.95	1.59	2.32	
Titanium, Ti alloys	3.7164 (TiAl6V4)	1100-1300 N/mm²				V_c m/min	60	60	60	60	60	60	60	60	60
			n min ⁻¹	19100	9550	6370	4770	3820	3180	2390	1910	1590	1190	950	
			f_z mm/tooth	0.004	0.008	0.011	0.016	0.022	0.026	0.034	0.043	0.047	0.058	0.068	
			V_f mm/min	310	310	280	310	340	330	330	330	300	280	260	
			a_p mm	1	2	3	4	5	6	8	10	12	16	20	
			a_e mm	0.02	0.04	0.06	0.08	0.1	0.12	0.16	0.2	0.24	0.32	0.4	
			Q cm³/min	0.01	0.02	0.05	0.10	0.17	0.24	0.42	0.66	0.86	1.43	2.08	
			Super alloy, Heat-resist- ance alloy	Inconel 718 Hastelloy	>1300 N/mm²	V_c m/min	25	25	25	25	25	25	25	25	25
n min ⁻¹	7960	3980				2650	1990	1590	1330	990	800	660	500	400	
f_z mm/tooth	0.002	0.005				0.007	0.01	0.014	0.016	0.022	0.027	0.029	0.037	0.043	
V_f mm/min	60	80				70	80	90	90	90	90	80	70	70	
a_p mm	1	2				3	4	5	6	8	10	12	16	20	
a_e mm	0.02	0.04				0.06	0.08	0.1	0.12	0.16	0.2	0.24	0.32	0.4	
Q cm³/min	0.001	0.01				0.01	0.03	0.05	0.06	0.12	0.18	0.23	0.36	0.56	

 In the case of 5xD underneck, please reduce both V_c and f_z to 70%
 Bei Auskraglängen von 5xD, reduzieren Sie bitte sowohl V_c als auch f_z auf 70%
 In caso di tipologia 5xD prego ridurre sia V_c che f_z al 70%
 En fresas destalonadas 5xD, reduzca V_c y f_z al 70%
 Dans le cas de longueurs détalonnées de D5, veuillez baisser V_c et f_z à 70%
 No caso de 5xD respigado, reduza V_c e f_z para 70%

EPSM-CR-PN | Recommended Cutting Conditions 3D Finishing



Material group	Example	Tensile strength	Parameter	Tool Diameter (mm)										
				D 1	D 2	D 3	D 4	D 5	D 6	D 8	D 10	D 12	D 16	D 20
Carbon Steels Alloy Steels Cast Irons EN-JL(GG) Ductile Cast Iron: EN-JS (GGG) (-300HB)			V _c m/min	150	150	150	150	150	150	150	150	150	150	150
			n min ⁻¹	47750	23870	15920	11940	9550	7960	5970	4770	3980	2980	2390
			f _z mm/tooth	0.008	0.016	0.025	0.035	0.047	0.055	0.074	0.091	0.096	0.127	0.150
			V _f mm/min	1490	1490	1570	1680	1790	1740	1770	1740	1530	1520	1430
			a _p mm	0.2*CR – 0.5*CR										
			a _e mm	0.2*CR – 0.5*CR										
Tool Steels Alloy Steels (35-45HRC)			V _c m/min	125	125	125	125	125	125	125	125	125	125	125
			n min ⁻¹	39790	19890	13260	9950	7960	6630	4970	3980	3320	2490	1990
			f _z mm/tooth	0.005	0.010	0.017	0.023	0.031	0.038	0.049	0.061	0.068	0.083	0.098
			V _f mm/min	830	830	900	930	990	1000	980	970	900	830	780
			a _p mm	0.1*CR – 0.3CR										
			a _e mm	0.1*CR – 0.3CR										
Tool Steels Pre-Hardened Steels (45-55HRC)			V _c m/min	80	80	80	80	80	80	80	80	80	80	80
			n min ⁻¹	25480	12740	8490	6370	5100	4250	3180	2550	2120	1590	1270
			f _z mm/tooth	0.004	0.009	0.014	0.019	0.025	0.030	0.039	0.049	0.053	0.068	0.079
			V _f mm/min	380	450	470	480	510	510	490	500	450	430	400
			a _p mm	0.1*CR – 0.3CR										
			a _e mm	0.1*CR – 0.3CR										
Stainless Steel Ferritic, Martensitic	1.4034 (X46Cr13), 1.4021 (X20Cr13), 1.4112 (X90CrMoV18)	<750 N/mm ²	V _c m/min	120	120	120	120	120	120	120	120	120	120	120
			n min ⁻¹	38200	19100	12730	9550	7640	6370	4770	3820	3180	2390	1910
			f _z mm/tooth	0.006	0.012	0.017	0.024	0.034	0.038	0.052	0.065	0.071	0.088	0.103
			V _f mm/min	920	920	860	920	1030	980	980	990	900	840	790
			a _p mm	0.2*CR – 0.5CR										
			a _e mm	0.2*CR – 0.5CR										
Stainless Steel Austenitic	1.4301 (X5CrNi18-10), 1.4404 (X2CrNi-Mo17-12-2), 1.4571 (X6CrNiMo-Ti17-12-2)	750-850 N/mm ²	V _c m/min	80	80	80	80	80	80	80	80	80	80	80
			n min ⁻¹	25460	12730	8490	6370	5090	4240	3180	2550	2120	1590	1270
			f _z mm/tooth	0.005	0.010	0.014	0.020	0.028	0.032	0.043	0.054	0.059	0.073	0.086
			V _f mm/min	490	490	490	520	560	550	550	550	500	470	440
			a _p mm	0.1*CR – 0.3CR										
			a _e mm	0.1*CR – 0.3CR										
Stainless Steel Duplex, Precipitation- hardenable	1.4542 (X5CrNi-CuNb16-4), 1.4501 (X2CrNiMoCu-WN25-7-4)	850-1100 N/mm ²	V _c m/min	60	60	60	60	60	60	60	60	60	60	60
			n min ⁻¹	19100	9550	6370	4770	3820	3180	2390	1910	1590	1190	950
			f _z mm/tooth	0.004	0.007	0.012	0.017	0.022	0.026	0.035	0.043	0.047	0.059	0.070
			V _f mm/min	280	280	310	320	330	340	330	330	300	280	260
			a _p mm	0.1*CR – 0.3CR										
			a _e mm	0.1*CR – 0.3CR										
Titanium, Ti alloys	3.7164 (TiAl6V4)	1100-1300 N/mm ²	V _c m/min	65	65	65	65	65	65	65	65	65	65	65
			n min ⁻¹	20690	10350	6900	5170	4140	3450	2590	2070	1720	1290	1030
			f _z mm/tooth	0.005	0.010	0.013	0.019	0.026	0.031	0.041	0.052	0.056	0.070	0.082
			V _f mm/min	400	400	360	400	440	430	420	430	390	360	340
			a _p mm	0.1*CR – 0.3CR										
			a _e mm	0.1*CR – 0.3CR										
Super alloy, Heat-resist- ance alloy	Inconel 718 Hastelloy	>1300 N/mm ²	V _c m/min	30	30	30	30	30	30	30	30	30	30	30
			n min ⁻¹	9550	4770	3180	2390	1910	1590	1190	950	800	600	480
			f _z mm/tooth	0.002	0.006	0.008	0.012	0.017	0.019	0.026	0.032	0.035	0.044	0.052
			V _f mm/min	90	110	110	110	130	120	130	120	110	110	100
			a _p mm	0.1*CR – 0.2CR										
			a _e mm	0.1*CR – 0.2CR										

🇬🇧 Theoretical cusp height in end milling (μm)
 🇩🇪 Die theoretische Rautiefe in der Fräsbearbeitung (μm)
 🇮🇹 Cresta teorica di fresatura (μm)
 🇪🇸 Cálculo de altura de la cresta teórica en fresado (mm)
 🇫🇷 Hauteur de crête théorique en fraisage (μm)
 🇵🇹 Altura da crista teórica em fresagem (μm)

🇬🇧 Feed pitch and cusp height
 🇩🇪 a_e (mm) Zeilensprung
 🇮🇹 Passo di avanzamento / Cresta
 🇪🇸 Paso y altura de cresta
 🇫🇷 Pas et hauteur de crête
 🇵🇹 Passo lateral x/ Altura da crista

$$h = R - \sqrt{\frac{(2 \cdot R)^2 - a_{p,e}^2}{4}}$$

$$h = \frac{a_e^2}{8 \cdot R}$$

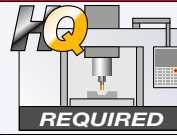
🇬🇧 In the case of 5xD underneck, please reduce V_c to 85% and keep 100% f_z , reduce 50% a_p
 🇩🇪 Bei Auskraglängen von 5xD, reduzieren Sie bitte V_c auf 85% unter Beibehaltung von f_z , und reduzieren a_p auf 50%
 🇮🇹 In caso di tipologia 5xD, ridurre V_c ad 85% e tenere il 100% f_z , ridurre a_p 50%
 🇪🇸 En las fresas destalonadas 5xD, reduzca la V_c al 85% y mantenga el 100% de la f_z , reducir también el 50% tanto de la a_p
 🇫🇷 Dans le cas de longueurs détalonnées de D5, veuillez baisser V_c à 85% en conservant f_z à 100%, réduire l' a_p de 50%
 🇵🇹 No caso de 5xD respigado, reduzir V_c para 85% e manter 100% f_z , reduzir 50% a_p

EPSM-CR-PN | Recommended Cutting Conditions

Please Note:

- 1. Please confirm your material type first.**
- If hardness harder than value in the same column: please follow by real hardness
 - If hardness is lower than that value: please follow material type.

2. Use the high-rigidity and high accuracy machine as possible



3. These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.

4. Please adjust it if chatter or abnormal vibration occurs.

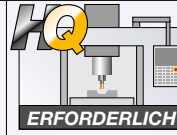
5. Please setup feed 1/3 that of slotting parameter and step 0.1 Dc for drilling application.

6. Please setup feed 70% of slotting parameter and ramping angle 3° for ramping application.

Bitte beachten Sie:

- 1. Bestimmen Sie zuerst den Werkstoff**
- Wenn die Härte den Wert in der ersten Spalte übersteigt: Verwenden Sie die Werte für die tatsächliche Härte
 - Wenn die Härte geringer ist als dieser Wert: Verwenden Sie die Werte für den Werkstofftyp

2. Verwenden Sie ein Bearbeitungszentrum und Werkzeughalter von höchster Präzision, Konzentrität und Stabilität.



3. Diese Schnittbedingungen dienen nur der allgemeinen Orientierung; die Bearbeitungsbedingungen müssen an die tatsächlichen Parameter der verwendeten Maschine und des jeweiligen Werkstücks angepasst werden.

4. Passen Sie die Schnittbedingungen an, falls Rattern oder übermäßige Vibrationen auftreten.

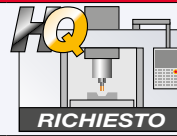
5. Stellen Sie den Vorschub auf 1/3 des Wertes für Nuten ein und Schritte von 0,1xD für Bohranwendungen.

6. Stellen Sie den Vorschub auf 70% des Wertes für Nuten ein und den Rampenfräswinkel auf 3°.

Note:

- 1. Avere la certezza del tipo di materiale lavorato**
- Se la durezza è maggiore del valore della Colonna Prego seguire indicazioni della durezza reale
 - Se la durezza è minore del valore indicato Prego seguire indicazioni del tipo di materiale

2. Utilizzare su macchina il più rigida possibile



3. I parametri raccomandati sono per impiego generico prego adattarli alle condizioni di lavoro effettivo considerando macchina in uso e staffaggio

4. Prego modificare in caso di flessione o vibrazioni

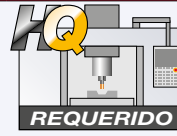
5. Prego ridurre avanzamento ad 1/3 rispetto ad applicazioni in cava piena e passo di 0.1 Dc in caso di foratura

6. Prego settare avanzamento al 70% rispetto ad applicazioni in cava piena ed angolo di 3° in caso di applicazioni in rampa

Nota:

- 1. Primero compruebe el material a mecanizar**
- Si la dureza es superior al valor indicado en la tabla para ese material: Utilice el cuadro correspondiente a dicha dureza
 - Si la dureza es inferior: Utilice el cuadro correspondiente al material

2. Utilice la máquina más rígida y precisa posible



3. Estas condiciones son una guía general; en condiciones reales de mecanizado ajustar los parámetros acorde con la máquina, la pieza y el amarre.

4. Ajustar si hay vibración

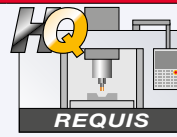
5. Utilizar 1/3 del avance de las condiciones de ranurado y pasos de 0.1 Dc para aplicaciones de taladrado.

6. Utilizar un 70% del avance de las condiciones de ranurado y un ángulo del 3° para entrar en rampa

A noter :

- 1. Avant toute chose veuillez vérifier le type de matière.**
- Si la dureté de la matière est supérieure à la valeur indiquée dans la même colonne : veuillez procéder selon la dureté réelle
 - Si la dureté est inférieure à cette valeur : veuillez adapter selon la matière

2. Réglez la rigidité et la précision de la machine au maximum



3. Ces conditions de coupe sont préconisées pour un usage général; adaptez les paramètres de votre machine selon son modèle et le type de pièce à usiner

4. Si cela broute ou vibre, veuillez ajuster vos réglages

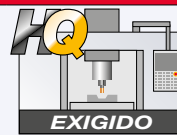
5. Veuillez paramétrer la vitesse à 1/3 pour rainurer et le pas à 0.1 Dc pour tréfler

6. Réglez la vitesse à 70% pour rainurer et appliquez un angle de 3° pour les descentes en ramping

Tome nota:

- 1. Confirme primeiro o tipo de material.**
- Se a dureza for maior que o valor na mesma coluna: prossiga com dados de dureza da peça
 - Se a dureza for menor que esse valor: Prossiga com dados do tipo de material.

2. Utilize máquina com a maior rigidez e precisão possível

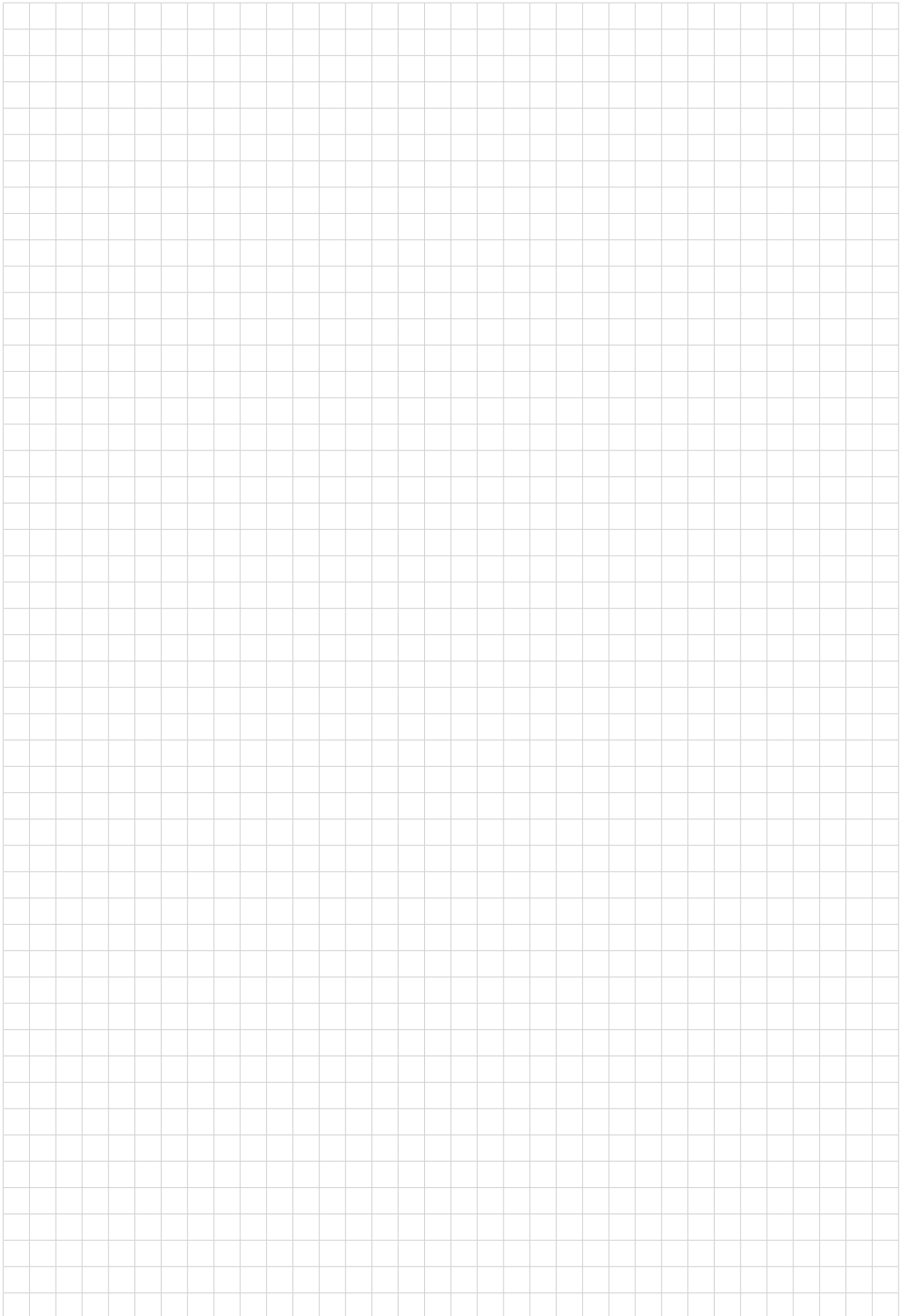


3. Estas condições são para orientação geral; conforme as condições de maquinação, ajuste os parâmetros de acordo com a máquina a uso e as condições da peça a maquinar.

4. Ajuste se surgirem marcas de vibração ou ocorrer vibração anormal.

5. Ajuste o avanço a 1/3 dos parâmetros das ranhuras/ribes e o passo a 0.1Dc, para aplicações de furação.

6. Ajuste o avanço a 70% dos parâmetros das ranhuras/ribes e o ângulo de rampa a 3°, para aplicações de rampa.



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Attentions on Safety

1. Cautions regarding handling

- (1) When removing the tool from its case (packaging), be careful that the tool does not pop out or is dropped. Be particularly careful regarding contact with the tool flutes.
- (2) When handling tools with sharp cutting flutes, be careful not to touch the cutting flutes directly with your bare hands.

2. Cautions regarding mounting

- (1) Before use, check the outside appearance of the tool for scratches, cracks, etc. and that it is firmly mounted in the collet chuck, etc.
- (2) When preparing for use, be sure that the inserts are firmly mounted in place and that they are firmly mounted on the arbor, etc.
- (3) If abnormal chattering, etc. occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Cautions during use

- (1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
- (2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
- (3) Cutting tools are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be attached when work is performed and safety equipment such as safety goggles should be worn to create a safe environment for work.
- (4) There is a risk of fire or inflammation due to sparks, heat due to breakage, and cutting chips. Do not use where there is a risk of fire or explosion. Please caution of fire while using oil base coolant, fire prevention is necessary.
- (5) Do not use the tool for any purpose other than that for which it is intended.

4. Cautions regarding regrinding

- (1) If regrinding is not performed at the proper time, there is a risk of the tool breaking. Replace the tool with one in good condition, or perform regrinding.
- (2) Grinding dust will be created when regrinding a tool. When regrinding, be sure to attach a safety cover over the work area and wear safety clothes such as safety goggles, etc.
- (3) This product contains the specified chemical substance cobalt and its inorganic compounds. When performing regrinding or similar processing, be sure to handle the processing in accordance with the local laws and regulations regarding prevention of hazards due to specified chemical substances.

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