Where Innovation Never Stops

Practical Guide Shoulder Milling

Overview - Radially Clamped 90° Shoulder Milling Systems

Member IMC Group

The allrounder - insert selection

HELI3MILL HM390 LINE

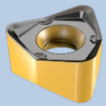
3 cutting edges

Smooth cut

★ ★ ★ ★ ★ ★

The economical radial insert

HELIDO 690 LINE



6 cutting edges

Smooth cut

★ ★ ★ ★ ★ ☆

The specialist for long overhangs

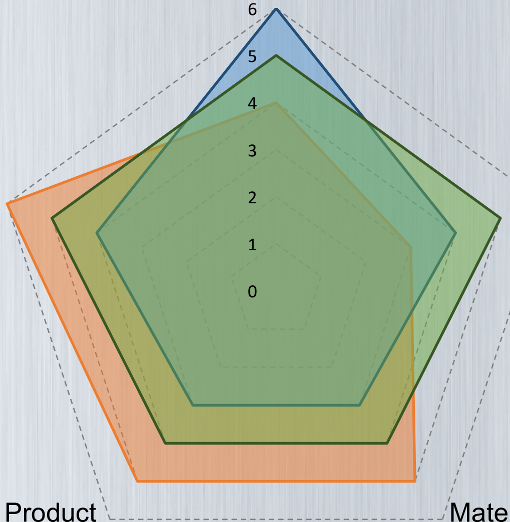
HELIDO 690 LINE

6 cutting edges

Smooth cut

★ ★ ★ ★ ☆ ☆

System features



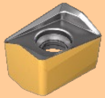
*
6 = low costs
1 = high costs

Supplementary Systems for Shoulder Milling

Member IMC Group

The hard working tool

HELIDO 490 LINE



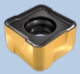
4 cutting edgs

Smooth cut

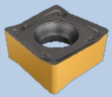
★ ★ ★ ★ ☆ ☆

The powerful option

HELIDO 890 LINE NEODO S90° LINE



90° lead angle



88° lead angle

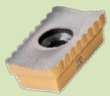
Smooth cut

★ ★ ★ ★ ☆ ☆

The noiseless specialist

Specialist eliminating vibrations by unique Kordelverzahnung

MILLSHRED P290 LINE

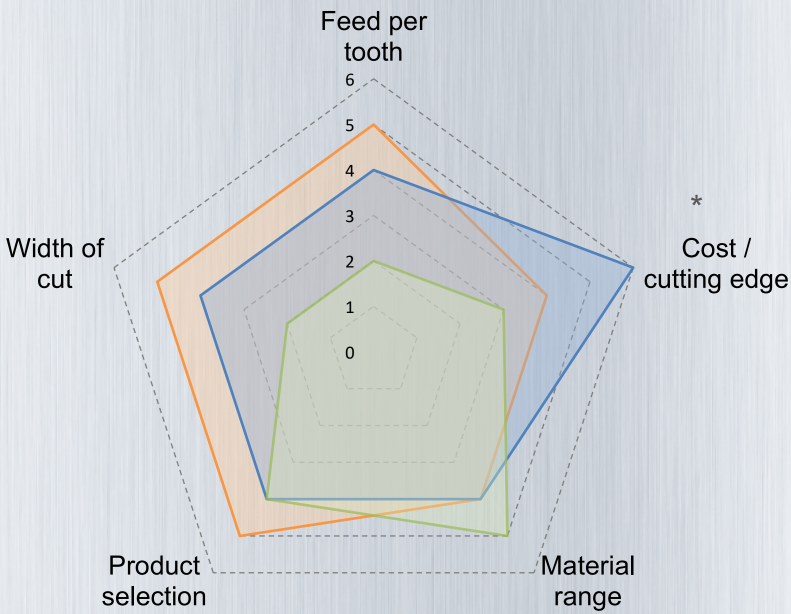


2 cutting edges

Smooth cut

★ ★ ★ ★ ★ ☆

System features



8 cutting edges

*
6 = low costs
1 = high costs

Overview - Tangentially Clamped 90° Shoulder Milling Inserts

Member IMC Group

The productivity booster

HELITANG T490 LINE

4 cutting edges

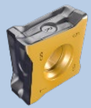
Smooth cut *

★★★★★★

* in relation to tangential tools

The economical tangential insert

LOGIQ8TANG T890 MILLING LINE

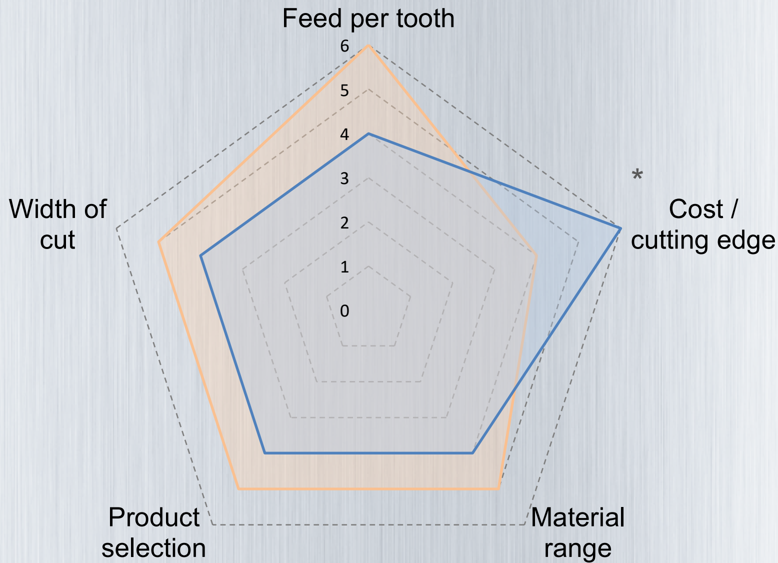


8 cutting edges

Smooth cut

★★★★★☆

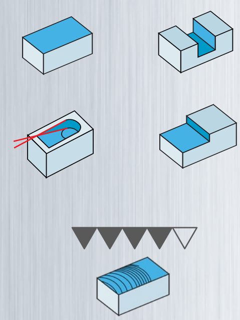
System features



*
6 = low costs
1 = high costs

HELI3MILL HM390 LINE **The *Allrounder***

- ✓ Positive, single-sided inserts with 3 cutting edges
- ✓ Very easy cut, first choice for ISO-M / S
- ✓ Effective and precise machining of 90° shoulders
- ✓ For roughing and finishing operations
- ✓ Flexible use for ISO P / M / K / N / S

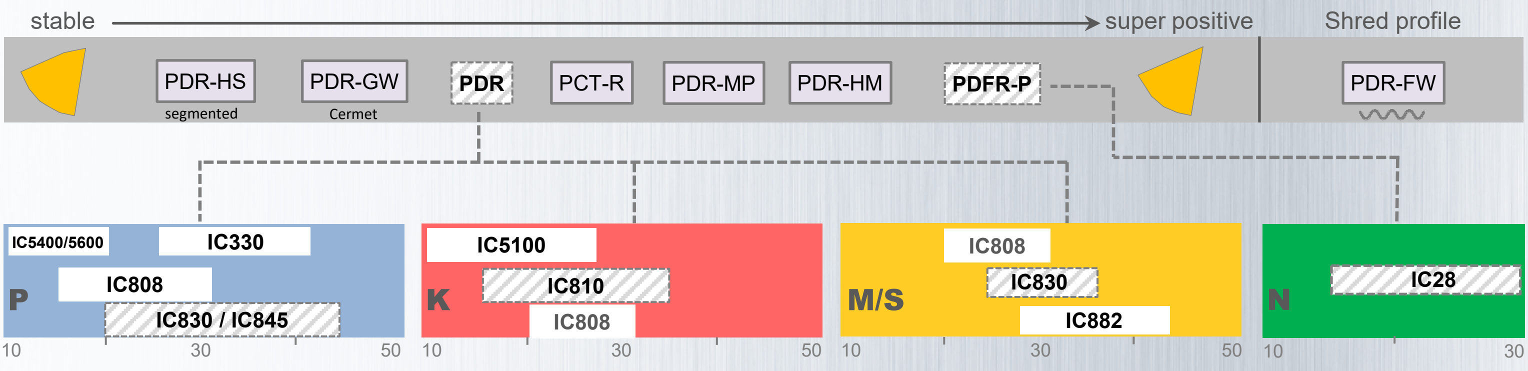


Product selection / chip formers / cutting grades

- End mills: Ø 6 – 50 mm *HM390 E__*
- Shell mills: Ø 32 – 200 mm *HM390 F__*
- Connections: shank / arbor / Camfix / MM / Flexfit
- Pitch: coarse and fine pitch / each with internal coolant
- Insert sizes [mm]: 04 / 05 / 07 / 10 / 15 / 19
- Insert corner radii [mm]: 0.2 / 0.4 / 0.8 / 1.0 / 1.2 / 1.6 / 2.0 / 2.4 / 3.2 / 4.0
- Insert designs: ground = *HM390 T_C_* // pressed = *HM390 T_K_*

Recommended chip formers & cutting grades

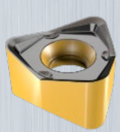
For ISO-S / M / N materials we recommend ground insert options.

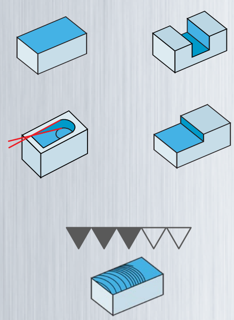


HELIDO 690 LINE — *The Economical Radial Insert*

Member IMC Group
ISCAR

- ✓ Double-sided insert
- ✓ 6 right-hand cutting edges
- ✓ Smooth cut
- ✓ Economical 90° face milling
- ✓ Semifinishing / roughing





Product selection / chip formers / cutting grades

- End mills: Ø 18 – 40 mm *H690 E___*
- Shell mills: Ø 40 – 125 mm *H690 F___*
- Connections: shank / arbor
- Pitch: coarse, regular / each with internal coolant
- Insert sizes [mm]: 04 / 07
- Insert corner radii [mm]: 0.8 / 1.2 / 1.6 / 2.0
- Insert designs: ground = *H690 WNHU_* // pressed = *H690 WNMU_*

Recommended chip formers & cutting grades

For ISO-S / M we recommend ground insert options.

stable → super positive

PNR-RM | PNN-MM | PNR-MM | **PNTR**

P: IC5400/5600, IC330, IC808, IC830 / IC845 (10 – 30 – 50)

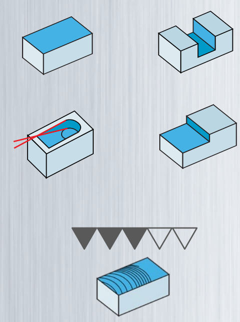
K: IC5100, IC810, IC808 (10 – 30 – 50)

M/S: IC808, IC830 / IC 330, IC840 / IC882 (10 – 30 – 50)

N (10 – 30)

HELIDO 690 LINE — The *Economical* Radial Insert

- ✓ 6 double-sided, right-hand cutting edges
- ✓ Low impact of axial forces on component
- ✓ For long overhangs
- ✓ Less vibrations
- ✓ Economical shoulder milling

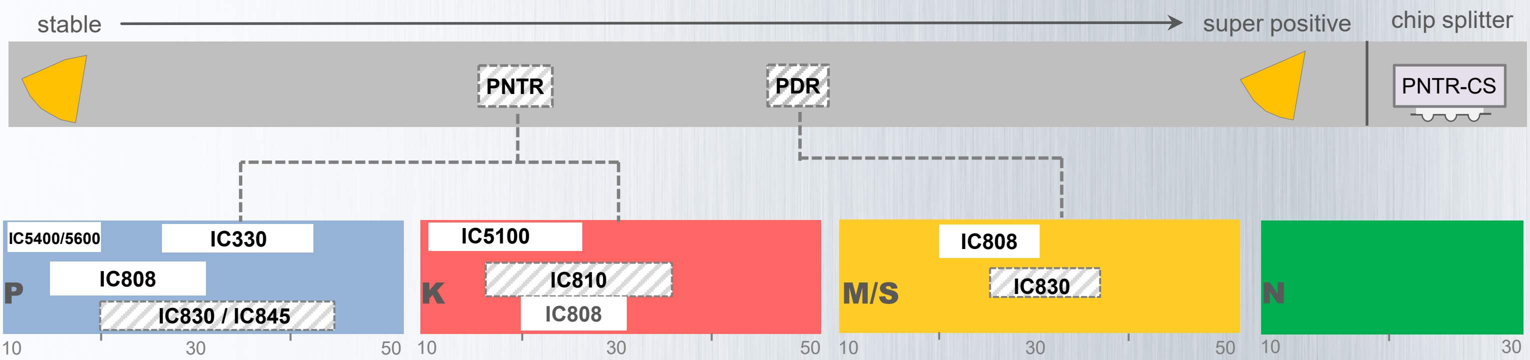


Product selection / chip formers / cutting grades

- End mills: Ø 32 – 40 mm *H690 E__...R10 / R16*
- Shell mills: Ø 40 – 160 mm *H690 F__...R10 / R16*
- Connection: shank / arbor
- Pitch: coarse, regular / each with internal coolant
- Insert sizes [mm]: 10 / 16
- Insert corner radii [mm]: 0.4 / 0.8 / 1.0
- Insert designs: ground = *H690 TNCX_* // pressed = *H690 TNKX_*

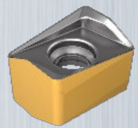
Recommended chip formers & cutting grades

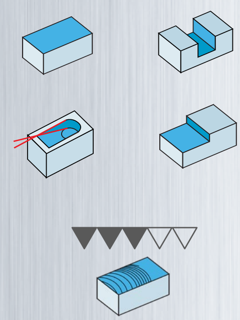
For ISO-S / M materials we recommend ground insert options.



HELIDO 490 LINE ***The hard working tool***

- ✓ Best productivity with double-sided insert
- ✓ Option instead of tangential milling systems
- ✓ Roughing geometries
- ✓ For large cutting widths



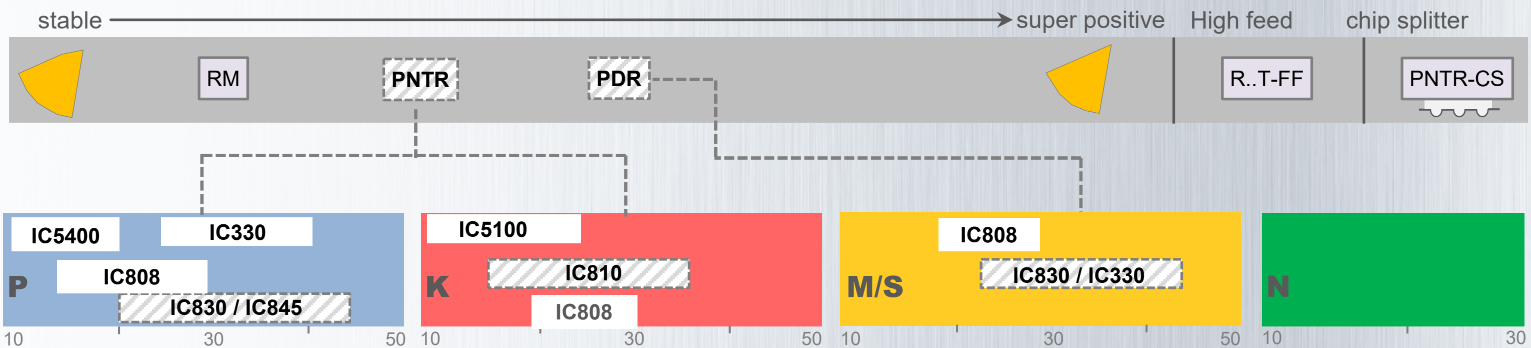


Product selection / chip formers / cutting grades

End mills:	Ø 16 – 32 mm	*H490 E90A__*
Shell mills:	Ø 32 – 250 mm	*H490 F90A__*
Extended flut shell mill:	Ø 50 – 80 mm	*H490 SM _*
Connections:	shank / arbor	
Pitch:	coarse, regular / each with internal coolant	
Insert sizes [mm]:	09 / 12 / 17	
Insert corner radii [mm]:	0.4 / 0.8 / 1.2 / 1.6 / 2.0 / 2.4	
Insert designs:	ground = *H490 ANCX_* // pressed = *H490 ANKX_*	

Recommended chip formers & cutting grades

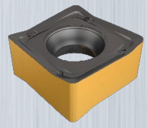
For ISO-S / M materials we recommend ground insert options.

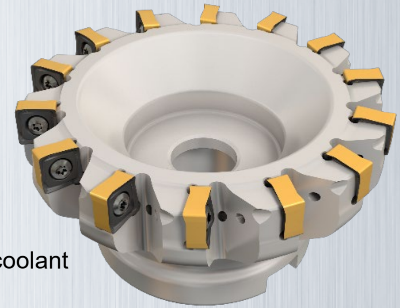


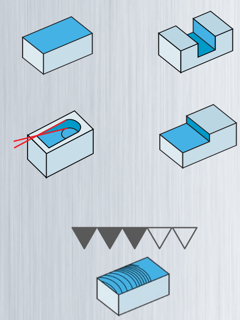
HELIDO 890 LINE The Powerful 88° Facemilling Cutter

Member IMC Group

- ✓ 8 right-hand or 8 left-hand cutting edges
- ✓ Most attractive price per cutting edge
- ✓ Option instead of face milling
- ✓ Ideal for special solutions







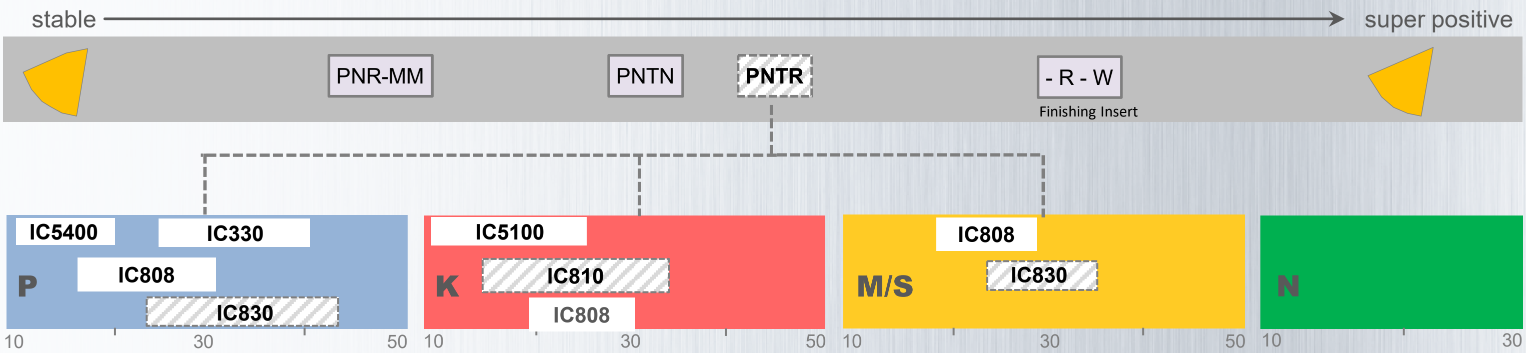
Product selection / chip formers / cutting grades

- Shell mills: Ø 40 – 160 mm *S890 FSN_*
- Slotting cutters: Ø 125 mm *S890 SSB_*
- Connection: arbor type A or B
- Pitch: coarse, regular / each with internal coolant
- Insert sizes [mm]: 13
- Insert corner radii [mm]: 0.8
- Insert designs: ground = S890 SN**H**U_ // pressed = *S890 SN**M**U_*

Finishing insert

Recommended chip formers & cutting grades

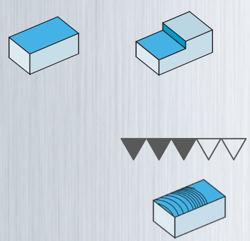
For ISO-S / M materials we recommend ground insert options.



NEODO S90° LINE

The Powerful 90° Facemilling Cutter

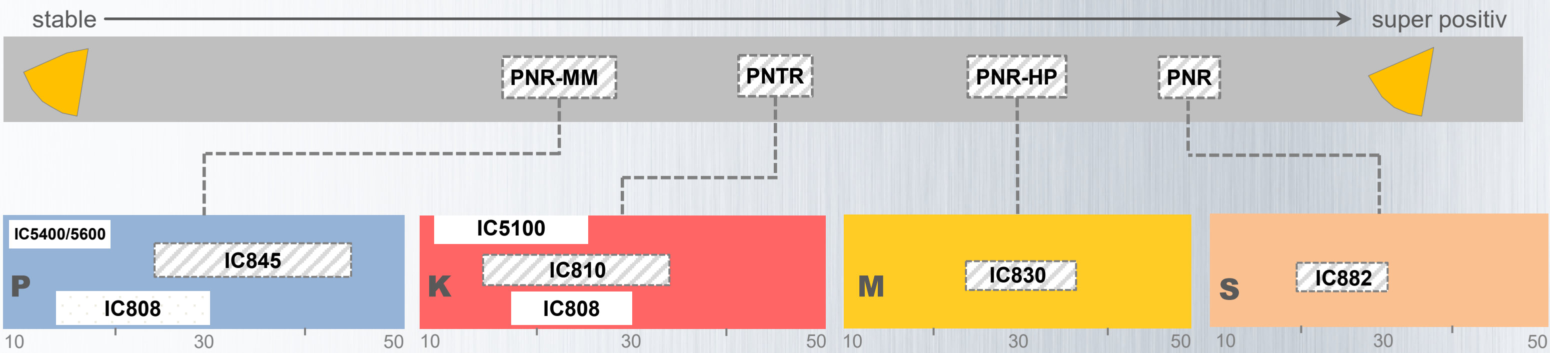
- ✓ 8 right-hand cutting edges
- ✓ very high Productivity
- ✓ carefree handling
- ✓ High process machining stability



Recommended chip formers & cutting grades

Product selection / chip formers / cutting grades

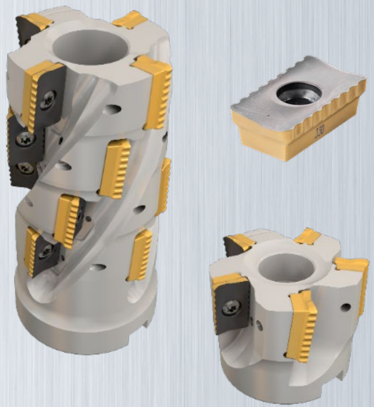
- End mills: Ø 25 – 32 mm *S890 E___*
- Shell mills: Ø 40 – 125 mm *S890 F___*
- Connection: arbor type A or B
- Pitch: regular / fine , each with internal coolant
- Insert sizes [mm]: 08
- Insert corner radii [mm]: 0,8 / 1,2
- Insert designs: pressed *S890 SZ**M**U 0804…_* *ground* = *S890 SZ**H**U_*

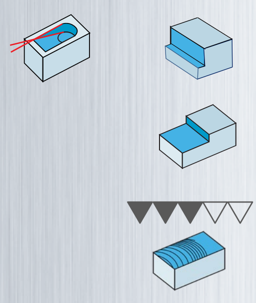


MILLSHRED P290 LINE — The Noiseless Specialist

Member IMC Group

- ✓ Single-sided, positive insert
- ✓ Best solution to eliminate vibrations
- ✓ Low cutting forces, less bending forces
- ✓ For long overhangs
- ✓ Excellent tool stability



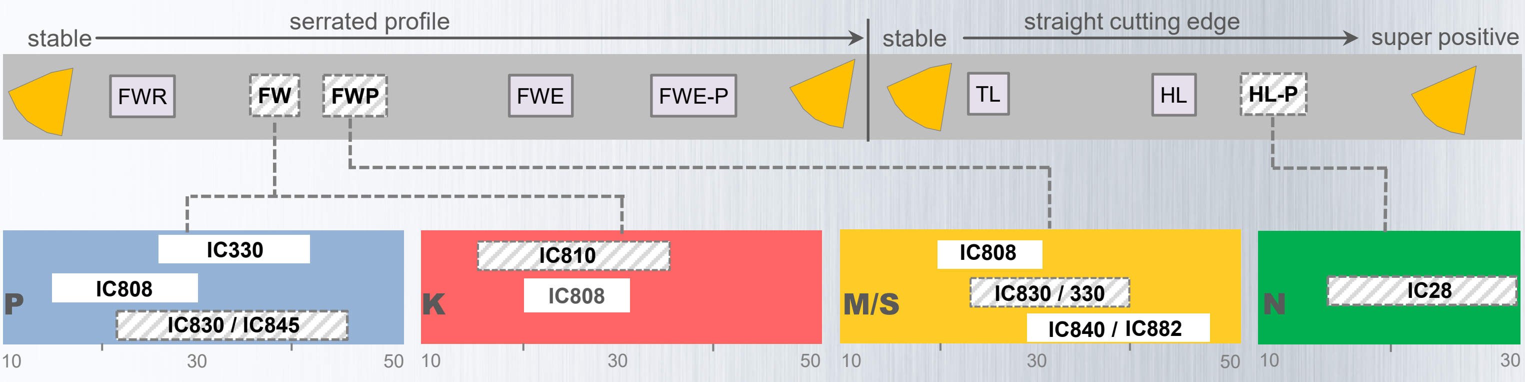


Product selection / chip formers / cutting grades

- End mills: Ø 20 – 40 mm *P290 EPW_*
- Shell mills: Ø 32 – 100 mm *P290 FPW_*
- Extended flute shell mill: Ø 32 – 100 mm *P290 SM / ACK_*
- Connections: shank / arbor / Flexfit
- Pitch: coarse, regular / each with internal coolant
- Insert sizes [mm]: 12 / 18
- Insert corner radii [mm]: special design, please refer to catalog
- Insert designs: ground = *P290 ACCT_* // pressed = *P290 ACKT_*

Recommended chip formers & cutting grades

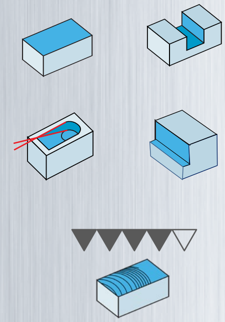
For ISO-S / M / N materials we recommend ground insert options.



HELITANG T490 LINE *Productivity* **Booster**

Member IMC Group

- ✓ Best productivity due to high feed per tooth
- ✓ Stable milling system
- ✓ First choice for series and mass production
- ✓ Wide selection of geometries
- ✓ Flexible use in ISO P / M / K / N / S materials

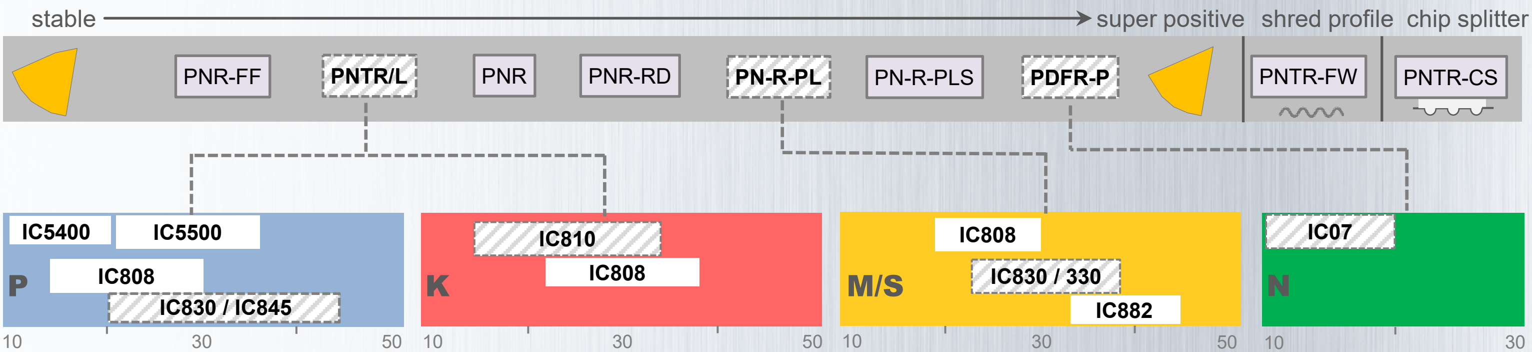


Product selection / chip formers / cutting grades

▪ End mills:	Ø 16 – 50 mm	*T490 ELN_*
▪ Shell mills:	Ø 32 – 200 mm	*T490 FLN_*
▪ Extended flute shell mill:	Ø 32 – 80 mm	*T490 LNK / SM_*
▪ Chamfering mill :	Ø 50 – 125 mm	T422 / T445_
▪ Connection:	shank / arbor / MM / Flexfit	
▪ Pitch:	coarse, regular and fine pitch / each with internal coolant	
▪ Insert sizes [mm]:	08 / 11 / 13 / 16 / 22	
▪ Insert corner radii [mm]:	0.4 / 0.8 / 1.2 / 1.6 / 2.0 / 2.4 / 3.1 / 4.0 / 5.0 / 6.4	
▪ Insert designs:	ground = *T490 LNHT_* // pressed = *T490 LNMT_*	

Recommended chip formers & cutting grades

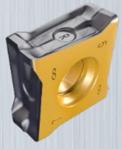
For ISO-S / M / N we recommend ground insert options.

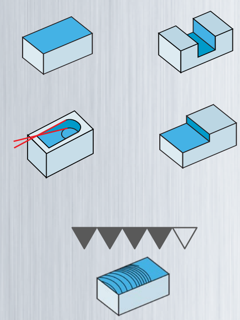


LOGIQ8TANG T890 MILLING LINE

The *Economical* Tangential Insert

- ✓ 8 right-hand cutting edges
- ✓ Stable tool body
- ✓ Machining of 90° shoulders (no mismatch)
- ✓ Low power consumption
- ✓ Plus finishing inserts

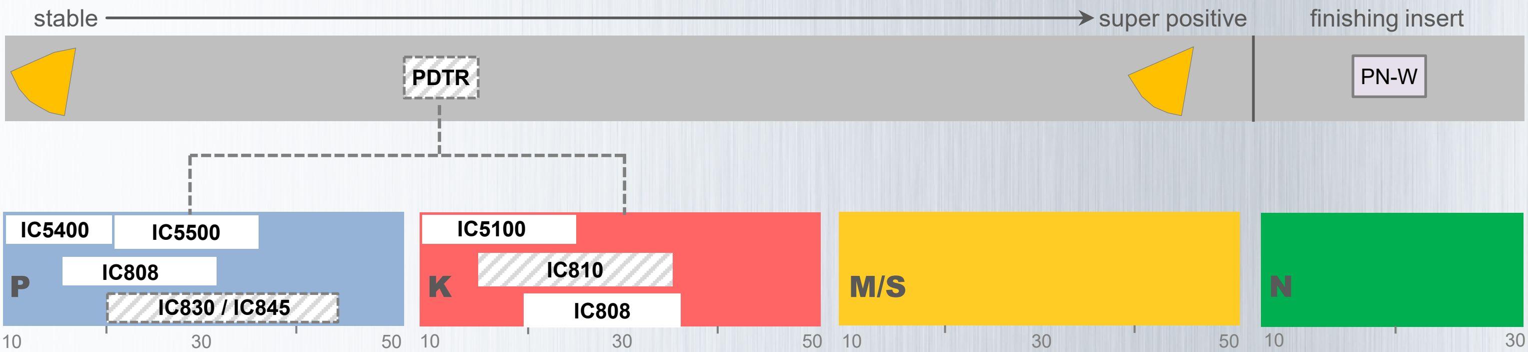




Product selection / chip formers / cutting grades

- End mills: Ø 32 – 40 mm *T890 ELN_*
- Shell mills: Ø 40 – 160 mm *T890 FLN_*
- Connections: shank / arbor
- Pitch: coarse, regular and fine pitch / each with internal coolant
- Insert sizes [mm]: 13
- Insert corner radii [mm]: 0.8
- Insert designs: ground = *T890 LN**H**_(**A**)_T 1306_*

Recommended chip formers & cutting grades



Material Numbers According to Workpiece Materials

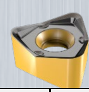
ISO	Material		Condition	Tensile strength [N/mm^2]	Hardness HB	Material No.	Material reference number																			
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1	1.0715	1.0718	1.0721	1.0722	1.0736	1.0737	1.0972	1.0976	1.0982	1.0984	1.0986	1.1121	1.1141	1.1151	1.2083	1.8900				
			Annealed	650	190	2	1.0406	1.0416	1.0473	1.0501	1.0503	1.0511	1.0540	1.0551	1.0553	1.0577	1.0726	1.0727	1.1157	1.1158	1.1166	1.1170	1.1178	1.1180	1.1181	1.1183
		>= 0.25 %C					1.1191	1.1206	1.1213	1.5423																
		< 0.55 %C	Quenched and tempered	850	250	3	1.0481	1.0503	1.0614	1.0616	1.0618	1.1165	1.1167	1.1186	1.1191	1.1201	1.7242	1.7337	1.7362							
		>= 0.55 %C	Annealed	750	220	4	1.0535	1.0601	1.0603	1.0605	1.1203	1.1209	1.1221	1.1231	1.1248	1.1269	1.1274	1.1663								
			Quenched and tempered	1000	300	5	1.0070	1.7238	1.7701																	
	Low alloy steel and cast steel (less than 5% of alloying elements)		Annealed	600	200	6	1.0116	1.0841	1.0904	1.0961	1.2067	1.2108	1.2210	1.2241	1.2311	1.2330	1.2419	1.2510	1.2542	1.2550	1.2713	1.2721	1.2842	1.3501	1.3505	1.3505
							1.5024	1.5025	1.5026	1.5027	1.5028	1.5120	1.5415	1.5419	1.5622	1.5732	1.5752	1.6587	1.6657	1.7015	1.7033	1.7035	1.7045	1.7131	1.7139	1.7176
							1.7220	1.7223	1.7225	1.7228	1.7262	1.7321	1.7335	1.7335	1.7380	1.7715	1.8509									
			vergütet	930	275	7	1.0038	1.5710	1.5755	1.6523	1.6546	1.6565	1.7218	1.7733	1.7755	1.8070										
				1000	300	8	1.0503	1.2332	1.3401	1.5736	1.6511	1.7361	1.8159	1.8161	1.8515	1.8523										
				1200	350	9	1.4882	1.5864																		
	High alloyed steel, cast steel, and tool steel		Annealed	680	200	10	1.0347	1.0401	1.0723	1.2080	1.2083	1.2085	1.2162	1.2210	1.2311	1.2312	1.2316	1.2343	1.2344	1.2363	1.2379	1.2436	1.2581	1.2601	1.2606	
							1.3343	1.5662	1.5680																	
			Quenched and tempered	1100	325	11	1.3202	1.3207	1.3243	1.3246	1.3247	1.3249	1.3255	1.3343	1.3348	1.3355	1.4718	1.4935								
	Stainless ferritic and stainless martensitic steel		Ferritic and martensitic	680	200	12	1.400	1.4001	1.4002	1.4005	1.4006	1.4016	1.4027	1.4028	1.4086	1.4104	1.4112	1.4113	1.4340	1.4417	1.4418	1.4510	1.4511	1.4512	1.4720	1.4724
							1.4742	1.4747	1.4749	1.4762	1.4871															
			Martensitic	820	240	13	1.4021	1.4031	1.4034	1.4057	1.4313	1.4544	1.4546	1.4922	1.4923											
M	Stainless steel and stainless cast steel		Austenitic	600	180	14	1.4301	1.4305	1.4306	1.4308	1.4310	1.4311	1.4312	1.4350	1.4362	1.4371	1.4401	1.4404	1.4406	1.4408	1.4410	1.4429	1.4435	1.4436	1.4438	1.4439
							1.4440	1.4449	1.4460	1.4462	1.4500	1.4504	1.4521	1.4539	1.4541	1.4542	1.4545	1.4547	1.4550	1.4552	1.4568	1.4571	1.4581	1.4583	1.4585	1.4821
							1.4823	1.4828	1.4833	1.4845	1.4878	1.4891	1.4893	1.4948	1.4980											
K	Grey cast iron (GG)		Ferritic and martensitic		180	15	0.6010	0.6015	0.6020	0.6660	0.7040															
			Perlitic		260	16	0.6020	0.6025	0.6030	0.6035	0.6040															
	Cast iron nodular (GGG)		Ferritic		160	17	0.7033	0.7043	0.7050	0.7652	0.7660															
			Perlitic		250	18	0.7060	0.7070																		
	Malleable cast iron		Ferritic		130	19	0.8055	0.8135	0.8145																	
			Perlitic		230	20	0.8035	0.8040	0.8045	0.8065	0.8155	0.8165	0.8170													
N	Aluminium Knetlegierungen		Not curable		60	21	3.0205	3.0255	3.3315																	
			Cured		100	22	3.1325	3.1655	3.2315	3.4345	3.2381	3.2382														
	Aluminum wrought alloys	<=12% Si	Not curable		75	23	3.2383	3.2581	3.3561	3.5101	3.5103	3.5812	3.5912													
			Cured		90	24	2.1871	3.1754	3.2163	3.2371	3.2373	3.5106														
		>12% Si	Over-eutectic		130	25																				
	Copper alloys	>1% Pb	Free cutting steel		110	26	2.1090	2.1096	2.1098	2.1182																
			Brass		90	27	2.0240	2.0321	2.0590	2.0592	2.0596	2.1293														
			Electrolytic copper		100	28	2.0060	2.0375	2.0966	2.0975	2.1050	2.1052	2.1292	2.4764												
	Non-ferrous		Fibreplastic/Duroplastics			29																				
			Hard rubber			30																				
S	High temp. Alloys	Fe Basis	Annealed		200	31	1.4558	1.4562	1.4563	1.4864	1.4865	1.4958	1.4562	1.4563	1.4864	1.4865	1.4958	2.4668								
			Cured		280	32	1.4977																			
		Ni or Co Basis	Annealed		250	33	2.4360	2.4603	2.4610	2.4630	2.4630	2.4642	2.4856	2.4858												
			Cured		350	34	2.4375	2.4631	2.4668	2.4694	2.4955	2.4668	2.4670	2.4662	2.4964											
			Bast		320	35	2.4669	2.4685	2.4810	2.4973	3.7115															
	Titanium and Ti-alloys		Pure	Rm = 400	Rm= 400(	36	3.7025	3.7225	2.4674																	
			Alpha+Beta alloys	Rm = 1050	Rm=	37	3.7124	3.7145	3.7165	3.7185	3.7195															
H	Hardened steel		Cured		55 HRC	38	1.1545	1.1545	1.2762	1.4125	1.6746															
			Cured		60 HRC	39																				
	Chilled cast iron		Cast		400	40	0.9620	0.9325	0.9630	0.9640	0.9650	0.9655	1.4841													
	Cast iron		Cured		55 HRC	41	0.9635	0.9645																		

Feed per Tooth for HELI3MILL HM390… 5 mm to 19 mm

HELI3MILL HM390 LINE

ISO	Material		Condition	Hardness HB	Material No.	HM390-05	HM390-07		HM390-10				HM390-15						HM390-19
						TPKT...PDR	TCCT... PCR	TCKT... PCTR	TPCR... PDFR-P	TPKR... PDRHM	TPCT... PDR	TPKT... PDR	TDKT... PDR	TDCT... PDR	TDKT... PDR-FW	TDKR...PDR-HM	TDKT... PDR-MP	TDCR... PDRR-P	TDKT... PDTR
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	125	1	0.10-0.12-0.15	0.10-0.11-0.12	0.10-0.12-0.15	-	0.10-0.12-0.15	0.10-0.11-0.12	0.10-0.12-0.15	0.10-0.13-0.15	0.08-0.11-0.15	0.10-0.13-0.18	0.10-0.13-0.18	0.10-0.13-0.18	-	0.12-0.16-0.2
		>= 0.25 %C	Annealed	190	2														
		< 0.55 %C	Quenched and tempered	250	3														
		>= 0.55 %C	Annealed	220	4														
			Quenched and tempered	300	5														
	Low alloy steel and cast steel (less than 5 % of alloying elements)		Annealed	200	6	0.08-0.11-0.14	0.07-0.09-0.11	0.08-0.11-0.14	-	0.08-0.11-0.14	0.07-0.09-0.11	0.08-0.10-0.14	0.08-0.12-0.14	0.08-0.10-0.15	0.10-0.12-0.18	0.10-0.12-0.18	0.10-0.12-0.18	-	0.1-0.15-0.18
			Quenched and tempered	275	7														
				300	8														
				350	9	0.08-0.10-0.13	0.07-0.09-0.11	0.08-0.10-0.13	-	0.08-0.10-0.13	0.07-0.09-0.11	0.08-0.10-0.13	0.08-0.11-0.13	0.08-0.10-0.13	0.10-0.12-0.15	0.10-0.12-0.15	0.10-0.12-0.15	-	0.1-0.12-0.15
	High alloyed steel, cast steel and tool steel		Annealed	200	10	0.08-0.10-0.12	0.07-0.09-0.10	0.08-0.10-0.12	-	0.08-0.09-0.12	0.07-0.08-0.10	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.13	0.10-0.10-0.15	0.10-0.10-0.15	0.10-0.10-0.15	-	0.1-0.11-0.13
			Quenched and tempered	325	11														
	Stainless ferritic and stainless martensitic steel		Ferritic, martensitisch	200	12	0.08-0.10-0.13	0.07-0.09-0.11	0.08-0.10-0.13	-	0.08-0.10-0.13	0.07-0.08-0.11	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.12	0.10-0.10-0.15	0.10-0.10-0.15	0.10-0.10-0.15	-	0.1-0.12-0.15
			Martensitic	240	13														
M	Stainless steel and stainless cast steel		Austenitic	180	14	0.08-0.10-0.13	0.06-0.08-0.11	0.08-0.10-0.13	-	0.08-0.10-0.13	0.06-0.08-0.11	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.15	0.10-0.12-0.15	0.10-0.12-0.15	0.10-0.12-0.15	-	-
K	Grey cast iron (GG)		Ferritic/ martensitic	180	15	0.10-0.12-0.15	-	-	-	-	0.08-0.10-0.12	0.10-0.12-0.15	0.10-0.13-0.15	0.10-0.13-0.15	0.10-0.15-0.22		0.10-0.15-0.22	-	0.12-0.2-0.3
			Pearlitic	260	16														
	Cast iron nodular (GGG)		Ferritic	160	17	0.08-0.11-0.14	-	-	-	-	0.07-0.09-0.11	0.08-0.11-0.14	0.08-0.12-0.14	0.08-0.12-0.15	0.10-0.15-0.20		0.10-0.15-0.20	-	0.12-0.2-0.25
			Pearlitic	250	18														
	Malleable cast iron		Ferritic	130	19														
			Pearlitic	230	20														
N	Aluminum wrought alloys		Not curable	60	21	-	-	-	0.1-0.18-0.25	0.1-0.12-0.15	-	-	-	-	-	-	-	0.08-0.15-0.25	-
			Cured	100	22	-	-	-			-	-	-	-	-	-	-		-
	Aluminum cast alloys	Si <=12%	Not curable	75	23	-	-	-			-	-	-	-	-	-	-		-
			Cured	90	24	-	-	-			-	-	-	-	-	-	-		-
		>12% Si	Hyper-eutectic	130	25	-	-	-			-	-	-	-	-	-	-		-
	Copper alloys	>1% Pb	Free cutting brass	110	26	-	-	-			-	-	-	-	-	-	-		-
			Brass	90	27	-	-	-			-	-	-	-	-	-	-		-
			Elelctrolytic copper	100	28	-	-	-			-	-	-	-	-	-	-		-
	Non-ferrous		CFRP / GRP		29	-	-	-			-	-	-	-	-	-	-		-
			Hard rubber		30	-	-	-			-	-	-	-	-	-	-		-
S	High temp. alloys	Fe Basis	Annealed	200	31	0.06-0.07-0.08	0.05-0.06-0.07	0.06-0.07-0.08	-	0.06-0.07-0.08	0.05-0.06-0.07	0.06-0.07-0.08	0.06-0.07-0.12	0.06-0.07-0.08	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12	-	0.06-0.07-0.08
			Cured	280	32														
		Ni or Co Basis	Annealed	250	33														
			Cured	350	34														
			Cast	320	35														
	Titanium and Ti alloys		Pure titanium	Rm= 400	36	0.08-0.09-0.10	0.06-0.07-0.08	0.08-0.09-0.10	-	0.08-0.09-0.10	0.06-0.07-0.08	0.08-0.09-0.10	0.08-0.09-0.12	0.08-0.09-0.10	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12	-	0.08-0.09-0.10
			Alpha+beta alloy	Rm= 1050	37														
H	Hardened steel		Hardened	55 HRC	38	0.04-0.05-0.06	0.05-0.06-0.07	0.04-0.05-0.06	-	-	0.05-0.06-0.07	0.04-0.05-0.06	0.04-0.05-0.06	-	-		-	-	-
			Hardened	60 HRC	39	-	-	-	-	-	-	-	-	-	-		-	-	-
	Chilled cast iron		Cast	400	40	0.04-0.05-0.06	0.05-0.06-0.07	0.04-0.05-0.06	-	-	0.05-0.06-0.07	0.04-0.05-0.06	0.04-0.05-0.06	-	-		-	-	-
	Cast iron		Hardened	55 HRC	41	0.04-0.05-0.06	0.05-0.06-0.07	0.04-0.05-0.06	-	-	0.05-0.06-0.07	0.04-0.05-0.06	0.04-0.05-0.06	-	-		-	-	-

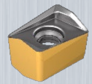
Feed per Tooth for HELIDO H690…   4 mm to 16 mm



HELIDO 690 LINE

ISO	Material		Condition	Tensile Strength $[N/mm^2]$	Hardness HB	Material No.	H690-04		H690-07			H690-10		H690-16
							WNMU...PNR-MM	WNMU... PNTR	WNHU... PNTR	WNMU... PNTR	WNMU...PNR-MM	TNCX... PDR	TNKX...PNTR	TNKX... PNTR
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1	0.10-0.11-0.15	0.10-0.11-0.15	0.1-0.15-0.2	0.15-0.2-0.35	0.15-0.20-0.35	0.10-0.11-0.13	0.10-0.12-0.15	0.15-0.22-0.30
		>= 0.25 %C	Annealed	650	190	2								
		< 0.55 %C	Quenched and tempered	850	250	3								
		>= 0.55 %C	Annealed	750	220	4								
			Quenched and tempered	1000	300	5								
	Low alloy steel and cast steel (less than 5 % of alloying elements)		Annealed	600	200	6	0.08-0.12-0.14	0.08-0.11-0.14	0.08-0.14-0.18	0.15-0.20-0.33	0.15-0.20-0.33	0.07-0.09-0.11	0.08-0.10-0.14	0.15-0.20-0.28
			Quenched and tempered	930	275	7								
				1000	300	8								
				1200	350	9	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.12-0.17	0.15-0.18-0.31	0.15-0.18-0.31	0.07-0.09-0.11	0.08-0.10-0.13	0.15-0.20-0.26
	High alloy steel, cast steel and tool steel		Annealed	680	200	10	0.08-0.09-0.12	0.08-0.09-0.12	0.08-0.12-0.16	0.15-0.18-0.28	0.15-0.18-0.28	0.07-0.08-0.10	0.08-0.10-0.12	0.15-0.18-0.24
			Quenched and tempered	1100	325	11								
	Stainless ferritic and stainless martensitic steel		Ferritic, martensitisch	680	200	12	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.12-0.17	0.15-0.18-0.31	0.15-0.18-0.31	0.07-0.09-0.11	0.08-0.10-0.13	0.15-0.18-0.26
			Martensitic	820	240	13								
M	Stainless steel and stainless cast steel		Austenitic	600	180	14	0.08-0.10-0.13	-	0.08-0.12-0.17	-	0.09-0.15-0.25	0.06-0.08-0.11	0.08-0.10-0.13	0.09-0.16-0.21
K	Grey cast iron (GG)		Ferritic/ martensitic		180	15	0.10-0.12-0.15	0.10-0.12-0.15	0.10-0.12-0.15	0.15-0.22-0.35	0.15-0.25-0.35	0.08-0.10-0.13	0.10-0.12-0.15	0.15-0.18-0.30
			Pearlitic		260	16								
	Cast iron nodular (GGG)		Ferritic		160	17	0.08-0.11-0.14	0.08-0.11-0.14	0.08-0.11-0.14	0.15-0.20-0.33	0.15-0.20-0.33	0.07-0.09.-0.11	0.08-0.11-0.14	0.15-0.18-0.26
			Pearlitic		250	18								
	Malleable cast iron		Ferritic		130	19								
			Pearlitic		230	20								
N	Aluminum wrought alloys		Not curable		60	21	-	-	-	-	-	-	-	-
			Cured		100	22	-	-	-	-	-	-	-	-
	Aluminum cast alloys	<=12 % Si	Not curable		75	23	-	-	-	-	-	-	-	- -
			Cured		90	24	-	-	-	-	-	-	-	-
		>12 % Si	Hyper-eutectic		130	25	-	-	-	-	-	-	-	-
	Copper alloys	>1 % Pb	Free cutting brass		110	26	-	-	-	-	-	-	-	-
			Brass		90	27	-	-	-	-	-	-	-	-
			Elelctrolytic copper		100	28	-	-	-	-	-	-	-	-
	Non-ferrous		CFRP / GRP			29	-	-	-	-	-	-	-	-
			Hard rubber			30	-	-	-	-	-	-	-	-
S	High temp. alloys	Fe Basis	Annealed		200	31	0.06-0.07-0.08	-	0.06-0.07-0.08	-	0.06-0.07-0.08	0.05-0.06-0.07	0.06-0.07-0.08	0.06-0.07-0.08
			Cured		280	32								
		Ni or Co Basis	Annealed		250	33								
			Cured		350	34								
			Cast		320	35								
	Titanium and Ti alloys		Pure titanium	Rm = 400	Rm= 400	36	0.08-0.09-0.10	-	0.08-0.09-0.10	-	0.08-0.09-0.10	0.06-0.07-0.08	0.08-0.10	0.08-0.10
			Alpha+beta alloy	Rm = 1050	Rm= 1050	37								
H	Hardened steel		Hardened		55 HRC	38	0.04-0.05-0.06	-	0.04-0.05-0.06	-	0.06-0.07-0.08	0.05-0.06-0.07	0.04-0.05-0.06	0.06-0.07-0.08
			Hardened		60 HRC	39	-	-	-	-	-	-	-	-
	Chilled cast iron		Cast		400	40	0.04-0.05-0.06	-	0.04-0.05-0.06	-	0.06-0.07-0.08	0.05-0.06-0.07	0.04-0.05-0.06	0.06-0.07-0.08
	Cast iron		Hardened		55 HRC	41	0.04-0.05-0.06	-	0.04-0.05-0.06	-	0.06-0.07-0.08	0.05-0.06-0.07	0.04-0.05-0.06	0.06-0.07-0.08

Feed per Tooth for HELIDO H490.. 9 mm to 17 mm



ISO	Material		Condition	Tensile Strength [N/mm²]	Hardness HB	Material No.	H490 09 mm		H490 12 mm				H490 17mm			
							ANCX PDR	ANKX PNTR	ANCX PDR	ANKX PNTR	ANKX PNTR-RM	ANKX PNTR-CS	ANCX PDR	ANKX PNTR	ANKX RM	ANKX CS
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1	0.08-0.11-0.15	0.10-0.12-0.16	0.10-0.14-0.20	0.10-0.17-0.25	0.10-0.20-0.25	0.10-0.14-0.20	0.10-0.14-0.20	0.10-0.17-0.25	0.10-0.20-0.30	0.15-0.20-0.22
		>= 0.25 %C	Annealed	650	190	2										
		< 0.55 %C	Quenched and tempered	850	250	3										
		>= 0.55 %C	Annealed	750	220	4										
			Quenched and tempered	1000	300	5										
	Low alloy steel and cast steel (less than 5 % of alloying elements)		Annealed	600	200	6	0.08-0.10-0.15	0.08-0.10-0.16	0.08-0.10-0.20	0.08-0.10-0.20	0.08-0.12-0.20	0.10-0.12-0.20	0.08-0.10-0.20	0.08-0.10-0.25	0.08-0.10-0.25	0.15-0.16-0.22
			Quenched and tempered	930	275	7										
				1000	300	8										
				1200	350	9	0.08-0.10-0.15	0.08-0.10-0.16	0.08-0.10-0.20	0.08-0.10-0.20	0.08-0.12-0.20	0.10-0.12-0.20	0.08-0.10-0.20	0.08-0.10-0.25	0.08-0.10-0.25	0.12-0.16-0.20
	High alloyed steel, cast steel and tool steel		Annealed	680	200	10	0.08-0.10-0.14	0.08-0.10-0.16	0.08-0.10-0.15	0.08-0.12-0.16	0.08-0.12-0.16	0.08-0.10-0.15	0.08-0.10-0.18	0.08-0.10-0.20	0.08-0.10-0.20	0.12-0.16-0.20
			Quenched and tempered	1100	325	11										
	Stainless ferritic and stainless martensitic steel		Ferritic, martensitisch	680	200	12	0.08-0.10-0.14	0.08-0.10-0.16	0.08-0.10-0.18	0.08-0.12-0.20	0.08-0.12-0.20	0.08-0.10-0.18	0.08-0.10-0.18	0.08-0.10-0.20	0.08-0.10-0.20	012-0.16-0.20
			Martensitic	820	240	13										
M	Stainless steel and stainless cast steel		Austenitic	600	180	14	0.08-0.10-0.14	0.08-0.10-0.16	0.08-0.10-0.20	0.08-0.10-0.20	-	0.08-0.10-0.20	0.08-0.10-0.20	0.08-0.10-0.20	-	-
K	Grey cast iron (GG)		Ferritic/ martensitic		180	15	0.10-0.12-0.14	0.10-0.12-0.18	0.10-0.15-0.25	0.10-0.12-0.30	0.10-0.20-0.30	0.10-0.15-0.20	0.10-0.18-0.20	0.10-0.12-0.30	0.12-0.18-0.35	0.12-0.18-0.25
			Pearlitic		260	16										
	Cast iron nodular (GGG)		Ferritic		160	17	0.08-0.12-0.14	0.08-0.12-0.18	0.08-0.15-0.20	0.08-0.17-0.25	0.08-0.18-0.25	0.08-0.15-0.20	0.08-0.18-0.20	0.08-0.18-0.25	0.12-0.18-0.30	0.12-0.18-0.22
			Pearlitic		250	18										
	Malleable cast iron		Ferritic		130	19										
			Pearlitic		230	20										
N	Aluminum wrought alloys		Not curable		60	21	-	-	-	-	-	-	-	-	-	-
			Cured		100	22										
	Aluminum cast alloys	Si <=12%	Not curable		75	23										
			Cured		90	24										
		>12% Si	Hyper-eutectic		130	25										
	Copper alloys	>1% Pb	Free cutting brass		110	26										
			Brass		90	27										
			Elelctrolytic copper		100	28										
	Non-ferrous		CFRP / GRP			29										
			Hard rubber			30										
S	High temp. alloys	Fe Basis	Annealed		200	31	-	-	-	-	-	-	-	-	-	-
			Cured		280	32										
		Ni or Co Basis	Annealed		250	33										
			Cured		350	34										
			Cast		320	35										
	Titanium and Ti alloys		Pure titanium	Rm = 400	Rm= 400	36										
			Alpha+beta alloy	Rm = 1050	Rm= 1050	37										
H	Hardened steel		Hardened		55 HRC	38	-	-	-	-	-	-	-	-	-	-
			Hardened		60 HRC	39	-	-	-	-	-	-	-	-	-	-
	Chilled cast iron		Cast		400	40	-	-	-	-	-	-	-	-	-	-
	Cast iron		Hardened		55 HRC	41	-	-	-	-	-	-	-	-	-	-

Feed per Tooth for HELITANG T490… 13 mm to 22 mm

HELITANG T490 LINE

ISO	Material		Condition	Tensile Strength [N/mm²]	Hardness HB	Material No.	T490-13								T490-16			T490-22	
							LNMT… -PNTR	LNHT…-PNTR	LNHT…PN-R-PL	LNMT…-PNTR-FW	LNMT… PNTR..-CS	LNHT PNTR -RD	LNAR PN -R	LNAR PN -R-P	LNMT… PN-R	LNHT… PN-R	LNAR PN -R	LNMT… -PNTR	LNHT… -PNTR
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1	0.1-0.12-0.25	0.1-0.12-0.2	0.1-0.15-0.2	0.1-0.12-0.2	0.1-0.15-0.2	0.1-0.12-0.2	0.1-0.12-0.2 noch prüfen		0.15-0.2-0.25	0.15-0.18-0.25		0.20-0.3-0.45	0.20-0.3-0.40
		>= 0.25 %C	Annealed	650	190	2													
		< 0.55 %C	Quenched and tempered	850	250	3													
		>= 0.55 %C	Annealed	750	220	4													
			Quenched and tempered	1000	300	5													
	Low alloy steel and cast steel (less than 5 % of alloying elements)		Annealed	600	200	6	0.1-0.16-0.23	0.1-0.13-0.18	0.1-0.13.0.18	0.1-0.13-0.18	0.1-0.14-0.18	0.1-0.13-0.18	0.1-0.13-0.18		0.13-0.18-0.23	0.13-0.16-0.23		0.20-0.30-0.42	0.20-0.30-0.40
			Quenched and tempered	930	275	7													
				1000	300	8													
				1200	350	9	0.1-0.16-0.21	0.1-0.12-0.16	0.1-0.12-0.16	0.1-0.12-0.16	0.1-0.13-0.16	0.1-0.12-0.16	0.1-0.12-0.16		0.13-0.17-0.21	0.13-0.15-0.21		0.18-0.25-0.35	0.18-0.22-0.35
	High alloyed steel, cast steel and tool steel		Annealed	680	200	10	0.1-0.14-0.19	0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14		0.13-0.16-0.19	0.13-0.14-0.19		0.18-0.25-0.35	0.18-0.22-0.35
			Quenched and tempered	1100	325	11													
	Stainless ferritic and stainless martensitic steel		Ferritic, martensitisch	680	200	12	0.1-0.15-0.21	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18		0.13-0.17-0.21	0.13-0.15-0.21		0.18-0.25-0.35	0.18-0.22-0.35
			Martensitic	820	240	13													
M	Stainless steel and stainless cast steel		Austenitic	600	180	14	0.1-0.14-0.18	0.1-0.13-0.16	0.1-0.13-0.16	0.1-0.13-0.16	0.1-0.13-0.16	0.1-0.13-0.16	0.1-0.13-0.16		0.13-0.16-0.19	0.13-0.14-0.19		-	0.15-0.2-0.25
K	Grey cast iron (GG)		Ferritic/ martensitic		180	15	0.1-0.18-0.25	0.1-0.15-0.2	0.1-0.12-0.2	0.1-0.15-0.2	0.1-0.15--0.2	0.1-0.15-0.2			0.15-0.2-0.25	0.15-0.18-0.25		0.25-0.3-0.45	0.20-0.28-0.40
			Pearlitic		260	16													
	Cast iron nodular (GGG)		Ferritic		160	17	0.1-0.16-0.23	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18			0.15-0.19-0.23	0.15-0.17-0.23		0.25-0.3-0.42	0.20-0.28-0.40
			Pearlitic		250	18													
	Malleable cast iron		Ferritic		130	19													
			Pearlitic		230	20													
N	Aluminum wrought alloys		Not curable		60	21	-	-	-	-	-	-	-	0.1-0.15-0.20	-	-	0.1-0.15-0.25	-	-
			Cured		100	22	-	-	-	-	-	-	-		-	-		-	-
	Aluminum cast alloys	<=12% Si	Not curable		75	23	-	-	-	-	-	-	-		-	-		-	-
			Cured		90	24	-	-	-	-	-	-	-		-	-		-	-
		>12% Si	Hyper-eutectic		130	25	-	-	-	-	-	-	-		-	-		-	-
	Copper alloys	>1% Pb	Free cutting brass		110	26	-	-	-	-	-	-	-		-	-		-	-
			Brass		90	27	-	-	-	-	-	-	-		-	-		-	-
			Elelctrolytic copper		100	28	-	-	-	-	-	-	-		-	-		-	-
	Non-ferrous		CFRP / GRP			29	-	-	-	-	-	-	-		-	-		-	-
			Hard rubber			30	-	-	-	-	-	-	-		-	-		-	-
S	High temp. alloys	Fe Basis	Annealed		200	31	0.06-0.07-0.08	0.06-0.07-0.08	0.06-0.08-0.09	0.06-0.07-0.08	0.06-0,07-0.08	0.06-0.07-0.08	0.06-0.07-0.08		0.06-0.07-0.08	0.06-0.07-0.08		0.06-0.08-0.09	-
			Cured		280	32													
		Ni or Co Basis	Annealed		250	33													
			Cured		350	34													
			Cast		320	35													
	Titanium and Ti alloys		Pure titanium	Rm = 400	Rm= 400	36	0.08-0.09-0.1	0.08-0.09-0.1	0.08-0.09-0.1	0.08-0.09-0.1	0.08-0.09-0.1	0.08-0.09-0.1	0.08-0.09-0.1		0.08-0.09-0.11	0.08-0.09-0.11		0.08-0.09-0.11	-
			Alpha+beta alloy	Rm = 1050	Rm= 1050	37													
H	Hardened steel		Hardened		55 HRC	38	0.06-0.07-0.08	0.06-0.07-0.08	-	0.06-0.07-0.08	0.06-0.07-0.08	0.06-0.07-0.08			0.06-0.07-0.08	0.06-0.07-0.08		0.06-0.07-0.08	-
			Hardened		60 HRC	39	-	-	-	-	-	-			-	-		-	-
	Chilled cast iron		Cast		400	40	0.06-0.07-0.08	0.06-0.07-0.08	-	0.06-0.07-0.08	0.06-0.07-0.08	0.06-0.07-0.08			0.06-0.07-0.08	0.06-0.07-0.08		0.06-0.07-0.08	-
	Cast iron		Hardened		55 HRC	41	0.06-0.07-0.08	0.06-0.07-0.08	-	0.06-0.07-0.08	0.06-0.07-0.08	0.06-0.07-0.08			0.06-0.07-0.08	0.06-0.07-0.08		0.06-0.07-0.08	-

Feed per Tooth for HELITANG T490… 08 mm to 11 mm

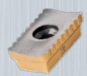
HELITANG T490 LINE

ISO	Material		Condition	Tensile Strength [N/mm²]	Hardness HB	Material No.	T490-08 LNHT… PNR	T490-08 LNMT… PNR	T490-08 LNMT…CS	T490-08 LNHT…RD	T490-08 LNHT…PLS	T490-08 LNAR…PN-R-P	T490-11 LNMT… PNTR	T490-11 LNHT… PNTR	T490-11 LNHT…PLS	T490-11 LNMT… ..CS	T490-11 LNMT… FW
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1	0.1-0.12-0.15	0.1-0.13-0.16	0.1-0.12-0.15	0.1-0.12-0.15	0.1-0.12-0.15		0.1-0.15-0.2	0.1-0.15-0.18	0.1-0.15-0.18	0.1-0.15-0.18	0.1-0.15-0.18
		>= 0.25 %C	Annealed	650	190	2											
		< 0.55 %C	Quenched and tempered	850	250	3											
		>= 0.55 %C	Annealed	750	220	4											
			Quenched and tempered	1000	300	5											
	Low alloy steel and cast steel (less than 5 % of alloying elements)		Annealed	600	200	6	0.08-0.11-0.14	0.08-0.12-0.14	0.08-0.11-0.14	0.08-0.11-0.14	0.08-0.11-0.14		0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18
			Quenched and tempered	930	275	7											
				1000	300	8											
				1200	350	9	0.08-0.10-0.13	0.08-0.11-0.13	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.13		0.1-0.13-0.16	0.1-0.13-0.16	0.1-0.13-0.16	0.1-0.13-0.16	0.1-0.13-0.16
	High alloyed steel, cast steel and tool steel		Annealed	680	200	10	0.08-0.10-0.12	0.08-0.11-0.12	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12		0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14
			Quenched and tempered	1100	325	11											
	Stainless ferritic and stainless martensitic steel		Ferritic, martensitisch	680	200	12	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.13		0.1-0.14-0.18	0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14	0.1-0.12-0.14
			Martensitic	820	240	13											
M	Stainless steel and stainless cast steel		Austenitic	600	180	14	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.13	0.08-0.10-0.13		0.1-0.13-0.16	0.08-0.12-0.14	0.08-0.12-0.14	0.08-0.12-0.15	0.08-0.12-0.15
K	Grey cast iron (GG)		Ferritic/ martensitic		180	15	0.1-0,12-0.15	0.1-0,13-0.15	0.1-0,12-0.15	0.1-0,12-0.15	0.1-0,12-0.15		0.1-0.15-0.25	0.1-0.15-0.2	0.1-0.15-0.2	0.1-0.15-0.2	0.1-0.15-0.2
			Pearlitic		260	16											
	Cast iron nodular (GGG)		Ferritic		160	17	0.08-0.12-0.14	0.08-0.13-0.14	0.08-0.12-0.14	0.08-0.12-0.14	0.08-0.12-0.14		0.1-0.14-0.25	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18	0.1-0.14-0.18
			Pearlitic		250	18											
	Malleable cast iron		Ferritic		130	19											
			Pearlitic		230	20											
N	Aluminum wrought alloys		Not curable		60	21	-	-	-	-	-	0.1-0.15-0.20	-				
			Cured		100	22	-	-	-	-	-		-				
	Aluminum cast alloys	Si <=12%	Not curable		75	23	-	-	-	-	-		-	-	-	-	-
			Cured		90	24	-	-	-	-	-		-	-	-	-	-
		>12% Si	Hyper-eutectic		130	25	-	-	-	-	-		-	-	-	-	-
	Copper alloys	>1% Pb	Free cutting brass		110	26	-	-	-	-	-		-	-	-	-	-
			Brass		90	27	-	-	-	-	-		-	-	-	-	-
			Elelctrolytic copper		100	28	-	-	-	-	-		-	-	-	-	-
	Non-ferrous		CFRP / GRP			29	-	-	-	-	-		-	-	-	-	-
			Hard rubber			30	-	-	-	-	-		-	-	-	-	-
S	High temp. alloys	Fe Basis	Annealed		200	31	0.06-0,07-0.08		0.06-0,07-0.08	0.06-0,07-0.08	0.06-0,07-0.08		0.06-0.07-0.08	0.05-0.07-0.08	0.05-0.07-0.08		0.05-0.07-0.08
			Cured		280	32											
		Ni or Co Basis	Annealed		250	33											
			Cured		350	34											
			Cast		320	35											
	Titanium and Ti alloys		Pure titanium	Rm = 400	Rm= 400	36	0.08-0.09-0.1		0.08-0.09-0.1	0.08-0.09-0.1	0.08-0.09-0.1		0.08-0.09-0.1	0.06-0.08-0.1	0.06-0.08-0.1		0.06-0.08-0.1
			Alpha+beta alloy	Rm = 1050	Rm= 1050	37											
H	Hardened steel		Hardened		55 HRC	38	-		-	-	-	-	0.05-0,06-0.08				
			Hardened		60 HRC	39	-		-	-	-	-	-				
	Chilled cast iron		Cast		400	40	-		-	-	-	-	0.05-0,06-0.08				
	Cast iron		Hardened		55 HRC	41	-		-	-	-	-	0.05-0,06-0.08				

Feed per Tooth for HELIDO S890… 13 & NEODO S890… 08

ISO	Material		Condition	Tensile Strength $[N/mm^2]$	Hardness HB	Material No.	V_c [m/min]	S890-13 SNMU PNTR	S890-13 SNMU MM	S890-13 SNMU PNTN	S890 -08 SZMU PNR MM	S890 -08 SZMU PNTR	S890 -08 SZMU PNRHP	S890 -08 SZHU PNR
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1	140-180-250	0.10-0.15-0.25	0.10-0.15-0.30	0.10-0.15-0.25	0.10-0.15-0.25	-		-
		>= 0.25 %C	Annealed	650	190	2								
		< 0.55 %C	Quenched and tempered	850	250	3								
		>= 0.55 %C	Annealed	750	220	4								
			Quenched and tempered	1000	300	5								
	Low alloy steel and cast steel (less than 5 % of alloying elements)		Annealed	600	200	6	130-160-200	0.08-0.15-0.20	0.08-0.10-0.20	0.08-0.10-0.20	0.1-0.12-0.20	-		-
			Quenched and tempered	930	275	7								
				1000	300	8								
				1200	350	9	130-140-180	0.08-0.15-0.20	0.08-0.15-0.20	0.08-0.15-0.20	0.08-0.10-0.20	-		-
	High alloyed steel, cast steel and tool steel		Annealed	680	200	10	120-130-180	0.08-0.14-0.18	0.08-0.14-0.18	0.08-0.14-0.18	0.08-0.10-0.15	-		-
			Quenched and tempered	1100	325	11								
	Stainless ferritic and stainless martensitic steel		Ferritic, martensitisch	680	200	12	90-110-160	0.08-0.12-0.20	0.08-0.12-0.20	0.08-0.12-0.20	0.08-0.10-0.15	-	0.08-0.10-0.20	-
			Martensitic	820	240	13								
M	Stainless steel and stainless cast steel		Austenitic	600	180	14	80-140-180	0.08-0.10-0.20	0.08-0.10-0.20	0.08-0.10-0.20	0.08-0.10-0.15		0.08-0.12-0.20	0.08-0.10-0.20
K	Grey cast iron (GG)		Ferritic/ martensitic		180	15	140-180-280	0.10-0.12-0.30	0.10-0.12-0.35	0.10-0.12-0.30	-	0.10-0.15-0.25	-	-
			Pearlitic		260	16								
	Cast iron nodular (GGG)		Ferritic		160	17	120-160-250	0.08-0.16-0.25	0.08-0.18-0.25	0.08-0.18-0.25	-	0.10-0.15-0.20	-	-
			Pearlitic		250	18								
	Malleable cast iron		Ferritic		130	19								
			Pearlitic		230	20								
N	Aluminum wrought alloys		Not curable		60	21	-	-	-	-	-	-	-	-
			Cured		100	22								
	Aluminum cast alloys	<=12% Si	Not curable		75	23								
			Cured		90	24								
		>12% Si	Hyper-eutectic		130	25								
	Copper alloys	>1% Pb	Free cutting brass		110	26								
			Brass		90	27								
			Elelctrolytic copper		100	28								
	Non-ferrous		CFRP / GRP			29								
			Hard rubber			30								
S	High temp. alloys	Fe Basis	Annealed		200	31	20-60-100	-	-	-	-	-	-	0.05-0.06-0.12
			Cured		280	32								
		Ni or Co Basis	Annealed		250	33	20-35-80							
			Cured		350	34								
			Cast		320	35								
	Titanium and Ti alloys		Pure titanium	Rm = 400	Rm= 400	36	30-50-80							0.06-0.07-0.12
			Alpha+beta alloy	Rm = 1050	Rm= 1050	37								
H	Hardened steel		Hardened		50 HRC	38	40-60-120	-	-	-	0.06-0.08-0.12	-	-	-
			Hardened		60 HRC	39	-	-	-	-	-	-	-	-
	Chilled cast iron		Cast		400	40	-	-	-	-	-	-	-	-
	Cast iron		Hardened		55 HRC	41	-	-	-	-	-	-	-	-

Feed per Tooth for MILLSHRED P290… 12 mm to 18 mm



MILLSHRED P290 LINE

ISO	Material		Condition	Tensile Strength $[N/mm^2]$	Hardness HB	Material No.	P290-12				P290-18							
							ACCT... PDR-TL	ACCT... PDR-HL	ACKT...PDR-FW	ACKT...PDR-FWP	ACCT... PDR-TL	ACCT... PDR-HL	ACCT... PDR-HL-P	ACKT...PDR-FWE	ACKT...PDR-FW	ACKT...PDR-FWE-P	ACKT...PDR-FWR	ACKT...PDR-FWP
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1												
		>= 0.25 %C	Annealed	650	190	2												
		< 0.55 %C	Quenched and tempered	850	250	3												
		>= 0.55 %C	Annealed	750	220	4												
			Quenched and tempered	1000	300	5												
	Low alloy steel and cast steel (less than 5 % of alloying elements)		Annealed	600	200	6												
			Quenched and tempered	930	275	7												
				1000	300	8	0.08-0.10-0.12	0.07-0.09-0.10	0.08-0.10-0.12		0.08-0.10-0.12	0.08-0.10-0.12		0.08-0.10-0.12	0.08-0.10-0.12		0.08-0.10-0.12	
				1200	350	9												
	High alloyed steel, cast steel and tool steel		Annealed	680	200	10												
			Quenched and tempered	1100	325	11												
	Stainless ferritic and stainless martensitic steel		Ferritic, martensitisch	680	200	12				0.08-0.10-0.12								0.08-0.10-0.12
			Martensitic	820	240	13												
M	Stainless steel and stainless cast steel		Austenitic	600	180	14	0.08-0.10-0.12	0.07-0.09-0.10	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12		0.08-0.10-0.12	0.08-0.10-0.12		0.08-0.10-0.12	0.08-0.10-0.12
K	Grey cast iron (GG)		Ferritic/ martensitic		180	15												
			Pearlitic		260	16												
	Cast iron nodular (GGG)		Ferritic		160	17	0.08-0.12-0.15	0.08-0.12-0.15	0.08-0.12-0.15	0.08-0.12-0.15	0.08-0.12-0.15	0.08-0.12-0.15		0.08-0.12-0.15	0.08-0.12-0.15		0.08-0.12-0.15	
			Pearlitic		250	18												
	Malleable cast iron		Ferritic		130	19												
			Pearlitic		230	20												
N	Aluminum wrought alloys		Not curable		60	21												
			Cured		100	22												
	Aluminum cast alloys	<=12% Si	Not curable		75	23												
			Cured		90	24												
		>12% Si	Hyper-eutectic		130	25		0.08-0.15-0.02		0.08-0.15-0.2			0.08-0.15-0.2			0.08-0.15-0.2		
	Copper alloys	>1% Pb	Free cutting brass		110	26												
			Brass		90	27												
			Elelctrolytic copper		100	28												
	Non-ferrous		CFRP / GRP			29												
			Hard rubber			30												
S	High temp. alloys	Fe Basis	Annealed		200	31												
			Cured		280	32												
		Ni or Co Basis	Annealed		250	33												
			Cured		350	34	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12	0.08-0.10-0.12	-	0.08-0.10-0.12	0.08-0.10-0.12		0.08-0.10-0.12	0.08-0.10-0.12
			Cast		320	35												
	Titanium and Ti alloys		Pure titanium	Rm = 400	Rm= 400	36												
			Alpha+beta alloy	Rm = 1050	Rm= 1050	37												
H	Hardened steel		Hardened		55 HRC	38	-	-	-	-	-	-	-	-	-	-	-	-
			Hardened		60 HRC	39	-	-	-	-	-	-	-	-	-	-	-	-
	Chilled cast iron		Cast		400	40	-	-	-	-	-	-	-	-	-	-	-	-
	Cast iron		Hardened		55 HRC	41	-	-	-	-	-	-	-	-	-	-	-	-

Feed per Tooth for LOGIQ8Tang T890… 13 mm

ISO	Material		Hardness HB	Material No.	V_c [m/min]	T890-13	
						LNHT… PNTR	LNAT… PN-W
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	125	1	140-180-250	0.12-0.16-0.2	0.12-0.16-0.2
		>= 0.25 %C	190	2			
		< 0.55 %C	250	3			
		>= 0.55 %C	220	4			
			300	5			
	Low alloy steel and cast steel (less than 5 % of alloying elements)		200	6	130-160-200	0.1-0.14-0.18	0.1-0.14-0.18
			275	7			
			300	8			
			350	9	130-140-180	0.1-0.13-0.15	0.1-0.12-0.15
	High alloyed steel, cast steel and tool steel		200	10	120-130-180	0.1-0.12-13	0.1-0.11-0.13
			325	11			
	Stainless ferritic and stainless martensitic steel		200	12	90-110-160	0.1-0.12-0.15	0.1-0.12-0.15
			240	13			
M	Stainless steel and stainless cast steel		180	14	80-140-180	-	-
K	Grey cast iron (GG)		180	15	140-180-280	0.1-0.15-0.2	0.1-0.15-0.2
			260	16			
	Cast iron nodular (GGG)		160	17	120-160-250	0.1-0.14-0.18	0.1-0.14-0.18
			250	18			
	Malleable cast iron		130	19			
			230	20			

Radius for programming

System	T490 LNHT 1306-FF	H490 ANKX 0904-FF	H490 ANKX 1205-FF	H490 ANKX 1706-FF
Radius for programming	1,95	1,2	2,5	2,85

Screw & Torque

System	HM390 TP.. 04	HM390 TP.. 05	HM390 TC.. 07	HM390 TC.. 10	HM390 TD.. 15	HM390 TD.. 19	T490 LN.. 08	T490 LN.. 11	T490 LN.. 13	T490 LN.. 16	T490 LN.. 22
Screw Torque	SR M2X0.4-3.5 T6 0.5 N/m	TS 18041I/HG 0.5 N/m	SR M2.5X5-T7-60 0.9 N/m	SR 14-562/S 3.2 N/m	SR 10511869 9 N/m	SR 14-591/L12 9 N/m	SR 10502813-HGSM 1.2 N/m	SR 34-535-SN 3.2 N/m	SR 34-535-SN 4.8 N/m	SR 14-591 9 N/m	SR 10507547 9 N/m
H690 WN.. 04	H690 WN.. 07	H690 TN.. 10	H690 TN.. 16	H490 AN.. 09	H490 AN.. 12	H490 AN.. 17	S890 SZ.. 08	S890 SN.. 13	P290 AC.. 12	P290 AC.. 18	T890 LN.. 13
SR M2.5X6-T7-60 0.9 N/m	SR M4X0.7IP15 4.8 N/m	SR 10508082-HG 1.2 N/m	SR 14-591 9 N/m	SR 10508082-HG 1.2 N/m	SR 14-544 4.8 N/m	SR 14-591 9 N/m	SR M3X0.5-L7.4 IP9 2 N/m	SR 11800745 4.8 N/m	SR M3X0.5-L7.4 IP9 2 N/m	SR 14-544/S 4.8 N/m	SR 10513105 8 N/m

Helical interpolation in full material

MDN - MDX & RPMX°																						
Tool body diameter	**Ø 6**	**Ø 8**	**Ø 10**	**Ø 12**	**Ø14**	**Ø 16**	**Ø18**	**Ø 20**	**Ø 22**	**Ø 25**	**Ø28**	**Ø 32**	**Ø 40**	**Ø 50**	**Ø 63**	**Ø 80**	**Ø 100**	**Ø 125**	**Ø160**	**Ø 200**	**Ø 250**	**Ø 315**
HM390 TPKR 0401		13.4 - 15 3°	17.4 - 19 2.5°																			
HM390 TPKT 0502	8 - 11 1°	12 - 15 1°	16 - 19 2°	20 - 23 1.5°	24 - 27 1.5°	28 - 31 1.5°		35.6 - 39 2.0°		45.6 - 49 1.5°												
HM390 TCKT 0703					25 - 27 1.9°	29 - 31 1.9°	33 - 35 1.4°	37 - 39 1.4°	41 - 43 1°	47 - 49 1°	53 - 55 1°	61 - 63 0.8°	77 - 79 0.6°									
HM390 TCKT 1003										46.4 - 49 2.9°	52.4 - 55 2.5°	60.4 - 63 2.1°	76.4 - 79 1.6°	96.4 - 99 1.2°	122.4 - 125 0.9°							
HM390 TDKT 1505													75 - 78.4 2.1°	93 - 98.4 1.5°	121 - 124.4 1.20°	155 - 158.4 0.90°	195 - 198.4 0.70°	245 - 248.4 0.50°	315 - 318.4 0.30°	395 - 398.4 0.20°		
HM390 TDKT 1907													73 - 78.4 2°	93 - 98.4 1.5°	119 - 124.4 1.10°	153 - 158.4 0.90°	193 - 198.4 0.70°	243 - 248.4 0.50°	313 - 318.4 0.40°			
H690 WNMU 0403							28 - 35.2 1.7°	32 - 39.2 1.5°		42 - 49.2 1.1°		56 - 63.2 0.8°	72 - 79.2 0.6°	92 - 99.2 0.5°	118 - 125.2 0.2°							
H690 WNMU 0703												54 - 62.4 2°	70 - 78.4 1.5°	90 - 98.4 1.2°	116 - 124.4 1.1°	150 - 158.4 1°	190 - 198.4 0.8°	240 - 248.4 0.5°				
H690 TNKX 1005								34.8 - 39.2 2.8°		44.8 - 49.2 2.6°		58.8 - 63.2 1.6°	74.8 - 79.2 1.1°	94.8 - 99.2 1°	120.8 - 125.2 0.7°							
H690 TNKX 1606														88.4 - 98 3°	114.4 - 124 2°	148.4 - 158 1°	188.4 - 198 1°	238.4 - 248 0.5°				
P290 ACCT 1204								25 - 38.2 2°		35 - 48.2 1.4°		49 - 62.2 1°	65 - 78.2 0.7°	85 - 98.2 0.5°								
P290 ACCT 1806										32.8 - 47.6 2.5°		46.8 - 61.6 2°	62.8 - 77.6 1.5°	82.8 - 97.6 1°	108.8 - 123.6 0.8°	142.8 - 157.6 0.5°	182.8 - 197.6 0.3°					
T490 LNMT 0804-RD						24.4 - 31.2 2.8°	28.4 - 35.2 2.3°	32.4 - 39.2 1.9°	36.4 - 43.2 1.6°	42.4 - 49.2 1.3°		56.4 - 63.2 0.9°	72.4 - 79.2 0.7°	92.4 - 99.2 0.5°								
T490 LNHT 1306-RD												52.8 - 62.4 2.8°	68.8 - 78.4 2°	88.8 - 98.4 1.5°	114.8 - 124.4 1.1°	148.8 - 158.4 0.9°	188.8 - 198.4 0.7°	238.8 - 248.4 0.5°				
T490 LNHT 1306-FF												53.6 - 62.4 3.9°	69.6 - 78.4 2.8°	89.6 - 98.4 2°	115.6 - 124.4 1.5°	149.6 - 158.4 1.1°	189.6 - 198.4 0.9°	239.6 - 248.4 0.7°	309.6 - 318.4 0.5°	389.6 - 398.4 0.4°	489.6 - 498.4 0.3°	
H490 ANKX 0904-FF						22.4 - 30 7.7°	26.4 - 34 5.7°	30.4 - 38 4.6°	34.4 - 42 3.8°	40.4 - 48 3°		54.4 - 62 2°	70.4 - 78 1.5°	90.4 - 98 1.1°	116.4 - 124 0.8°							
H490 ANKX 1205-FF										33.8 - 47 6.1°		47.8 - 61 3.3°	63.8 - 77 2.2°	83.8 - 97 1.5°	109.8 - 123 1.1°	143.8 - 157 0.8°	183.8 - 197 0.6°	233.8 - 247 0.4°	303.8 - 317 0.3°	383.8 - 397 0.2°		
H490 ANKX 1706-FF												46.6 - 60.8 6.5°	62.6 - 76.8 4°	82.6 - 96.8 2.7°	108.6 - 122.8 1.9°	142.6 - 156.8 1.4°	182.6 - 196.8 1°	232.6 - 246.8 0.8°	302.6 - 316.8 0.6°	382.6 - 396.8 0.4°	482.6 - 496.8 0.3°	612.6 - 626.8 0.2°

MDN – MDX = Minimum – maximum diameter in mm for Helical interpolation in full material
RPMX° = Maximum ramp angle
Rg = Radius for programming

If a pilot hole is made, the minimum diameter (MDN) can also be selected smaller.
Formula for the pre-drilling: Dmin (MDN) – Dset + 1

Recommended Cutting Speeds and Appliations According to Cutting Grades

Based on practical experience – average data

Grades with PVD coatings and Cermet

Material Group		IC330 (min. / to start / max.)	IC380 (min. / to start / max.)	IC845 (min. / to start / max.)	IC840 (min. / to start / max.)	IC830 (min. / to start / max.)	IC716 (min. / to start / max.)	IC882 (min. / to start / max.)	IC810 (min. / to start / max.)	IC808 (min. / to start / max.)	IC30N (min. / to start / max.)
P Non-alloy / alloy steel	1. Choice / 2. Choice	120 **160** 230	160 **200** 250	80 **150** 220	---	120 **200** 230	---	---	160 **220** 250	180 **230** 250	90 **220** 350
P Ferritic / martensitic steel	1. Choice / 2. Choice	80 **120** 140	---	100 **120** 160	---	100 **130** 160	---	---	---	140 **170** 220	100 **170** 220
M Stainless steel Reference: 1.4301, v_c200, try 1.4404, v_c90, wet 1.4462, v_c80, wet	1. Choice / 2. Choice	60 **100** 160	120 **160** 220	---	90 **120** 160	60 **140** 200	---	70 **100** 140	---	120 **160** 220	---
K Gray cast iron	1. Choice / 2. Choice	---	---	---	---	120 **160** 250	---	---	180 **250** 300	---	---
K Cast iron nodular	1. Choice / 2. Choice	---	---	---	---	120 **140** 200	---	---	160 **200** 260	160 **180** 250	---
S High temp / titan alloys	1. Choice / 2. Choice	30 **40** 100	30 **50** 100	---	25 **40** 90	30 **40** 100	20 **45** 70	20 **40** 60	---	30 **50** 100	---
N Aluminum / non ferrous	1. Choice / 2. Choice	---	---	---	---	---	---	---	---	---	---
H Hardened steel (≤55HRc)	1. Choice / 2. Choice	---	---	---	---	40 **80** 120	---	---	60 **100** 150	80 **120** 200	50 **100** 140

Legend:	Cutting speed declaration (m/min)	
	red line:	dry machining
	blue line:	wet machining
	bold font:	recommended start value

Recommended Cutting Speeds and Appliations According to Cutting Grades

Based on practical experience – average data

Grades with CVD coatings, Ceramics, CBN and uncoated

Material Group		IC5400 min. to start max.	IC5500 min. to start max.	IC5600 min. to start max.	IC5100 min. to start max.	DT7150 min. to start max.	IC5820 min. to start max.	IS8/IS80 min. to start max.	IB55/IB85 min. to start max.	IC28 min. to start max.	IC08 min. to start max.
P	Non-alloy / alloy steel (1. Choice / 2. Choice)	160 **200** 250	90 **200** 280	160 **210** 280	180 **250** 320	100 **160** 250	---	---	---	---	---
P	Ferritic / martensitic steel (1. Choice / 2. Choice)	140 **180** 240	140 **200** 270	150 **180** 240	---	---	---	---	---	---	---
M	Stainless steel (1. Choice / 2. Choice)	100 **130** 180	---	---	---	---	100 **120** 160	---	---	---	---
K	Gray cast iron (1. Choice / 2. Choice)	---	---	---	200 **280** 350	150 **220** 320	---	250 **500** 800	**Please ask your Product Management**	---	---
K	Cast iron nodular (1. Choice / 2. Choice)	120 **160** 250	---	---	---	160 **250** 350	---	250 **450** 900	---	---	---
S	High temp / titan alloys (1. Choice / 2. Choice)	---	---	---	---	---	25 **50** 95	---	---	---	10 **20** 50
N	Aluminum / non ferrous (1. Choice / 2. Choice)	---	---	---	---	---	---	---	---	160 **450** 650	350 **750** 1500
H	Hardened steel (≤55HRc) (1. Choice / 2. Choice)	---	---	---	---	---	---	---	**Please ask your Product Management**	---	---

Legend: Cutting speed declaration (m/min)

- red line: dry machining
- blue line: wet machining
- bold font: recommended start value

Milling Inserts – Cutting Grades

P Steel (ISO P01–P50, hard → tough)

Grade	Range	Coating Type	Condition	Applications / Description
Basis				
IC808 (IC908)	P15-P30	PVD	Strong edge, wear resistance	Roughing, Roughing under stable conditions, medium to high cutting parameters
IC5600	P10-P15	CVD	Stable heat, strong edge, high wear resistance	Roughing and finishing udner stable conditions, high cutting speed, dry machining
IC5500	P15-P35	CVD	Stable heat, wear resistance	Roughing, ferritic and martensitic high alloyed steel (group 12 and 13), high cutting speed, dry machining
IC830 (IC928)	P20-P40	PVD	Tough, no breakage under mechanical load	Universal cutting grade, basic grade for initial machining, roughing, wet or dry
IC845	P30-P50	PVD	Tough, no breakage, thermal crack resistance	Roughing at high feed, interrupted cut
Special Grades				
IC5400	P05-P20	CVD	Stable heat resistance, wear resistance	Roughing at medium to high cutting speed, dry machining
IC30N	P10-P30	PVD, **Cermet**	Strong wear resistance against plastic deformation	Finishing at high cutting speeds and medium feed
IC810 (IC910)	P15-P30	PVD	Wear resistance, stable to breakage	Roughing of high-strength steel and tool steel (group 10 and 11), at medium feed
IC330 (IC328)	P25-P50	PVD, TiCN	Tough, no breakage, thermal crack resistance	Roughing at low cutting speed, interrupted cut, wet machining only

M Stainless Steel (ISO M01–M50, hard → tough)

Grade	Range	Coating Type	Condition	Applications / Description
Basis				
IC840	M20-M40	PVD	Tough, thermal crack resistance	Roughing and finishing at low to medium cutting speed, wet or dry machining
IC830 (IC928)	M25-M35	PVD	Tough, resistance to breakage under high mechanical load	Universal grade for austenitic steel, low to medium cutting speed, wet or dry machining
IC808 (IC908)	M20-M30	PVD	Strong edges, wear resistance	Finishing at medium to high cutting speed under stable conditions, wet or dry machining
IC330 (IC328)	M30-M40	PVD	Tough, resistance to breakage under high mechanical load	Universal grade for austenitic steel, low cutting speed, interrupted cut, wet machining only
Special Grades				
IC5820	M20-M35	CVD	Tough, resistance to breakage, heat resistance	Roughing in austenitic and Duplex materials at high cutting speed under stable conditions
IC882	M25-M45	PVD	Tough, resistance to breakage, heat resistance	Roughing in austenitic and Duplex materials at low to medium cutting speed, wet machining

Milling Inserts – Cutting Grades

K – Cast Iron (ISO K01 K05 K10 K15 K20 K25 K30 K35 K40 K45 K50; hard → tough)

Grade	Range	Coating Type	Condition	Application / Description
Basis				
IC5100	K10-K25	CVD	Thick coating, wear resistance	Grey cast (GG) at high cutting speed
IC810 (IC910)	K15-K35	PVD	Wear resistance, heat resistance	First choice for nodular cast iron and grey cast at low to medium cutting speed
Special Grades				
IS08	K01-K015	**Si_3N_4 Ceramic**	Uncoated, high heat resistance	Grey cast at very high cutting speed, medium feed under stable conditions
DT7150	K10-K25	PVD+CVD	Wear resistance, heat resistant	Optional grade instead of GG and GGG at medium cutting speeds, troubleshoot for wet machining
IC808 (IC908)	K20-K40	PVD	Stable edges, wear resistance	Finishing of nodular cast iron (GGG) under stable conditions
IC830 (IC928)	K15-K40	PVD	Tough, resistance to breakage under high mechanical load	For GGG40, under instable conditions, at low to medium cutting speeds and high feed
IC30N	P10-P30	PVD, **Cermet**	Extremely wear resistance against plastic deformation	GGG50 and above, finishing at high cutting speeds

N – Non Ferrous Mat. (ISO N01 N05 N10 N15 N20 N25 N30 N35 N40 N45 N50; hard → tough)

Grade	Range	Caoting type	Condition	Applications / Description
Basis				
ID5	N01-N10	uncoated, **Diamond**	Soldered TIP based on solid carbide insert	Al-Si alloys <12 % Si share, graphite, general non-ferrous metals
ID8	N05-N15	uncoated., **Diamond**	Soldered TIP based on solid carbide insert	Al-Si alloys >12 % Si share, fibre composite materials (CFRP and GFK)
IC28	N15-N35	uncoated	Tough, resistance to breakage under high mechanical load	Roughing of aluminum alloys and non-ferrous metals, high feed, medium cutting speeds, wet machining
IC08	N05-N20	uncoated	Strong edges, wear resistance	Roughing and finishing of aluminum alloys, < 10 % S share, non-ferrous metals, wet machining
IC07	N05-N20	uncoated	Strong edges, high wear resistance	Optional grade for IC08, better wear resistance

Milling Inserts – Cutting Grades

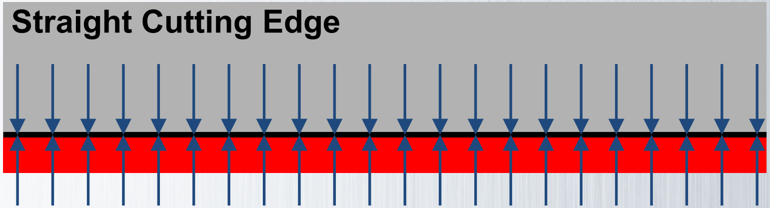
ISO	(S01 … S50; hard → tough)	Range	Coating Type	Condition	Applications / Description
S Super Alloy	**Basis**				
	IC882	S30-S50	PVD	Tough, h. heat resistance, contains Rutenium	Roughing and finishing of HTSA, low to medium cutting speeds, wet machining only
	IC716	S20-25	PVD	Tough, h. heat resistance, thermal crack resistance	Roughing and finishing of titanium alloys (ISO S36-S37) at medium cutting speeds.
	IC808 (IC908)	S15-S30	PVD	Strong edges, wear resistance	Finishing under stable conditions, medium cutting speed
	IC840	S25-S40	PVD	Tough, thermal crack resistance	Roughing of Ti-alloys, low cutting speed, wet machining only
	Special Grades				
	IC380	S20-S30	PVD	Strong edges, wear resistant, special cutting	Roughing and finishing of titanium under lable conditions, wet machining only
	IC5820	S20-S35	CVD	High heat resistance, wear resistance, +Rutenium	Optional grade for IC882, high cutting speed, wet and dry machining
	IC830 (IC928)	S20-S40	PVD	Tough, resistance to breakage under high mechanical load	Optional grade for IC840 and IC808 at low cutting speeds, high feed, wet machining.
	IC330 (IC328)	S30-S50	PVD	Tough, resistance to breakage under high mechanical load	Optional grade for IC840, IC808, IC830, high thermal crack resistance, sufficient coolant supply is essential

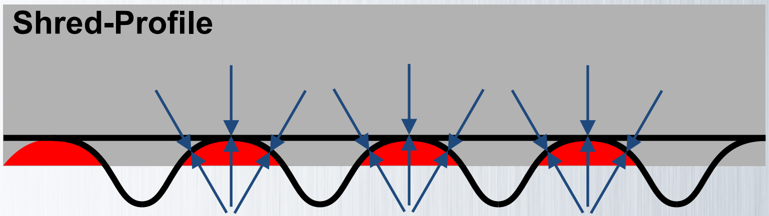
ISO	(H01 … H50; hard → tough)	Range	Coating Type	Condition	Applications / Description
H Hardened Mat.	**Basis**				
	IC808 (IC908)	H10-H20	PVD	Strong edges, resistance to breakage	Hardened steel up to 55 HRc (max. 60 HRc), under stable conditions, down-mill only, max. 45 % a_e/D
	IB85	H01-H30	no coating, **CBN**	Soldered TIP based on solid carbide insert, resistance to breakage	Finishing of hardened steel up to 65 HRc, up-mill if possible
	Special Grades				
	IC30N	H10-H25	PVD, **Cermet**		Finishing under stable conditions at high cutting speeds

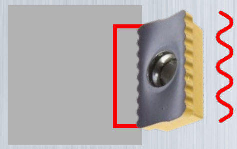
Contact length determines cutting force!

Effects of reduced contact area due to shred profile:

- 20 – 30% less cutting forces
- lower temperature development
- less repulsive forces
- reduced noise development







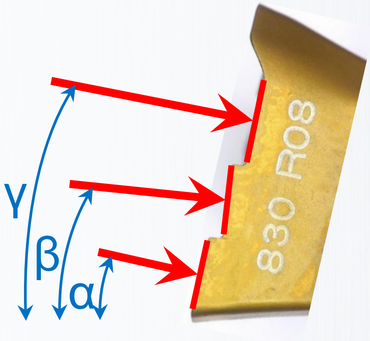
Indexable inserts with ...-FW in the designation

HELISTAR - Geometry

SHREDMILLING

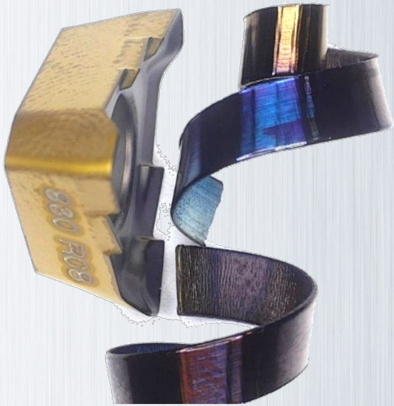
Unique geometry for segmenting the chips

Distribution of forces



α ≠ β ≠ γ

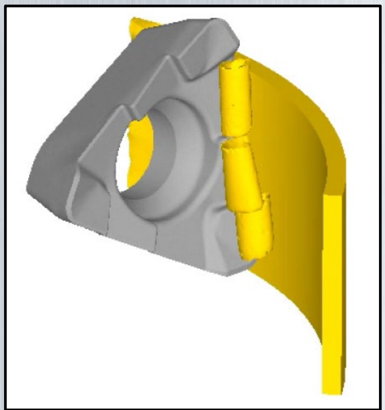
Chips segmentation



Highly positive, soft-cutting geometry

Effects through HELISTAR - Geometry:

- 10 – 15% less cutting forces
- less repulsive forces
- reduced noise development

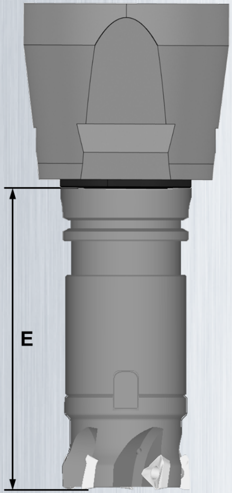


Indexable inserts with …-HS in the designation

Correction factors depending on the cantilever length/stability factor

Counteracting by reducing the cutting data

Correction factor for various tool length					
Overhang ratio	up to 1 x D	up to 2 x D	up to 3 x D	up to 4 x D	up to 5 x D
Factor f_z	**1,00**	**0,95**	**0,85**	**0,75**	**0,65**
Factor v_c	**1,00**	**1,00**	**0,80**	**0,70**	**0,60**



Example:
L/D = 150/50 = 3

Feed correction factor
Tooth feed selected: 0.26 mm
Cutting speed selected: 180 m/min

Alternatively, you can also use the stability factor ks!
The factor is determined by the following: Assessment of the milling process determines:
ks = 1.0 • With regular stability
ks = 0.7 • For unstable machining (large projection length, unstable clamping, thin-walled workpieces, etc.)

Example:
Stability factor ks 0.7 selected
To be used f_z: 0,26 x **0,7** = **0,182 mm**
To be used v_c: 180 x **0,7** = **126 m/min**

Not valid when using high feed milling cutters

Bending Moment Load

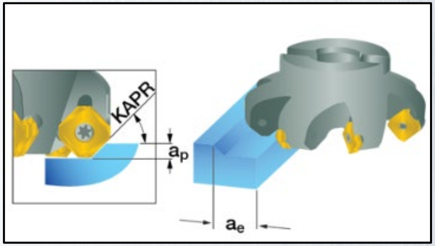
The longer the tool overhang, the more important it is to consider the bending moment.
Too high a bending moment can lead to massive spindle damage.

The bending moment can be calculated using the formula or using machining power.
The load limits can be requested from the machine manufacturer.

Calculate the spindle bending moment using the Machining Power tool : https://mpwr.iscar.com

Machining Power (Full)

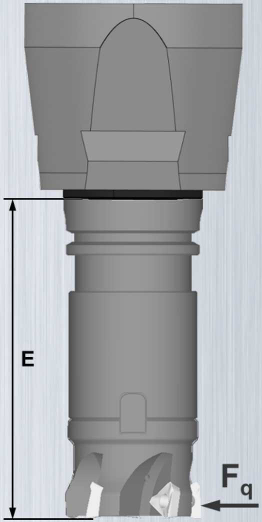
- Vc/n - Cutting / Spindle speed
- Vf - Feed speed
- P/T - Power / Torque
- Q - Material removal rate
- F - Cutting forces
- h - Chip thickness
- T - Cutting time
- a_e - Max. cutting width
- **M - Max. spindle bending moment**



Cutting diameter (DC):	63	mm
Cutting width (a_e):	42	mm
Face effective cutting edge count (ZEFP):	5	
Feed per tooth (f_z):	0,2	mm
Depth of cut (a_p):	4	mm
Workpiece material: ...	C45E; Ck 45	DIN
Tool cutting edge angle (KAPR):	90	deg.
Effective rake angle (γ): ?	5	deg.
Tool extension (E):	**250**	**mm**

Reset Calculate

Max spindle bending force:	2.818,88	N
Max spindle bending moment:	704,72	Nm



$$M_b = F_q \times E \quad [Nm]$$

General Guide Values

Interfaces	Bending moment limit [Nm]
HSK32	85
HSK40	140
HSK50	230
HSK63	450
HSK80	810
HSK100	1230
HSK125	2900
Big Plus 40	45
Big Plus 50	60
C5	420
C6	700
C8	1000
C10	1700
Driven tool holders	
VDI30	80
VDI40	150

We cannot take a guarantee for the specified guideline values.

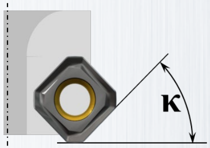
Recommended chip thickness h guidelines

General recommendations (for stable conditions)

ISO	Material	Roughing	Medium Application	Finishing
P	Steel	0,12 - 0,22 mm	0,10 - 0,16 mm	0,04 - 0,08 mm
M	Stainless Ssteel	0,12 - 0,18 mm	0,08 - 0,14 mm	0,04 - 0,08 mm
K	Cast Iron	0,12 - 0,25 mm	0,10 - 0,20 mm	0,04 - 0,08 mm
S	Highly Heat Resistant M.	0,08 - 0,10 mm	0,06 - 0,08 mm	0,04 - 0,08 mm

Kappa:	Sinus-value:
90°	1
60°	0,87
45°	0,71
30°	0,5

$$f_z = \frac{h}{\sin \kappa}$$



Valid for a_e/D > 33%

The attack angle Kappa must be taken into account.

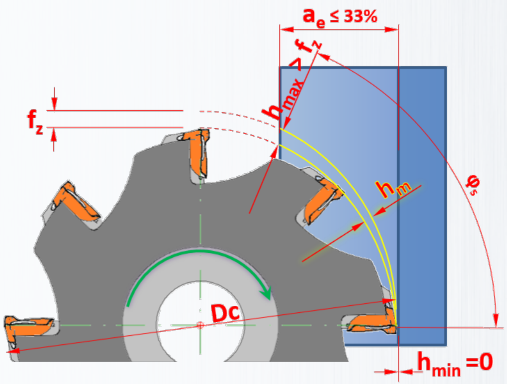
Not valid when using high feed milling cutters

Calculate recommended feed per tooth fz with cutting width ≤ 33%

When milling with a cutting width of ≤ 33%, the maximum chip thickness h_{max} is always significantly smaller than f_z.

Under these conditions we recommend calculating the feed using the center chip thickness h_m.

Calculating the correct f_z with formula:



Formula f_z:

Feed per tooth

$$f_z = hm \times \sqrt{Dc/ae} \quad \text{[mm]}$$

Example:

With a cutting width (a_e 18 mm / Dc 63 mm) of 29%, a tooth per feed of 0.17 mm should be used in order to achieve the necessary center chip thickness and the associated process reliability and cost-effectiveness.

Step 1:

Select recommended f_z from tooth feed table.

S890-13
SNMU MM
0.10-0.15-0.30

Step 2:

Middle chip thickness h_m calculation by using factor of 0.6

h_m = 0,6 x recommended f_z value

Step 3:

Feed per tooth f_z calculation

Feed per tooth

$$f_z = hm \times \sqrt{Dc/ae} \quad \text{[mm]}$$

Example calculation:

h_m = 0,15 • 0,6 = 0,09 mm

f_z = 0,09 • $\sqrt{(63 / 18)}$ = 0,17 mm

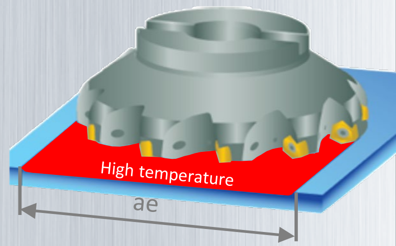
Cutting Speed Adjustment

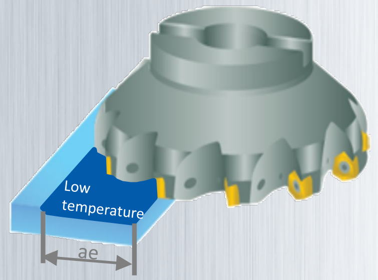
Increased productivity by cutting speed adjustment [m/min] depending on actual width of cut

The real temperature volume depends on the basic cutting speed value and the width of cut in relation to the cutter diameter (E%). Usually, the cutting speed is adjusted after the first toolife(s) determined. The reason why is that the real temperature in the cutting zone is normally not measured.

Basic rules:

1. If most of the temperature is conducted via the chips, it is possible to increase the cutting speed.
2. The better the overall stability (short overhang, no vibrations), the better the options to adjust the cutting speed.
3. The lower the specific thermal conductivity, the less options for cutting speed adjustments. With the help of the below thermal conductivity table of various material groups you may better judge the options for cutting speed adjustments. There are exceptions in the field of special alloys.
4. Main wear should be flank wear.





$E\% = a_e / D_c \cdot 100$ (%)	5%	10%	15%	20%	25%	30%
Factor for v_c	1,50	1,45	1,40	1,35	1,30	1,25

$$v_c = v_o \cdot Factor$$

<u>Thermal conductivity: [W/(mK)]</u>

Al alloys:	+/-150
Carbon steel:	+/- 50
Tool steel:	+/- 25
RSH[1] steel:	+/- 15
Ti alloys:	+/- 10
Nickel based alloys:	+/- 13

<u>Explanations</u>

v_o = Basic start cutting speed

v_c = Actual cutting speed

1 = Stainless, resistant to heat and acid

(arrow blue to red) = Temperature in the cutting zone

Feed per Tooth According to Tooth Load Areas

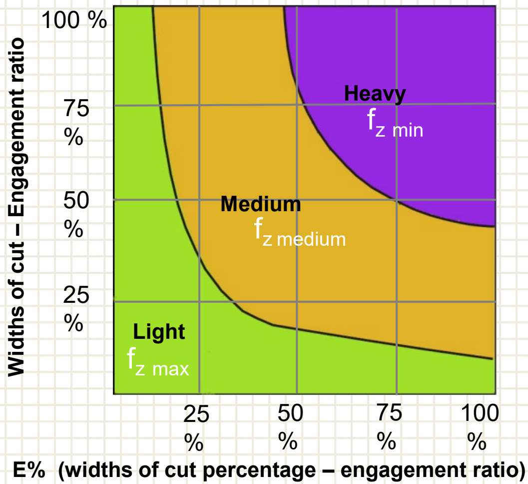
1 Feed per tooth / basic calculation

Material		Tensile Strength [N/mm²]	Hardness HB	HM390-05 TPKT...PDR
Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	420	125	0.10-0.12-0.15
	>= 0.25 %C	650	190	
	< 0.55 %C	850	250	
	>= 0.55 %C	750	220	
		1000	300	
Low alloy steel and cast steel (less than 5% of alloying elements)		600	200	0.08-0.11-0.14
		930	275	
		1000	300	
		1200	350	0.08-0.10-0.13

First of all, specify the load

Example:
light machining
= maximum
feed per tooth

Please refer to values from the tables on the left



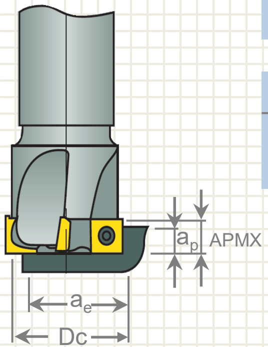
■ = $f_{z\ min}$ ■ = $f_{z\ medium}$ ■ = $f_{z\ max}$

Engagement ratio a_e

$$E\%\ a_e = \frac{a_e}{D} \times 100(\%)$$

Engagement ratio a_p

$$E\%\ a_p = \frac{a_p}{APMX} \times 100(\%)$$



2 f_z-corrective value for long overhang tools

Correction factor for various tool lengths					
Overhang ratio	up to 1 x D	up to 2 x D	up to 3 x D	up to 4 x D	up to 5 x D
Factor	**1,00**	**0,95**	**0,85**	**0,75**	**0,65**

f_z = Basic feed per tooth (1) * corrective value, overhang (2)

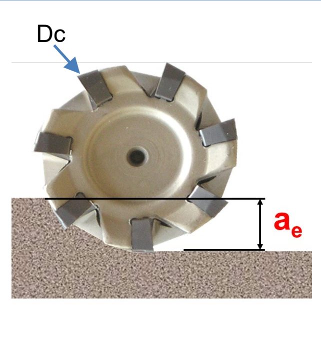
Corrective value does not apply to high feed milling cutters.

Feed per Tooth Calculation

According to Radial Depth of Cut a_e

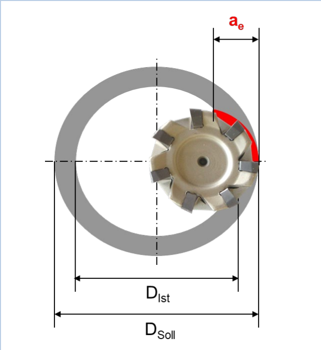
$$a_e = \frac{D_{ist}{}^2 - D_{soll}{}^2}{4 \cdot (D_{soll} + Dc)}$$

Linear milling



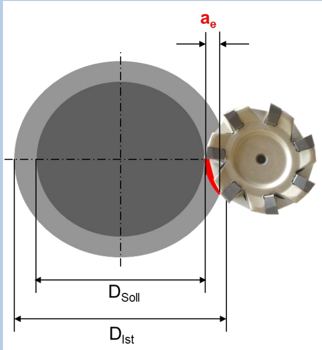
$$radial\ depth = ae$$

Internal circular interpolation

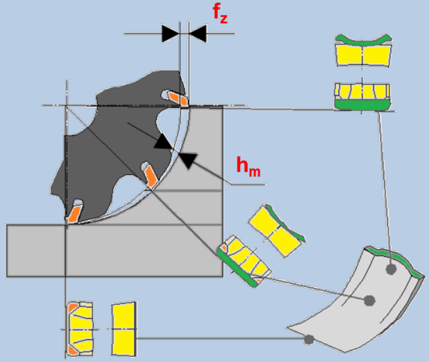


$$a_e = \frac{D_{soll}{}^2 - Dist^2}{4 \times (Dsoll - Dc)}$$

External circular interpolation



$$a_e = \frac{D_{ist}{}^2 - Dsoll^2}{4 \times (Dsoll + Dc)}$$



Eingriffsverhältnis

$$E = \frac{a_e}{Dc} \times 100\%$$

mittlere Spandicke

$$h_m = fz \times \sqrt{ae/Dc}$$

Vorschub pro Zahn

$$f_z = hm \times \sqrt{Dc/ae}$$

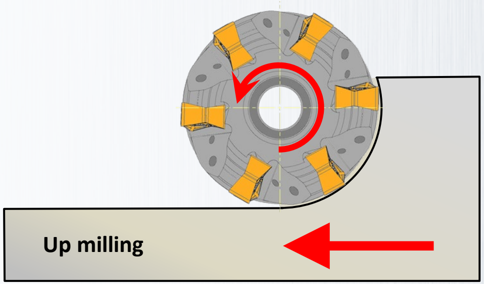
Info:

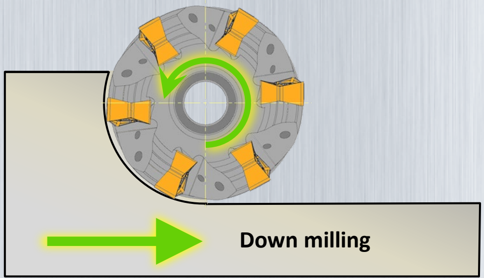
Only if the tooth feed is correctly calculated and set does the chip formation (constriction) required by the cutting geometry take place.

If the f_z values are too low, they promote premature wear and can cause the chips to jam.

If the f_z values are too high, the cutting inserts will break due to overloading.

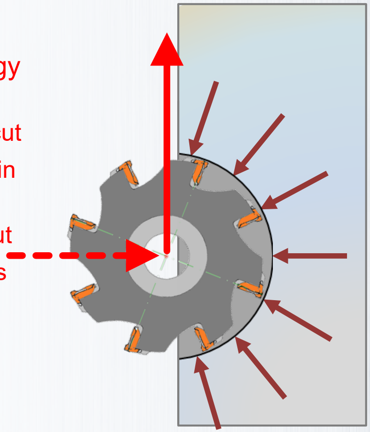
Milling Strategies for Optimal Toolife and Machining Process





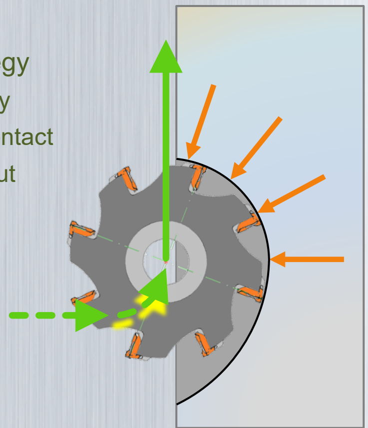
Unfavorable penetration strategy

- Long arc of engagement in cut
- Too many teeth in contact
- High energy input
- Risk of vibrations



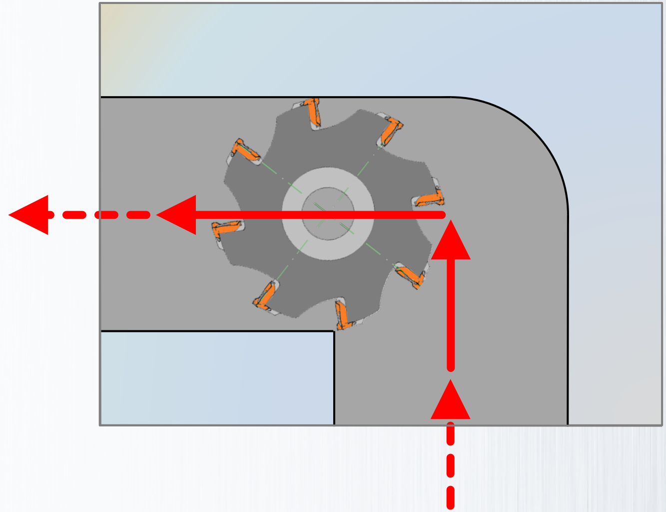
Favorable penetration strategy

- „Roll-In“ strategy
- Less teeth in contact
- Low energy input
- Safe and stable process

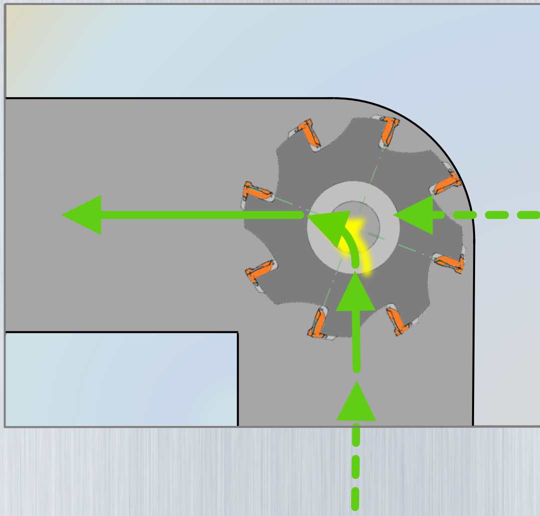


Milling Strategies for Optimal Toolife and Machining Process

Without bottom radius in the edge, unfavorable



With bottom radius in the edge, favorable



At internal edge radius, programming always with roll-in strategy!

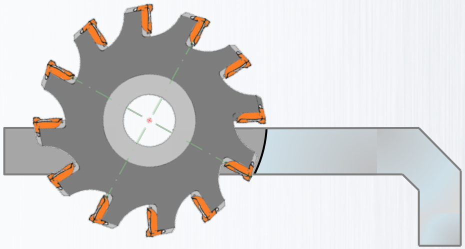
Remark:

Entering the material with 50 % of feed until minimum 2 teeth are constantly in contact.

Exit from material with 50 % of feed in order to avoid hooking and insert breakage.

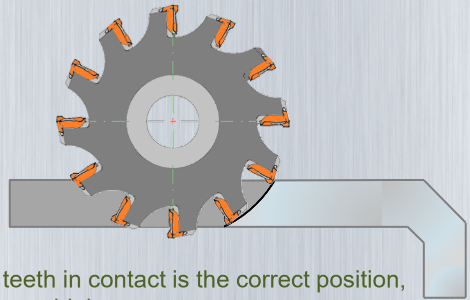
Milling Strategies for Optimal Toolife and Machining Process

Unfavorable Conditions



One tooth in contact, high risk of hooking, tends to chatter.

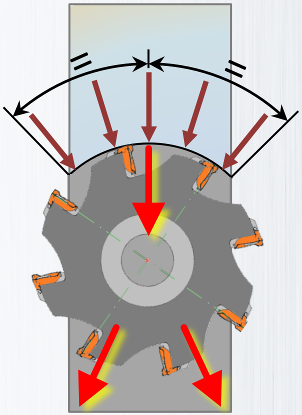
Good conditions, stable process

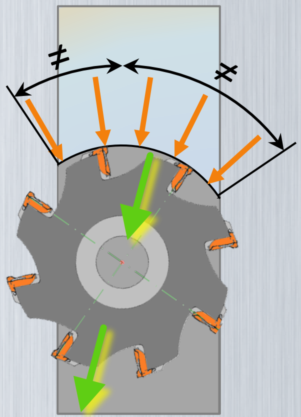


Two teeth in contact is the correct position, calm machining.

Unfavorable tool position

- No resulting direction of radial force
- Tends to vibrate!



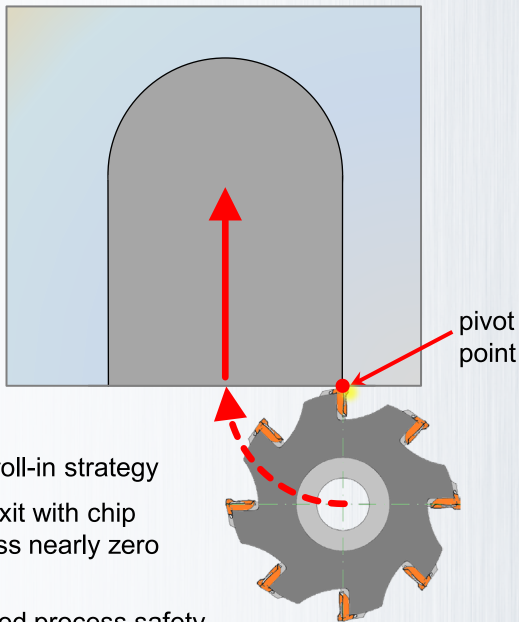


Good tool position

- Resulting direction of radial force
- Little load at material exit (thin chip)

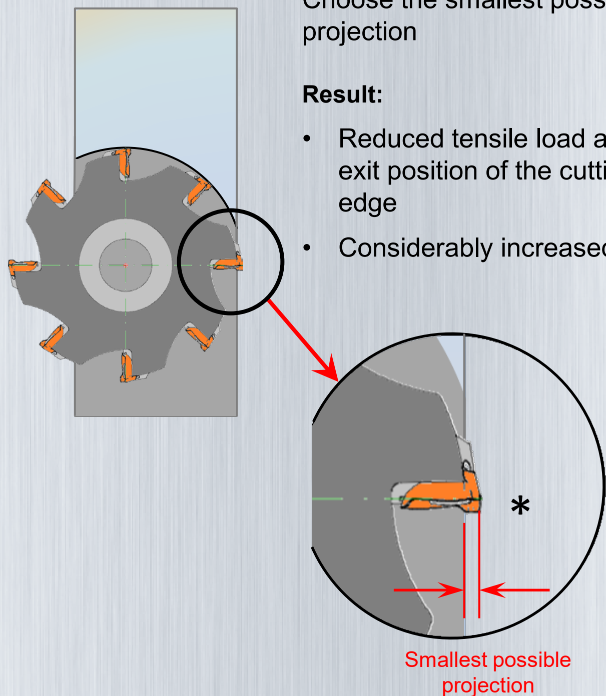
Milling Strategies for Optimal Toolife and Machining Process

Super Alloys and Difficult to Machine Workpiece Materials



Milling by roll-in strategy

- Insert exit with chip thickness nearly zero [mm]
- Increased process safety and toolife
- ISO programming in G3 command



Action:

Choose the smallest possible projection

Result:

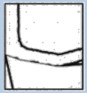
- Reduced tensile load at the exit position of the cutting edge
- Considerably increased toolife

* Caution:

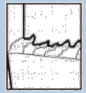
Please pay attention to corner radius

Chip formation and Geometries Required According to Workpiece Materials

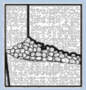
Nonferrous materials

Non ferrous	Machining process	Geometry required
	• mostly long chipping • poor chip control • low temperature	• high positive rake angle • sharp cutting edge • uncoated: with PCD

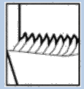
Stainless steel

Stainl. steel	Machining process	Geometry required
	• lamellar chip • poor chip control • high temperature	• positive rake angle • small honing • little layer thickness

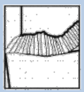
Cast materials

Cast	Machining process	Geometry required
	• very short chipping • good chip breaking • low temperature	• rake angle 0° - 10° • big land • big layer thickness

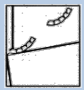
Super alloys and titanium

Super alloys	Machining process	Geometry required
	• discontinuous chip • strain hardening • very high temperature	• positive rake angle • ultra fine grade • smooth coating

Non alloy and high alloy steel

Steel	Machining process	Geometry required
	• mostly long chipping • chip breaking okay • medium temperature	• positive rake angle • small land • medium layer thickness

Hardened steel

Hardened	Machining Process	Geometry required
	• short crumbled chips • high power consumption • very high temperature	• negative rake angle • very big wedge angle • big land: CBN

Wear

Wear never occurs as individual appearance but always occurs in various combinations.
Therefore, it is essential to monitor the tool's insert soonest possible in order to
detect the main wear type and to take counter action accordingly.

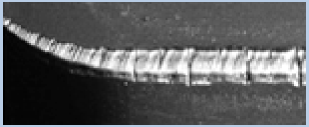
	Flank wear	Crater wear	Notch wear	Chipping
Type of wear				
Reason	• Cutting speed too high • Temperature too high • Wear resistance of carbide grade not sufficient	• Cutting speed too high • Temperature too high • Insufficient feed	• Cutting speed too high • Wear resistance of carbide grade not sufficient	• Wear resistance of carbide grade too strong • Cutting edge too positive • Build-up edge
Help	• Reduce cutting speed • Choose more wear resistant carbide grade • Choose reduced lead angle	• Reduce cutting speed • Choose harder carbide grade • Increase feed	• Reduce cutting speed • Choose more wear resistant carbide grade • Variable depth of cut	• Choose tougher carbide grade • Increase cutting speed • Choose more stable cutting edge

Important:

When adjusting or correcting the cutting parameters, we recommend to change the parameters one after another, (not several ones at the same time). To change the cutting conditions by 10 % -20 % (according to workpiece material).

Wear

Wear never occurs as individual appearance but always occurs in various combinations.
Therefore, it is essential to monitor the tool‘s insert soonest possible in order to detect the main wear type and to take counter action accordingly.

Type of wear	Breakage	Thermal cracks	Build-up-edge	Plastic deformation
				
Reason	• Cutting edge too positive • Carbide grade too hard • Vibrations	• Various thermal stress • Strongly interrupted cut • Thermal cracks by coolant	• Low cutting speed • Feed to low • Cutting edge too negative	• Feed too high • Cutting speed too high • Carbide grade too tough
Help	• Reduce depth of cut • Reduce feed • Choose a more stable wedge	• Choose tougher carbide grade • Improve coolant supply • Dry machining	• Increase cutting speed • Increase feed • Smooth, positive cutting edge	• Reduce cutting speed • Reduce feed • Choose harder carbide grade

Important:

When adjusting or correcting the cutting parameters, we recommend to change the parameters one after another, (not several ones at the same time). To change the cutting conditions by 10 % -20 % (according workpiece material).

General recommendations for insert milling

- ✓ Down-milling is to be preferred as the first choice - especially for shoulder milling due to the 90° setting angle.
- ✓ The milling strategy should be chosen so that the cutting forces are directed towards the support points of the clamping device; up-milling can be advantageous in some cases (Figure 1).
- ✓ The strategy regarding the positioning of the milling cutter on the component is of the utmost importance; planning in this regard should be carried out in great detail.
- ✓ For components that are clamped on a clamping tower, 90° milling cutters with a positive insert basic shape (HM390) are recommended. A wide cutter pitch can significantly improve machining, even with negative systems. In any case, the forces should be directed towards the machine bed (Figure 2). We advise against systems with an adjustment angle < 90° due to the higher axial force influence component.
- ✓ The choice of milling pitch should also depend on the stability of the entire system (machine, workpiece clamping, workpiece material, etc.)
- ✓ For SK40 and smaller machines, cutters with a wider pitch are recommended due to the limited stability.

Figure 1

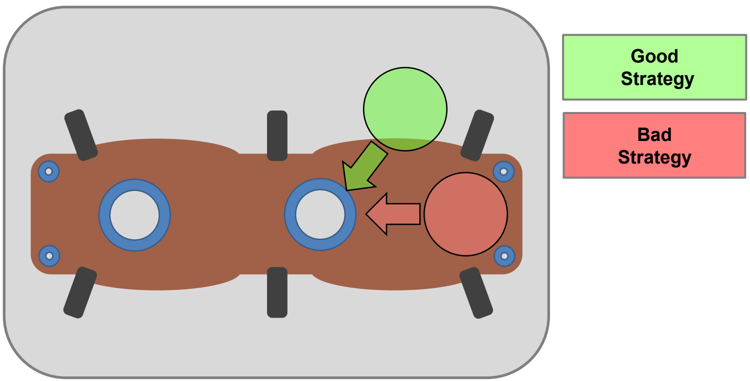
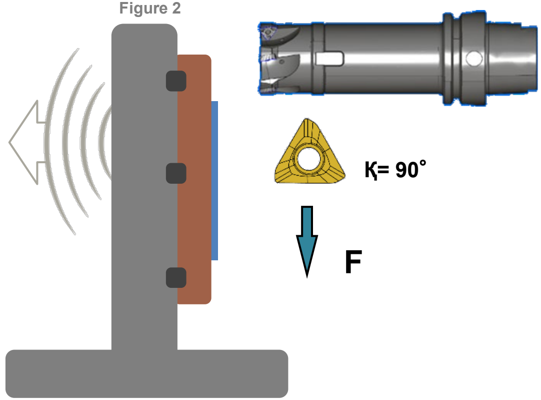
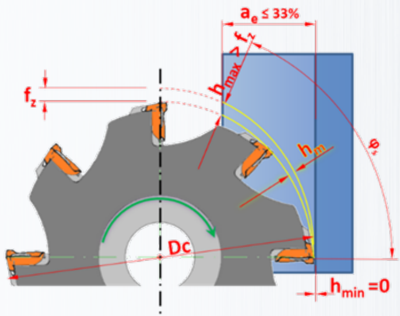


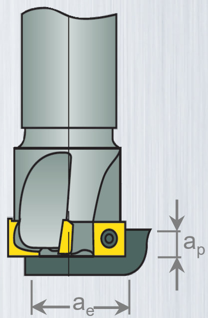
Figure 2

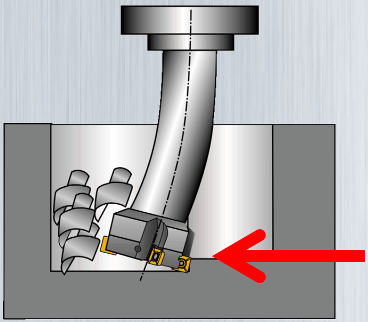


General recommendations for insert milling

- ✓ For the highest possible wall quality, we recommend a cutting depth that is less than 75% of the cutting edge length.
- ✓ For shoulder milling, we recommend starting with a tougher type of carbide than for face milling.
- ✓ When using extended flute cutters, the conditions are often very demanding, so we recommend starting with the toughest grade available, which is recommended for the respective ISO workpiece material range.
- ✓ To avoid vibrations: the deeper the cut, the lower the cutting speed should be. v_c can be chosen.
- ✓ If vibrations occur, we recommend as a first step to reduce the cutting speed v_c and increase the feed f_z to an acceptable range and pay attention to the recommended chip thickness.
- ✓ As a first choice, we recommend using ground inserts. The cutting pressure is lower due to the smaller cutting edge honing.
- ✓ Up-milling can also help stabilize the tool.
- ✓ Make sure that the required machine power is available for the selected cutting values and that the permissible bending moment is not exceeded.
- ✓ Use the ISCAR Machining Power program for this. https://mpwr.iscar.com/

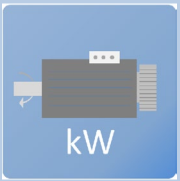






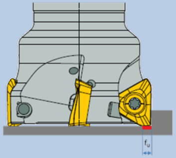
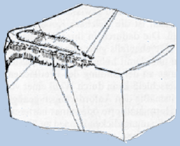
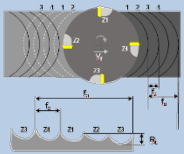
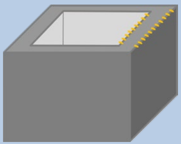
Problems and Troubleshooting

TIPS & TRICKS

	Problem	Reason	Troubleshooting
	Vibrations on tool	• Feed insufficient • Tool diameter too small • Instable tool clamping • Insufficient number of teeth in contact • Minor cutting-edge pushes	• Increase feed • Reduce tool overhang • Improve tool clamping • Use tool with fine tooth pitch • Choose a shorter minor cutting edge • Reduce lead angle
	Vibrations on workpiece	• Instable workpiece clamping • Instable tool • Instable tool clamping • Insufficient number of teeth in contact • Minor cutting-edge pushes	• Improve general clamping situation • Cutting force towards stopper • Reduce axial cutting forces • Reduce radial cutting force • Choose a shorter minor cutting edge • Choose more positive insert • Choose cutter with coarse tooth pitch
	Drive power	• Insufficient machine power • Metal removal rate too high • Insert too negative	• Reduce depth of cut • Reduce width of cut • Reduce feed per tooth • Reduce radial cutting force • Reduce $Z_{eff.}$ • Choose more positive insert

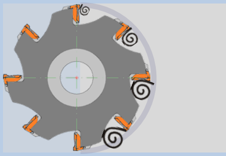
Problems and Troubleshooting

TIPS & TRICKS

	Problem	Reason	Troubleshooting
	Poor surface quality	• Poor axial runout of cutter • Poor radial runout of cutter • Poor radial runout of spindle • Minor cutting edge too small	• Adjust axial runout • Check spindle runout • Check spindle surface • Check precision of toolholder • Choose an insert with wiper edge • Feed per revolution = max. 75 % of minor cutting edge
	Tool wear	Please refer to „Types of Wear And Help“	Please refer to „Types of Wear and Help“
	Re-cut on second side	• Radial cutting forces too high • Cutter vibrates • Cutter diameter too big • Spindle inclination	• Reduce depth of cut • Work with spindle inclination • Check position of wiper insert
	Breakages on workpiece	• Worn cutting edge • Insert too negative • Increased feed per tooth • High chip thickness at exit • Poor radial runout	• Choose cutter with very fine tooth pitch • Reduce lead angle • Reduce chip cross section • Choose sharper cutting edge • Soft exit from material

Problems and Troubleshooting

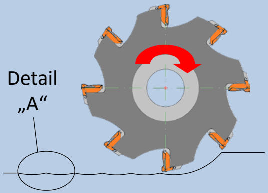
TIPS & TRICKS

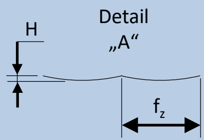


Problem	Reason	Troubleshooting
Insufficient chip evacuation	• Depth of cut too big • Working angle too big • Chip gullet too small	• Reduce depth of cut • Reduce width of cut • Reduce feed per tooth • Reduce $Z_{eff.}$ • Choose more positive insert
Deformation of arbor Fretting corrosion by micro movements	• Adaptation too small • Depth of cut too big • Feed per tooth too big • Feather key not hardened	• Choose bigger adaptation • Reduce $Z_{eff.}$ • Reduce feed per tooth • Reduce depth of cut

Surface geometry – shoulder milling

$$H = \frac{f_z^2}{4 \times D_{tool}}$$





General Formulas

Cutting speed

$$v_c = \frac{Dc \cdot \pi \cdot n}{1000} \; [{}^{m}/_{min}]$$

Feed per tooth

$$f_z = \frac{v_f}{n \cdot z} \; [\text{mm}]$$

Engagement ratio

$$E = \frac{a_e}{Dc} \cdot 100\%$$

RPM

$$n = \frac{v_c \cdot 1000}{Dc \cdot \pi} \; [\text{mm}^{-1}]$$

Feed

$$v_f = f_z \cdot z \cdot n \; [{}^{mm}/_{min}]$$

Medium chip thickness

$$h_m = f_z \cdot \sqrt{{}^{a_e}/_{Dc}}$$

Metal removal rate

$$Q = \frac{a_e \cdot a_p \cdot v_f}{1000} \; [{}^{cm^3}/_{min}]$$

Inserts needed for quantity ordered X

$$= \frac{\text{Workpiece } \cdot \text{number of teeth} \cdot \text{production days/month}}{\text{Toolife number of c.e./insert}}$$

Time of engagement

$$t_h = \frac{L \cdot i}{v_f} \; [\text{min}]$$

Cutting grade costs per workpiece

$$= \frac{\frac{\text{Cost}}{\text{Insert}} \cdot \text{number of pockets}}{\text{Number of cutting edges/insert} \cdot \text{toolife}}$$

Number of pieces per cutting edge

$$= \frac{\text{Toolife (in min.)} \cdot 60}{\text{Time of engagement/workpiece (in sec.)}}$$

Explanations:

Dc = Tool diameter
z =Number of effective c.e.

v_c = Cutting speed
n = RPM of tool
f_z = Feed per tooth
v_f = Feed

a_e = Cutting width (radial)
a_p = Depth of cut (axial)

E = Engagement ratio (%)
h_m = Medium chip thickness

l = Cutting length
i = Number of passes
Q = Metal removal rate
t_h = Main period of use

π = Pi (3,1415…)

Empirical Formulas for Theoretical Power Consumption

Calculation of performance and torque for cutting parameters review

Steel up to 1000 N/mm² (GGG50/60)	Cast	Aluminum alloys	Torque calculation
Performance	**Performance**	**Performance**	**Performance**
$P_{nutz} = \frac{a_p \cdot a_e \cdot v_f}{24.000}$ [kW]	$P_{nutz} = \frac{a_p \cdot a_e \cdot v_f}{30.000}$ [kW]	$P_{nutz} = \frac{a_p \cdot a_e \cdot v_f}{60.000}$ [kW]	$M = 9550 \cdot \frac{P_{nutz}}{n}$ [Nm]

Remark:

Performance and torque should be calculated before starting the machining process. By calculating these two parameters, one will be in the position to avoid later tool or machine damage. Just compare the performance and torque chart of the machine tool with the parameters calculated.

Important:

Only if both of these parameters are within the machine tool's performance and torque curve available, a metal cutting process with the metal removal rate calculated will be possible.

You can also carry out all calculations on the ISCAR Machining Power Tool. https://mpwr.iscar.com

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