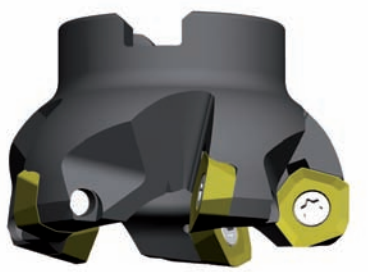
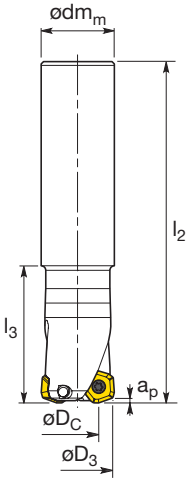
PENTA HIGH FEED

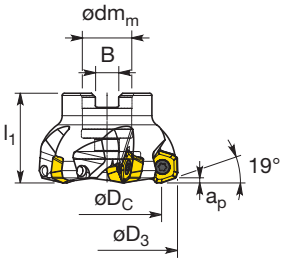
High Feed face milling cutter with positive pentagonal inserts

Cutter program, PF 09





Cylindrical shank



Arbor mounting

Reference	Dimensions (mm)								Z	Insert style	Nb of inserts	Coolant channels	Max. RPM	kg
	D_c	D_3	Max. a_p	dm_m	l_1	l_2	l_3	B						
Cylindrical shank														
PF-09/032-02-QC32-250-R	18.60	32.00	2.00	32.00	-	250.00	60.00	-	2	PD.. 09 05 ZE…	2	No	26000	1.421
PF-09/040-03-QC32-250-R	25.80	40.00	2.00	32.00	-	250.00	60.00	-	3	PD.. 09 05 ZE…	3	No	22000	1.500
Arbor normal pitch														
PF-09/042-03-ALC16-040-R	27.80	42.00	2.00	16.00	40.00	-	-	8.40	3	PD.. 09 05 ZE…	3	Yes	21000	0.180
PF-09/050-04-AL22-040-R	35.60	50.00	2.00	22.00	40.00	-	-	10.40	4	PD.. 09 05 ZE…	4	No [1]	19000	0.236
PF-09/052-04-AL22-040-R	37.60	52.00	2.00	22.00	40.00	-	-	10.40	4	PD.. 09 05 ZE…	4	No [1]	18000	0.248
PF-09/063-05-AL22-040-R	48.60	63.00	2.00	22.00	40.00	-	-	10.40	5	PD.. 09 05 ZE…	5	No [1]	16000	0.325
PF-09/066-06-AL22-040-R	51.60	66.00	2.00	22.00	40.00	-	-	10.40	6	PD.. 09 05 ZE…	6	No [1]	16000	0.331
Arbor coarse pitch														
PF-09/050-03-AL22-040-R	35.60	50.00	2.00	22.00	40.00	-	-	10.40	3	PD.. 09 05 ZE…	3	No [1]	19000	0.248
PF-09/063-04-AL22-040-R	48.60	63.00	2.00	22.00	40.00	-	-	10.40	4	PD.. 09 05 ZE…	4	No [1]	16000	0.315
PF-09/080-05-AL27-050-R	65.60	80.00	2.00	27.00	50.00	-	-	12.40	5	PD.. 09 05 ZE…	5	No [1]	14000	0.818
PF-09/100-06-AL32-050-R	85.60	100.00	2.00	32.00	50.00	-	-	14.40	6	PD.. 09 05 ZE…	6	No [1]	12000	1.441

[1] Optional coolant screw can be ordered separately

Spare parts

Insert style	Diameter D_3	Insert screw			Screw driver		Special mounting screw
		Reference	Size		Reference		Reference
PD.. 09 05 ZE…	32 - 40 mm	DVF 3608	M 5.0	5.0 N.m	DMP 3662	20 IP	-
PD.. 09 05 ZE…	42 mm	DVF 3608	M 5.0	5.0 N.m	DMP 3662	20 IP	DVZ 1715
PD.. 09 05 ZE…	50 - 100 mm	DVF 3608	M 5.0	5.0 N.m	DMP 3662	20 IP	-

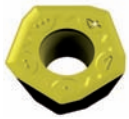
Optional spare parts

Insert style	Diameter D_3	Coolant screw
		Reference
PD.. 09 05 ZE…	42 mm	-
PD.. 09 05 ZE…	50 - 52 mm	DVZ 3523
PD.. 09 05 ZE…	63 - 66 mm	DVZ 3523
PD.. 09 05 ZE…	80 mm	DVZ 3535
PD.. 09 05 ZE…	100 mm	DVZ 3536

PENTA HIGH FEED

High Feed face milling cutter with positive pentagonal inserts

Insert program

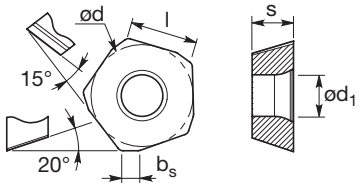


PDKX... ZE ER-41

PDMX... ZE ER-51

PDMX... ZE SER-81

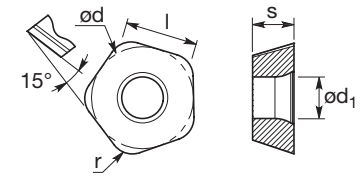
Utility inserts



PDKT... 30 ER-41

PDMW... 30 SR-91

Inserts with radius



Reference	Dimensions (mm)							Grades													
	d	s	d_1	l	r	b_s	t_1	1020	1120	1130	2003	5007	5020	5040	5050	8030	5135	KX05	KX20	KX2	N
Utility inserts																					
PDKX 09 05 ZE ER-41	13.50	5.47	5.5	9.00	-	2.00	-	-	✓	-	✓	-	-	-	✓	✓	-	-	-	-	-
PDMX 09 05 ZE ER-51	13.50	5.47	5.5	9.00	-	2.00	-	-	-	-	✓	-	✓	-	✓	✓	-	-	-	-	-
PDMX 09 05 ZE SR-81	13.50	5.47	5.5	9.00	-	2.00	-	-	-	-	✓	-	✓	✓	✓	-	-	-	-	-	-
Inserts with radius																					
PDKT 09 05 30 ER-41	13.50	5.47	5.5	9.00	3.0	-	-	-	-	-	✓	-	✓	-	✓	✓	-	-	-	-	-
PDMW 09 05 30 SR-91	13.50	5.47	5.5	9.00	3.0	-	-	-	-	✓	-	-	-	-	✓	-	✓	-	-	-	-

✓Article which can be ordered

Ordering example: PDMX 09 05 ZE ER-51 5020

Cutting conditions

		P Steel				M Stainless steel			K Cast iron				N Non-ferrous aluminum				S Super alloys			H Hardened materials			
Grade	Feed per tooth (mm)	Free machining and low carbon (120-170 HB)	Medium and high carbon (180-220 HB)	Alloy and easy to machine tool steels (200-240 HB)	Tool and die steels (220-260 HB)	Ferritic and martensitic (180-240 HB)	Austenitic (140-180 HB)	Ph and duplex (220-260 HB)	Gray cast iron (180-220 HB)	Gray cast iron (220-260 HB)	Ductile iron (180-220 HB)	Ductile iron (220-260 HB)	Aluminum < 7% Si (<100 HB)	Aluminum 7% - 12% Si (<100 HB)	Aluminum > 12% Si (<130 HB)	Non-ferrous (<100 HB)	Iron based alloys (200-300 HB)	Nickel and cobalt base alloys, hastelloy, inconel, stellite (135-425 HB)	Titanium alloys 6AL-V4 (110-450 HB)	Case hardened carbon steels (50Rc - 62Rc)	Case hardened alloy steels (40Rc - 50Rc)	Hardened tools steels (45Rc - 62Rc)	Hardened irons (400 BHN)
1120	v_{c1}	324	295	228	149	-	-	-	254	232	199	169	-	-	-	-	-	-	-	-	-	-	-
	f_{z1}	0.50	0.50	0.50	0.50	-	-	-	0.50	0.50	0.50	0.50	-	-	-	-	-	-	-	-	-	-	-
	v_{c2}	163	151	115	103	-	-	-	166	144	106	76	-	-	-	-	-	-	-	-	-	-	-
	f_{z2}	2.00	2.00	2.00	1.50	-	-	-	2.00	2.00	2.00	2.00	-	-	-	-	-	-	-	-	-	-	-
1130	v_{c1}	-	-	-	-	-	-	-	193	174	139	109	-	-	-	-	-	-	-	-	-	-	-
	f_{z1}	-	-	-	-	-	-	-	0.50	0.50	0.50	0.50	-	-	-	-	-	-	-	-	-	-	-
	v_{c2}	-	-	-	-	-	-	-	165	145	101	64	-	-	-	-	-	-	-	-	-	-	-
	f_{z2}	-	-	-	-	-	-	-	2.00	2.00	2.00	2.00	-	-	-	-	-	-	-	-	-	-	-
2003	v_{c1}	-	-	-	236	270	226	170	259	239	209	189	-	-	-	-	86	76	58	90	110	90	90
	f_{z1}	-	-	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-	-	-	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	v_{c2}	-	-	-	200	246	190	146	170	151	130	114	-	-	-	-	50	40	40	66	86	66	66
	f_{z2}	-	-	-	1.50	1.50	1.50	1.50	2.00	2.00	2.00	2.00	-	-	-	-	1.20	1.20	1.20	1.20	1.20	1.20	1.20
5020	v_{c1}	304	275	208	129	196	181	130	239	217	184	154	938	482	410	516	56	46	43	33	38	33	28
	f_{z1}	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	v_{c2}	147	135	99	83	152	145	106	154	132	94	64	810	290	330	420	40	30	35	25	30	25	20
	f_{z2}	2.00	2.00	2.00	1.50	1.50	1.50	1.50	2.00	2.00	2.00	2.00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
5040	v_{c1}	274	245	178	99	148	126	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	f_{z1}	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	v_{c2}	123	111	75	53	40	20	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	f_{z2}	2.00	2.00	2.00	1.50	1.50	1.50	1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5050	v_{c1}	234	206	142	81	123	81	70	-	-	-	-	-	-	-	-	46	36	28	-	-	-	-
	f_{z1}	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-	-	-	-	-	-	-	-	0.50	0.50	0.50	-	-	-	-
	v_{c2}	134	117	75	45	89	65	58	-	-	-	-	-	-	-	-	39	29	20	-	-	-	-
	f_{z2}	2.00	2.00	2.00	1.50	1.50	1.50	1.50	-	-	-	-	-	-	-	-	1.20	1.20	1.20	-	-	-	-
8030	v_{c1}	-	-	-	-	164	131	100	-	-	-	-	-	-	-	-	51	41	35	-	-	-	-
	f_{z1}	-	-	-	-	0.5	0.5	0.5	-	-	-	-	-	-	-	-	0.5	0.5	0.5	-	-	-	-
	v_{c2}	-	-	-	-	120	105	82	-	-	-	-	-	-	-	-	40	30	28	-	-	-	-
	f_{z2}	-	-	-	-	2	2	2	-	-	-	-	-	-	-	-	1.2	1.2	1.2	-	-	-	-
5135	v_{c1}	245	222	152	88	118	84	76	-	-	-	-	-	-	-	-	51	41	33	-	-	-	-
	f_{z1}	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-	-	-	-	-	-	-	-	0.50	0.50	0.50	-	-	-	-
	v_{c2}	130	120	83	58	70	20	60	-	-	-	-	-	-	-	-	44	34	25	-	-	-	-
	f_{z2}	2.00	2.00	2.00	1.50	1.20	1.20	1.20	-	-	-	-	-	-	-	-	1.20	1.20	1.20	-	-	-	-

The cutting speed (v_c) and the feed per tooth values have to be optimized depending on specific machined material.

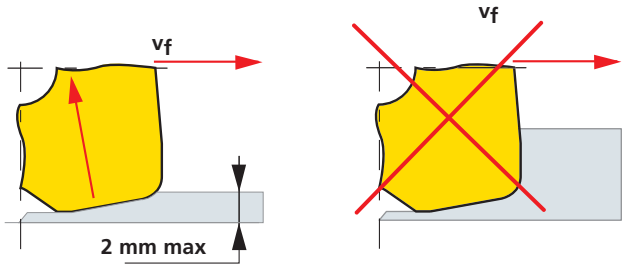
PENTA HIGH FEED

Milling cutter characteristics

Use for high feed facing

The cutter characteristic angles are designed to direct the cutting forces (R) mainly up the spindle thus allowing high machining feed with low cutting depth. It is essential to maintain a cutting depth of 2mm max.

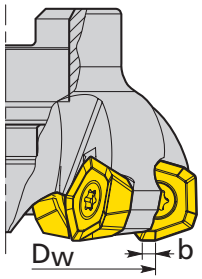
High-Feed use



For a good surface finish

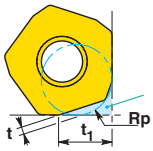
In finishing, the best surface finish is obtained without exceeding the value of b = 2mm for a f_n feed and a maximum profiling pitch (cut width) $a_e \leq D_W$.

Diameter D	32	40	42	50	52	63	66	80	100
Effective diameter D_W (mm	18,4	25,5	27,5	35,3	37,3	48,2	51,2	65,3	85,3



Programming – Remaining material

Programming radius

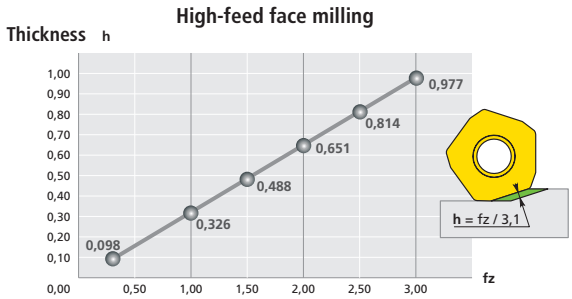


Remaining material

Ø	Rp	t	t1
32	4,5	1,1	6,8
40-100	4,5	1,1	7,3

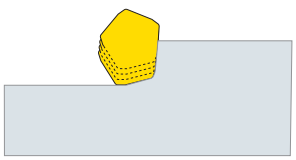
The insert radius is different from the radius to program (Rp)

Actual chip thickness



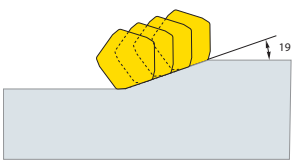
Approach of vertical faces

1st machining strategy with vertical faces



Reduce f_z feed to 0,5 max. when approaching a vertical face in order to avoid vibrations and insert flaking.

2nd machining strategy with no vertical face



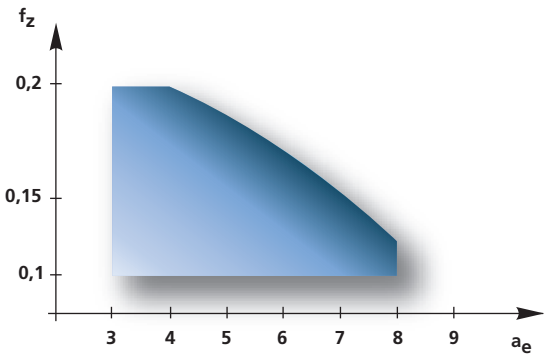
To maintain "High Feed" without creating vertical faces, apply a 19° slope.

PENTA HIGH FEED

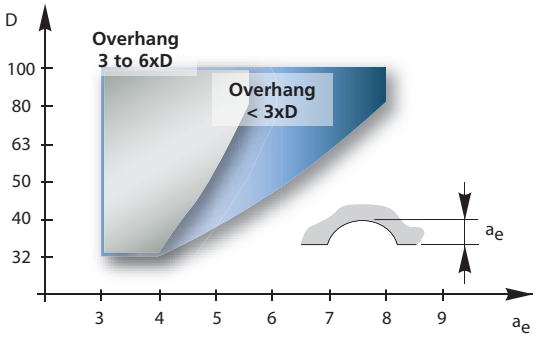
Milling cutter characteristics

Machining strategy in plunging

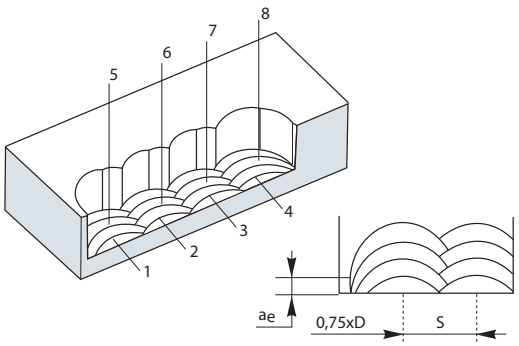
f_z value depending on infeed a_e



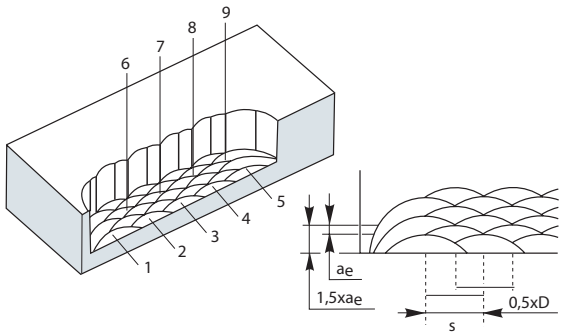
a_e infeed depending on overhang



Cutter with overrun L ≤ 3xD

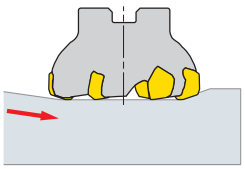


Cutter with overrun L ≥ 3xD

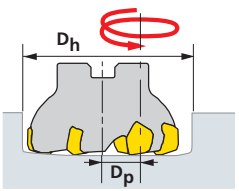


Use

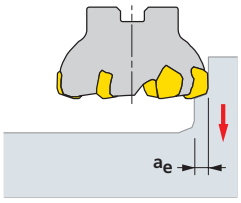
Ramping



Helical interpolation



Plunging



Diameter	Cutting depth	Ramping		Helical interpolation (mm)				Plunging (1)
D (mm)	a_p max. (mm)	Angle α	L (mm)	D_h min.	D_p min.	D_h max.	D_p max.	a_e max. (mm)
32	2	0°	-	-	-	-	-	4
40	2	0° to 8°	14,2	63,5	23,5	77,7	37,7	4
42	2	0° to 8°	14,2	67,5	25,5	81,7	39,7	5
50	2	0° to 8°	14,2	83,3	33,3	97,7	47,7	6
52	2	0° to 8°	14,2	87,3	35,3	101,7	49,7	6
63	2	0° to 7°	16,2	109,2	46,2	123,7	60,7	7
66	2	0° to 6°	19,0	115,2	49,2	129,7	63,7	7
80	2	0° to 5°	22,8	143,3	63,3	157,7	77,7	8
100	2	0° to 3°	38,1	183,3	83,3	197,7	97,7	8

(1) Reduce from 50 to 80% the cutting conditions for plunging in accordance with a_e