



GEAR PRODUCTION TOOLS

GASHERS

HOBS

SOLID CARBIDE END MILLS



Your trusted partner for gear production tools also offers roughing and finishing gashers for internal and external gears, as well as hobs with carbide inserts. Kennametal provides these innovative tool concepts to increase your productivity and to optimize existing and new production lines. Our tools are available in the module range from 6 to 40 and are recognized for:

- *Smooth cuts at high feed rates with positive cutting geometries and balanced insert arrangements.*
- *Optimum number of effective teeth for each profile section to minimize the insert wear behavior, to achieve a vibration-free cutting process, and to increase productivity.*
- *Achieve high cutting speeds through innovative and material-specific carbide grades.*
- *Inserts with up to 8 usable cutting edges provide low tooling costs.*
- *Easy-to-change inserts for the best performance under all conditions.*
- *High profile accuracy to reduce time and cost of grinding operations.*

Gasher



*Solid Carbide
End Mills*

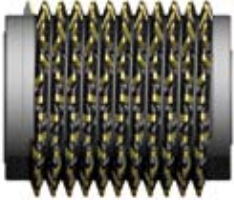


Hob



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Tool	Gasher			Hob		Solid Carbide End Mill	
	Rougher	Finisher internal	Finisher external		with Protuberance	Rougher	Finisher
Application							
Page Number	6–7	8–9	10–11	16–17	18–19	22–23	22–23
External Gear	●		●	●	●	●	●
Internal Gear	●	●				●	●
Workpiece Size/Module	●●	●●	●●	●●●	●●●	●	●
Lot Size to Manufacture	●●	●●	●●	●●●	●●●	●	●
Investment Cost	●●	●●	●●	●●●	●●●	●	●
Suitability for Gear Prototyping	●●	●●	●●	●	●	●●●	●●●
Internal Coolant	●	●	●	●	●	●	●
Roughing	●				●	●	
Finishing		●	●	●			●
Roughing + Finishing		●	●	●	●		
Productivity	●●	●●	●●	●●●	●●●	●●	●●
Machining Time	●●	●●	●●	●●●	●●●	●●	●●
Tool Life	●●	●●	●●	●●●	●●●	●	●
Application Specific Grade	●	●	●	●	●	●	●
Easy Handling	●●	●	●	●	●	●●●	●●●
Delivery Time of the Tools	●●●	●●	●●	●	●	●●●	●●●

- Possible application
- First choice for the application
- Acceptable for the application
- Possible, but not advisable

Cutter Joint According to DIN Standard

- High-precision joint.
- Safe cutter mounting.
- Optimal torque transmission.

Eight Cutting Edges per Insert

- Lower tool cost.
- Easy insert indexing.
- Lower set-up time and cost.

Optimized Insert Arrangement

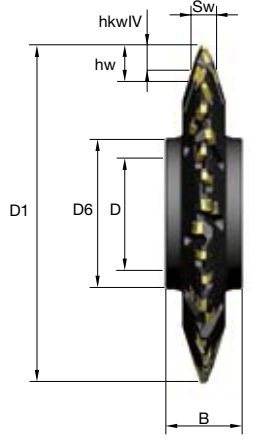
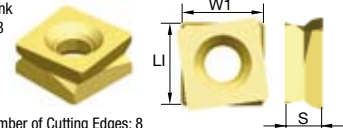
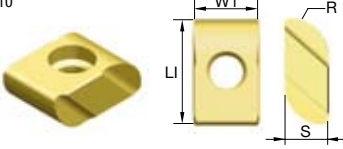
- Equal chip thickness through the cut.
- Even, highly productive, and safe cutting process.
- Very good gear quality.

Application-Specific Carbide Substrate and Coating

- Very high tool life.
- High productivity through higher cutting parameters.
- Shorter production cycles.



Roughing Gasher Basic Rack Profile IV (DIN 3972)

	Type	Insert Dimensions							
		Module Range	Catalog Number	Type	W1	LI	S	R	Insert Screw
 Cutter with Radial Keyway DIN 138	Flank 1-3  Number of Cutting Edges: 8	8-10	FR121255R FR121255L	1	11,35	11,35	5,50	—	MS1941
	Root 4-10  Number of Cutting Edges: 4	12-28	FR151566R FR151566L	2	14,35	14,35	6,60	—	MS1308
		30-40	FR181877R FR181877L	3	18,05	18,05	7,70	—	192.373
		6-7	RR09224713	4	9,52	22	4,76	1,3	193.492
		8-10	RR09194718	5	9,52	19,05	4,76	1,8	MS2107
		12-16	RR09196328	6	9,52	19,05	6,35	2,8	MS1273
		18-22	RR12197940	7	12,70	19,05	7,94	4,0	MS1160
		24-28	RR12259552	8	12,70	25,40	9,52	5,2	MS1571
		30-32	RR14297962	9	14,30	29,00	7,94	6,2	MS1160
		34-40	RR14299574	10	14,30	29,00	9,52	7,4	MS1571

Module DP (Diametral Pitch)	Catalog Number	Cutter Dimensions				Profile			Zeff.	Number of Inserts per Type									
		D1	B	D	D6	hw	hkwIV	Sw		1	2	3	4	5	6	7	8	9	10
6 4,233	GR06220	220	50	50	120	14,70	8,59	9,42	8/4				16						
	GR06270	270	60	60	140				10/5				20						
7 3,629	GR07220	220	50	50	120	17,15	9,90	11,00	8/4				16						
	GR07270	270	60	60	140				10/5				20						
8 3,175	GR08220	220	50	50	120	19,60	11,20	12,57	8/4	16				16					
	GR08270	270	60	60	140				10/5	20				20					
9 2,822	GR09220	220	50	50	120	22,05	12,50	14,14	8/4	16				16					
	GR09270	270	60	60	140				10/5	20				20					
10 2,540	GR10220	220	50	50	120	24,50	13,79	15,71	8/4	16				16					
	GR10270	270	60	60	140				10/5	20				20					
12 2,117	GR12270	270	70	60	140	29,40	16,37	18,85	6/3		12				12				
	GR12360	360	90	80	170				8/4		16				16				
14 1,814	GR12270	270	70	60	140	34,30	18,95	21,99	6/3		18				12				
	GR14360	360	90	80	170				8/4		24				16				
16 1,588	GR16270	270	70	60	140	39,20	21,51	25,13	6/3		18				12				
	GR16360	360	90	80	170				8/4		24				16				
18 1,411	GR18360	360	90	80	170	44,10	24,07	28,27	8/4		24					16			
	GR18450	450	120	100	190				10/5		30					20			
20 1,155	GR20360	360	90	80	170	49,00	26,63	31,42	8/4		32					16			
	GR20450	450	120	100	190				10/5		40					20			
22 1,155	GR22360	360	90	80	170	53,90	29,18	34,56	8/4		32					16			
	GR22450	450	120	100	190				10/5		40					20			
24 1,058	GR24360	360	90	80	170	58,80	31,73	37,70	8/4		32						16		
	GR24450	450	120	100	190				10/5		40						20		
26 0,977	GR26360	360	90	80	170	63,70	34,28	40,84	8/4		40						16		
	GR26450	450	120	100	190				10/5		50						20		
28 0,907	GR28360	360	90	80	170	68,60	36,82	43,98	8/4		40						16		
	GR28450	450	120	100	190				10/5		50						20		
30 0,847	GR30400	400	100	100	170	73,50	39,36	47,12	8/4	8		40						16	
	GR30500	500	120	100	190				10/5	10		50						20	
32 0,794	GR32400	400	100	100	170	78,40	41,90	50,27	8/4	8		40							16
	GR32500	500	120	100	190				10/5	10		50							20
34 0,747	GR34400	400	100	100	170	83,30	44,44	53,41	8/4	8		48							16
	GR34500	500	120	100	190				10/5	10		60							20
36 0,706	GR36400	400	100	100	170	88,20	46,98	56,55	8/4	8		48							16
	GR36500	500	120	100	190				10/5	10		60							20
40 0,635	GR40400	400	100	100	170	98,00	52,05	62,83	8/4		8	56							16
	GR40500	500	120	100	190				10/5		10	70							20

Roughing Gasher Grade and Cutting Parameter Recommendation

- First Choice
- Alternate Choice

S		●	●
N		○	
K			●
M		○	
P		○	

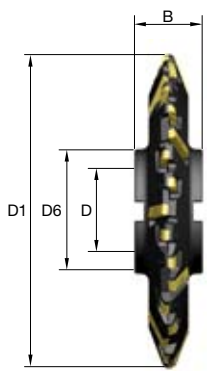
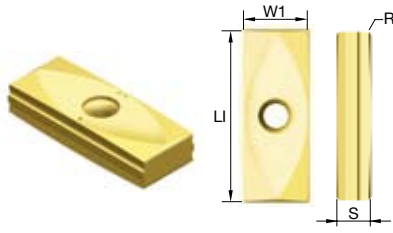
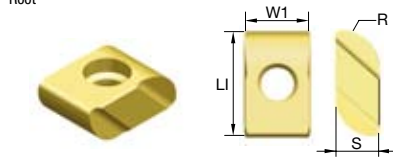
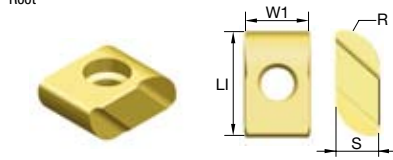
Type	Module Range	Catalog Number	Type	KCP15	KCKP15
	8–10	FR121255R FR121255L	1	●	●
	12–28	FR151566R FR151566L	2	●	●
	30–36	FR181877R FR181877L	3	●	●
	6–7	RR09224713	4	●	●
	8–10	RR09194718	5	●	●
	12–16	RR09196328	6	●	●
	18–22	RR12197940	7	●	●
	24–28	RR12259552	8	●	●
	30–32	RR14297962	9	●	●
	32–36	RR14299574	10	●	●

The tool has been designed according to profile IV in the DIN standard 3972. Other customer-specific profiles or modules are available upon request.

Module DP (Diametral Pitch)	Catalog Number	Cutting Parameter Recommendation*						
		D1	ae1	fz1	vc1	ae2	fz2	vc2
6 4,233	GR06220	220	13,50	0,42–0,52	150–170	—	—	—
	GR06270	270	13,50	0,52–0,62	150–170	—	—	—
7 3,629	GR07220	220	15,75	0,42–0,52	150–170	—	—	—
	GR07270	270	15,75	0,52–0,62	150–170	—	—	—
8 3,175	GR08220	220	18,00	0,40–0,50	150–170	—	—	—
	GR08270	270	18,00	0,50–0,60	150–170	—	—	—
9 2,822	GR09220	220	20,25	0,40–0,50	140–160	—	—	—
	GR09270	270	20,25	0,50–0,60	140–160	—	—	—
10 2,540	GR10220	220	22,50	0,37–0,47	140–160	—	—	—
	GR10270	270	22,50	0,42–0,52	140–160	—	—	—
12 2,117	GR12270	270	27,00	0,37–0,47	140–160	—	—	—
	GR12360	360	27,00	0,42–0,52	140–160	—	—	—
14 1,814	GR12270	270	31,50	0,35–0,45	130–150	—	—	—
	GR14360	360	31,50	0,40–0,50	130–150	—	—	—
16 1,588	GR16270	270	36,00	0,35–0,45	130–150	—	—	—
	GR16360	360	36,00	0,40–0,50	130–150	—	—	—
18 1,411	GR18360	360	40,50	0,32–0,42	130–150	—	—	—
	GR18450	450	40,50	0,37–0,47	130–150	—	—	—
20 1,155	GR20360	360	45,00	0,32–0,42	130–150	—	—	—
	GR20450	450	45,00	0,37–0,47	130–150	—	—	—
22 1,155	GR22360	360	39,60	0,32–0,42	110–130	9,90	0,60–0,75	130–150
	GR22450	450	39,60	0,37–0,47	110–130	9,90	0,70–0,85	130–150
24 1,058	GR24360	360	43,20	0,32–0,42	110–130	10,80	0,60–0,75	130–150
	GR24450	450	43,20	0,37–0,47	110–130	10,80	0,70–0,85	130–150
26 0,977	GR26360	360	46,80	0,32–0,42	110–130	11,70	0,55–0,70	130–150
	GR26450	450	46,80	0,37–0,47	110–130	11,70	0,65–0,80	130–150
28 0,907	GR28360	360	50,40	0,32–0,42	110–130	12,60	0,55–0,70	130–150
	GR28450	450	50,40	0,37–0,47	110–130	12,60	0,65–0,80	130–150
30 0,847	GR30400	400	54,00	0,32–0,42	110–130	13,50	0,55–0,70	130–150
	GR30500	500	54,00	0,37–0,47	110–130	13,50	0,65–0,80	130–150
32 0,794	GR32400	400	57,60	0,32–0,40	110–130	14,40	0,55–0,70	130–150
	GR32500	500	57,60	0,33–0,43	110–130	14,40	0,65–0,80	130–150
34 0,747	GR34400	400	61,20	0,32–0,40	110–130	15,30	0,50–0,65	130–150
	GR34500	500	61,20	0,33–0,43	110–130	15,30	0,60–0,75	130–150
36 0,706	GR36400	400	64,80	0,30–0,38	110–130	16,20	0,50–0,65	130–150
	GR36500	500	64,80	0,32–0,42	110–130	16,20	0,60–0,75	130–150
40 0,635	GR40400	400	72,00	0,26–0,36	100–120	18,00	0,50–0,65	130–150
	GR40500	500	72,00	0,32–0,42	100–120	18,00	0,60–0,75	130–150
		1. Cut			2. Cut			

* The indicated cutting parameters are recommendations. They should be optimized to the specific application. They are valid for materials with a tensile strength of up to 1,000 N/mm² (285 HB). If higher tensile strength materials are used, a reduction of up to 20% of the cutting parameters is recommended.

Finishing Gasher • Internal Basic Rack Profile II (DIN 3972)

	Type	Insert Dimensions										
		Module	Catalog Number	W1	LI	S	R	Insert Screw				
	Flank		6	FF151543IN	15,88	15,88	4,35	—	193.196			
			7	FF151543IN	15,88	15,88	4,35	—	193.196			
			8	FF141963IN	14,30	19,05	6,35	—	MS1492			
			9	FF142563IN	14,30	25,40	6,35	—	MS1492			
			10	FF142563IN	14,30	25,40	6,35	—	MS1492			
			12	FF142980IN	14,30	29,00	8,00	—	MS1571			
			14	FF143180IN	14,30	31,75	8,00	—	MS1571			
			16	FF143880IN	14,30	38,10	8,00	—	MS1571			
			18	FF174190IN	17,00	41,28	9,00	—	PM1916190			
			20	FF174590IN	17,00	45,00	9,00	—	PM1916190			
			22	FF142580IN	14,30	25,40	8,00	—	MS1571			
			24	FF142980IN	14,30	29,00	8,00	—	MS1571			
			26	FF143180IN	14,30	31,75	8,00	—	MS1571			
			28	FF143180IN	14,30	31,75	8,00	—	MS1571			
			30	FF143880IN	14,30	38,10	8,00	—	MS1571			
				Root		6	RF09154322	9,52	15,88	4,35	2,28	PM1822494
						7	RF09154326	9,52	15,88	4,35	2,66	PM1822494
						8	RF09224730	9,52	22,00	4,76	3,04	193.492
9	RF09224734	9,52				22,00	4,76	3,42	193.492			
10	RF09224738	9,52				22,00	4,76	3,80	193.492			
12	RF09196345	9,52				19,05	6,35	4,56	MS1273			
14	RF09196353	9,52				19,05	6,35	5,32	MS1273			
16	RF12257960	12,70				25,40	7,94	6,08	MS1160			
18	RF12257968	12,70				25,40	7,94	6,84	MS1160			
20	RF12259576	12,70				25,40	9,52	7,60	MS1571			
22	RF14289583	14,30				28,58	9,52	8,36	MS1571			
24	RF14289583	14,30				28,58	9,52	9,12	MS1571			
26	RF14289598	14,30				28,58	9,52	9,88	MS1571			
28	RF15157910	15,88				15,88	7,94	10,64	MS1571			
30	RF15157911	15,88				15,88	7,94	11,40	MS1571			

Module DP (Diametral Pitch)	Catalog Number	Cutter Dimensions				Zeff.	Number of Inserts	
		D1	B	D	D6		Root	Flank
6 4,233	GF06240IN	240	50	50	120	8/4	16	8
	GF06300IN	300	60	60	140	10/5	20	10
7 3,629	GF07240IN	240	50	50	120	8/4	16	8
	GF07300IN	300	60	60	140	10/5	20	10
8 3,175	GF08240IN	240	50	50	120	8/4	16	8
	GF08300IN	300	60	60	140	10/5	20	10
9 2,822	GF09240IN	240	50	50	120	8/4	16	8
	GF09300IN	300	60	60	140	10/5	20	10
10 2,540	GF10240IN	240	50	50	120	8/4	16	8
	GF10300IN	300	60	60	140	10/5	20	10
12 2,117	GF12300IN	300	70	60	140	10/5	20	10
	GF12360IN	360	90	80	170	12/6	24	12
14 1,814	GF14300IN	300	70	60	140	10/5	20	10
	GF14360IN	360	90	80	170	12/6	24	12
16 1,588	GF16300IN	300	70	60	140	10/5	20	10
	GF16360IN	360	90	80	170	12/6	24	12
18 1,411	GF18360IN	360	90	80	170	12/6	24	12
	GF18450IN	450	120	100	190	14/7	28	14
20 1,155	GF20360IN	360	90	80	170	12/6	24	12
	GF20450IN	450	120	100	190	14/7	28	14
22 1,155	GF22360IN	360	90	80	170	12/6	24	24
	GF22450IN	450	120	100	190	14/7	28	28
24 1,058	GF24360IN	360	90	80	170	12/6	24	24
	GF24450IN	450	120	100	190	14/7	28	28
26 0,977	GF26400IN	400	90	80	170	12/6	24	24
	GF26500IN	500	120	100	190	16/8	32	28
28 0,907	GF28400IN	400	90	80	170	12/6	24	24
	GF28500IN	500	120	100	190	16/8	32	28
30 0,847	GF30400IN	400	90	80	170	12/6	24	24
	GF30500IN	500	120	100	190	16/8	32	28

Finishing Gasher • Internal Grade and Cutting Parameter Recommendation

● First Choice
○ Alternate Choice

S	●	○
N	○	○
K	●	●
M	○	○
P	●	●

	Module	Catalog Number	KCP10	KCP15
 Number of Cutting Edges: 4	6	FF151543IN	●	●
	7	FF151543IN	●	●
	8	FF141963IN	●	●
	9	FF142563IN	●	●
	10	FF142563IN	●	●
	12	FF142980IN	●	●
	14	FF143180IN	●	●
	16	FF143880IN	●	●
	18	FF174190IN	●	●
	20	FF174590IN	●	●
	22	FF142580IN	●	●
	24	FF142980IN	●	●
	26	FF143180IN	●	●
	28	FF143180IN	●	●
	30	FF143880IN	●	●

● First Choice
○ Alternate Choice

S	●	○
N	○	○
K	●	●
M	○	○
P	●	●

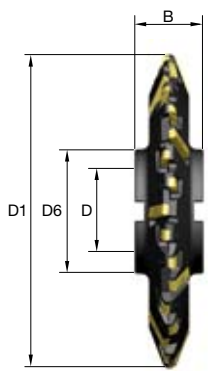
	Module	Catalog Number	KCP10	KCP15
 Number of Cutting Edges: 4	6	RF09154322	●	●
	7	RF09154326	●	●
	8	RF09224730	●	●
	9	RF09224734	●	●
	10	RF09224738	●	●
	12	RF09196345	●	●
	14	RF09196353	●	●
	16	RF12257960	●	●
	18	RF12257968	●	●
	20	RF12259576	●	●
	22	RF14289583	●	●
	24	RF14289583	●	●
	26	RF14289598	●	●
	28	RF15157910	●	●
	30	RF15157911	●	●

The profile of the flank inserts will be designed to the gear specification. On gears with a small number of teeth, the quantity and shape of the flank inserts will be adapted to the required involute shape. Other modules are available upon request.

Module DP (Diametral Pitch)	Catalog Number	Cutting Parameter Recommendation*				
		D1	Full Profile Cut		Finishing (Stock 0,5 mm–2mm)	
			fz	vc	fz	vc
6 4,233	GF06240IN	240	0,35–0,45	150–170	0,42–0,52	170–190
	GF06300IN	300	0,45–0,55	150–170	0,52–0,62	170–190
7 3,629	GF07240IN	240	0,35–0,45	150–170	0,42–0,52	170–190
	GF07300IN	300	0,45–0,55	150–170	0,52–0,62	170–190
8 3,175	GF08240IN	240	0,33–0,43	150–170	0,40–0,50	170–190
	GF08300IN	300	0,43–0,53	150–170	0,50–0,60	170–190
9 2,822	GF09240IN	240	0,33–0,43	140–160	0,40–0,50	160–180
	GF09300IN	300	0,43–0,53	140–160	0,50–0,60	160–180
10 2,540	GF10240IN	240	0,30–0,40	140–160	0,37–0,47	160–180
	GF10300IN	300	0,35–0,45	140–160	0,42–0,52	160–180
12 2,117	GF12300IN	300	0,30–0,40	140–160	0,37–0,47	160–180
	GF12360IN	360	0,35–0,45	140–160	0,42–0,52	160–180
14 1,814	GF14300IN	300	0,28–0,38	130–150	0,35–0,45	150–170
	GF14360IN	360	0,33–0,43	130–150	0,40–0,50	150–170
16 1,588	GF16300IN	300	0,28–0,38	130–150	0,35–0,45	150–170
	GF16300IN	360	0,33–0,43	130–150	0,40–0,50	150–170
18 1,411	GF18360IN	360	0,25–0,35	130–150	0,32–0,42	150–170
	GF18450IN	450	0,30–0,40	130–150	0,37–0,47	150–170
20 1,270	GF20360IN	360	0,25–0,35	130–150	0,32–0,42	150–170
	GF20450IN	450	0,30–0,40	130–150	0,37–0,47	150–170
22 1,155	GF22360IN	360	0,22–0,32	120–140	0,29–0,39	140–160
	GF22450IN	450	0,27–0,37	120–140	0,34–0,44	140–160
24 1,058	GF24360IN	360	0,22–0,32	120–140	0,29–0,39	140–160
	GF24450IN	450	0,27–0,37	120–140	0,34–0,44	140–160
26 0,977	GF26400IN	400	0,20–0,30	110–130	0,27–0,37	130–150
	GF26500IN	500	0,25–0,35	110–130	0,32–0,42	130–150
28 0,907	GF28400IN	400	0,20–0,30	110–130	0,27–0,37	130–150
	GF28500IN	500	0,25–0,30	110–130	0,32–0,42	130–150
30 0,847	GF30400IN	400	0,20–0,30	110–130	0,27–0,37	130–150
	GF30500IN	500	0,25–0,35	110–130	0,32–0,42	130–150

* The indicated cutting parameters are recommendations. They should be optimized to the specific application. They are valid for materials with a tensile strength of up to 1,000 N/mm² (285 HB). If higher tensile strength materials are used, a reduction of up to 20% of the cutting parameters is recommended.

Finishing Gasher • External Basic Rack Profile II (DIN 3972)

	Type	Insert Dimensions								
		Module	Catalog Number	W1	LI	S	R	Insert Screw		
	Flank	6	FF151543EX	15,88	15,88	4,35	—	193.196		
		7	FF151543EX	15,88	15,88	4,35	—	193.196		
		8	FF141963EX	14,30	19,05	6,35	—	MS1492		
		9	FF142563EX	14,30	25,40	6,35	—	MS1492		
		10	FF142563EX	14,30	25,40	6,35	—	MS1492		
		12	FF142980EX	14,30	29,00	8,00	—	MS1571		
		14	FF143180EX	14,30	31,75	8,00	—	MS1571		
		16	FF143880EX	14,30	38,10	8,00	—	MS1571		
		18	FF174190EX	17,00	41,28	9,00	—	PM1916190		
		20	FF174590EX	17,00	45,00	9,00	—	PM1916190		
		22	FF142580EX	14,30	25,40	8,00	—	MS1571		
		24	FF142980EX	14,30	29,00	8,00	—	MS1571		
		26	FF143180EX	14,30	31,75	8,00	—	MS1571		
		28	FF143180EX	14,30	31,75	8,00	—	MS1571		
		30	FF143880EX	14,30	38,10	8,00	—	MS1571		
			Root	6	RF09154322	9,52	15,88	4,35	2,28	PM1822494
				7	RF09154326	9,52	15,88	4,35	2,66	PM1822494
				8	RF09224730	9,52	22,00	4,76	3,04	193.492
9	RF09224734			9,52	22,00	4,76	3,42	193.492		
10	RF09224738			9,52	22,00	4,76	3,80	193.492		
12	RF09196345			9,52	19,05	6,35	4,56	MS1273		
14	RF09196353			9,52	19,05	6,35	5,32	MS1273		
16	RF12257960			12,70	25,40	7,94	6,08	MS1160		
18	RF12257968			12,70	25,40	7,94	6,84	MS1160		
20	RF12259576			12,70	25,40	9,52	7,60	MS1571		
22	RF14289583			14,30	28,58	9,52	8,36	MS1571		
24	RF14289583			14,30	28,58	9,52	9,12	MS1571		
26	RF14289598	14,30	28,58	9,52	9,88	MS1571				
28	RF15157910	15,88	15,88	7,94	10,64	MS1571				
30	RF15157911	15,88	15,88	7,94	11,40	MS1571				

Module DP (Diametral Pitch)	Catalog Number	Cutter Dimensions				Zeff.	Number of Inserts	
		D1	B	D	D6		Root	Flank
6 4,233	GF06240EX	240	50	50	120	8/4	16	8
	GF06300EX	300	60	60	140	10/5	20	10
7 3,629	GF07240EX	240	50	50	120	8/4	16	8
	GF07300EX	300	60	60	140	10/5	20	10
8 3,175	GF08240EX	240	50	50	120	8/4	16	8
	GF08300EX	300	60	60	140	10/5	20	10
9 2,822	GF09240EX	240	50	50	120	8/4	16	8
	GF09300EX	300	60	60	140	10/5	20	10
10 2,540	GF10240EX	240	50	50	120	8/4	16	8
	GF10300EX	300	60	60	140	10/5	20	10
12 2,117	GF12300EX	300	70	60	140	10/5	20	10
	GF12360EX	360	90	80	170	12/6	24	12
14 1,814	GF14300EX	300	70	60	140	10/5	20	10
	GF14360EX	360	90	80	170	12/6	24	12
16 1,588	GF16300EX	300	70	60	140	10/5	20	10
	GF16360EX	360	90	80	170	12/6	24	12
18 1,411	GF18360EX	360	90	80	170	12/6	24	12
	GF18450EX	450	120	100	190	14/7	28	14
20 1,155	GF20360EX	360	90	80	170	12/6	24	12
	GF20450EX	450	120	100	190	14/7	28	14
22 1,155	GF22360EX	360	90	80	170	12/6	24	24
	GF22450EX	450	120	100	190	14/7	28	28
24 1,058	GF24360EX	360	90	80	170	12/6	24	24
	GF24450EX	450	120	100	190	14/7	28	28
26 0,977	GF26400EX	400	90	80	170	12/6	24	24
	GF26500EX	500	120	100	190	16/8	32	28
28 0,907	GF28400EX	400	90	80	170	12/6	24	24
	GF28500EX	500	120	100	190	16/8	32	28
30 0,847	GF30400EX	400	90	80	170	12/6	24	24
	GF30500EX	500	120	100	190	16/8	32	28

Finishing Gasher • External Grade and Cutting Parameter Recommendation

● First Choice
○ Alternate Choice

S	●	○
N	●	○
K	●	○
M	○	●
P	●	●

	Module	Catalog Number	KCP10	KCP15
 Flank Number of Cutting Edges: 4	6	FF151543EX	●	●
	7	FF151543EX	●	●
	8	FF141963EX	●	●
	9	FF142563EX	●	●
	10	FF142563EX	●	●
	12	FF142980EX	●	●
	14	FF143180EX	●	●
	16	FF143880EX	●	●
	18	FF174190EX	●	●
	20	FF174590EX	●	●
	22	FF142580EX	●	●
	24	FF142980EX	●	●
	26	FF143180EX	●	●
	28	FF143180EX	●	●
	30	FF143880EX	●	●

● First Choice
○ Alternate Choice

S	●	○
N	●	○
K	●	○
M	○	●
P	●	●

	Module	Catalog Number	KCP10	KCP15
 Root Number of Cutting Edges: 4	6	RF09154322	●	●
	7	RF09154326	●	●
	8	RF09224730	●	●
	9	RF09224734	●	●
	10	RF09224738	●	●
	12	RF09196345	●	●
	14	RF09196353	●	●
	16	RF12257960	●	●
	18	RF12257968	●	●
	20	RF12259576	●	●
	22	RF14289583	●	●
	24	RF14289591	●	●
	26	RF14289598	●	●
	28	RF15157910	●	●
	30	RF15157911	●	●

The profile of the flank inserts will be designed to the gear specification. On gears with a small number of teeth, the quantity and shape of the flank inserts will be adapted to the required involute shape. Other modules are available upon request.

Module DP (Diametral Pitch)	Catalog Number	Cutting Parameter Recommendation*				
		D1	Full Profile Cut		Finishing (Stock 0,5 mm–2 mm)	
			fz	vc	fz	vc
6 4,233	GF06240EX	240	0,35–0,45	150–170	0,42–0,52	170–190
	GF06300EX	300	0,45–0,55	150–170	0,52–0,62	170–190
7 3,629	GF07240EX	240	0,35–0,45	150–170	0,42–0,52	170–190
	GF07300EX	300	0,45–0,55	150–170	0,52–0,62	170–190
8 3,175	GF08240EX	240	0,33–0,43	150–170	0,40–0,50	170–190
	GF08300EX	300	0,43–0,53	150–170	0,50–0,60	170–190
9 2,822	GF09240EX	240	0,33–0,43	140–160	0,40–0,50	160–180
	GF09300EX	300	0,43–0,53	140–160	0,50–0,60	160–180
10 2,540	GF10240EX	240	0,30–0,40	140–160	0,37–0,47	160–180
	GF10300EX	300	0,35–0,45	140–160	0,42–0,52	160–180
12 2,117	GF12300EX	300	0,30–0,40	140–160	0,37–0,47	160–180
	GF12360EX	360	0,35–0,45	140–160	0,42–0,52	160–180
14 1,814	GF14300EX	300	0,28–0,38	130–150	0,35–0,45	150–170
	GF14360EX	360	0,33–0,43	130–150	0,40–0,50	150–170
16 1,588	GF16300EX	300	0,28–0,38	130–150	0,35–0,45	150–170
	GF16360EX	360	0,33–0,43	130–150	0,40–0,50	150–170
18 1,411	GF18360EX	360	0,25–0,35	130–150	0,32–0,42	150–170
	GF18450EX	450	0,30–0,40	130–150	0,37–0,47	150–170
20 1,270	GF20360EX	360	0,25–0,35	130–150	0,32–0,42	150–170
	GF20450EX	450	0,30–0,40	130–150	0,37–0,47	150–170
22 1,155	GF22360EX	360	0,22–0,32	120–140	0,29–0,39	140–160
	GF22450EX	450	0,27–0,37	120–140	0,34–0,44	140–160
24 1,058	GF24360EX	360	0,22–0,32	120–140	0,29–0,39	140–160
	GF24450EX	450	0,27–0,37	120–140	0,34–0,44	140–160
26 0,977	GF26400EX	400	0,20–0,30	110–130	0,27–0,37	130–150
	GF26500EX	500	0,25–0,35	110–130	0,32–0,42	130–150
28 0,907	GF28400EX	400	0,20–0,30	110–130	0,27–0,37	130–150
	GF28500EX	500	0,25–0,30	110–130	0,32–0,42	130–150
30 0,847	GF30400EX	400	0,20–0,30	110–130	0,27–0,37	130–150
	GF30500EX	500	0,25–0,35	110–130	0,32–0,42	130–150

* The indicated cutting parameters are recommendations. They should be optimized to the specific application. They are valid for materials with a tensile strength of up to 1,000 N/mm² (285 HB). If higher tensile strength materials are used, a reduction of up to 20% of the cutting parameters is recommended.

Roughing Gasher



Roughing Gasher



Workpiece: External Gear ($\emptyset$ 3,500mm x 450mm)
 Material: 42CrMo4 (4140)
 Operation: Roughing Module 25mm–50mm
 Coolant: Oil
 Machine: Hobbing Machine
 Tool: $D = 500\text{mm}$; $m = 25\text{mm}–50\text{mm}$; $z_{\text{eff}} = 10/5$
 Cutting Data: $v_c = 60 \text{ m/min}$; $v_f = 30 \text{ m/min}$

Workpiece: Internal Gear (Bearing Ring)
 Material: 42CrMo4 (4140)
 Operation: Roughing Module 16mm; $Z = 120–218$
 Coolant: Air
 Machine: Gantry Milling Machine
 Tool: $D = 450\text{mm}$; $m = 16\text{mm}$; $z_{\text{eff}} = 8/4$
 Cutting Data: $v_c = 160 \text{ m/min}$; $v_f = 110 \text{ m/min}$

Roughing Gasher



Workpiece: External Gear (Pinion Gear)
 Material: 42CrMo4 (4140)
 Operation: Roughing Module 16mm–20mm
 Coolant: Air
 Tool: $D = 260\text{mm}$; $B = 80\text{mm}$; $z_{\text{eff}} = 6/3$
 Material Stock after Milling 0,8mm–2,7mm

Finishing Gasher Internal



Workpiece: Internal Gear (Inner Ring Planetary Gearbox)
 Material: 34CrNiMo6 (4340)
 Operation: Premachining for grinding in 1 cut
 $m = 19\text{mm}$; $Z = 117$; $B = 470\text{mm}$
 Tool: $D = 420\text{mm}$; $B = 165\text{mm}$; $z_{\text{eff}} = 14/7$
 Cutting Data: $v_c = 130\text{ m/min}$; $f_z = 0,15\text{mm}$
 Benefits:

- Four cutting edges per insert.
- Better chip flow and lower power consumption through positive chip former.
- Profile quality 9 with 1 cut.



The modular concept of the Kennametal hob has been optimized for the module range of 6–40. Through the use of the newest carbide substrates and coating technologies, these tools are applied with higher cutting speeds that provide high chip removal rates.

These tools consist of the pickup arbor and respective precision segments, which are placed onto a carrier slot and then mounted onto the arbor via an easily accessible screw connection. This modular concept guarantees easy and fast tool assembly and disassembly.

The positioning of the inserts has been optimized to achieve a very high number of effective teeth. The mounting or indexing of the inserts can easily be performed with a fully assembled tool. No disassembly is required.

Hob Assembly:

$D = 270\text{mm}$; $m = 7\text{mm}$

Number of segments = 33

Pickup Arbor



Segment 1–17 x
Segment 2–16 x



Assembly of a Hob with 2 Starts:

$D = 280\text{mm}$; $m = 8\text{mm}$

Number of segments = 56

Clamping Screw
Actuation



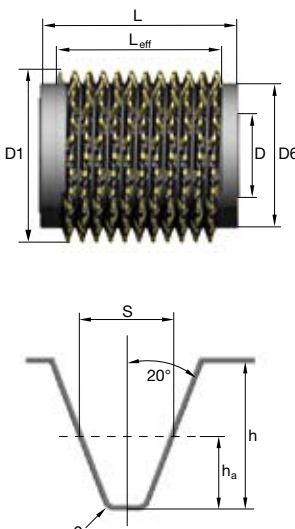
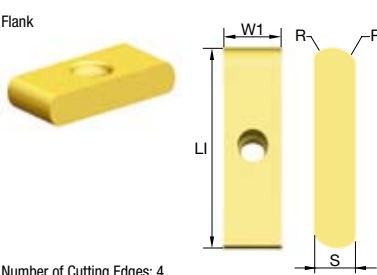
Fully Assembled Tool





Workpiece: Railway Drive Wheel
 Coolant: Oil
 Tool: $D = 270\text{mm}$; $L = 310\text{mm}$; quality class A
 $m = 7\text{mm}$, single thread, 33 segments
 $z_{\text{eff.}} = 22,5/7,5$; $z_{\text{tot}} = 310$
 $z_{\text{flank}} = 7,5$; $z_{\text{head}} = 22,5$;
 Gear: $z = 71$; $\beta = 10^\circ$; $d_a = 517\text{mm}$; $b = 145\text{mm}$
 Material: 18CrNiMo
 Cutting Data: $v_c = 140\text{ m/min}$; $f = 4\text{mm/WU}$

Basic Rack Profile II (DIN 3972)

	Type	Insert Dimensions						
		Module	Catalog Number	W1	LI	S	R	Insert Screw
	Flank	6	FU09204712	9,52	20,00	4,76	1,20	193.492
		7	FU09234714	9,52	23,00	4,76	1,40	193.492
		8	FU09235516	9,52	23,00	5,55	1,60	193.492
		9	FU09285518	9,52	28,58	5,55	1,80	MS1273
		10	FU09316320	9,52	31,80	6,35	2,00	MS1273
		12	FU12386324	12,70	38,10	6,35	2,40	MS1160
		14	FU12457328	12,70	45,00	7,35	2,80	MS1160
		16	FU12507932	12,70	50,80	7,94	3,20	MS1160
		18	FU14579536	14,30	57,15	9,52	3,60	MS1571
		20	FU14349580	14,30	34,29	9,52	4,00	MS1571
		22	FU14389544	14,30	38,10	9,52	4,40	MS1571
		Number of Cutting Edges: 4						
	Root	6	RU09154312	9,52	15,88	4,35	1,20	PM1822494
		7	RU09154314	9,52	15,88	4,35	1,40	PM1822494
		8	RU09194716	9,52	19,05	4,76	1,60	MS2107
		9	RU09194718	9,52	19,05	4,76	1,80	MS2107
		10	RU09195520	9,52	19,05	5,55	2,00	MS1273
		12	RU09195524	9,52	19,05	5,55	2,40	MS1273
		14	RU12286328	12,70	28,58	6,35	2,80	MS1160
		16	RU12287932	12,70	28,58	7,94	3,20	MS1160
		18	RU12289536	12,70	28,58	9,52	3,60	MS1571
		20	RU12289540	12,70	28,58	9,52	4,00	MS1571
		22	RU14319544	14,30	31,80	9,52	4,40	MS1571
		Number of Cutting Edges: 4						

Module DP (Diametral Pitch)	Catalog Number	Cutter Dimensions							Profile				Number of Inserts		
		D1	D	D6	L	Leff	Windings	Z/W	h	ha	s	ka	Z total	Flank	Root
6 4,233	HU06220BR1	220	50	170	230	169,6	9	22	13,5	7,5	9,42	1,2	198	99	99
	HU06270BR1	270	60	220	280	226,2	12	30					360	180	180
7 3,629	HU07220BR1	220	50	170	230	175,9	8	22	15,75	8,75	11,00	1,4	176	88	88
	HU07270BR1	270	60	220	300	241,9	11	30					330	165	165
8 3,175	HU08220BR1	220	50	160	230	175,9	7	22	18	10	12,57	1,6	154	77	77
	HU08270BR1	270	60	210	310	251,3	10	30					300	150	150
9 2,822	HU09220BR	220	50	160	230	169,6	6	20	20,25	11,25	14,14	1,8	120	60	60
	HU09270BR1	270	60	210	310	254,5	9	26					234	117	117
10 2,540	HU10220BR1	220	50	150	250	188,5	6	20	22,5	12,5	15,71	2	120	60	60
	HU10270BR1	270	60	200	350	282,7	9	26					234	117	117
12 2,117	HU12240BR1	240	60	160	290	226,2	6	24	27	15	18,85	2,4	144	72	72
	HU12300BR1	300	80	230	370	301,6	8	30					240	120	120
14 1,814	HU14240BR1	240	60	150	330	263,9	6	24	31,5	17,5	21,99	2,8	144	72	72
	HU14300BR1	300	80	210	420	351,9	8	30					240	120	120
16 1,588	HU16270BR1	270	60	170	380	301,6	6	22	36	20	25,13	3,2	132	66	66
	HU16360BR1	360	100	260	480	402,1	8	30					240	120	120
18 1,411	HU18360BR1	360	100	250	420	339,3	6	30	40,5	22,5	28,27	3,6	180	90	90
	HU18450BR1	450	100	340	480	395,8	7	38					266	133	133
20 1,155	HU20360BR1	360	100	240	400	314,2	5	45	45	25	31,42	4	225	150	75
	HU20450BR1	450	100	330	530	439,8	7	57					399	266	133
22 1,155	HU22360BR1	360	100	230	430	345,6	5	30	49,5	27,5	34,56	4,4	225	150	75
	HU22450BR1	450	100	340	500	414,7	6	38					270	180	90

Standard: Quality class B according to DIN 3968, 1 start, RH thread.

Hobs in quality class A, multi-thread, or left-hand design hobs and hobs with module >22 available upon request.

Inserts with positive chip former profiles are also available.

Hob Basic Rack Profile II • DIN 3972

Grade and Cutting Parameter Recommendation

- First Choice
- Alternate Choice

S	●	○
N	●	○
K	●	○
M	●	○
P	●	○

	Module	Catalog Number	KCP10	KCP15
 Number of Cutting Edges: 4	6	FU09204712	●	●
	7	FU09234714	●	●
	8	FU09235516	●	●
	9	FU09285518	●	●
	10	FU09316320	●	●
	12	FU12386324	●	●
	14	FU12457328	●	●
	16	FU12507932	●	●
	18	FU14579536	●	●
	20	FU14349580	●	●
	22	FU14389544	●	●

- First Choice
- Alternate Choice

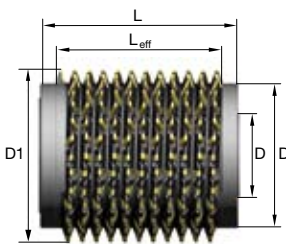
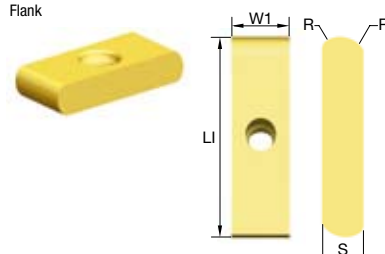
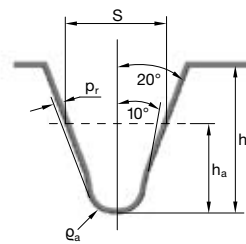
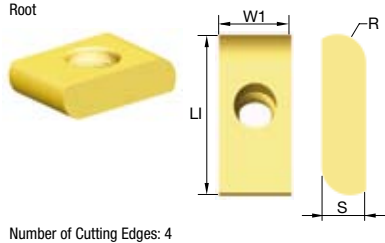
S	●	○
N	●	○
K	●	○
M	●	○
P	●	○

	Module	Catalog Number	KCP10	KCP15
 Number of Cutting Edges: 4	6	RU09154312	●	●
	7	RU09154314	●	●
	8	RU09194716	●	●
	9	RU09194718	●	●
	10	RU09195520	●	●
	12	RU09195524	●	●
	14	RU12286328	●	●
	16	RU12287932	●	●
	18	RU12289536	●	●
	20	RU12289540	●	●
	22	RU14319544	●	●

The indicated cutting parameters are recommendations. They should be optimized to the specific application. They are valid for materials with a tensile strength of up to 1,000 N/mm² (285 HB). If higher tensile strength materials are used, a reduction of up to 20% of the cutting parameters is recommended.

Module DP (Diametral Pitch)	Catalog Number	Cutting Parameter Recommendation*							
		D1	ae1	vc1	ae2	vc2	fa z ≤50	fa z ≤50–100	fa z ≤100
6 4,233	HU06220BR1	220	14,70	150–170	—	—	2,00–3,00	3,00–5,00	5,00–6,00
	HU06270BR1	270	14,70	150–170	—	—	2,50–3,75	3,75–5,00	5,00–6,00
7 3,629	HU07220BR1	220	17,20	150–170	—	—	1,75–2,75	2,75–4,75	4,75–6,00
	HU07270BR1	270	17,20	150–170	—	—	2,40–3,75	3,75–5,00	5,00–6,00
8 3,175	HU08220BR1	220	19,60	130–150	—	—	1,60–2,60	2,60–4,50	4,50–6,00
	HU08270BR1	270	19,60	130–150	—	—	2,30–3,60	3,60–5,00	5,00–6,00
9 2,822	HU09220BR1	220	22,00	130–150	—	—	1,50–2,50	2,50–4,25	4,25–5,50
	HU09270BR1	270	22,00	130–150	—	—	2,20–3,25	3,25–5,00	5,00–6,00
10 2,540	HU10220BR1	220	24,50	130–150	—	—	1,30–2,30	2,30–3,75	3,75–5,00
	HU10270BR1	270	24,50	130–150	—	—	2,00–3,00	3,00–4,50	4,50–6,00
12 2,117	HU12240BR1	240	29,40	110–130	—	—	1,10–2,20	2,20–3,30	3,30–4,00
	HU12300BR1	300	29,40	110–130	—	—	1,75–2,50	2,50–4,00	4,00–5,50
14 1,814	HU14220BR1	240	34,30	110–130	—	—	1,00–2,00	2,00–3,00	3,00–4,00
	HU14300BR1	300	34,30	110–130	—	—	1,60–2,35	2,35–4,00	4,00–5,25
16 1,588	HU16270BR1	270	37,20	110–130	2,00	130–150	1,00–1,75	1,75–2,75	2,75–4,00
	HU16360BR1	360	37,20	110–130	2,00	130–150	1,50–2,25	2,25–3,75	3,75–5,25
18 1,411	HU18360BR1	360	41,60	100–120	2,50	130–150	0,90–1,60	1,60–2,50	2,50–3,80
	HU18450BR1	450	41,60	100–120	2,50	130–150	1,40–2,10	2,10–3,50	3,50–5,00
20 1,155	HU20360BR1	360	46,00	100–120	3,00	130–150	0,75–1,50	1,50–2,25	2,25–3,75
	HU20450BR1	450	46,00	100–120	3,00	130–150	1,00–1,75	1,75–3,50	3,50–4,75
22 1,155	HU22360BR1	360	50,60	100–120	3,30	130–150	0,50–1,25	1,25–2,00	2,00–3,50
	HU22450BR1	450	50,60	100–120	3,30	130–150	0,75–1,50	1,50–3,25	3,25–4,50
		1. Cut			2. Cut				

Roughing Hobs with Protuberance Dimensions

	Type	Insert Dimensions						
		Module	Catalog Number	W1	LI	S	R	Insert Screw
	Flank							
	 Number of Cutting Edges: 4	6	FU09204724	9,52	20,00	4,76	2,40	193.492
		7	FU09234728	9,52	23,00	4,76	2,80	193.492
		8	FU09235532	9,52	23,00	5,55	3,20	193.492
		9	FU09285536	9,52	28,58	5,55	3,60	MS1273
		10	FU09316340	9,52	31,80	6,35	4,00	MS1273
		12	FU12386348	12,70	38,10	6,35	4,80	MS1160
		14	FU12457356	12,70	45,00	7,35	5,60	MS1160
		16	FU12507964	12,70	50,80	7,94	6,40	MS1160
		18	FU14579572	14,30	57,15	9,52	7,20	MS1571
20		FU14349580	14,30	34,29	9,52	8,00	MS1571	
	Root							
	 Number of Cutting Edges: 4	22	FU14389588	14,30	38,10	9,52	8,80	MS1571
		6	RU09154324	9,52	15,88	4,35	2,40	PM1822494
		7	RU09154328	9,52	15,88	4,35	2,80	PM1822494
		8	RU09194732	9,52	19,05	4,76	3,20	MS2107
		9	RU09194736	9,52	19,05	4,76	3,20	MS2107
		10	RU09195540	9,52	19,05	5,55	4,00	MS1273
		12	RU09195548	9,52	19,05	5,55	4,80	MS1273
		14	RU12286356	12,70	28,58	6,35	5,60	MS1160
		16	RU12287964	12,70	28,58	7,94	6,40	MS1160
18		RU12289572	12,70	28,58	9,52	7,20	MS1571	
20	RU12289580	12,70	28,58	9,52	8,00	MS1571		
22	RU14319588	14,30	31,80	9,52	8,80	MS1571		

Module DP (Diametral Pitch)	Catalog Number	Cutter Dimensions							Profile				Number of Inserts		
		D1	D	D6	L	Leff	Windings	Z/W	h	ha	s	ka	Ztotal	Flank	Root
6 4,233	HU06220EPBR1	220	50	170	230	169,6	9	22	15,6	8,4	9,42	2,4	198	99	99
	HU06270EPBR1	270	60	220	280	226,2	12	30					360	180	180
7 3,629	HU07220EPBR1	220	50	170	230	175,9	8	22	18,2	9,8	11,00	2,8	176	88	88
	HU07270EPBR1	270	60	220	300	241,9	11	30					330	165	165
8 3,175	HU08220EPBR1	220	50	160	230	175,9	7	22	20,8	11,2	12,57	3,2	154	77	77
	HU08270EPBR1	270	60	210	310	251,3	10	30					300	150	150
9 2,822	HU09220BR	220	50	160	230	169,6	6	20	23,4	12,6	14,14	3,6	120	60	60
	HU09270EPBR1	270	60	210	310	254,5	9	26					234	117	117
10 2,540	HU10220EPBR1	220	50	150	250	188,5	6	20	26	14	15,71	4	120	60	60
	HU10270EPBR1	270	60	200	350	282,7	9	26					234	117	117
12 2,117	HU12240EPBR1	240	60	160	290	226,2	6	24	31,2	16,8	18,85	4,8	144	72	72
	HU12300EPBR1	300	80	230	370	301,6	8	30					240	120	120
14 1,814	HU14240EPBR1	240	60	150	330	263,9	6	24	36,4	19,6	21,99	5,6	144	72	72
	HU14300EPBR1	300	80	210	420	351,9	8	30					240	120	120
16 1,588	HU16270EPBR1	270	60	170	380	301,6	6	22	41,6	22,4	25,13	6,4	132	66	66
	HU16360EPBR1	360	100	260	480	402,1	8	30					240	120	120
18 1,411	HU18360EPBR1	360	100	250	420	339,3	6	30	46,8	25,2	28,27	7,2	180	90	90
	HU18450EPBR1	450	100	340	480	395,8	7	38					266	133	133
20 1,155	HU20360EPBR1	360	100	240	400	314,2	5	45	52	28	31,42	8	225	150	75
	HU20450EPBR1	450	100	330	530	439,8	7	57					399	266	133
22 1,155	HU22360EPBR1	360	100	230	430	345,6	5	30	57,2	30,8	34,56	8,8	225	150	75
	HU22450EPBR1	450	100	340	500	414,7	6	38					270	180	90

Standard: Quality class B according to DIN 3968, 1 start, RH thread.

Hobs in quality class A, multi-thread, or left-hand design hobs and hobs with module >22 available upon request.

Inserts with positive chip former profiles are also available.

Roughing Hobs with Protuberance Grade and Cutting Parameter Recommendation

- First Choice
- Alternate Choice

S	●	○
N	●	○
K	●	○
M	●	○
P	●	○

	Module	Catalog Number	KCP10	KCP15
 Number of Cutting Edges: 4	6	FU09204724	●	●
	7	FU09234728	●	●
	8	FU09235532	●	●
	9	FU09285536	●	●
	10	FU09316340	●	●
	12	FU12386348	●	●
	14	FU12457356	●	●
	16	FU12507964	●	●
	18	FU14579572	●	●
	20	FU14349580	●	●
	22	FU14389588	●	●

- First Choice
- Alternate Choice

S	●	○
N	●	○
K	●	○
M	●	○
P	●	○

	Module	Catalog Number	KCP10	KCP15
 Number of Cutting Edges: 4	6	RU09154324	●	●
	7	RU09154328	●	●
	8	RU09194732	●	●
	9	RU09194736	●	●
	10	RU09195540	●	●
	12	RU09195548	●	●
	14	RU12286356	●	●
	16	RU12287964	●	●
	18	RU12289572	●	●
	20	RU12289580	●	●
	22	RU14319588	●	●

The indicated cutting parameters are recommendations. They should be optimized to the specific application. They are valid for materials with a tensile strength of up to 1,000 N/mm² (285 HB). If higher tensile strength materials are used, a reduction of up to 20% of the cutting parameters is recommended.

Module DP (Diametral Pitch)	Catalog Number	Cutting Parameter Recommendation*							
		D1	ae1	vc1	ae2	vc2	fa z ≤50	fa z ≤50-100	fa z ≤100
6 4,233	HU06220EPEPBR1	220	14,70	150-170	—	—	2,00-3,00	3,00-5,00	5,00-6,00
	HU06270EPEPBR1	270	14,70	150-170	—	—	2,50-3,75	3,75-5,00	5,00-6,00
7 3,629	HU07220EPEPBR1	220	17,20	150-170	—	—	1,75-2,75	2,75-4,75	4,75-6,00
	HU07270EPEPBR1	270	17,20	150-170	—	—	2,40-3,75	3,75-5,00	5,00-6,00
8 3,175	HU08220EPEPBR1	220	19,60	130-150	—	—	1,60-2,60	2,60-4,50	4,50-6,00
	HU08270EPEPBR1	270	19,60	130-150	—	—	2,30-3,60	3,60-5,00	5,00-6,00
9 2,822	HU09220EPEPBR1	220	22,00	130-150	—	—	1,50-2,50	2,50-4,25	4,25-5,50
	HU09270EPEPBR1	270	22,00	130-150	—	—	2,20-3,25	3,25-5,00	5,00-6,00
10 2,540	HU10220EPEPBR1	220	24,50	130-150	—	—	1,30-2,30	2,30-3,75	3,75-5,00
	HU10270EPEPBR1	270	24,50	130-150	—	—	2,00-3,00	3,00-4,50	4,50-6,00
12 2,117	HU12240EPEPBR1	240	29,40	110-130	—	—	1,10-2,20	2,20-3,30	3,30-4,00
	HU12300EPEPBR1	300	29,40	110-130	—	—	1,75-2,50	2,50-4,00	4,00-5,50
14 1,814	HU14220EPEPBR1	240	34,30	110-130	—	—	1,00-2,00	2,00-3,00	3,00-4,00
	HU14300EPEPBR1	300	34,30	110-130	—	—	1,60-2,35	2,35-4,00	4,00-5,25
16 1,588	HU16270EPEPBR1	270	37,20	110-130	2,00	130-150	1,00-1,75	1,75-2,75	2,75-4,00
	HU16360EPEPBR1	360	37,20	110-130	2,00	130-150	1,50-2,25	2,25-3,75	3,75-5,25
18 1,411	HU18360EPEPBR1	360	41,60	100-120	2,50	130-150	0,90-1,60	1,60-2,50	2,50-3,80
	HU18450EPEPBR1	450	41,60	100-120	2,50	130-150	1,40-2,10	2,10-3,50	3,50-5,00
20 1,155	HU20360EPEPBR1	360	46,00	100-120	3,00	130-150	0,75-1,50	1,50-2,25	2,25-3,75
	HU20450EPEPBR1	450	46,00	100-120	3,00	130-150	1,00-1,75	1,75-3,50	3,50-4,75
22 1,155	HU22360EPEPBR1	360	50,60	100-120	3,30	130-150	0,50-1,25	1,25-2,00	2,00-3,50
	HU22450EPEPBR1	450	50,60	100-120	3,30	130-150	0,75-1,50	1,50-3,25	3,25-4,50
		1. Cut			2. Cut				

Duplex Finishing Gasher



Tool: $D = 210\text{mm}$; $m = 5\text{mm}$
 $z_{\text{eff}} = 16/8$

Finishing Gasher



Workpiece: $m = 3\text{mm}$; $d = 44\text{mm}$
 Tool: $D = 120\text{mm}$; HSK63A
 $z_{\text{eff}} = 18/9$; $z_{\text{tot}} = 18$
 Roughing: $v_c = 180\text{ m/min}$; $fz = 0,5\text{mm}$; $a_p = 5,5\text{mm}$
 Machining Time 34 s
 Finishing: $v_c = 250\text{ m/min}$; $fz = 0,25\text{mm}$; $a_p = 0,5\text{mm}$
 Machining Time 60 s
 Quality: IT9, Rz 3–4

Roughing Cutter for Sprocket Wheels



Finishing Cutter for Sprocket Wheels



Workpiece: Control Wheel for Ship Engines $d = 4\text{-}1/2''$
Coolant: Dry
Machine: Hobbing Machine
Tool: $D = 400\text{mm}$; $z_{\text{eff}} = 6/3$
Cutting Data: $v_c = 120 \text{ m/min}$; $h_{\text{max}} = 0,3\text{mm}$
 $a_p = 114,3\text{mm}$; $a_e = 65,43\text{mm}$

Workpiece: Control Wheel for Ship Engines $d = 4\text{-}1/2''$
Coolant: Dry
Machine: Hobbing Machine
Tool: $D = 400\text{mm}$; $z_{\text{eff}} = 12$
Cutting Data: $v_c = 160 \text{ m/min}$; $h_{\text{max}} = 0,016\text{mm}$
 $a_p = 0,5\text{mm}$; $a_e = 65,43\text{mm}$



With hirth couplings, the demand of modern mechanical engineering to provide

- light-weight designs and
- high-strength connections

can be realized. This type of self-centering, radial face tooth connection is being used to connect shafts, discs, wheels, and cranks with a high accuracy. The hirth serrations are widely used as a high-precision indexing and positioning element, especially in the machine tool industry.

Face Gear Machining on CNC Centers



Roughing and finishing end mills are designed upon request. Standard shank diameters are 16mm, 20mm, and 25mm.



Finishing End Mill

Roughing End Mill

Workpiece: Face Gear (hirth serration) $Z = 96$
 Material: 35CrMoV10 — 1,200 N/mm²
 Coolant: Wet
 Machine: BAZ (40KW)
 Tools: Roughing End Mill $Z = 3$; $d = 16\text{mm}$
 $n = 4000\text{ U/min}$; $v_f = 840\text{ m/min}$
 $f_z = 0,07\text{mm}$; $a_p = 13,6\text{mm}$ (full profile cut)
 Tool Life: 11 m
 Finishing End Mill $Z = 4$; $d = 20\text{mm}$
 $n = 4000\text{ U/min}$; $v_f = 1120\text{ m/min}$
 $f_z = 0,07\text{mm}$; $a_p = 14,5\text{mm}$ (full profile cut)
 Tool Life: 27 m

Gear Milling Cutter

G	R	06	220																																														
Type of Tool	Application	Module	Cutter Diameter D (mm)																																														
G Gasher H Hob	R Roughing F Finishing U Universal Machining	<table><tr><td>06</td><td>6</td></tr><tr><td>07</td><td>7</td></tr><tr><td>08</td><td>8</td></tr><tr><td>09</td><td>9</td></tr><tr><td>10</td><td>10</td></tr><tr><td>12</td><td>12</td></tr><tr><td>14</td><td>14</td></tr><tr><td>16</td><td>16</td></tr><tr><td>18</td><td>18</td></tr><tr><td>20</td><td>20</td></tr><tr><td>22</td><td>22</td></tr><tr><td>24</td><td>24</td></tr><tr><td>26</td><td>26</td></tr><tr><td>28</td><td>28</td></tr><tr><td>30</td><td>30</td></tr><tr><td>32</td><td>32</td></tr><tr><td>34</td><td>34</td></tr><tr><td>36</td><td>36</td></tr><tr><td>38</td><td>38</td></tr><tr><td>40</td><td>40</td></tr></table>	06	6	07	7	08	8	09	9	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	<table><tr><td>220</td></tr><tr><td>270</td></tr><tr><td>300</td></tr><tr><td>400</td></tr><tr><td>450</td></tr><tr><td>500</td></tr></table>	220	270	300	400	450	500
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Inserts

R	R	09	15	43																																																				
Produced Teeth Profile	Application	Insert Width (mm)	Insert Length (mm)	Insert Thickness (mm)																																																				
R Root F Flank	R Roughing F Finishing	<table><tr><td>09</td><td>9,52</td></tr><tr><td>12</td><td>12,70</td></tr><tr><td>14</td><td>14,30</td></tr><tr><td>15</td><td>15,88</td></tr><tr><td>17</td><td>17,00</td></tr><tr><td>18</td><td>18,00</td></tr></table>	09	9,52	12	12,70	14	14,30	15	15,88	17	17,00	18	18,00	<table><tr><td>15</td><td>15,88</td></tr><tr><td>18</td><td>18,00</td></tr><tr><td>19</td><td>19,05</td></tr><tr><td>22</td><td>22,00</td></tr><tr><td>25</td><td>25,40</td></tr><tr><td>29</td><td>29,00</td></tr><tr><td>31</td><td>31,75</td></tr><tr><td>38</td><td>38,10</td></tr><tr><td>41</td><td>41,28</td></tr><tr><td>45</td><td>45,00</td></tr></table>	15	15,88	18	18,00	19	19,05	22	22,00	25	25,40	29	29,00	31	31,75	38	38,10	41	41,28	45	45,00	<table><tr><td>06</td><td>4,35</td></tr><tr><td>07</td><td>4,76</td></tr><tr><td>08</td><td>5,50</td></tr><tr><td>09</td><td>6,35</td></tr><tr><td>10</td><td>6,60</td></tr><tr><td>12</td><td>7,70</td></tr><tr><td>14</td><td>7,94</td></tr><tr><td>16</td><td>8,00</td></tr><tr><td>18</td><td>9,00</td></tr><tr><td>20</td><td>9,52</td></tr></table>	06	4,35	07	4,76	08	5,50	09	6,35	10	6,60	12	7,70	14	7,94	16	8,00	18	9,00	20	9,52
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07	4,76																																																							
08	5,50																																																							
09	6,35																																																							
10	6,60																																																							
12	7,70																																																							
14	7,94																																																							
16	8,00																																																							
18	9,00																																																							
20	9,52																																																							

Optional Descriptions

only for Hobs

IN

Gear Type

IN Internal Gear
EX External Gear
IP Internal Gear
with Protuberance
EP External Gear
with Protuberance

B

Quality Class

AA	
A	
B	
C	

The milling cutters
are generally
produced in quality
class B according to
DIN standard 3968.

R

Hand of Tool

R Right-Hand Thread
L Left-Hand Thread

2

Number of Threads

1 Single-Start Design
2 Double-Thread Design

05

Insert Radius
(mm)

05	0,50
06	0,60
08	0,80
13	1,30
18	1,80
22	2,28
26	2,66
28	2,80
30	3,04
34	3,42
38	3,80
40	4,00
45	4,56
52	5,20
53	5,32
60	6,00
64	6,40
68	6,84
76	7,60

IN

Gear Type Hand of Insert

IN Internal Gear
EX External Gear
IP Internal Gear
with Protuberance
EP External Gear
with Protuberance
R Right-Hand Insert
L Left-Hand Insert

06

Module

06	6
07	7
08	8
09	9
10	10
12	12
14	14
16	16
18	18
20	20
22	22
24	24
26	26
28	28
30	30
32	32
34	34
36	36
38	38
40	40

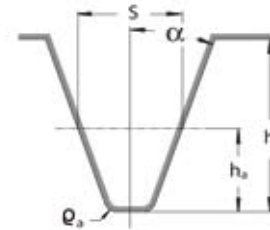
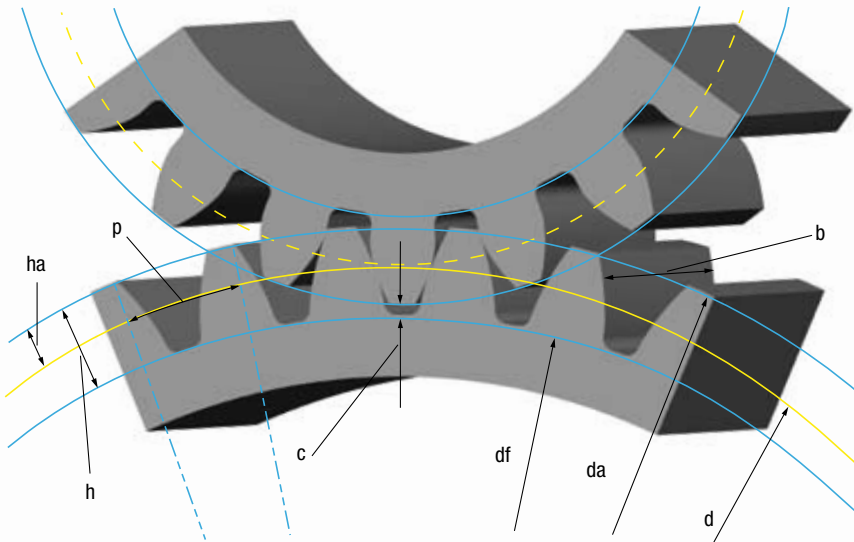
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Number of Gear Teeth

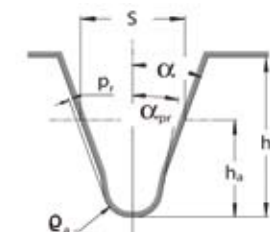
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Addendum Modification
of the Gear

Gear Parameters



Profile Parameter
without Protuberance
Finishing Process



Profile Parameter
with Protuberance
Roughing Process

b [mm]	h [mm]	h _a [mm]	h _f [mm]	d [mm]	d _a [mm]	d _f [mm]
Tooth Width	Tooth Depth	Tooth Addendum	Tooth Dedendum	Pitch Diameter	Tip Diameter	Root Diameter

c [mm]	p [mm]	m [mm]	s [mm]	z	x	α [°]
Bottom Clearance	Pitch	Module	Tooth Thickness	Number of Teeth	Addendum Modification Coefficient	Pressure Angle

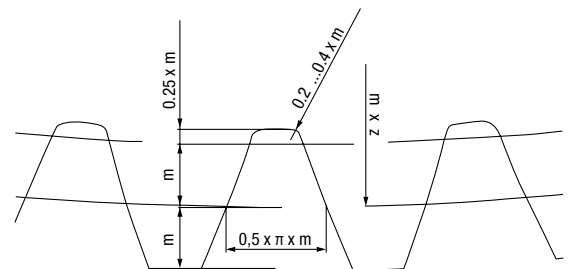
α _{Pr} [°]	p _r [mm]	β [°]	k _a [°]	k _r [°]	f _a (mm/rev)
Protuberance Angle	Protuberance Amount	Helix Angle	Tip Radius	Root Radius	Feed per Workpiece Revolution

Module

The Module “m” is an important gear parameter and is defined as:

$$m = \frac{d}{z} = \frac{p}{\pi}$$

The gear and counter gear must have the same module. Other parameters, such as addendum modification, tooth addendum and dedendum, root radius, and tip relief, are multiples of the module. Gears can be manufactured for every module. In the standard DIN780, preferential modules are defined. In countries with the imperial system, “Diametral Pitch” (DP with the unit inch -1) is used instead of module.



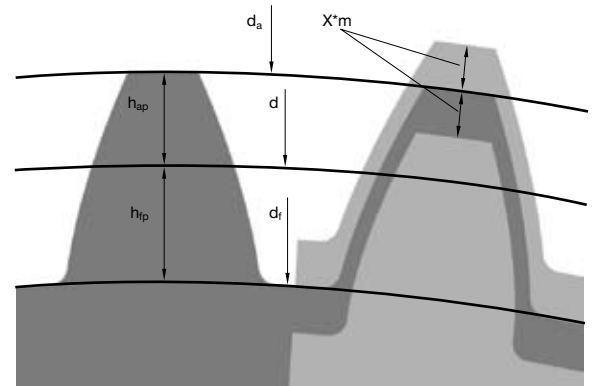
Addendum Modification

Gears can be designed and manufactured with an addendum modification. Therefore, the form of the tooth flank has been modified to influence the properties of the gear. On a gear with the addendum modification, another part of the same involute is being used as the tooth flank. The addendum modification $x \cdot m$ is the distance in millimeters where the tool is cutting deeper or shallower into the workpiece.

The addendum modification: *coefficient x is the addendum modification divided by the module m of the gear. The addendum modification factor is usually between -1 and $+1$.

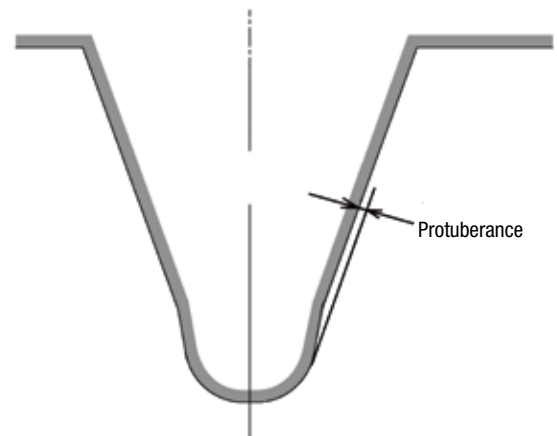
Addendum modification benefits:

- Unrestricted gear center distances can be realized by using the standardized modules (DIN780).
- With a positive addendum modification, a higher root stability and pitting load capacity ("stronger" teeth) is being realized.
- Through the adjustment of the addendum modification, coefficients between the pinion and the gear load capacity can be adjusted.
- A positive addendum modification prevents undercutting unwanted cuts on a part of the tooth flank on gears with a small number of teeth — usually less than 14.



Protuberance

The function of the protuberance is to generate a clearance cut at the root of the teeth. This is needed if the gear has been finished in another operation, like a shaping, grinding, or other milling process. The clearance cut is needed to prevent a weakening of the teeth root during the finishing process through the appearance of notches. In addition, the collision of the grinding or shaping wheel in the teeth root is prevented. The protuberance has been characterized through the protuberance amount p_r and the protuberance angle α_{pr} .





The basic rack profiles to DIN3972 for gear milling tools generate an involute teeth profile on cylindrical gears according to DIN867 used in general or heavy engineering applications.

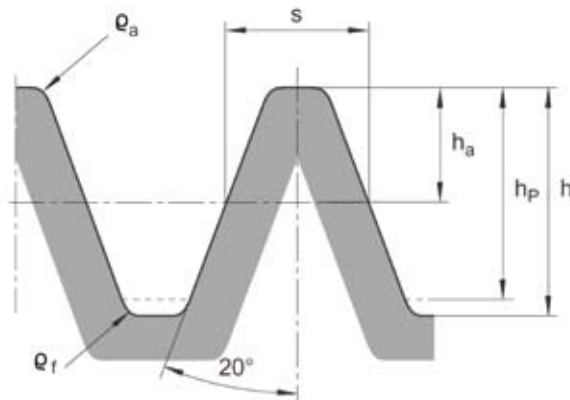
With the same tool, multiple cylindrical or screw-type gears with arbitrary helix angles, number of teeth, and addendum modifications can be manufactured if no further profile modification (e.g., special tip topping, protuberance, etc.) has been incorporated into the tool design.

Other profiles for specific applications are needed (for example for chain profiles) according to DIN8164, 8187, 8188 and others, slot and wedge profiles, and other specific profiles. For such applications, specific milling cutters can be provided upon request.

Basic Rack Profile I

$h_a = 1,167 \text{ m}$
 $h_p = 2,167 \text{ m}$
 $h = 2,367 \text{ m}$
 $k_a = 0,2 \text{ m}$
 $k_f = 0,2 \text{ m}$
 $s = \pi/2 \text{ m}$

For Finishing Applications

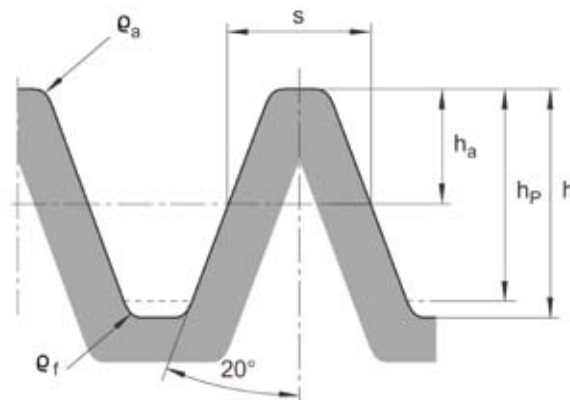


...used for finishing tools such as finishing hobs, gashers, or mesh cutters. If the profile has been preshaped with a tool with the basic rack profile III or IV, then the tool with the basic rack profile I does not touch the root of the tooth during the finishing operation. It can also be further used for tools that generate a very small material stock on the teeth in a following operation such as a post-shaving process.

Basic Rack Profile II

$h_a = 1,250 \text{ m}$
 $h_p = 2,250 \text{ m}$
 $h = 2,450 \text{ m}$
 $k_a = 0,2 \text{ m}$
 $k_f = 0,2 \text{ m}$
 $s = \pi/2 \text{ m}$

For Finishing Applications

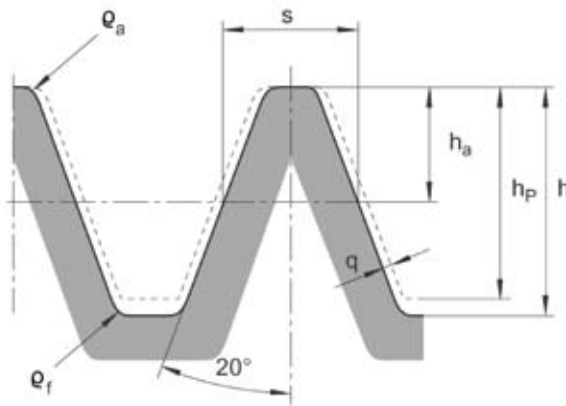


...used for finishing tools. It can also be used for hobs if a larger radius on the tooth root is needed or for tools that generate a very small material stock on the teeth for a following operation, such as for a post-shaving process.

Basic Rack Profile III

$$\begin{aligned} h_a &= 11,25 \text{ m} + 0,25 \\ h_p &= 2,250 \text{ m} \\ h &= 2,450 \text{ m} \\ k_a &= 0,2 \text{ m} \\ k_f &= 0,2 \text{ m} \\ s &= \pi/2 \text{ m} \\ q &= 0,25 \cdot \sin 20^\circ \end{aligned}$$

Preshaping for Grinding or Shaving

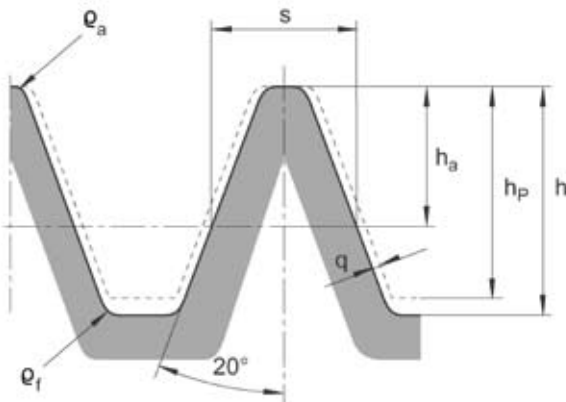


...used for tools to preshape the gear for operations, such as a post-grinding process.

Basic Rack Profile IV

$$\begin{aligned} h_a &= 1,25 \text{ m} + 0,6 \\ h_p &= 2,250 \text{ m} \\ h &= 2,450 \text{ m} \\ k_a &= 0,2 \text{ m} \\ k_f &= 0,2 \text{ m} \\ s &= \pi/2 \text{ m} \\ q &= 0,6 \cdot \sin 20^\circ \end{aligned}$$

Preshaping for Finishing

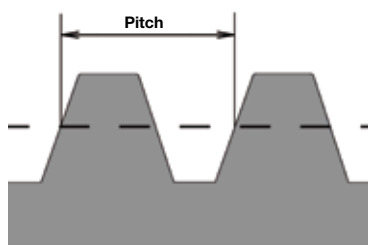


...used for tools to preshape the gear for finishing operations with a larger machining tolerance as defined in Basic Rack Profile III, such as rough milling and finish shaping process.

Pitch	Module	Diametral Pitch	Circular Pitch
0,31416	0,10		
0,34558	0,11		
0,37699	0,12		
0,39898		200	
0,43982	0,14		
0,44331		180	
0,45598		175	
0,49873		160	
0,50265	0,16		
0,53198		150	
0,56549	0,18		
0,62831	0,20		
0,62832		127	
0,66497		120	
0,69115	0,22		
0,75997		105	
0,78540	0,25		
0,79796		100	
0,83121		96	
0,87965	0,28		
0,90678		88	
0,94248	0,30		
0,99746		80	
1,09557	0,35		
1,10828		72	
1,24682		64	
1,25664	0,40		
1,32994		60	
1,41372	0,45		
1,57080	0,50		
1,58750			1/16
1,59593		50	
1,66243		48	
1,72788	0,55		
1,73471		46	
1,81356		44	
1,88496	0,60		
1,89992		42	
1,99491		40	
2,04204	0,65		
2,09991		38	
2,19911	0,70		
2,21657		36	
2,34695		34	
2,35619	0,75		
2,49364		32	
2,51327	0,80		
2,65988		30	
2,67035	0,85		
2,82743	0,90		

Pitch	Module	Diametral Pitch	Circular Pitch
2,84987		28	
2,98451	0,95		
3,06909		26	
3,14159	1		
3,17500			1/18
3,32485		24	
3,62711		22	
3,92699	1,25		
3,98982		20	
4,43314		18	
4,71239	1,5		
4,76250			3/16
4,98728		16	
5,49779	1,75		
5,69975		14	
6,28319	2		
6,35000			1/4
6,64970		12	
7,06858	2,25		
7,85398	2,5		
7,93750			5/16
7,97965		10	
8,63938	2,75		
8,86627		9	
9,42478	3		
9,52500			3/8
9,97456		8	
10,21018	3,25		
10,99557	3,50		
11,11250			7/16
11,39949		7	
11,78097	3,75		
12,56637	4		
12,70000			1/2
13,29941		6	
14,13717	4,5		
14,28750			9/16
14,50845			5-1/2
15,70796	5		
15,87500			5/8
15,95930		5	
17,27876	5,5		
17,46250			11/16
17,73255		4-1/2	x
18,84956	6		
19,05000			3/4
19,94911		4	
20,42035	6,5		
20,63750			13/6
21,99115	7		

Pitch	Module	Diametral Pitch	Circular Pitch
22,22500			7/8
22,79899		3-1/2	
23,81250			1-5/16
25,13274	8		
25,40000			1
26,59892		3	
26,98750			1-1/16
28,27433	9		
28,57500			1-1/8
29,01689		2-3/4	x
30,16250			1-3/16
31,41593	10		
31,75000			1-1/4
31,91858		2-1/2	
33,33750			1-5/16
34,55752	11		
34,92500			1-3/8
35,46509		2-1/4	
36,51250			1-7/16
37,69911	12		
38,10000			1-1/2
39,89823		2	
41,27500			1-5/8
43,98230	14		
44,45000			1-3/4
45,59797		1-3/4	x
47,62500			1-7/8
50,26548	16		
50,80000			2
53,19764		1-1/2	
56,54867	18		
62,83185	20		
63,83716		1-1/4	
69,11504	22		
75,39822	24		
78,53982	25		
79,79645		1	
81,68141	26		
87,96459	28		
91,19595		7/8	
94,24778	30		
100,53096	32		
106,39527		3/4	
109,95574	35		
113,09734	36		
125,66371	40		
127,67432		5/8	
141,37167	45		
157,07963	50		
159,59290		1/2	



Module

$$m = \frac{25,4}{DP}$$

$$m = 8,08507111 \times CP$$

Diametral Pitch

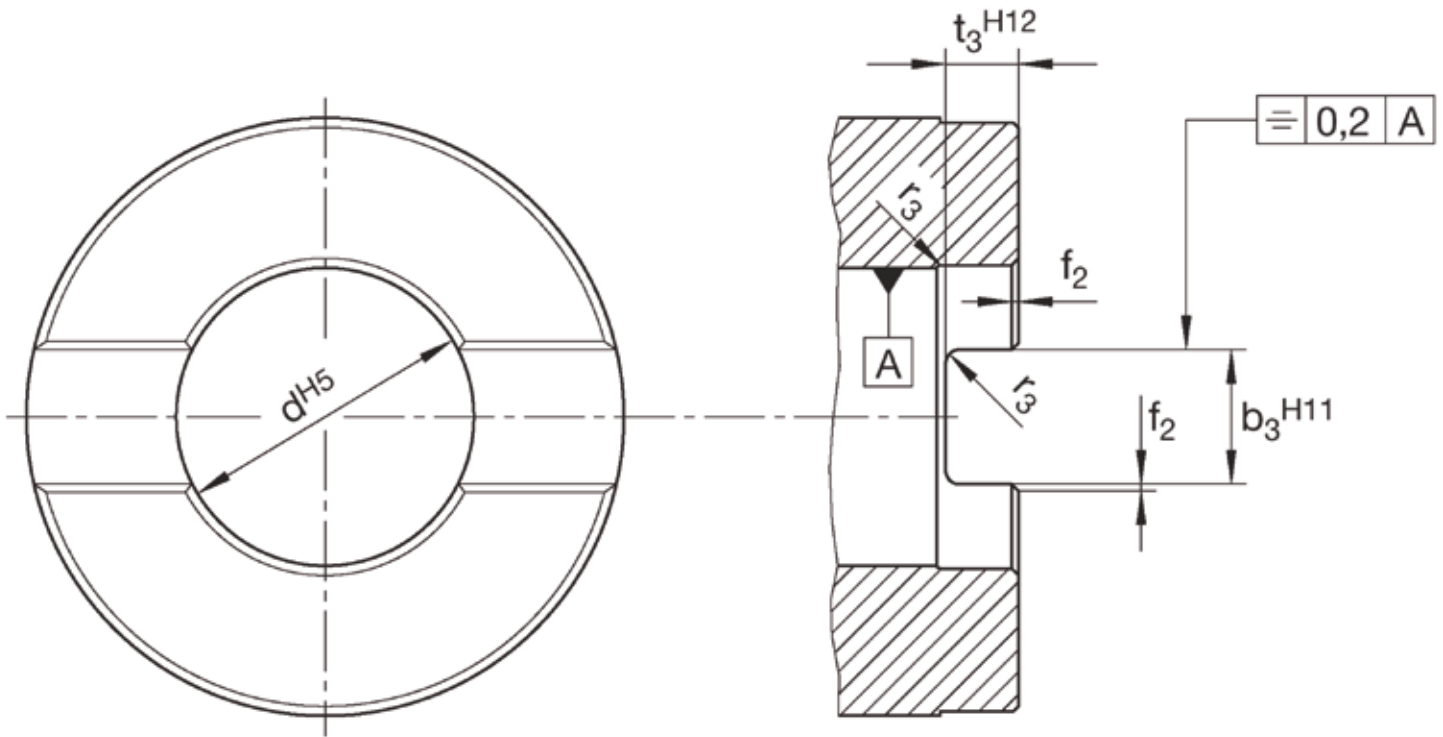
$$DP = \frac{3,14159265}{CP}$$

$$DP = \frac{25,4}{m}$$

Circular Pitch

$$CP = \frac{3,14159265}{DP}$$

$$CP = \frac{m}{8,08507111}$$



The radial keyway dimensions for gear milling cutters are made according to DIN 138 and are listed in the table.

Hole Diameter	b_3	t_3	r_3	Tolerance Allowance	f_2	Tolerance Allowance
8	5,4	2,00	0,6	-0,2	0,4	0,1
10	6,4	2,25	0,8	-0,2	0,5	0,1
13	8,4	2,50	1,0	-0,2	0,5	0,1
16	8,4	2,80	1,0	-0,3	0,6	0,2
22	10,4	3,15	1,2	-0,3	0,6	0,2
27	12,4	3,50	1,2	-0,3	0,8	0,2
32	14,4	4,00	1,6	-0,4	0,8	0,2
40	16,4	4,50	2,0	-0,5	1,0	0,3
50	18,4	5,00	2,0	-0,5	1,0	0,3
60	20,5	5,60	2,0	-0,5	1,0	0,3
70	22,5	6,25	2,5	-0,5	1,2	0,3
80	24,5	7,00	2,5	-0,5	1,2	0,3
100	24,5	8,00	3,0	-0,5	1,6	0,5



SUSTAINABLE ENGINEERING

***Kennametal leads the way with innovation, engineering,
and service in standard and custom tooling.***

Successful project engineering requires planning, team-work, and disciplined execution. Through our extensive experience in developing and implementing new project engineering strategies, Kennametal has pioneered a proven methodology to help you manufacture new products and bring them to market quickly. Service deliverables are carefully outlined and jointly agreed to before the project begins. We formally evaluate progress and results with you throughout the project through our stage-gate management systems.

Kennametal can provide your engineering teams and machine tool builders with process engineering support, advanced metalcutting technologies, and project management expertise to help you achieve your sustainable goals. With our best-in-class process, you'll experience accelerated time-to-market, lower overall costs, and reduced risks to implement new technologies.

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Kennametal has more than 700 highly trained and innovative research scientists and development engineers. They are creating new, advanced materials or demanding applications and are designing proprietary components that deliver superior performance for our customers.



DISCOVERY AND PROPOSAL DEVELOPMENT

- Review project needs with customer and/or machine tool builder.
- Customer decision gate: Request proposal.

PROPOSAL PRESENTATION

- Discuss how Kennametal can be of service.
- Customer decision gate: Request proposal.

BUILT PROJECT PLAN

- Clarify technical and commercial aspects of projects.
- Develop engineering and project schedule.
- Approve drawings.

PROJECT PLAN APPROVAL

- Present drawings and confirm order.
- Customer decision gate: Approve project plan and deliverables.

EXECUTION

- Manufacturing
- Procurement
- Project Management
- Assembly
- Pre-Setting
- Balancing
- Inspection
- Shipping
- Training
- Run-Off Support

ACCEPTANCE

- Review performance versus contract.
- Customer decision gate: Formal acceptance.

PRODUCTION LAUNCH ASSISTANCE

- Support program launch schedule through assistance in spare part and consumable procurement planning and further process optimization.

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