

NIGEL GEAR CUTTING TOOL



Nigel Precision Machiner(shanghai)Co.,Ltd





COMPANY PROFILE

Nigel Precision Machinery Co., Ltd. is located in Shanghai, China. We specialize in cutting tools and have more than 20 years' experience in this field. We always adhere to the principles of quality first, reputation first, and customer first to provide customers with the highest quality cutting tool solutions.

We are also one of the world's best supplier and manufacturer of cutting tools with full range of cutting tools. Products cover turning, grooving, milling, drilling and other processing methods. The main products are PCBN, PCD inserts, carbide inserts, gear cutting tools, and small boring tools, replaceable drills bits, BTA drills and so on, We have advanced fully automated production equipment, presses, sintering furnaces, coating equipment and Mazak 5-axis CNC machine, Switzerland STUDER grinding machine for internal and external cylindrical grinding, Zoller tool detector, Swiss Alicona passivation testing equipment, German Zeiss CMM. In the production process, we inspect each process of the product to ensure the precision and accuracy of each product. In addition, we can also provide customized services and OEM services according to customer needs.

Our products are favored by customers all over the world, especially in Europe, North America, Asia and other countries with developed manufacturing industries. In the future, our goal is to continuously improve our technical level and product quality and create new markets. We hope that NIGEL's products can create value and competitiveness for you.

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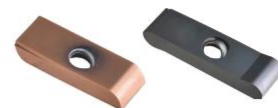
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Manufacturing Equipment 制造设备



Inspection Equipment 检测设备



Hobs for producing straight - and helical-tooth spur gears with involute flanks

加工圆柱渐开线齿轮的直齿轮和斜齿轮的滚刀

- The fundamental geometrical concepts of a spur gear hob for generating gears with involute flanks are laid down and explained in detail in DIN 3968. According to this, the basic body of a hob is always a worm. If this worm is now provided with flutes, cutting teeth result. These become capable of cutting by being backed off or relieved.

关于渐开线齿形的直齿轮滚刀的基本图形公差及DIN 3968的有关项目在下方的图形中有体现。相对应的，滚刀就是一个蜗杆。如果这个蜗杆带有齿槽，那么齿形经过铲背后就能切削。

- This relieving operation is carried out on machine tools specially developed for this process, it is very time consuming and therefore also expensive. For hobs to moderate accuracy specifications, relief turning is sufficient; for stricter quality requirements the hob is relief ground.

这个铲背量是通过专门的加工机床用设置好的工艺来保证的；它很费时，因此费用很高。对于中等精度的滚刀，铲齿就可以了。对于高精度质量的滚刀，必需采用铲磨。

- Generally, relief turned hobs achieve quality class B approximately to DIN 3968. Relief ground hobs achieve quality classes A, AA and higher. The highest quality class in DIN 3968 is AA. For exceptionally high quality requirements it is usual to restrict the tolerances of quality class AA still further. Quality class corresponding to AAA to DIN 3968, without comment, means the restriction to 75 % of the AA tolerances for all measurable variables.

通常，铲齿滚刀可达到DIN 3968中的B级精度，铲磨滚刀能达到DIN 3968中的A、AA级或更高的精度。最高精度是DIN 3968的AA级。再高的精度要求，一般采用按DIN 3968 AA级为基础控制公差来保证，来达到对应的DIN 3968 AAA级，对于所有能够检测的项目按AA级公差的75%的值进行控制。

- If special tolerance restrictions of the AA tolerance are required this is also done with the AAA reference, but the individual measurable variables and the tolerance restriction are now given in % or directly in mm. E.g. quality class AAA to DIN 3968, item nos. 16 and 17 restricted to 50 % of the tolerance of AA.

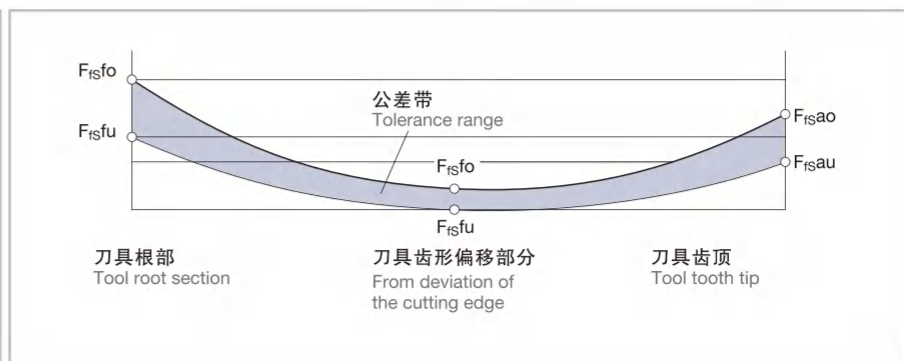
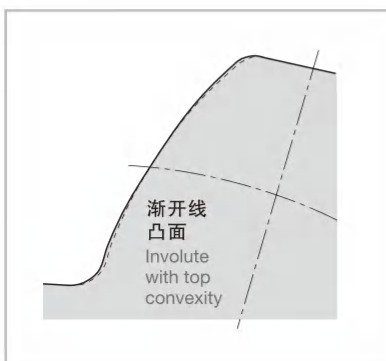
如果AA级公差受到限制是必需的，这样就可以参照AAA级，但是，可测量的变量和公差限制可用%或者直接用 μm 给出。例如，精度等级DIN 3968的AAA级中的第16和17项控制在AA级的50%以内。

- The purpose of hob tolerances is to assign the tools to a quality class according to their accuracy. On the basis of the hob quality classes, the expected gear quality can then be forecast.

滚刀公差的目的给予刀具一个相应的精度等级使其达到准确度。在这个滚刀精等级的基础上，我们能预测相应的齿轮的精度。

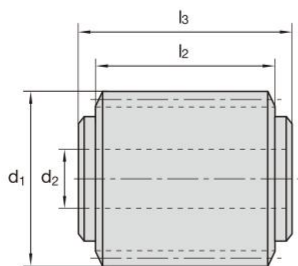
- Not all requirements aimed at a "good gear quality" in the wider sense, e.g. very quiet running or a specific addendum and dedendum relief are achieved solely through a high cutter quality. For such needs, hobs with a defined crowning depth have proved successful. Depending on the load and the required gear performance, the suitable crowning depth can be selected from the various tables N102S, N102S/3 or N102S/5. It must be noted that the tool depth crowning is not transmitted completely to the gear. The lower the number of teeth of the gear, the less the effective convexity portion.

从广义上讲，不是所有需求都是要一个“高精度”齿轮，例如：高静音的运行或特殊的齿顶，齿根减薄完全可以通过高精度刀具实现。对于这种需求，我们在滚刀上作一个凹入量，被证明很成功。根据大载荷和齿轮性能的需要，这个适当的凹入量可以从表格N102S、N102S/3、N102S/5中选择。必须指出这个刀具的凹入量不完全传输给齿轮。对于小齿数的齿轮，齿轮的齿数越少有效凸起部分也越少。



Hobs for involute gear forms

渐开线齿轮滚刀



目录号 Cat.-No.

m	d ₁	l ₂	l ₃	d ₃	Z
1	50	25	31	22	14
1.25	50	25	31	22	14
1.5	56	32	38	22	12
1.75	56	32	38	22	12
2	63	40	46	27	12
2.25	70	50	56	27	12
2.5	70	50	56	27	12
2.75	70	50	56	27	12
3	80	63	69	32	12
3.25	80	63	69	32	12
3.5	80	63	69	32	12
3.75	90	70	78	32	12
4	90	70	78	32	12
4.5	90	70	78	32	10
5	100	80	88	32	10
5.5	100	80	88	32	10
6	115	100	108	40	10
6.5	115	100	108	40	10
7	115	100	108	40	10
8	125	130	138	40	10
9	125	130	138	40	10
10	140	160	170	40	10
11	160	170	180	50	9
12	170	185	195	50	9
13	180	200	210	50	9
14	190	215	225	50	9
15	200	225	235	60	9
16	210	238	248	60	9
17	220	238	248	60	9
18	230	260	270	60	9
19	240	260	270	60	9
20	250	286	296	60	9
21	260	290	300	60	9
22	270	290	300	60	9
23	280	310	320	60	9
24	280	310	320	60	9
25	290	320	330	60	9
26	310	320	330	80	9
27	320	330	340	80	9
28	320	330	340	80	9
29	340	340	350	80	9
30	340	340	350	80	9

1) Onrequest 需要时选择

Coatingson request 涂层需选择

HSS hobs for gear cutting success story

高速钢滚刀案例



Geardata/齿轮参数:

Module/模数: m2.55

Width/齿宽: 33mm

Material/材料: 20CrMnTi

Hardness/硬度: 159~190HB

Cutting Parameter/切削参数:

		Vc(m/min)	F(mm/n)
1 st	cutting	260	2.4
2 nd	cutting	420	4

Hobdata/滚刀参数:

Outside diameter/直径: 80mm

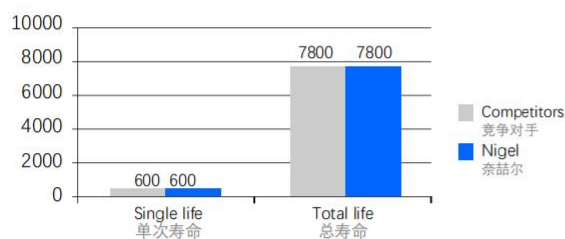
Cutting face width/滚刀切削长度: 224mm

No. of threads/头数: 3

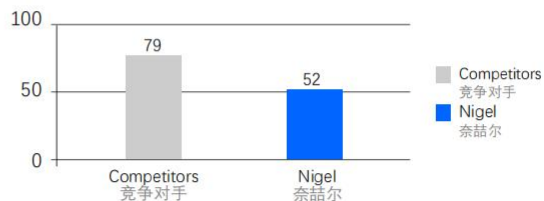
No. of flutes/槽数: 17

No. of possible sharpenings/修磨次数: 12

Tool life
寿命



Cutting Time
加工节拍(秒)



Carbide hobs for gear cutting

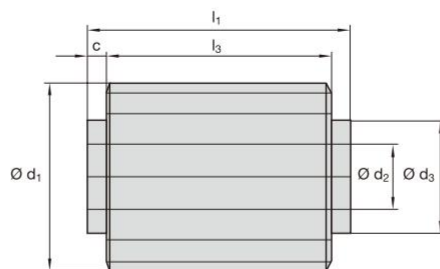
整体硬质合金滚刀

- Carbide hobs are generally used to process K and P materials. Due to the different material components (alloy components) and particle sizes, the materials have corresponding advantages and disadvantages.
硬质合金滚刀，一般加工K类和P类材料。由于其材料组成元素（合金组成元素）以及颗粒度不同，决定了材料具有对应的优点和缺点。
- Solid carbide hobs allow high speed cutting like speeds. Its speed is significantly higher than those of high speed steel hobs.
整体硬质合金滚刀允许达到像高速切削一样的速度。它的速度明显高于那些高速钢滚刀。
- Solid carbide hobs require continuous development of the rated speeds of the hobbing machines to suit their applications.
整体硬质合金滚刀要求不断开发滚齿机的额定速度，以适应其应用。
- The combination of high-speed cutting and dry machining is more economical.
高速切削与干加工结合是比较经济的。
- Superior properties of modern solid carbide hobs.
现代整体硬质合金滚刀的优越特性。
 - High cutting speed · 高的切削速度
 - Short processing time · 短的加工时间
 - Long service life · 长的使用寿命
 - Suitable for flat processing · 很适合平加工
 - Reduce gear processing costs · 降低齿轮加工成本



Size table for solid carbide hobs

整体硬质合金滚刀尺寸表

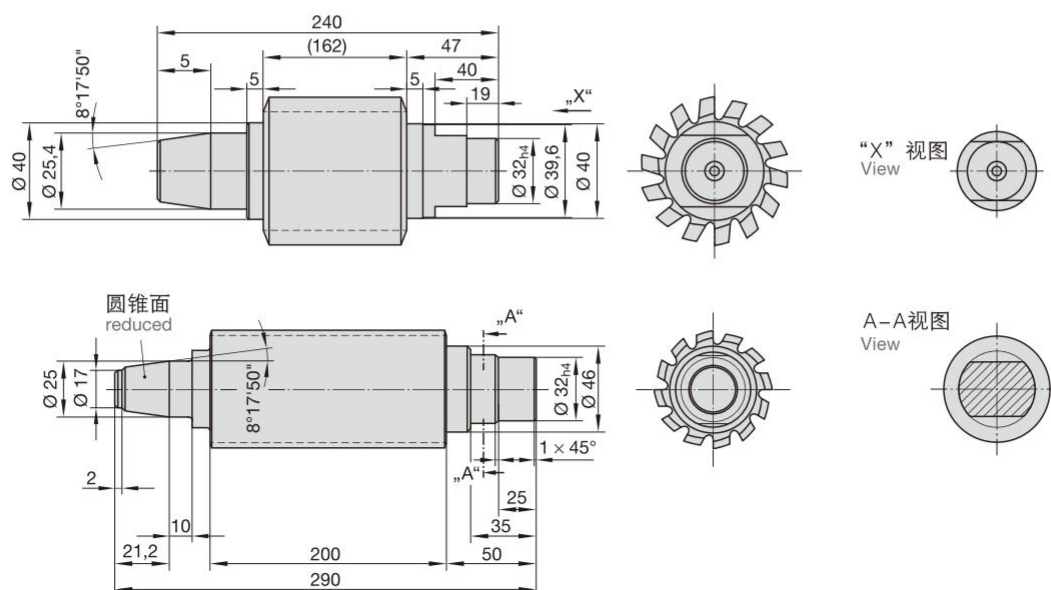


Recommended dimensions / 推荐尺寸

d ₁	l ₃	l ₁	d ₂	c	d ₃	h ₀	Z
short / 短系列							
56	52	70	22	9	42	3	19
63	72	90	27	9	48	4	19
70	100	120	32	10	54	5	19
80	100	120	32	10	54	7	19
90	100	120	40	10	66	8	19
100	120	140	40	10	72	10	19
120	138	160	50	11	80	13	19
long / 长系列							
56	82	100	22	9	42	3	19
63	112	130	27	9	48	4	19
70	160	180	32	10	54	5	19
80	160	180	32	10	54	7	19
90	160	180	40	10	66	8	19
100	180	200	40	10	72	10	19
120	208	230	50	11	80	13	19

Possible shank dimensions

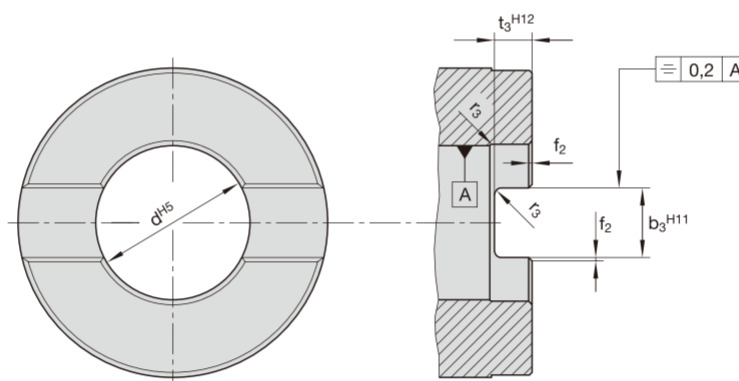
可能的柄部尺寸



Bore diameter 孔径	b_3	t_3	r_3	Permissible deviation 需可偏差	f_2	Permissible deviation 需可偏差
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

t_3 =DIN 138 1/2深度
1/2 depth to DIN 138

Drive slot dimensions of a carbide hob
硬质合金滚刀驱动键槽尺寸



Carbide hobs for gear cutting success story

整体硬质合金滚刀案例



Gear data/齿轮参数:

Module/模数: m1.95

Width/齿宽: 45mm

Hardness/硬度: HRC58~62

Removal stock/余量: 0.15mm

Cutting Parameter/切削参数:

Line speed Vc/线速度: 129m/min

Feed rate F/进给量: 1mm/n

Cycle time/循环时间: 46s

Hob data/滚刀参数:

Outside diameter/直径: 40mm

Cutting face width/切削长度: 180mm

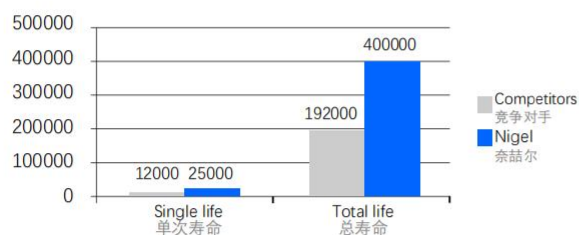
Material/材料: Carbide

No. of threads/头数: 1

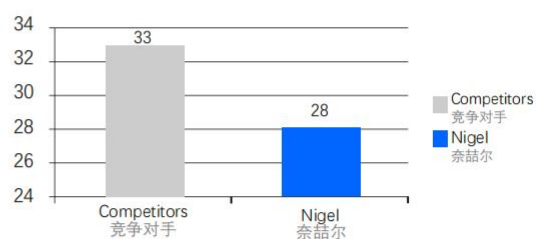
No. of flutes/槽数: 14

No. of possible sharpenings/修磨次数: 15

Tool life
寿命



Cutting Time
加工节拍(秒)



Carbide hobs for gear cutting

可转位硬质合金刀片滚刀

- Rough machining of gears from module 6 onwards can be achieved with this very economical modern tool.
模数6以上齿轮的粗加工可以用这种非常经济的现代刀具实现。
- The idea is to combine the economical indexable carbide inserts with the well-known advantages of rolling. In a given time, a large amount of metal can be removed at a high cutting speed.
设计构想是用经济的可转位硬质合金刀片与众所周知的滚切优势的结合。在规定的时间内，可以在高切削速度下切大量金属。
- Solid carbide hobs require continuous development of the rated speeds of the hobbing machines to suit their applications.
整体硬质合金滚刀要求不断开发滚齿机的额定速度，以适应其应用。
- Regrinding, which is necessary with conventional hobs, is not necessary here. This saves on refurbishment costs and tool change time. The wear marks on the individual teeth vary depending on the process. For large gears, they can be partially made equal by shifting. The hobs therefore always have different wear marks across the tooth width.
重磨对于传统滚刀是必需的，在这里没有必要。这节省了修成本和换刀时间。单个刀齿上的磨损痕迹因过程而异。对于大齿轮，它们可以通过移位来部分地实现等同。因此滚刀在齿宽上总是有不同的磨损痕迹。
- When indexable inserts are used, these are rotated or replaced when the maximum wear mark width is reached.
当使用转位刀片时，这些刀片在达到了最大的磨损痕迹宽度时被旋转或替换。
- When replacing the indexable insert, the hob does not need to be removed from the machine tool, which saves waiting time. When replacing the indexable insert, the insert brand needs to match the gear material.
更换转位刀片，不用将滚刀从机床上卸下来，这样就节省了待工时间。更换转位刀片需要使刀片牌号与齿轮材料匹配。
- In order to successfully use these carbide tools, the machine tool must have sufficient rigidity and the required speed and drive power.
为了成功使用这些硬质合金刀具，要求机床有足够好的刚性和所需的转速及驱动功率。



Saving = 126 min machining time
节约时间 = 126分钟

Guideline: Depth of feed marks 5 μm .
指导方针：进给切痕深度5 μm 。

Example: Finish hobbing a gear rim

例如：精滚一个齿圈

Module/模数	m : 12
Pressure angle/压力角	$E\alpha$: 20°
No. of teeth/齿数	z : 231
Gear width/齿宽	b : 150
Material/材料	: 42 CrMo 4

Tools 工具

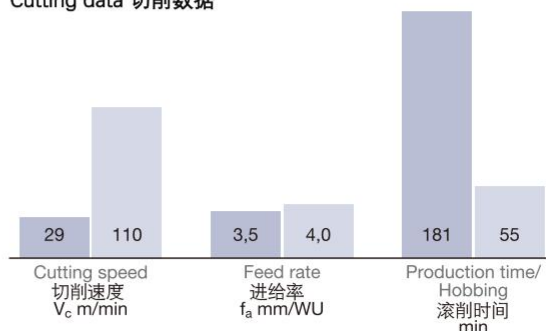
Double-start gear hob with indexable carbide inserts
双头可转位硬质合金滚刀

Outside diameter/外径	280
Number of gashes/容屑数	eff. 16
Number of starts/头数	2

Heavy duty of roughing hob
重切粗滚刀

Outside diameter/外径	220
Number of gashes/容屑数	22
Number of starts/头数	2

Cutting data 切削数据



Hobs with indexable carbide success story

可转位硬质合金刀片滚刀案例



Parts/零件: Wind power solar wheel gear shaft 风电太阳轮齿轮轴

Geardatas/齿轮数据: M10.2Z23A22.5

Material/材料: 1 8CrNiMo7-6

Machine tool/机床: Gleason-PfauterP1600

Spindle workingrate/主轴功率: 57KW

Cooling method/冷却方式: Oil 油冷

Processing method/加工方式: Smooth milling 顺铣

Process/工序: Processing before grinding 磨前加工

Tooth width/齿宽: 255mm

Hardness/硬度: HB230

	Competitors/竞争对手	Nigel/奈喆尔
tool/刀具	Before grinding hob 磨前滚刀	Before grinding hob 磨前滚刀
Cutt parameters/刀具参数	AE:28.5mm VC=110m/min FA=1.5mm/WU [mm/rev.]	AE:28.5mm VC=130m/min FA=2.2mm/WU [mm/rev.]
Cutting time (min) /切削时间	42	24
Life/寿命 (件数)	170	320
Accuracy (DIN3962) /精度	11	9

Gear milling cutter for roughing,
with indexable carbide inserts
粗加工齿轮铣刀
可转位硬质合金刀片



Gear milling cutter for roughing,
with indexable carbide inserts, involute profile
精加工齿轮铣刀
可转位硬质合金刀片，渐开线齿形



Roughing-/Finishing cutters 粗加工/粗加工		Quality 精度等级
	Gear milling cutter with indexable inserts Module: 6 to 70 可转位齿轮 铣刀 模数:6-70	up to wheel quality 9 最高9级

They can be found wherever large loads and forces are in motion: large gear units. These units are used in industries such as wind energy, marine industry and machine construction. In these gear units, the gearwheels, with external and internal gears, work with the highest precision. These components are produced with different manufacturing processes. For more than 100 years, Nigel has been manufacturing gear cutting tools for the production of large-module gearwheels. During this time, our customers have been relying on our know-how gained in the development and use of state-of-the-art tool technology.

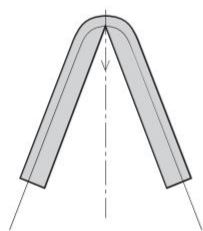
大型齿轮组无处不在，只要有大大载荷和大力在运动，它们就会出现。这些装置用于风能、海洋工业和机械制造等行业。在这些齿轮组中，带有外齿轮和内齿轮的齿轮以最高的精度工作。这些部件采用不同的制造工艺生产。一百多年来，Nigel 一直制造用于生产大模数齿轮的齿轮切削刀具。在此期间，我们的客户一直依赖我们在开发和使用最先进工具技术方面获得的专业知识。

Gear milling cutter with indexable carbide inserts success story

可转位硬质合金刀片齿轮铣刀案例

These gear milling cutters are high-performance tools for finishing. The double-negative cutter geometry combined with the high number of inserts produces good cutting behavior (flaking cut). The indexable inserts with high precision and surface finish produce clean gear flanks. In addition, an additional hard material coating ensures a long tool life.

这些齿轮铣刀是精加工的高性能工具。双负刀几何形状与大量刀片相结合，产生良好的切割行为（剥落切割）。具有高精度和表面光洁度的可转位刀片可产生清洁的齿轮侧翼。此外，额外的硬质材料涂层确保了较长的刀具寿命。

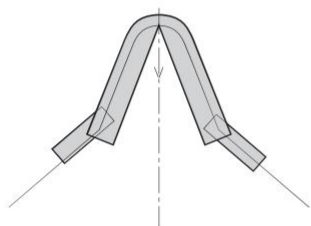


Modul 16

$\alpha_0 = 20^\circ$
 $z = 89$

For roughing cutting
we recommend
gear roughing cutters
Fette Cat.-No. 2667.

Cutter diameter: 300 mm
Bore diameter: 80 mm
Form indexable inserts: 24



Modul 10

$\alpha_0 = 20^\circ$
 $z = -94$

Cutter diameter: 380 mm
Bore diameter: 80 mm
Form indexable inserts: 30
Indexable inserts
for chamfer: 10

Rotor cutters with indexable carbide inserts

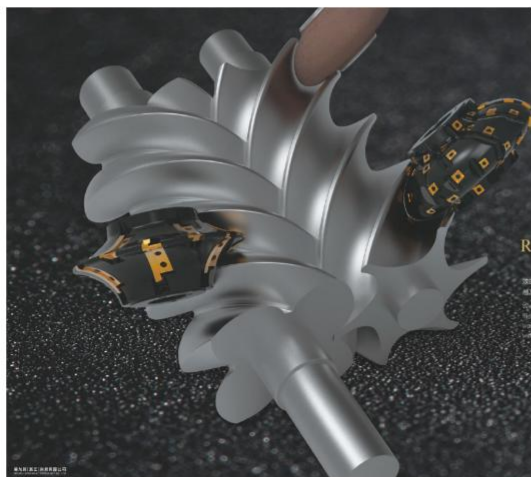
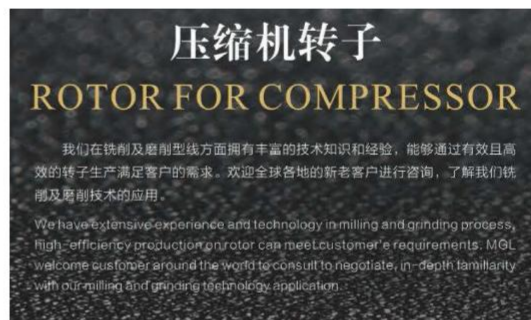
可转位硬质合金转子铣刀

We have extensive technical knowledge and experience in milling and grinding profiles, and are able to meet customer needs through effective and efficient rotor production. We welcome new and old customers from all over the world to consult and learn about the application of our milling and grinding technology.

我们在铣削及磨削型线方面拥有丰富的技术知识和经验，能够通过有效且高效的转子生产满足客户的需求。欢迎全球各地的新老客户进行咨询，了解我们铣削及磨削技术的应用。

ROUGH MILLING ADVANTAGES 粗铣优势

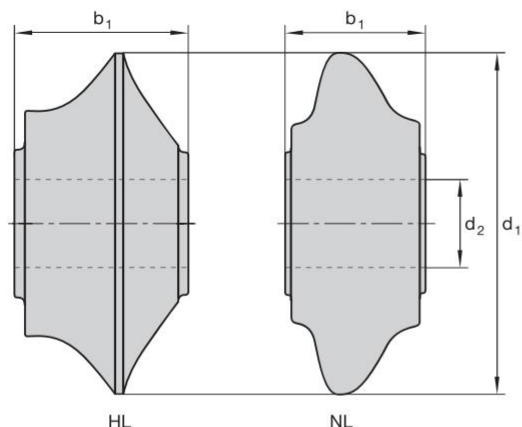
- Blade solid line standardization, 95% blades, no minimum order quantity, stock supply, immediate delivery
- Rough milling tool profile accuracy $\leq 0.05\text{mm}$, and uniform grinding amount
- Blade multi-position design reduces blade cost
- Dry processing possible
- Dense tooth design greatly improves cutting efficiency · Anti-misinstallation design, and the blade model is engraved on the cutter body
- 刀片实现标准化，95%的刀片，无最低起订量，库存供应，立即交货
- 粗铣刀具轮廓精度 $\leq 0.05\text{mm}$ ，且留磨量均匀
- 刀片多转位设计，降低了刀片成本
- 可干式加工
- 密齿设计，大幅提高切削效率
- 防装错设计，同时刀体上刻有刀片型号



FINISHING MILLING ADVANTAGES 精铣优势

- The contour accuracy of the fine milling tool is $\leq 0.01\text{mm}$
- The fine grinding blade has good surface quality
- For larger rotors or rotors with smaller batches, it has good economic efficiency
- 精铣刀具轮廓精度 $\leq 0.01\text{mm}$
- 精磨刀片，良好的表面质量
- 对于较大的转子或者批量较小的转子，具有良好的经济性

2695



Rotor measurements			Cutter measurements			Number of indexable inserts
Outside diameter	Profile height	Type	d1	b1	d2	
100	22	HL	220	60	60	25-36
100	22	NL	220	60	60	
127.5	27.5	HL	250	70	80	32-45
127.5	27.5	NL	250	70	80	
163.2	35.5	HL	250	80	80	40-56
163.2	35.5	NL	250	80	80	
204	44	HL	300	100	100	50-70
204	44	NL	300	100	100	
255	55	HL	320	125	100	63-85
255	55	NL	320	100	100	
318	70	HL	350	160	100	70-100
318	70	NL	350	125	100	

Because of their high cutting performance and maintenance-free characteristics, these tools are particularly economical. The contour is straight and the cross-section forms a polygon, which contains the minimum allowance for finishing. In order to obtain the most balanced finishing allowance, in addition to the standard indexable inserts, special inserts with chamfered edges are also used.

因为它们的高切削性能和无需维护特点，使这些刀具具有特别经济性，轮廓又直截面形成多边形，包含精加工的最小余量，为获得尽可能均衡的精加工余量，除了标准的可转位刀片外，还使用了带倒角圆边的非标刀片。

Rotor cutters withindexable carbide inserts success story

可转位硬质合金转子铣刀案例

Parts/零件: Screw air compressor rotor 螺杆空压机阴转子

Tool/刀具/: Rough milling female rotor阴转子粗铣刀

Material/材料: QT500

Machine too/机床: 国产机床

Cooling method/冷却方式: Emulsion 乳化液

Process/工序: Rough milling 粗铣

Hardness/硬度: HB200

	Competitors/竞争对手	Nigel/奈喆尔
tool/刀具	Rough milling rotor 转子粗铣刀	
Effective tooth /有效齿	2/4	2/6
Cutting parameters/加工参数	VC=120m/min F=200mm/min	VC=140m/min F=300mm/min
Life/寿命（件数）	100	150
Grinding margin（mm）/磨削余量	0.5	0.3

Result/结果

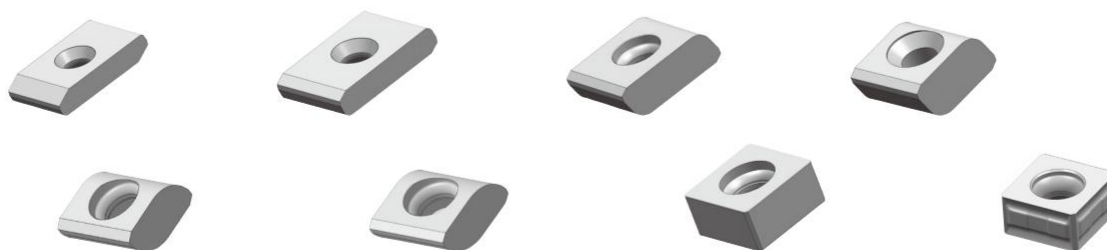
Nigel tool life increasedby 50%, efficiency increased by 50% and reduced the grindingmargin by 0.2mm.

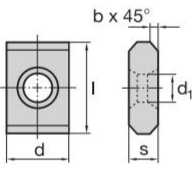
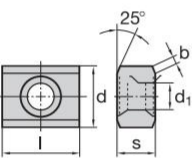
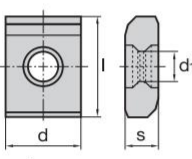
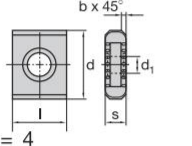
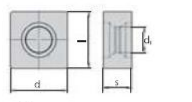
奈喆尔刀具寿命提高50%，效率提高50%，减少磨削余量0.2mm。



Indexable insert forms

可转位刀片形式



N= Number of cutting edges	l	S	d	d ₁	b/r	ISO-Code Cat-No.
 N = 4	12.7	6.35	14.3	5.5	0.78	LNHX 1206
	19.05	6.35	14.3	5.5	0.78	LNHX 1906
	25.4	5	14.3	5.5	1.1	LNHX 2505
 N = 4	15.88	7.94	12.7	5.4	1.65	LNHX 1207
 N = 4	19.05	6.35	14.3	5.8		LNHX 1906
	25.4	5	14.3	5.5		LNHX 2505
 N = 4	19.06	6.35	14.3	5.8	0.75	LNMX1906
 N = 8	12.7	6.35	12.7	5.8	0.4	LNHQ2006

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