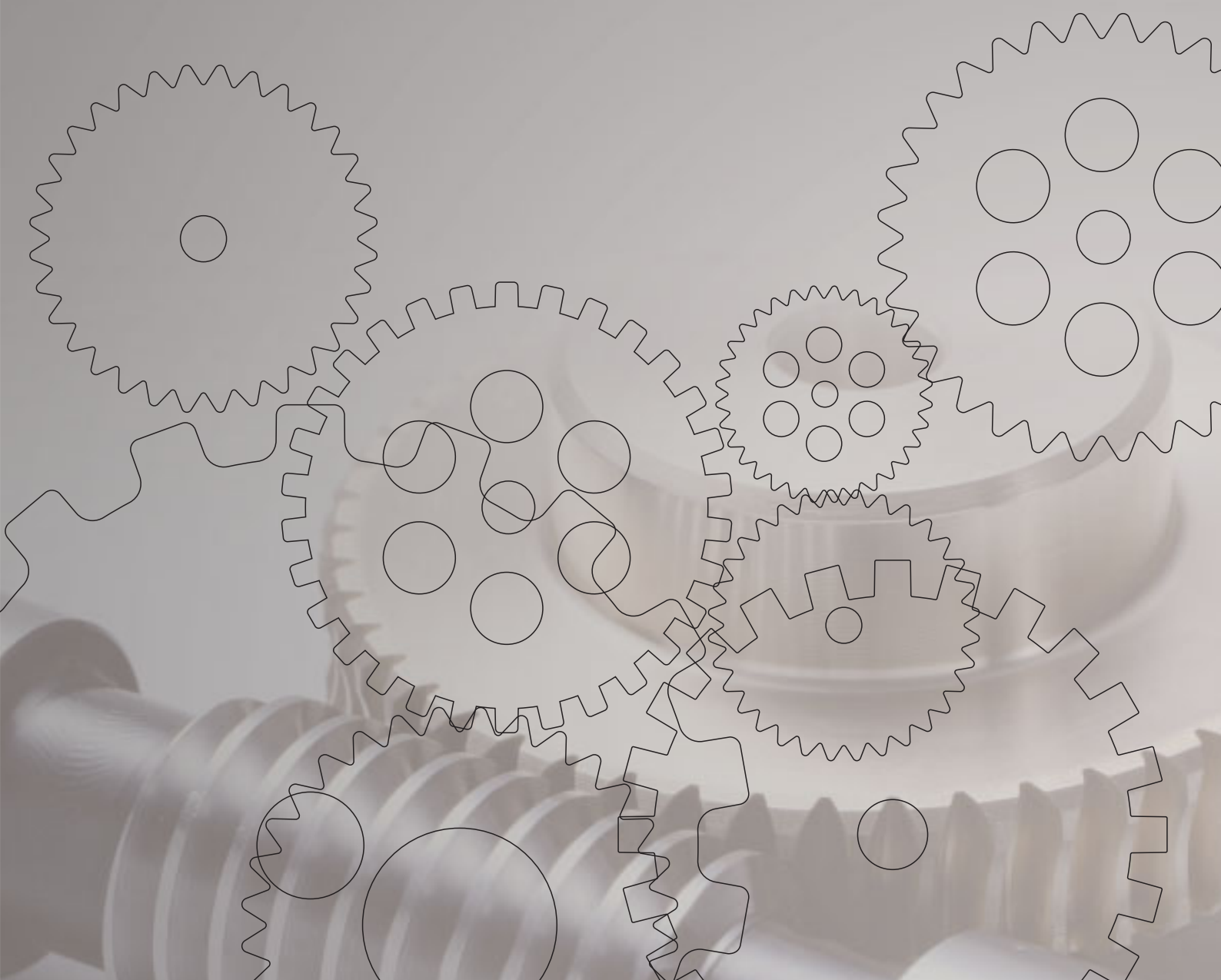


**NACHI**

# *MACHINE TOOLS*

加工機械



# 爱护人类和环境，追求更高速、更高度化

不二越从开发日本第一台拉床起步，至今一直在研究开发不断取得进展的生产系统所不可缺少的多种加工机械。

我们通过本公司自己制造的切削工具和加工机械的最佳匹配，获得了用户的好评和信任，并且，如准备将（100万分之1mm）级的超精密技术实用化等，我们正在集中综合技术，生产出支持多样化需求、使用方便的加工机械。

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# Pursuing advanced high-speed technology that is both user and environmentally friendly

Since producing the first broaching machine in Japan, NACHI-FUJIKOSHI has been developing a wide array of machine tools that are crucial to the continuing evolution of production systems.

The seamless fusion of FUJIKOSHI's cutting tools and machines has received high praise and respect.

Today, FUJIKOSHI is producing easy-to-use machines that support the diverse needs of customers by combining its integrated technologies to make nanometer-order (1 millionth of 1 mm) ultra-precision technology a reality.

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## 拥有世界顶级的拉刀和拉床 拉削加工

拉削加工是一种能够将需要滚齿机、插齿机和铣床等进行组合加工的零件在短时间内加工出来的加工方法。并且，由于能够使加工精度稳定在很高水平，所以广泛用于汽车制造业等各种产业领域。另外，这种加工方法还被用于发电机制造业和飞机制造业所使用的涡轮盘之类难切削材料的高精度加工，作为现代产业不可缺少的一种加工法倍受瞩目。

## World's Top Broaches and Broaching Machines Broaching

Broaching makes it possible to reduce production time on components that require a combination of work on a hobbing press, gear shaver and a milling machine. Also, because broaching has a steady high-level of precision, it can be used for a wide range of production industries such as automobile manufacturing. Because broaching is being used to produce difficult to machine materials like turbine discs used for electric power production and the aeronautics industry, it is garnering widespread attention as an essential element of production in modern industry.

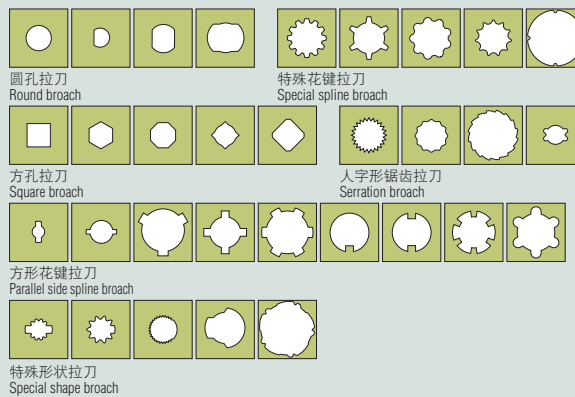
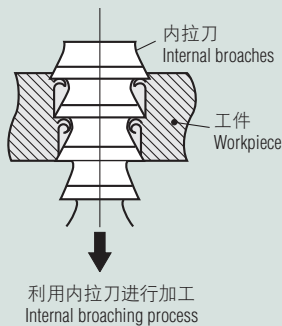
### 拉削加工的特点 Broaching features

- 能在短时间内加工完成，实现高效生产
- 稳定的高加工精度
- 只要在轴向上相同，即使是复杂且不规则的加工面也能够进行加工
- 良好的精修面
- 极为经济的加工方法
- 不需要熟练的加工技术
- Achieve high-performance through shorter work time
- High-precision machining that is stable
- Complex and irregular machining surfaces are possible as long as the axes coincide
- Superior finished surfaces
- Extremely economical machining method
- Skilled labor not needed for machining

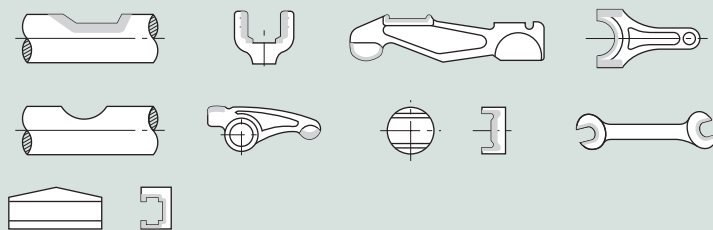
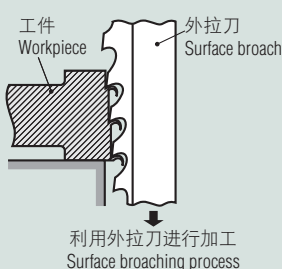


### 性能和加工例 Performance

#### [内拉削加工例]



#### [平面拉削加工例]



## 在世界上率先实现拉削加工的MQL化 MQL加工

拉削加工是一种能够以极高的精度和其它加工方法无法达到的高效率将加工对象加工成复杂形状的加工方法，这种加工方法在大批量生产中是不可缺少的。以往在加工时使用了大量的切削油。采用MQL拉床和MQL拉刀，在世界上率先实现了利用MQL的MQL拉削加工。

## World's First MQL Broaching. MQL broaching

Able to handle complex shapes with high precision, broaching is an absolutely essential component for large lot production with productivity higher than other machining methods. In the past, broaching required large quantities of cutting fluid, but now the MQL broaching machine and the semi-dry broaching machine are the world's first MQL broaching achieved with mist processing.

### MQL加工的特点 MQL broaching features

- 由于减少了冷却液的使用量，改善了作业环境（照片1、2）
- 降低运营成本
- 取消了后洗净工序

- Reduced quantity of coolant used to improve work environment. (photo1,2)
- Reduced of running cost
- Eliminated of post-cleaning process



■ 照片1 photo1  
以往的加工  
Conventional  
大量使用含有大量氯的油性冷却剂

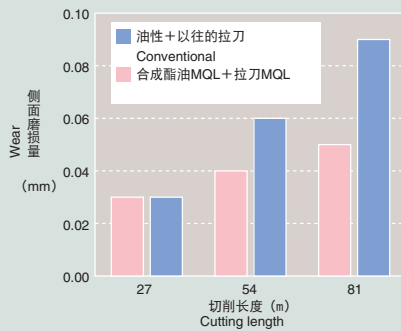


■ 照片2 photo2  
MQL拉削加工  
MQL Broaching  
通过使环保型的植物油雾化，实现了利用微量供油进行加工

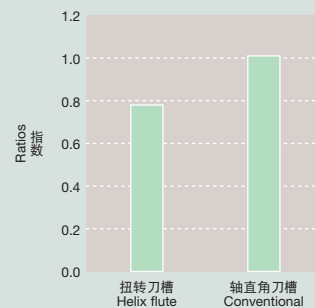
### 性能和加工例 Performance

- MQL加工
- MQL broaching

- 扭转刀槽拉刀的实际最大切削负荷
- Maximum cutting load of helix flute broach



被切削材料 Work	S45C (200HB)
拉刀规格 Broach	m2xPA30xNT16
切削条件 Cutting conditions	切削速度 Broaching speed 5m/min 切削深度 Cutting depth 0.06m/直径



### MQL拉刀 MQL broaching

- 通过采用新膜涂层和高级拉刀材料，提供了超过湿式加工的长寿命
- 通过扭转刀槽设计，改善了切屑的排出效率，并且降低了切削负荷，实现了振动较少的节能加工
- 大幅改善切屑的回收效率
- New film coating and adoption of high-quality broach materials means tool life is longer than with wet broaching.
- Helix flute design improves chip removal, reduces grinding load, and lowers vibration for great energy savings.
- Chip collection is greatly improved.

MQL拉刀



扭转刀槽  
拉刀的切屑  
Helix flute

以往的类型



轴直角刀槽  
拉刀的切屑  
Conventional



以实际加工时间不足1秒的超高效率  
实现50~60HRC淬火钢的精加工

## 高硬加工

拉削加工能够以极高的精度和效率将加工对象加工成复杂的形状。为了进一步提高经过上述拉削加工的加工部件的性能，会对其实施热处理。但是，在热处理时会发生热处理变形，所以必须实施磨削精加工。然而，随着超高硬拉刀和高硬拉床的开发，对上述热处理变形的除去加工也成为可能，因此能够实现部件的高精度化和稳定化。

## 特点 Features

- 高硬度材料的高精度加工  
因为能够完全除去硬度为50~60HRC的加工对象的热处理变形，所以能够对之前难以加工的异形孔进行精加工，因此能够实现部件的高精度化和稳定化
- 高效率加工  
使用组装式超硬拉刀和高硬拉床，以60m/min的切削速度进行高速加工。实际切削加工时间不足1秒
- 半干式切断  
使用微量雾状冷却，环保，无需清洗工件，无需对切屑进行脱油处理，无需进行废液处理

## 性能和加工例 Performance

	高硬加工前 Before	高硬加工后 After
Appearance 外观		
Surface 表面		
Profile 齿形		
Lead 齿距		

■ 加工规格 Work  
 齿数 (No. of teeth): 24  
 齿直角模数 (Normal Module): 1  
 齿直角压力角 (Normal Pressure Angle): 45°  
 基准节距圆直径 (Pitch Dia.): 24.000  
 基础圆直径 (Dia.): 16.971  
 大径 (Major Dia.): 25.46  
 小径 (Minor Dia.): 23.76

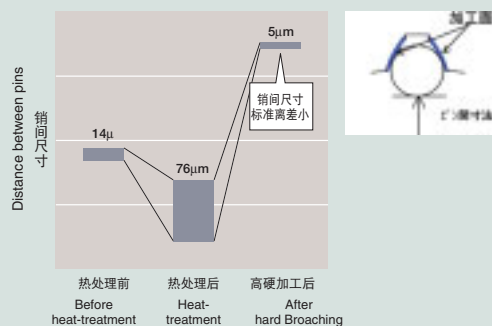
Finish 50-60 HRC hardened materials and the actual broaching time is less than one second.

## Hard broaching

Broaching provides high productivity on complex shapes with superior precision. Components that have been produced by broaching are heat treated to increase functionality. However, heat treatment causes warping that requires finishing grinding. Now, with the development of the super-hard broach and the hard broaching machine, it is possible to eliminate the process to correct the warpage caused by heat treatment. This results in more stable components with higher precision.

- Highly precise broaching of very hard materials (50-60HRC).
- Sectional carbide broach and hard broaching machine are used for a high speed broaching speed of 60m/min. Actual cutting time is less than one second.
- Micro-mist coolant is environmentally friendly, the workpiece does not need to be washed, chip removal is unnecessary, and waste processing is not needed.

■ 销间尺寸 Distance between pins



## 高硬拉刀 Hard broaching

- 由超硬更换刀片和钻套构成。刀部使用了新开发的超微粒硬质合金，并且实施了TiAlN系的特殊涂层，因此具有优良的耐磨损性能和耐热性能。
- 通过选择正确的前角，改善了刀头强度和耐崩刃性
- 通过重磨前倾面，能够重复使用
- Sectional hard broach consists of carbide blade and a holder. The cutting edge is made from our newly developed micro-grain carbide alloy and coated with TiAlN coating so it has superior friction and heat resistance.
- Optimized front angle improves cutting edge rigidity and chipping resistance.
- Cutting face can be re-sharpened for repeated use.



拉刀外观  
Appearance of hard broach

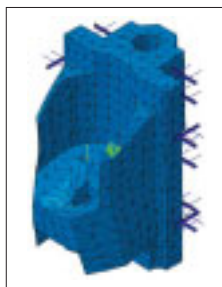
## 硬式拉床 Hard broaching machines

### HW-5008

- 切削速度为1 ~ 60m/min。适应硬式拉刀的最佳加工条件50 ~ 60m/min
- 通过线性滚子导轨和高刚性的特殊滚珠丝杆，确保高速驱动时的可靠性
- 根据刚性解析，对机器主体、工作台进行优化设计
- 采用工件移动式，降低工件安装高度，提高作业效率
- 无液压系统实现了节省能源、节省空间

- Cutting speed 1-60m/min. Supports most suitable machining condition 50-60m/min a hard broach.
- Secure reliability in high-speed drive with ball screw and linear roller guide.
- Rigidity analysis used to optimize design of main unit and worktable.
- Adjustable worktable improves productivity by lowering height of mounted workpieces.
- Hydraulic components eliminated to save energy and space.

■ 工作台刚性解析  
Optimized design by 3D-FEM



HW-5008



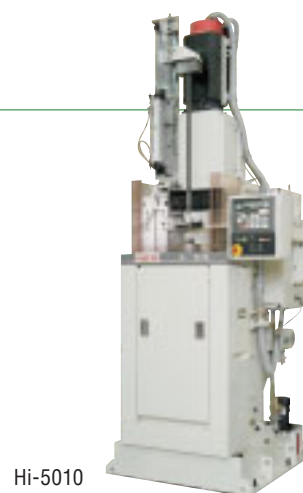
■ 加工例 Sample  
汽车用齿轮部件等的渐开线花键孔的齿面、CVT 球形槽、各种异形孔等  
Involute spline hole (gear part for autos),  
CVT ball groove, various variant holes

		HW-5008
拉力 (KN)	Pulling force	50
最大行程 (mm)	Max. stroke	800
切削速度 (m/min,60Hz)	Cutting speed	1~60 (常用60)
回程速度 (m/min,60Hz)	Return speed	1~60
垫孔径 (mm)	Bolster hole dia.	120
工件最大外径 (mm)	Max. outside dia. of workpiece	280
工件安装面高度 (mm)	Workpiece fitting height	1,000
机器高度 (mm)	Machine height	3,400
占地面积 (mm×mm)	Floor space	1,780×1,900
机器质量 (kg)	Weight	5,700

## 高速精加工拉床 Highspeed finishing broaching machines

### Hi-5010

- 通过组合以往的10倍切削速度和半干拉削，可降低15%的加工成本。
- 采用刀具移动式，还可以对应表面加工
- Ten times the cutting speed of previous models, and semi-dry broaching capability reduces production costs by 15%.
- Surface cutting with movable cutter.



Hi-5010

		Hi-5008/5010	Hi-5014
拉力 (KN)	Max. pulling force.	50	50
最大行程 (mm)	Max. stroke.	800/1,000	1,400
切削速度 (m/min,60Hz)	Broaching speed.	1~80	1~44
回程速度 (m/min,60Hz)	Return speed.	1~80	1~44
拉刀升降装置行程 (mm)	Lifter stroke.	400	—
垫孔径 (mm)	Bolster hole dia.	120	—
工件最大外径 (mm)	Max. outside dia. of workpiece.	280	280
主电动机 (kW)	Main motor	AC (交流) 伺服电机 52	AC (交流) 伺服电机 16
机器高度 (mm)	Machine height	2,900/3,300	4,340
占地面积 (mm×mm)	Floor space	1,300×1,700	1,300×2,000
机器质量 (kg)	Weight	3,700	6,000

## 小型机械拉床 Small size mechanical broaching machines

### NBx 系列 series

- 依靠伺服马达高速加工  
切削速度2.3倍 6→15m/min  
工作台往返时间 14→6秒
- 通过无液压化实现节省能源、节省空间
- Servo motors mean high speed machining  
Cutting speed increased 2.3 times from 6 to 15 m/min  
Ram return speed reduced from 14 to 6 seconds
- Hydraulics removed to save energy and space.



NBx-7.5-10

		NBx-7.5-10
拉力 (KN)	Pulling force	75
最大行程 (mm)	Max. stroke	1,000
切削速度 (m/min,60Hz)	Broaching speed	15
回程速度 (m/min,60Hz)	Return speed	Max.27.2
拉刀升降装置行程 (mm)	Lifter stroke	400
垫孔径 (mm)	Bolster hole dia.	120
工件最大外径	Max. outside dia. of workpiece	290
台面高度	Workpiece fitting height	1,475
占地面积 (mm×mm)	Floor space	1,250×2,200
机器质量 (kg)	Weight	2,500

## 小型内拉床 Small size broaching machines

### NBV 系列 series

- 构造简单，节省空间的内拉床
- 从键槽到花键均能高效加工
- Internal broaching machine has simple construction and saves space.
- High productivity from keyway to spline cutting.

#### 加工例 Sample



NBV-5-10A

		NBV-5-6/8/10A	NBV-7.5-8/10/12A
拉力 (KN)	Pulling force	50	75
最大行程 (mm)	Max. stroke	600/800/1,000	800/1,000/1,200
切削速度 (m/min,60Hz)	Cutting speed	1~6.5	1~6.5
回程速度 (m/min,60Hz)	Return speed	14	14
拉刀升降装置行程 (mm)	Broach lifter stroke	400	400
垫孔径 (mm)	Bolster hole diameter	120	120
工件最大直径 (mm)	Max. workpiece dia	300	—
台面高度 (mm)	Table height	1,000/1,200/1,400	1,250/1,450/1,650
主电动机 (kW)	Main motor	5.5	7.5
机器高度 (mm)	Machine height	2,350/2,750/3,200	2,850/3,300/3,900
占地面积 (mm×mm)	Floor space	1,300×1,600	—
机器质量 (kg)	Weight	1,900	2,200



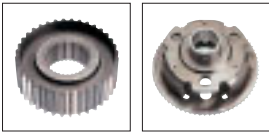
# 立式机械工件移动式拉床

## Mechanical table-up type broaching machines

### BV-T-※MS 系列 series

- 对应节省能源，高效率，高精度的机械方式
- 由于此可移动式拉床无需地坑且不使用液压，所以小型，节省空间
- 通过ATC，切削状态的自动调整，对应FMS
- Power-saving, high-efficiency, high-precision mechanical system.
- Hydraulics are not used in this pit-free table-up type.
- Compact, space-saving ATC. Automated setting of cutting conditions helps respond to FMS requirements.

#### ■ 加工例 Sample



BV-T7.5-12M



		BV-T5-8/10MS	BV-T7.5-10/13MS	BV-T10-10/16MS	BV-T12-12MS
拉力 (KN)	Pulling force	50	75	100	120
最大行程 (mm)	Max. stroke	800/1,000	1,000/1,300	1,000/1,600	1,200
切削速度 (m/min,60Hz)	Cutting speed	6	6	6	7.5
回程速度 (m/min,60Hz)	Return speed	6	6	6	7.5
拉刀升降装置行程	Broach lifter stroke	450	450	500	500
垫孔径 (mm)	Bolster hole diameter	90	90	127	127
工件最大直径 (mm)	Max. workpiece dia	260	260	300	300
台面高度 (mm)	Table height	950	950	1,050	1,150
主电动机 (kW)	Main motor	5.5	7.5	11	11
机器高度 (mm)	Machine height	2,850/3,050	4,000/4,300	4,200/4,800	4,450
占地面积 (mm×mm)	Floor space	1,500×1,750	2,000×2,000	2,500×3,000	2,500×3,000
机器质量 (kg)	Weight	3,500	5,500	7,500	7,500

# 立式工件移动式拉床

## Table-up type broaching machines

### BV-T-※S 系列 series

- 通过无需地坑的工件移动方式，能够容易变线生产
- 作业位置低，维护和操作性超群
- No pit needed so relocating machines in the line is easy.
- Lower working position results in better maintenance and operation.

#### ■ 加工例 Sample



BV-T15-14S



		BV-T5-8/10S	BV-T7.5-8/10S	BV-T10-10S	BV-T15-14S	BV-T20-14/23S	BV-T30-20S
拉力 (KN)	Pulling force	50	75	100	150	200	300
最大行程 (mm)	Max. stroke	800/1,000	800/1,000	1,000	1,400	1,400/2,300	2,000
切削速度 (m/min,60Hz)	Cutting speed	1~7.2	1~8	1~8	1~8	1~8	1~6.5
回程速度 (m/min,60Hz)	Return speed	12.5	16	16	24	24	20
拉刀升降装置行程 (mm)	Broach lifter stroke	440	500	500	600	600	700
垫孔径 (mm)	Bolster hole diameter	90	90	90	127	127	140
工件最大直径 (mm)	Max. workpiece dia	260	300	300	300	300	360
台面高度 (mm)	Table height	900	900	1,050	1,150	1,150	1,250
主电动机 (kW)	Main motor	5.5	11	15	22	30	37
机器高度 (mm)	Machine height	2,985/3,385	3,250/3,650	3,650	4,250	4,250/5,650	5,100
占地面积 (mm×mm)	Floor space	1,500×1,800	2,000×2,500	2,300×2,500	2,500×3,500	2,500×3,500	2,800×4,000
机器质量 (kg)	Weight	2,500	4,000	5,000	7,500	8,000	10,000

## 小型螺旋拉床 Small size helical broaching machines

### NBV-※M 系列 series

- 即使螺旋花键的规格不同或是直齿花键加工，也可以自由切换  
通过和选配件ATC装置的组合，能够实现自动生产线的柔性生产
- 小型减速机、两轮车离合器的内螺旋齿轮的高效加工
- 利用紧凑设计实现节省空间
- Flexible production on automated production lines is possible through a combination with the optional ATC which makes it easy to switch between helical splines and straight gear splines with different specifications.
- High-performance machining of compact reduction gears and internal helical gears for motorcycle clutches.
- Compact design reduces space requirements.



NBV-3-6MNC

		NBV-3-6MNC	NBV-5-8MNC
拉力 (KN)	Pulling force	30	50
最大行程 (mm)	Max. stroke	600	800
切削速度 (m/min,60Hz)	Cutting speed	1 ~ 78	1 ~ 8
回程速度 (m/min,60Hz)	Return speed	~ 11	1 ~ 8
拉刀升降装置行程 (mm)	Broach lifter stroke	600	800
垫孔径 (mm)	Bolster hole diameter	90	100
工件最大直径 (mm)	Max. workpiece dia	100	170
螺距控制方式	Lead control	NC控制	NC控制
主电动机 (kW)	Main motor	AC (交流)伺服电机 5.5	AC (交流)伺服电机 5.5
机器高度 (mm)	Machine height	2,671	3,177
占地面积 (mm×mm)	Floor space	1,950×1,900	1,750×2,500
机器质量 (kg)	Weight	2,500	3,000

## 螺旋拉床 Helical broaching machines

### BV-T 系列 series

- 内斜齿轮的高效加工
- 实现切齿机无法达到的高精度加工
- Internal helical gear can be cut with high accuracy.
- High-accuracy cutting of difficult jobs using gear cutter.

#### 加工例 Sample



Hx-T25-17

		BV-T7.5-12MNC	Hx-T25-17	Hx-T25-20	Hx-T50-20
拉力 (KN)	Pulling force	75	250	250	500
最大行程 (mm)	Max. stroke	1,200	1,700	2,000	2,000
切削速度 (m/min,60Hz)	Cutting speed	1~6	1~10	1~10	1~10
回程速度 (m/min,60Hz)	Return speed	1~8	11.7	11.7	15.5
拉刀升降装置行程 (mm)	Broach lifter stroke	500	450	800	800
垫孔径 (mm)	Bolster hole diameter	127	200	200	186×2
工件最大直径 (mm)	Max. workpiece dia	140	190	190	190
螺距控制方式	Lead control	NC控制	NC控制	NC控制	NC控制
主电动机 (kW)	Main motor	AC (交流)伺服电机 8.2	AC (交流)伺服电机 40	AC (交流)伺服电机 40	AC (交流)伺服电机 60
机器高度 (mm)	Machine height	5,365	4,900	5,400	5,400
占地面积 (mm×mm)	Floor space	2,050×2,925	4,000×4,100	4,000×4,100	7,000×6,300
机器质量 (kg)	Weight	11,000	15,000	20,000	35,000

## 机械立式平面拉床

## Mechanical vertical broaching machines

### SV-20-23M

- 用于重切削，高精度的大型拉床
- 通过齿条齿轮传动不需维护
- 提高热刚度，保证高精度
- Large type broaching machine for heavy cutting and high accuracy.
- Rack and pinion drive makes it maintenance free.
- Thermal rigidity is greatly improved and high accuracy is guaranteed.

#### ■ 加工例 Sample



SV-20-28M

		SV-16-28M	SV-20-28M
拉力 (KN)	Pulling force	160	200
最大行程 (mm)	Max. stroke	2,800	2,800
切削速度 (m/min,60Hz)	Cutting speed	1.5~15	1.5~15
回程速度 (m/min,60Hz)	Return speed	2~20	2~20
最大NC轴数	Maximum number of NC axes	5	5
主电动机 (kW)	Main motor	AC (交流)伺服电机 60	AC (交流)伺服电机 60
占地面积 (mm×mm)	Floor space	5,000×6,000	5,000×6,000
机器质量 (kg)	Weight	60,000	60,000

## 卧式平面拉床

## Horizontal surface broaching machines

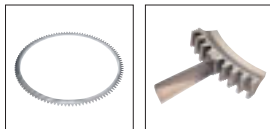
### NSL 系列 series

- 可高速高效率加工缸体，涡轮盘等
- 包括机械方式在内，系列产品丰富
- High speed and efficient two-way cutting for cylinder blocks, turbine disks, etc.
- NSL series has a wide selection including mechanical types.



NSL-35-S61M

#### ■ 加工例 Sample

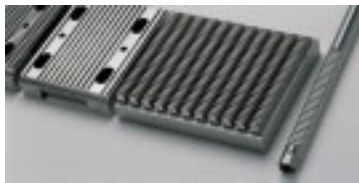


		NSL-35-D31M	NSL-35-S61M
拉力 (KN)	Pulling force	350	350
最大行程 (mm)	Max. stroke	3,100	6,100
切削速度 (m/min)	Cutting speed	1~30	1~18
最大NC轴数	Maximum number of NC axes	1	4
主电动机 (kW)	Main motor	AC (交流)伺服电机 80	AC (交流)伺服电机 80
占地面积 (mm×mm)	Floor space	10,000×5,000	16,500×7,000
机器质量 (kg)	Weight	45,000	130,000

## 机械转塔拉床 Mechanical turret broaching machines

### TSL 系列 series

- 小型，高效率的往返切削
- 夹具对应多种工件
- 节省能源，节省空间的紧凑设计
- Small design, high efficiency and two way cutting.
- Turret type holder to handle a variety of work.
- Compact design to save energy and space.



TSL-7.5-15

		TSL-2.5-10/12	TSL-7.5-15	TSL-15-23
拉力 (KN)	Pulling force	25	75	150
最大行程 (mm)	Max. stroke	1,000/1,200	1,500	2,300
切削速度 (m/min,60Hz)	Cutting speed	10	11	4~15
工件同时加工件数 (pcs.)	Number of simultaneous procedures	1	1	2
拉刀附着面数	No. of Broach attaching section	2/4	4/6	4
主电动机 (kW)	Main motor	AC (交流)伺服电机 4.4	AC (交流)伺服电机 15	AC (交流)伺服电机 30
机器高度 (mm)	Machine height	2,300	2,800	3,800
占地面积 (mm×mm)	Floor space	2,500×4,300	2,900×5,800	5,300×6,000
机器质量 (kg)	Weight	6,000	15,000	35,000

## 筒型拉床 Pot broaching machines

### EV 系列 series

- 构造简单的上推方式
- 多凹槽周围的加工可一次完成
- 高效率加工的EV系列
- Simple push-up type of construction.
- Multiple grooves on circumference can be cut in one pass.
- EV series for high efficiency cutting.

#### 加工例 Sample



EV-10-8

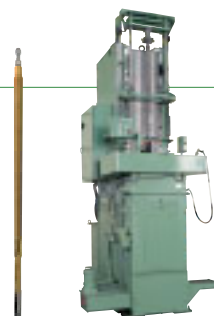
		EV-10-8	EV-15-11	EV-25-15
拉力 (KN)	Pulling force	100	150	250
最大行程 (mm)	Max. stroke	800	1,100	1,500
切削速度 (m/min,60Hz)	Cutting speed	1~9	1~6	1~7
回程速度 (m/min,60Hz)	Return speed	13.5	8	10
工件最大直径 (mm)	Min. workpiece dia.	90	160	200
主电动机 (kW)	Main motor	18.5	18.5	30.0
机器高度 (mm)	Machine height	3,750	4,500	4,800
占地面积 (mm×mm)	Floor space	2,500×4,100	2,500×4,100	4,200×4,100
机器质量 (kg)	Weight	7,000	9,000	12,000

## 立式内拉床 Vertical interior broaching machines

### NUV 系列 series

- 通用型重切削对应机床
- 能够多轴的大批量生产用
- 能够经受繁重切削的高刚性
- General purpose heavy-duty machinery
- Mass production using multiple axes
- High-rigidity to handle extreme work conditions

#### ■ 加工例 Sample



NUV-20-16

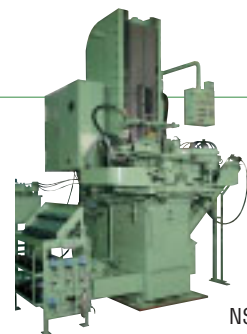
		NUV-10-14	NUV-15-14	NUV-20-16/19	NUV-30-18	NUV-40-23
拉力 (KN)	Pulling force	100	150	200	300	450
最大行程 (mm)	Max. stroke	1,400	1,400	1,600/1,900	1,800	2,300
切削速度 (m/min,60Hz)	Cutting speed	1~6	1~8	1~6.5	1~6.5	1~5
回程速度 (m/min,60Hz)	Return speed	15	20	15	15	11.5
拉刀升降装置行程 (mm)	Broach lifter stroke	440	440	540	540	1,000
垫孔径 (mm)	Bolster hole diameter	127	127	170	230	320
工件最大直径 (mm)	Max. workpiece dia	380	380	380	500	520
主电动机 (kW)	Main motor	15	22	22	37	37
机器高度 (mm)	Machine height	4,900	5,000	6,100	6,100	5,850
占地面积 (mm×mm)	Floor space	1,600×2,900	2,400×3,300	2,800×4,800	2,800×4,800	3,500×5,100
机器质量 (kg)	Weight	6,500	8,000	12,000	13,000	24,000

## 立式平面拉床 Vertical surface broaching machines

### NSV 系列 series

- 重切削表面加工机床
- 表面加工专用的高效率拉床
- 利用各种夹具和工作台，实现加工的多样化
- 利用高刚性，长期维持高精度
- Heavy-duty surfacing machine
- High-performance broaching machine for surfacing
- Wide variety of operations using jigs and tables
- High rigidity maintains great accuracy over the long term

#### ■ 加工例 Sample



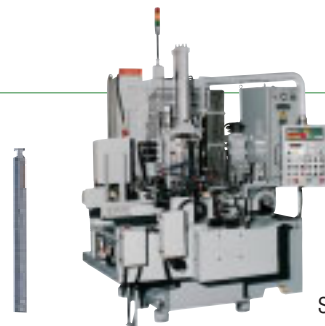
NSV-10-14

		NSV-10-14	NSV-15-17	NSV-20-23	NSV-25-24
拉力 (KN)	Pulling force	100	150	200	250
最大行程 (mm)	Max. stroke	1,400	1,700	2,300	2,400
切削速度 (m/min,60Hz)	Cutting speed	1~8.2	2~10	2~15	2~18
回程速度 (m/min,60Hz)	Return speed	20	26	31	30
滑枕宽度 (mm)	Ram width	430	430	480	580
主电动机 (kW)	Main motor	15	37	55	37×2台
机器高度 (mm)	Machine height	4,600	4,800	6,760	7,750
占地面积 (mm×mm)	Floor space	2,500×4,500	2,950×5,500	4,300×8,000	5,200×6,500
机器质量 (kg)	Weight	11,000	11,000	17,000	35,000

## 小型平面拉床 Small size surface broaching machines

### SV 系列 series

- 高速切削，高效率
- 最适合小型工件表面的加工
- High speed and high efficiency
- Most suitable for surface broaching of small size workpieces.



SV-3-6

		SV-3-6/9	SV-3-6/9M	SV-5-6/9	SV-5-6/9M
拉力 (KN)	Pulling force	30	30	50	50
最大行程 (mm)	Max. stroke	600/900	600/900	600/900	600/900
切削速度 (m/min,60Hz)	Cutting speed	1~7.2	10	1~7.2	10
回程速度 (m/min,60Hz)	Return speed	12	10	12	10
台面高度 (mm)	Table height	1,000/1,300	1,000/1,300	1,000/1,300	1,000/1,300
主电动机 (kW)	Main motor	5.5	3.7	7.5	5.5
机器高度 (mm)	Machine height	2,800/3,400	3,000/3,300	2,800/3,400	3,000/3,300
占地面积 (mm×mm)	Floor space	1,800/2,000	1,800/2,000	1,800/2,000	1,800/2,000
机器质量 (kg)	Weight	2,500	2,500	2,700	2,700

## 技术资料 Technical materials

### ■ 拉刀切削负荷的计算

预想负荷 (kgf) = 切削宽度 (mm) × 1 刃的切深 (mm)  
 × 单位面积切削阻力 (kgf/mm<sup>2</sup>) × 同时切削刃数

安全负荷 (kgf) = 1.8 × 预想负荷 (kgf)

- 预想负荷是拉刀在普通状态下加工时所必需的切削力。
- 随着拉刀刃的不断磨损，就需要逐渐加大切削力，但加大到一定程度后拉刀会破损，或者因拉床的维护状态不良而在切削中停机。安全负荷就是指为了防止出现上述情况的允许切削力。

### 切削负荷计算例

各花键拉刀：φ20×φ16×4×NT6

耐热钢，切削长度=25mm

- 节距=7.5
- 同时切削刃数=25/7.5=3.3 → 4
- 1刃的切深（离表面）=25μm
- 预想负荷=(4×6) × 0.025 × 0.4 × 4 = 1ton
- 安全负荷=1 × 1.8 = 1.8ton

### ■ Calculation of pulling force

Expected force (kgf) = Cutting width × Cutting depth / 1 tooth (mm)  
 × specific cutting resistance (kgf/mm<sup>2</sup>)  
 × Number of simultaneous cutting teeth

Safety load (kgf) = 1.8 × Expected force

- Expected force means the necessary cutting force for broaching under normal conditions.
- Safety load is the permitted cutting force

### Example of calculation

Square spline broach : φ20×φ16×4×NT6

Heat resisting steel, cutting length = 25mm

- Pitch = 7.5
- Number of simultaneous cutting teeth = 25/7.5 = 3.3 → 4
- Cutting depth / 1 tooth (show below) = 25μm
- Expected force = (4×6) × 0.025 × 0.4 × 4 = 1ton
- Safety load = 1 × 1.8 = 1.8ton

加工件的材料 Material	每1刃的切深（单边）(μm) Cutting depth / 1 tooth (one side) (μm)			单位面积切削阻力 Specific cutting resistance (kgf/mm <sup>2</sup> )
	圆 Round	花键 Spline	平面 Surface	
合金钢 Alloy steel	10~20	25~30	30~70	300~400
软铁 Steel	10~20	25~35	30~70	300
铸铁 Cast iron	25~40	25~40	50~75	200
可锻铸铁 Malleable cast iron	25~35	25~35	50~75	150~200
轻合金 Light alloy metal	35~50	30~40	60~100	100~200

### ■ 拉刀全长和拉床行程的关系

拉刀的长度要受到拉床的行程及夹具的限制。

- 拉刀刃长+后部柄长 (MAX) = (最大行程) - (切削长度)
- 所需行程=刃长+后部柄长+切削长度 < 拉床最大行程

### ■ Broach cutter length and machine stroke

Broach length is limited by machine stroke and jig / fixture.

- Broach cutter teeth length + Length of rear end shank (Max) = (Max stroke) - (Cutting length)
- Necessary stroke = Teeth length + Length of rear shank + Broaching length < Machine max stroke

### ■ 切削速度

切削速度会影响到拉削加工的精度和表面精度，还会影响刀具寿命。下表为高速工具钢拉刀用于各种加工材料时的切削速度的推荐值。

加工材料 Material		切削速度 Cutting speed (m/min)
钢 Steel		3~8
不锈钢 Stainless steel	强韧 Tough	2.5
	快削 Free cutting	6~8
铸铁 Cast iron		10
黄铜 Brass		10
青铜 Bronze		10
铝 Aluminum		10
镁 Magnesium		10

### ■ 工件硬度

适合进行拉削加工的工件的硬度一般在200 ~ 230HB，但现在使用范围广泛扩大到300HB左右。加工材料如果是极软的钢材，则在刃刀侧面和刃背部容易出现熔结，有可能产生啃削等，降低表面精度。加工硬度超过300HB的材料时，会降低拉刀的使用寿命，很不经济。

### ■ 切削油剂

拉削加工的切削油剂，建议采用有利环境的无氯型冷却剂。特别是含有大量无机添加剂的油性切削油剂，能够确保加工数量、加工精度和加工面粗糙度，其性能并不低于含有大量氯素的传统活性硫化氯化油。我公司根据工件材质和加工部位的不同，备有各种合适的油剂，在选择无氯切削油剂时，请务必与不二越公司商洽。

我公司具有丰富的半干式加工的实绩，为改善作业环境、废除清洗工序、节能和延长刀具使用寿命作出贡献。充分利用我们在实际加工中积累起来的经验，为用户提供满意的加工机械。

### ■ Cutting speed

Broaching accuracy, surface finish and life of cutters are influenced by cutting speed. The table below shows recommended cutting speeds for materials to be broached.

### ■ Hardness of workpiece

Suitable hardness for broaching is between 200 to 300 HB, however a hardness up to 300 HB is normally used. Extremely soft steels may tend to cause deposits to form and result in splits, which creates a poor finished surface. Broaching material harder than 300 HB is not economical because of shorter tool life.

### ■ Cutting oil

We recommend using chlorine-free coolants that are environmentally friendly for cutting oil when doing broaching work. Thus assuring piece count, machining precision, and surface roughness functions for which traditional cutting oils, particularly cutting oils that have excessive inorganic additives such as large amounts of active surface chloride, are inferior. At Nachi-Fujikoshi, we have a wide variety of lubricants ready for each type of work and work material, so be sure to contact us for the best selection in chlorine-free cutting oils.

We deliver machines that absolutely satisfy our customers by applying the knowledge developed through our extensive experience in semi-dry machining, through which we have contributed to improving the work environment, eliminating cleaning processes, saving energy, and increasing tool life.

数秒间将螺丝，  
花键和蜗杆精密搓齿成形。  
**搓齿机**

Precision roll-forming of screws, splines and worm shafts in just several seconds  
**Precision roll forming machines**

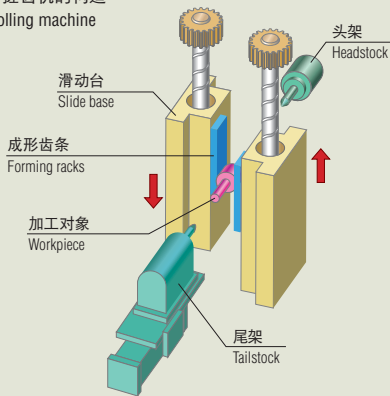
## 精密搓齿加工的特点 Features of precision roll forming

一般情况下在数秒内完成加工，与从前的加工相比，其高效率显而易见。由于生成滚形过程，加工时的稳定性高，可获得极好的加工精度和表面粗糙度。搓齿部是沿着搓齿面的组织，与搓齿效果相互结合使强度增加。同一轴上的花键和螺丝等能够通过一道工序加工完成，阶梯轴花键也可以被加工到轴阶梯附近。

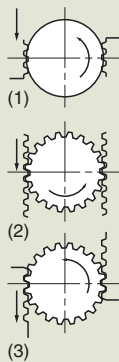
Generally, roll forming is completed in a matter of several seconds, which is far more efficient than conventional machining. With roll forming, the machining stability is high, and machining accuracy and surface roughness are extremely good. The structure of the roll formed area is designed to pass along the surface to be rolled, which improves both the roll forming effect and strength. Splines and screws along the same axis can be machined in a single pass, and stepped shaft splines can be machined up to next to the step.

### [搓齿加工法]

#### ■ 搓齿机的构造 Rolling machine



#### ■ 搓齿流程 Rolling process



#### ■ 塑性加工工具 Rolling tools



#### ■ 搓齿工件 Rolling work



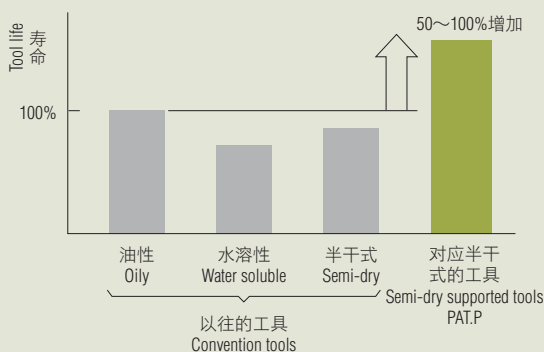
## 有利于环境保护的半干式搓齿 Environmentally friendly semi-dry roll forming

- 有利于环境保护  
采用本公司的半干式加工工具和高刚性本体，可实现半干式搓齿
- 节省能源  
通过电动驱动方式和半干式搓齿，可降低能源消耗
- 便于工步转换  
机械前面开口部较大，便于工具的装卸

- Environmentally friendly  
Semi-dry roll forming is achieved by NACHI semi-dry forming rack and highly rigid solid main body of machine.
- Energy saving  
Power consumption is reduced by an electric power drive and semi-dry rolling.
- Easy setup change  
A wide opening is provided on the front of the machine to facilitate tool mounting and dismounting.

#### ■ 花键齿条的寿命比较

Comparison of spline rack's life





## 立式数控精密搓齿机

## Vertical NC precision roll forming machines

### PFM 系列 series

- 稳定和优化搓齿条件，大幅度提高加工精度
- 实现小型化、节省能源和低噪音的数控搓齿机
- Stabilization and optimization of rolling conditions greatly improves machining accuracy.
- Compact energy saving and low noise NC machines



PFM-330E



PFM-610X



PFM-915X

		PFM-330E	PFM-610X	PFM-915X
可搓齿最大加工直径 (mm)	Max. rolling dia.	20	40	40
齿条夹具最大宽度 (mm)	Max. rack holder width	60	145	145
可搓齿最大模数	Max. rolling module	m1.0	m1.30	m1.30
可安装的齿条的最大长度 (mm)	Max. rack length	346	725	1,028
齿条最大移动行程 (mm)	Max. rack stroke	400	800	1,150
开口部尺寸 (mm)	Opening section distance	90	139.7	139.7
占地面积 (mm×mm)	Floor space	800×1,650	1,900×2,800	1,900×2,800
机器质量 (kg)	Weight	2,000	9,000	12,000

## 卧式精密搓齿机

## Horizontal roll forming machine

PFL-1220B (液压驱动) (Hydraulic drive)

PFL-1220X (NC驱动) (NC Drive)



PFL-1220B/X

		PFL-1220B/X
可搓齿最大加工直径 (mm)	Max. rolling dia.	50/55
齿条夹具最大宽度 (mm)	Max. rack holder width	300
可搓齿最大模数	Max. rolling module	m1.75
可安装的齿条的最大长度 (mm)	Max. rack length	1,220
齿条最大移动行程 (mm)	Max. rack stroke	1,600
开口部尺寸 (mm)	Opening section distance	152.4
占地面积 (mm×mm)	Floor space	5,000×6,000/5,800×4,000
机器质量 (kg)	Weight	23,000/2,200

### 加工例 Sample

(PFM 系列 / PFL-1220B 通用) (PFM series / PFL-1220B compatible)



## 对轴承面进行高精度精加工的加工系统 强力抛光机

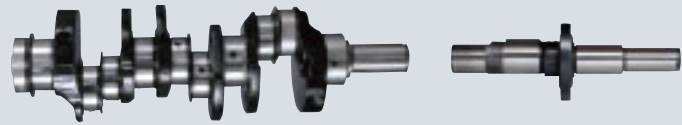
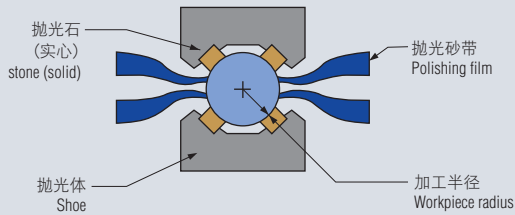
### 加工系统 Machining System

利用硬质石头支撑研磨纸，对曲轴的轴颈轴承部等圆筒面进行高精度的精加工。

Lapping film with a solid backup stone provides high-precision finishing on crankshaft bearings and other cylindrical surfaces.



#### 加工系统（工具图） Machining System (tooling)

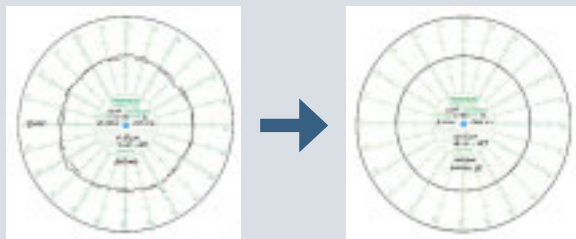


### 特点 Features

- 能够矫正圆度  
因为使用了整体硬式抛光石和非压缩性的抛光带，所以能够矫正圆度。
- 创建高品质的轴承面  
利用加工系统的等级II，能够将表面粗糙度提高至Ra0.08 $\mu$ m (Rz0.4 $\mu$ m)。
- 能够对圆角部进行研磨（拐角R）  
使用两端面被切断成弧纹状的研磨纸，能够同样对拐角R部进行研磨精加工。
- 铁氧体帽的除去  
除去析出到球状石墨铸铁的表面，会对轴承寿命产生很大影响的铁氧体帽。

- Making true roundness possible  
The solid backup shoe and relatively incompressible lapping film improve roundness
- Generating high-quality bearing surfaces  
With Machining System's level II, it is possible to improve surface roughness to Ra 0.08 $\mu$ m (Rz 0.04 $\mu$ m).
- Lapping for fillet is possible (corner R)  
Lapping finish can be done for corner R by using film cut in a wave shape on both ends.
- Ferrite cap removal  
Removal of ferrite caps protruding from spherical graphite cast iron, which have a major effect on the service life of bearings.

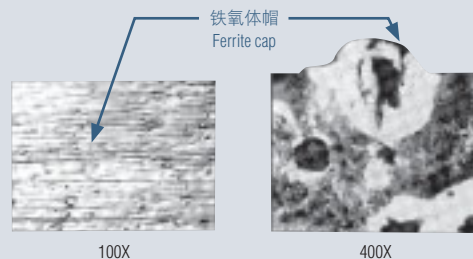
#### 圆度的矫正 Roundness correction



加工前  
Before machining

加工后  
After machining

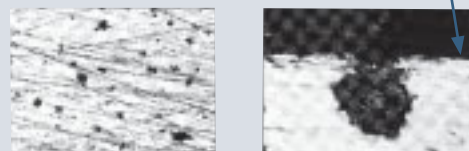
#### 铁氧体帽 Ferrite cap



100X

400X

#### 除去铁氧体帽后的轴承面 Bearing surface after removing ferrite cap



100X

400X

轴承面  
Bearing surface

## 强力抛光机 Power Finisher

### MF650

- 所需空间为原来的55% (与本公司以往机型相比)
- 耗电量为原来的50% (与本公司以往机型相比)
- 滚珠丝杠、线性导轨采用自润滑装置无需进行润滑油日常管理
- 抛光砂带更换、回收全部可以在机器前侧进行
- 连杆颈、曲轴颈可以同时加工的高效率加工系统, 更换不同规格曲轴更加容易



MF650

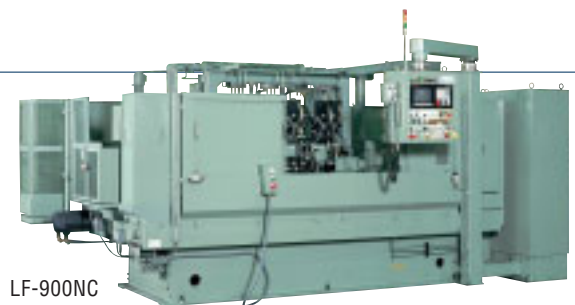
- The required machine space has been reduced to 55 percent (compared to our previous model).
- Power consumption has been reduced to 50 percent (compared to our previous model).
- Use of a self-lubricating device for the ball screw and linear guide eliminates the need for routine lubricating oil management.
- Film can be changed and recovered from the front of the machine.
- Simultaneously working on pins and journals means this high performance machining system makes it easy to change the setup for crankshafts with different specifications.

		MF650
能够加工的最大长度 (mm)	Max. workpiece length	350~630
能够加工的直径 (mm)	Workpiece dia.	φ95
能够加工的宽度 (mm)	Polishing width	15~50
最大行程 (mm)(偏心时)	Max. stroke(Eccentricity)	51.5
支持节距 (mm)	Supported pitch	31~51.5
手臂数 (只)	Number of arms	Max.11

## 强力抛光机 Power Finisher

### LF-500/900/2500NC

- 3轴NC的多种少量生产用
- 利用触摸探头自动检测基准面
- 3 Axis NC is flexible for small volumes and a wide variety of workpieces.
- Automatic datum surface sensing system with touch probe.



LF-900NC

		LF-900NC
能够加工的最大长度 (mm)	Max. workpiece length	900
最大振幅 (mm)	Max. swing	250
能够加工的直径 (mm)	Workpiece dia.	20~100
能够加工的宽度 (mm)	Polishing width	15~50
最大行程 (mm)(偏心时)	Max. stroke (eccentricity)	Max. 60

### 加工等级 Machining Level

- 加工等级I  
使用粒度 # 500 (30 μm) 左右的抛光带, 主要改善圆度。
- 加工等级II  
使用粒度 # 1000 (15 μm) 左右的抛光带, 主要改善表面粗糙度。  
能够将前加工为 Ra0.5 μm (Rz2.4 μm) 的部件改善到 Ra0.08 μm (Rz0.4 μm) 左右。
- 加工等级III  
使用粒度 # 2000 (9 μm) 左右的抛光带, 在等级 I、等级 II 后, 实施本工序, 进一步改善表面粗糙度。  
能够将前加工为 Ra0.5 μm (Rz2.4 μm) 的部件最终改善到 Ra0.04 μm (Rz0.2 μm) 左右。

- Machining Level I  
Improved roundness due mainly to use of lapping film with a #500 grain (30μm)
- Machining Level II  
Improved surface roughness due mainly to use of lapping film with a #1000 grain (15μm)  
Components with a pre-process roughness of Ra 0.5μm (Rz 2.4μm) can be improved to about Ra 0.08μm (Rz 0.4μm).
- Machining Level III  
By using a lapping film with a #2000 grain (9μm), surface roughness can be even further improved beyond level I and level II.  
Components with a pre-process roughness of Ra 0.5μm (Rz 2.4μm) can have their finished surface roughness improved to Ra 0.04μm (Rz 0.2μm).

## 强力抛光机 Power Finisher

### LF-1500/1510/1520

- 曲轴、凸轮轴加工的加工等级 I、II 通用机床
- LF-1500 是由 1 个加工台或左右 2 个加工台构成的用来加工曲轴和凸轮轴等的通用型机床。
- 能够将各种轴宽的加工对象加工到加工等级 II，除了连杆颈、主轴颈部、密封部以外，还能够加工止推面。
- LF-1520 是由 1 个加工台构成的用来加工凸轮轴的通用型机床。

- Standard machine for Machining level I and II for crankshaft and camshaft machining
- The LF-1510 is the standard machine for lapping crankshafts and camshafts and can be set up as one station or as two side-by-side stations.
- LF-1500 can machine a variety of bearings, from pins to main journal bearings to seals and other pieces, and the thrust surface can also be used for machining.
- The LF-1520 is the standard one station machine for camshaft machining.



LF-1500

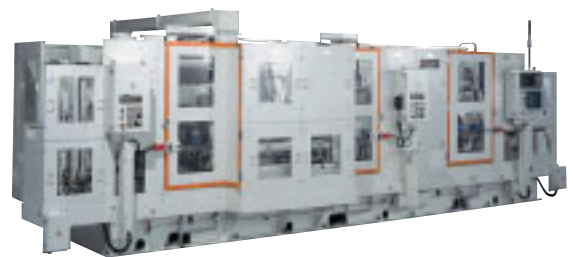
		LF-1510	LF-1520	LF-1500
主要的对象工件	Main workpiece	曲轴 Crankshaft	凸轮轴 Camshaft	曲轴/凸轮轴 Crank/Camshaft
加工台数	Number of stations	1个加工台 station	1个加工台 station	1 ~ 3个加工台 station
能够加工的最大长度 (mm)	Max. length of workpiece	640	550	640/550
最大振幅 (mm)	Max. swing	240	—	240/—
能够加工的直径 (mm)	Workpiece dia.	φ15~72	φ15~72	φ15~72
能够加工的宽度 (mm)	Polishing width	—	Max. 50	Max. 50
最大行程 (mm)(偏心时)	Max. stroke (Eccentricity)	Max. 60	—	Max. 60/—

## 强力抛光机 Power Finisher

### LF-740/1800

- 加工等级 II、III 的凸轮轴、曲轴加工的全自动对应机床
- 这是由多个加工台构成的自动传送型机床，主要用来加工凸轮轴。
- 根据刀具布局能够加工到加工等级 III，凸轮凸角加工自不用说，还可以在同一个加工台进行轴颈加工。
- 不仅是凸轮凸角、轴颈加工，还可以进行油封和去毛刺加工。

- Fully automatable Machining Level II and III camshaft crankshaft machining
- Transfer type machine that is configurable in multiple station layouts and is used mainly for camshaft machining.
- Up to Machining level III machining is possible depending on tooling layout. Course cam lobes and machine journal bearings can be machined at the same station.
- It's not just for cam lobes and journal bearings; oil seals and burr removal can also be handled.



LF-740

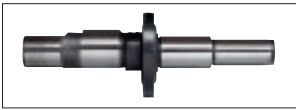
		LF-1800	LF-740
能够加工的凸轮轴的最大长度 (mm)	Max. length of camshaft that can be worked	625	600
能够加工的凸轮底座直径 (mm)	Radius of cam space that can be worked	15~60	20~40
能够加工的凸轮凸角宽度 (mm)	Width of cam lobe that can be worked	10~46	4~30
能够加工的轴颈直径 (mm)	Radius of journal that can be worked	15~72	15~60
能够加工的轴颈宽度 (mm)	Width of journal that can be worked	10~40	10~50

## 小型强力抛光机 Small size Power Finisher

### LF-250

- 用来加工小部件的旋转轴承部
- 也有能够进行内径加工的机床
- For lapping of small parts.
- Machines capable of internal lapping are also available.

#### ■ 加工例 Sample



LF-250

		LF-250
能够加工的部件长度 (mm)	Max. length of workpiece	50~250
能够加工的直径的范围 (mm)	Range of O.D.of workpiece	φ10~70
最大加工宽度 (mm)	Max. microfinishing width of workpiece	40
振动最大速度 (cpm)	Max. speed of oscillation	360
最大转速 (min <sup>-1</sup> )	Max. revolution of workpiece	180
加工中心的高度 (mm)	Center height	1,000
占地面积 (mm×mm)	Floor space	1,600×1,200
机床的重量 (kg)	Weight	1,000

## 端面强力抛光机 End surface Power Finisher

### SF-70V

- 用来加工CVT的皮带轮面
- 用来加工小部件的端面
- For CVT sheave surfacing
- For facing of small parts



SF-70V

		SF-70V
能够加工的部件的最大长度 (mm)	Max. length of workpiece	250
能够加工的平面 (mm)	Surfaces that can be worked	内径40 ~ 外径190的范围 40mm inside dia ~ 190mm outside dia
能够加工的平面的角度 (度)	Angles of surfaces that can be worked	6 ~ 16
振动最大速度 (cpm)	Max. speed of oscillation	100
最大转速 (min <sup>-1</sup> )	Max. revolution of workpiece	1,000
占地面积 (mm×mm)	Floor space	1,350×1,350
机床的重量 (kg)	Weight	2,000

实现5倍的加工效率，  
并且一次加工L/D20深孔

## MQL高效加工单元

使用钻头进行深孔加工时，因为切屑的排出性较差，通常必须分段加工。而且，由于切削油无法充分地供给到加工点会缩短刀具使用寿命，并且刀头的振动会产生崩刃或异常磨损等，所以难以提高加工效率。作为深孔加工的代表工艺，有汽车部件曲轴的油孔加工等，通过将MQL强力长柄钻头与专用于该部件的MQL POWER CELL进行组合，能够实现5倍的加工效率。

Realize 5 times the drilling efficiency non-step drilling of L/D 20 deep holes.

## MQL Power Cell

Drilling deep holes requires a step process because chips are difficult to remove. On top of that, not applying cutting fluid directly to the cutting point shortens the service life of the cutting edge and vibration may cause damage and uneven wear to the cutting edge. This makes it difficult to increase productivity. Drilling lubrication holes for auto crankshafts is a typical example of deep drilling where using the MQL Power Long Drill combined with the MQL Power Cell improves productivity five-fold.

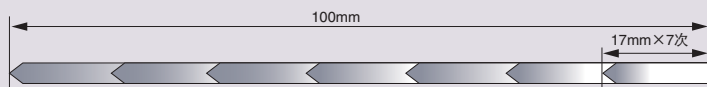
对曲轴进行的钻孔加工  
MQL machining of a crankshaft



## 特点 Features

- 通过一次加工，将加工效率提高至5倍
- Non-step drilling, increases efficiency five-fold

### ■ 以往的加工 Conventional drilling



加工时间：51秒  
Work Time 51 second

切削条件 Drilling condition  
HSS长柄钻头 (HSS Long Drill):  $\phi 5\text{mm}$   
切削速度 (Cutting Speed): 20m/min  
进给速度 (Feed): 150mm/min

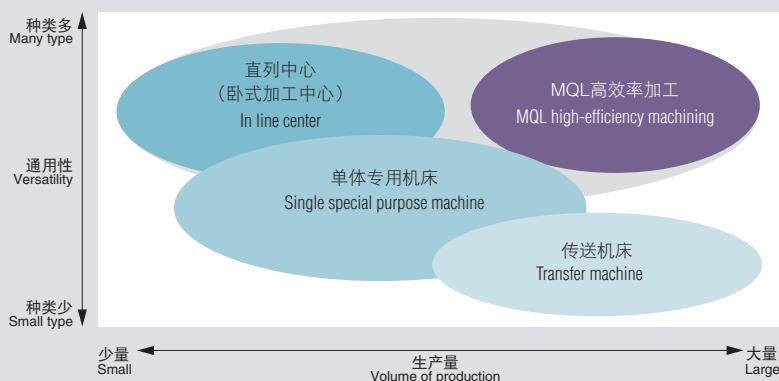
### ■ MQL加工系统 MQL drilling



加工时间：10秒  
Work Time 10 second

切削条件 Drilling condition  
MQL强力长柄钻头 (MQL Power Long Drill):  $\phi 5\text{mm}$   
切削速度 (Cutting Speed): 80m/min  
进给速度 (Feed): 750mm/min

- 通过加工效率的改善和加工设备的紧凑设计，能够对应多种柔性生产
- Supports flexible production for efficiency improvement and space-saving.



MQL强力长柄钻头  
MQL Power Long Drill

## 加工用途 Work Materials

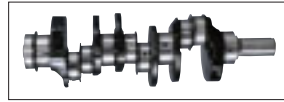
- 曲轴、齿轮轴、变速箱轴油孔
- Oil holes of crankshafts, pinion shafts, transmission shafts.

# MQL 高效加工单元 MQL Power Cell

DH524/DH514/DH314/GH423

- 大幅度提高曲轴的钻孔工序的生产效率，对应“MQL加工”，实现节省空间和高效率加工
- Achieving high-performance machining in a small space with support for “MQL Machining” to dramatically improve productivity in crankshaft drilling operations.

■ 加工例 Sample



DH524

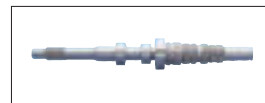
		DH524	DH514/DH314	GH423
●移动				
行程 (X-Y-Z)(mm)	Stroke (X-Y-Z)	500×200×460	500×125×460/340×125×460	475×200×300
快进速度 (X-Y-Z)(mm)	Rapid speed (X-Y-Z)	48×48×48	48×30×48	48×32×48m/min
加减速 (X-Y-Z)(mm)	Acceleration (X-Y-Z)	0.46×0.42×0.82	0.46×0.26×0.82	0.46G×0.36G×0.82G
●主轴				
主轴锥度	Spindle taper	KM6350 or HSK-A63	KM6350 or HSK-A63	KM6350 or HSK-A63
主轴转速 (min <sup>-1</sup> )	Spindle speed	~8,000	~8,000	~8,000
主轴电机	Spindle motor	5.5/3.7kWAC主轴电机 Spindle motor	5.5/3.7kWAC主轴电机 Spindle motor	11.0/7.5kWAC主轴电机 Spindle motor
●ATC				
工具收容数量 (支)	Number of stored tools	12	9	20
刀库	Magazine	刀库移动式 Movable magazine type	刀库移动式 Movable magazine type	臂式 Arm type
工具选择方法	Tool selection method	地点固定 Fixed address	地点固定 Fixed address	地点固定 Fixed address
工具最大直径 (mm)	Max. tool diameter	φ90	φ90	φ90
工具最大长度 (mm)	Max. tool length	KM6350···240 HSK-A63···235	KM6350···240 HSK-A63···235	100
工具最大重量 (kg)	Max. tool weight	3	3	5
●机械尺寸				
宽度×深度 (mm×mm)	Width by depth	1,200×4,100	1,200×3,000/1,000×3,000	1,300×3,280
高度 (mm)	Height	2,000	1,570	2,050
机器质量 (Kg)	Weight	3,850	3,000	5,300

# MQL 高效加工单元 MQL Power Cell

ZH524

- 大幅改善轴的钻孔工序的生产效率。对应“MQL加工”，实现省空间、高效率加工
- Achieving high-performance machining in a small space with support for “MQL Machining” to dramatically improve productivity in shaft drilling operations.

■ 加工例 Sample



ZH524

		ZH524
●移动		
行程 (X-Y-Z)(mm)	Stroke (X-Y-Z)	500×200×460
快进速度 (X-Y-Z)(mm)	Rapid speed (X-Y-Z)	48×48×48
加减速 (X-Y-Z)(mm)	Acceleration (X-Y-Z)	0.46G×0.42G×0.82G
●主轴		
主轴锥度	Spindle taper	KM6350 or HSK-A63
主轴转速 (min <sup>-1</sup> )	Spindle speed	~8,000
主轴电机	Spindle motor	5.5/3.7kWAC主轴电机 Spindle motor
●ATC		
工具收容数量 (支)	Number of stored tools	12
刀库	Magazine	刀库移动式 Movable magazine type
工具选择方法	Tool selection method	地点固定 Fixed address
工具最大直径 (mm)	Max. tool diameter	φ90
工具最大长度 (mm)	Max. tool length	240
工具最大重量 (kg)	Max. tool weight	3
●机械尺寸		
宽度×深度 (mm×mm)	Width by depth	1,200×3,250
高度 (mm)	Height	2,000
机器质量 (Kg)	Weight	3,850

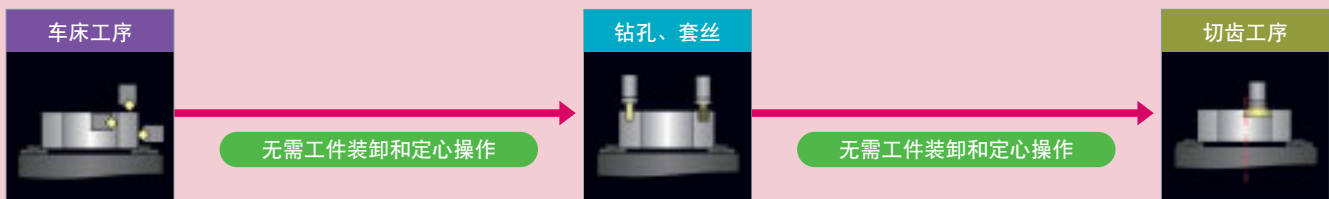
## 集车削、钻孔、切齿于一身 插齿机加工中心

插齿机加工中心是以插齿机为基础，集车床和加工中心于一身的复合型加工机械。

可通过一次装卡加工建筑机械、减速机等齿轮产品，大幅度缩短了非加工时间，实现了稳定的加工精度。

### 特点 Features

- 从车床工序到切齿加工，通过一次装卡加工大幅度缩短了非加工时间，加工精度也更加稳定



## Turning, drilling, and gear shaping combined in one center Gear Shape machining center

This gear shaping machining center has multiple functions based on a gear shaper combined with a lathe. Reduction gears and gears for construction machinery can be made using just one chuck mounting for consistent production accuracy and greatly reduced idle time.

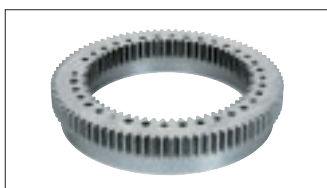
- Production accuracy is stabilized and idle time is greatly reduced through one-chuck production from turning to cutting teeth.

## 插齿机加工中心 Gear shape machining center

### GM7134

- 实现了加工精度的稳定化、节省空间及提高性价比
- Improves cost performance with stable production accuracy and smaller footprint

#### 加工例 Sample



#### 插齿刀 Gear shapers and cutters

根据用途，我们准备了各种插齿刀

盘形插齿刀  
Disk type gear shaper cutter

碗形插齿刀  
Bell type gear shaper cutter

带柄插齿刀  
Shank type gear shaper cutter



GM7134

		GM7134	
●加工能力		●Machining performance	
工件最大直径	内齿 Maximum diameter of workpiece: Inner teeth		φ700
	外齿 Outer teeth		φ700
加工最大模数	Maximum production module		m8
最大加工齿宽 (mm)	Maximum tooth width (mm)		200
最大插齿刀行程宽度 (mm)	Maximum cutter stroke width (mm)		230
最大主轴行程数 (str/min)	Maximum axial stroke count (str/min)		30~300
切齿工具	Tooth cutting tool	插齿刀 Gear shapers and cutters	
●工作台		●Table	
直径	Diameter		φ800
最大转矩 (额定30分钟) (Nm)	Maximum torque (30 minute rating) (Nm)		2,352
车削 转速	Lathe RPM		300
	电机 (kw)		26/22
分度 转速	Divisions RPM		8
	电机 (kw)		2.7
从地板到工作台上面的距离 (mm)	Distance from floor to top surface of table (mm)		1,200
●工具主轴		●Cutter spindle	
主轴锥孔	Main shaft taper hole		7/24锥度No.50 (BBT50)
容许扭矩 (额定30分钟)	Allowable torque (30 minute rating)		200

		GM7134	
●工具主轴		●Cutter spindle	
开孔 转速 (rpm)	Drilling RPM		3,000
	电机 (kw)		15/11
分度 转速	Indexing RPM		40
	电机 (kw)		2.7
●部件		●Unit	
左右移动量 (X轴)	Left-right traverse (X axis)		880
上下移动量 (Z轴)	Up-down traverse (Z axis)		350
工作台移动量 (Y轴) (mm)	Table motion range (Y axis) (mm)		1,300
进给速度 (X/Y/Z通用)	Feed speed (X/Y/Z common)		15
●ATC		●ATC	
工具收容根数	Number of stored tools		30
工具选择方法	Tool selection method		地点固定 Location fixed
●实用程序		●Utilities	
总使用功率 (kVA)	Overall power used (kVA)		94.2
●机械尺寸		●Machine size	
宽度×深度 (mm)	Width × depth (mm)		4,080 × 4,560
高度 (mm)	Height (mm)		3,940
机器质量 (kg)	Weight (kg)		30,000



# 齿轮复合加工中心 Skiving machining center for Gears

NACHI-GMS450

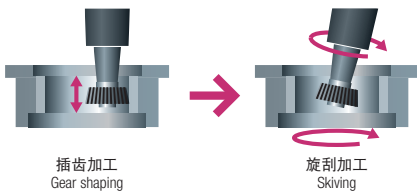
- 凭借高效率的旋刮加工，最大可将加工时间缩短到原来的1/5（与插齿加工相比）。
- 利用特有的技术，在旋刮加工机基础上增加了车削和开孔功能的齿轮复合加工机。
- 不仅可支持多品种小批量生产，还可支持大批量加工。
- 虽然机型小巧，但最大可支持 $\phi 450\text{mm}$ 的工件加工。
- 硬式旋刮加工，可支持淬火齿轮的高精度加工。
- 利用对话型操作画面，可实现优异的人机界面功能。

- High efficiency gear skiving reduces machining time to as much as 1/5 (compared to gear shaping).
- Proprietary technologies used to add lathe and drill to skiving machine for a multi-functional gear shaper.
- Both mass production & multi-type-small-lot production.
- Compact yet can be machining up to 450mm diameter part.
- Hard-skiving achieves high-precision machining of hardened gears.
- Interactive operation screen provides excellent man-machine interface.



NACHI-GMS450

## ■ 高效率旋刮加工 High-efficiency gear skiving



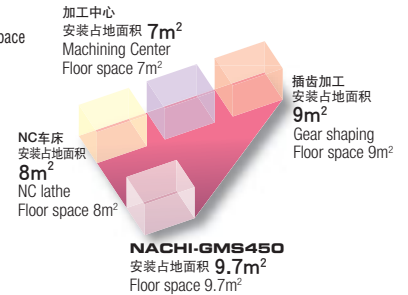
插齿加工  
Gear shaping

旋刮加工  
Skiving

## ■ 从减少安装空间，到实现更高效生产线 To achieve smart production lines by reducing floor space

利用可节省空间的齿轮复合加工中心，既可将齿轮加工生产线改造成更高效的生产线，还可支持小批量多品种生产和大批量加工等各种生产方式。

Skiving machining center for Gears requires little space to improve gear production lines to be smart production lines that can handle a variety of production formats from multi-type small-lot production to high-volume production.

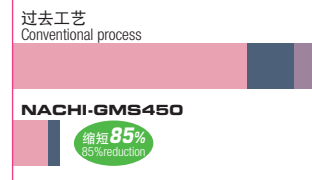


## ■ 旋刮加工时间 Gear machining time



## ■ 非加工时间 Idle time

工艺准备时间 Change over time    装卸时间 Loading & Unloading time    搬运时间 Handling time



工艺准备时间削减 **85%**  
Change over time reduced by 85%

零搬运时间  
Handling time is zero

工件装卸时间削减 **74%**  
Time to mount and unmount workpiece reduced by 74%

## ■ 加工示例 Sample



## ■ 旋刮刀具 Skiving cutter

本公司可根据工件的参数和用途，提供相应的旋刮刀具和加工条件解决方案。  
Propose our skiving cutter and cutting conditions to match the various workpiece specifications and applications.



## ■ NACHI 刀具的特点 Features of NACHI cutters

- 利用到目前为止积累的齿轮加工技术、刀具设计技术，通过对切削机理进行深入分析，实现了加工工件高精度化、刀具长寿命化。
- 在膜的成分设计和成膜工艺优化基础上进行了表面调质，确立了旋刮加工中所必需的表面处理技术。
- 利用超硬材质旋刮刀具，可实现淬火后的高精度加工。
- Analyzed cutting mechanism with the cutting tool design technology and gear cutting technology that we have developed. Improved precision of machining work and extended tool life.
- Established surface processing technology needed for skiving that produces better surfaces with optimized deposition process and design of coating components.
- Carbide skiving cutters are able to achieve hard skiving process after heat treatment.

		NACHI-GMS450
●加工能力		●Machining performance
工件最大直径 (mm)	Maximum diameter of workpiece	$\phi 450$
最大生产模数	Maximum production module	m4.5
最大齿宽 (mm)	Maximum tooth width (mm)	120
工件最大高度 (mm)	Max. workpiece height (mm)	250
齿切刀具	Tooth cutting tool	旋刮刀具 Skiving cutter
●工具主轴		●Cutter spindle
主轴锥孔 (刀柄型号)	Spindle taper hole (tool shank type)	7/24锥度No.50 (BBT50)
主轴最高转速 (min <sup>-1</sup> )	Max. RPM of spindle (min <sup>-1</sup> )	3,000
电机 (30分钟/连续) (kw)	Motor (kw)	26/22
●工件主轴		●Workpiece spindle
主轴最高转速 (min <sup>-1</sup> )	Max. RPM of spindle (min <sup>-1</sup> )	1,400
电机 (30分钟/连续) (kw)	Motor (kw)	26/22
●各轴移动量		●Each unit traverse
左右移动量 (X轴) (mm)	Left-right traverse (X axis)	700
前后移动量 (Y轴) (mm)	Forward - Back traverse (Y axis)	350
上下移动量 (Z轴) (mm)	Up-down traverse (Z axis)	300
刀具回旋角 (B轴) (°)	Tool swivel angle (B axis) (°)	±25

		NACHI-GMS450
●ATC		●ATC
刀具容纳数量 (只)	Number of stored tools	6
刀具最大直径 (mm)	Max. tool diameter (mm)	$\phi 150$
刀具最大长度 (mm)	Max. tool length (mm)	250
刀具选择方法	Tool selection method	位置固定/随机
●NC装置		●NC device
类型	Type	FANUC 31i-B
显示器	Display	FANUC PANEL-i
●实用程序		●Utilities
总消耗功率 (kVA)	Overall power used (kVA)	88
●机器尺寸		●Machine size
宽度×深度 (mm)	Width × depth (mm)	2,500×3,860
高度 (mm)	Height (mm)	2,700
机器质量 (kg)	Weight (kg)	22,000
●选购件		●Options
工件夹具 外部光栅尺 ATC22把	Workpiece chuck External scale 22 piece ATC	
硬材加工组件	Hard machining package	
利用机器人的工件搬出搬入	Workpiece handling by robots	

## 内磨床 Internal grinding machines

### IG 系列 series

- 对精密部件进行高精度、高效率的内面加工。  
生产型的全自动内磨床
- 通过耐热变形的卧式特殊床身结构和安全罩等的特殊设计，有效的抑制磨削热产生的影响。即使在常温下也能够实现稳定的加工精度。无需冷却装置。
- High accurate and efficient internal grinders for precision parts.
- Heat from grinding is suppressed with an improved cover and special horizontal bed configuration that stands up to heat deformation. This means that grinding accuracy remains consistent even at normal temperatures, and cooling equipment is no longer necessary.

#### ■加工例 Sample



IG-06SA

		IG-06SA	IG-10SA	IG-20SA
能够加工的孔径的范围 (mm)	Grinding bore	10 ~ 60	10~100	10~200
工作台上的振动 (mm)	Swing over table	400	400	400
工作台最大移动量 (mm)	Max. table stroke	185	250	350
工作台最大移动速度 (m/min)	Table speed	20	15	15
进刀机床移动量 (mm)	Cross table travel	150	150	160
工作主轴最大转速 (min <sup>-1</sup> )	Max. work spindle revolution	2,200	1,500	1,500
占地面积 (主体) (Wmm×Dmm)	Floor space	1,800×1,640	2,400×2,200	2,700×2,250
机器重量 (kg)	Weight	4,200	4,500	5,000

## 拉刀磨床 Broach grinding machines

### NACOM 系列 series

- 具有拉刀制作方面的丰富经验和技能。
- 借助专有软件和传感器，简化了设置和操作。
- Concentrated know-how and experience in making broaches.
- Streamline setup and operability together with our proprietary software and sensors.



NACOM-420

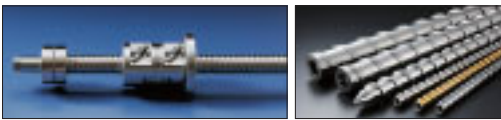
		NACOM-320	NACOM-420	NACOM-426
●工件	●Workpieces			
可加工的拉刀	Broaches that can be machined	方形 Square	方形、圆形和螺旋形 Square, round, and helical	方形、圆形和螺旋形 Square, round, and helical
可磨削的圆形拉刀的最大直径 (mm)	Maximum diameter of round broach that can be ground (mm)	—	180	200
可磨削的圆形拉刀的最大长度 (mm)	Maximum length of round broach that can be ground (mm)	—	1,950	2,540
可磨削的方形拉刀的最大高度 (包括夹具) (mm)	Maximum height (including chuck) of square broach that can be ground (mm)	185	185	185
●移动范围	●Range of movement			
工作台左右移动量 (mm)	Left - Right table traverse (mm)	1,950	1,950	2,380
滑枕前后移动量 (mm)	Ram Forward - Back traverse (mm)	280	280	280
立柱上下移动量 (mm)	Column Up - Down traverse (mm)	260	260	260
磨轮主轴沿垂直轴的内表面旋转角 (°)	Wheel spindle's angle of traverse for internal surface on vertical axis (°)	0~50	0~50	0~50
磨轮主轴沿水平轴的内表面旋转角 (°)	Wheel spindle's angle of traverse for internal surface on horizontal axis (°)	±15	±15	±15
●尺寸	●Dimensions			
安装占地面积 (主机 (宽度mm×深度mm))	Required floor space (main unit (W mm x D mm))	5,800×2,300	5,800×2,300	6,850×2,300
机器高度 (mm)	Machine height (mm)	2,200	2,200	2,200
机器重量 (kg)	Machine weight (kg)	6,000	6,000	8,000

## 螺杆磨床 Thread grinding machines

### GTE 系列 series

- 螺纹磨床可加工各种工件，如滚珠丝杠、注塑螺杆、轧辊模具等等。
- 加工长度可达5,400mm。
- 凭借出色的加工技术，可实现高精度加工。
- Thread grinding machine can process a wide range of workpieces, such as ball screws, injection screws, roll dies, and more.
- Supports lengths up to 5400 mm.
- High-precision machining through excellent machining technology.

#### 加工示例 Sample



GTE-30A

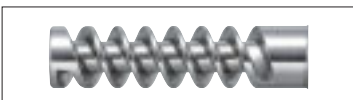
		GTE-5	GTE-10A	GTE-20A	GTE-30A	GTE-40A	GTE-50A
最大中心间距 (mm)	Max. center distance	500	1,500	2,300	3,650	4,500	5,400
能够磨削的最大外径 (mm)	Max. grinding outside diameter	80	200	200	200	200	200
能够磨削的螺纹长度 (mm)	Grinding lead	450	1,300	2,100	3,300	4,000	5,000
磨石的尺寸 (外径×宽度×内径) (mm)	Grinding wheel size (OD×W×ID)	355×(10~32)×152.4	510×(10~75)×228.6	510×(10~75)×228.6	510×(10~75)×228.6	510×(10~75)×228.6	510×(10~75)×228.6
磨石轴的倾斜角度 (°)	Wheel spindle swivel angle	±25	±45	±45	±45	±45	±45
工作台整体移动量 (mm)	Max. table stroke	500	1,400	2,200	3,400	4,100	5,100
占地面积 (主体) (Wmm×Dmm)	Floor space	3,100×4,200	5,800×4,200	8,000×4,200	10,000×4,200	12,200×4,200	13,900×4,200
机器重量 (kg)	Weight	6,500	12,000	14,000	18,000	19,000	20,000

## 生产型螺纹磨床 Production type thread grinding machines

### GTE-SA 系列 series

- 生产型螺纹磨床可用于汽车及其他产品零部件的小批量或大批量生产。
- 支持零部件的自动化处理，可提高生产效率，节省空间。
- Production type thread grinding machine for small-lot or mass production of automotive and other parts.
- Automate parts for high productivity and to save space.

#### 加工示例 Sample



GTE-5SA2

		GTE-5SA2	GTE-5SA4
最大中心间距 (mm)	Max. center distance	200	400
能够磨削的最大外径 (mm)	Max. grinding outside diameter	250	250
能够磨削的螺纹长度 (mm)	Grinding lead	150	350
磨石的尺寸 (外径×宽度×内径) (mm)	Grinding wheel size (OD×W×ID)	405×(10~32)×152.4	405×(10~32)×152.4
磨石轴的倾斜角度 (°)	Wheel spindle swivel angle	±30	±30
工作台整体移动量 (mm)	Max. table stroke	200	400
占地面积 (主体) (Wmm×Dmm)	Floor space	2,000×2,800	2,400×2,800
机器重量 (kg)	Weight	6,500	7,500



安全注意  
事项

- 为了使您安全地使用本机，在设备到货后，请仔细阅读随附“安全指南”。  
Before operating any machinery be sure to read through the "Safety Handbook" for your safety.

- 本产品目录所介绍的商品有可能因改进性能不经预告而更改外观和规格等。
- The designs, specifications and/or dimensions in this catalog are subject to change without notice.

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