

PRODUCTIVE & PROFITABLE GEAR MANUFACTURING WITH MULTI-TASKING MACHINES

SMOOTH Gear Milling | SMOOTH Gear Hobbing
SMOOTH Gear Skiving | CAM Surfacing

Mazak



Let Us GEAR YOU UP For Success

Advancements in metalworking technology have made it possible for manufacturers, especially those involved in the automotive transmissions, heavy equipment, aerospace, marine and power generation industries, to take a different, more streamlined approach to gear and spline production.

Today's gear-making processes, from hobbing to skiving, no longer have to be performed on expensive single-purpose equipment. Multi-Tasking machines, along with the right software and CAD/CAM system, can produce gears of all shapes and sizes faster and more precise than ever before.

At Mazak, we know what it takes to process gears productively and profitably on Multi-Tasking machines with 5-axis capabilities. So, whether you want produce gears and splines through milling, hobbing, skiving or CAM surfacing, we have the most advanced solutions and support resources available to get the job done right.



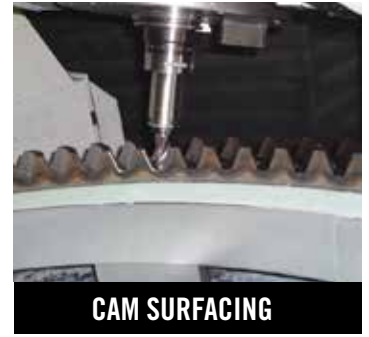
MILLING



HOBGING



SKIVING



CAM SURFACING

TECHNOLOGY

With more than 90 configurations, we have the largest selection of advanced, highly versatile Multi-Tasking machines in the industry. So whether you're making small-to-medium batch sizes of complex spiral bevel gear sets or processing large volume splines, we have a solution to streamline your operations.

Ways our Multi-Tasking machines influence gear production:

- A more affordable capital equipment purchase when compared with single-purpose machines.
- Maximize your investment by making more than just gears. These machines can also process gear-related components, such as gearboxes, and completely different complex parts.
- Increase part accuracy, productivity and process control by machining gears in single setups.
- Shorten machine set-up times and eliminate complicated programming operations.
- User-friendly CNC technology makes programming easy for operators of all skill levels.
- Become less reliant on tribal knowledge to produce a quality product.
- Profitably produce gears of all types in all volume requirements.
- Perform fewer pre- and post-manufacturing operations as compared with dedicated machines.
- Save valuable shop floor space by eliminating dedicated gear-making equipment that often goes underutilized.

SMOOTH Gear Cutting Solutions



Increase gear machining accuracy and productivity with SMOOTH Gear Cutting Solutions from Mazak. The solutions employ graphical user interfaces for gear/spline data entry along with cutting parameters for writing programs within a matter of minutes.

SMOOTH Gear Cutting Solutions include three modules:

- SMOOTH Gear Milling for OD parallel axis gears
- SMOOTH Gear Hobbing for OD gears and splines
- SMOOTH Gear Power Skiving for OD/ID gears and splines

DONE IN ONE® Machining

Our Multi-Tasking solutions incorporate all processes from raw material input through final machining on just one piece of equipment. As a result, gear manufacturers can reduce production lead times, lower operating expenses and reduce operator involvement.

Support

Through our extensive support network, well-established machine service infrastructure, industry partnerships and expertise, we can help you maximize your gear-making operations.

- Eight regional Technology Centers and a Technical Center enhance our support capabilities across North America.
- We work with certified technology partners to provide highly optimized turnkey systems.
- Our vast CAM knowledge can optimize your Multi-Tasking and 5-axis programming.
- Our **Optimum Plus** total support program fulfills your every part, service and training need.
- We provide secure applications development and guarantee system design privacy.

SMOOTH GEAR MILLING

In this quick, highly accurate gear-making process, our Multi-Tasking machines equipped with secondary spindles and lower turrets make it possible to perform simultaneous gear milling and turning operations on a single machine to improve throughput. The use of standard milling cutters such as end mills and ball mills to make a series of progressive cuts along the tooth profile and create the involute form allows for greater flexibility for various tooth pitches.

Benefits of Milling on Mazak Machines

- Quickly produce involute gears with high surface finishes in low volumes
- Freedom to design smaller, stronger gears, gearboxes and transmissions
- Machine datum features in the same setup as milling teeth to achieve minimal runout
- Cost effectively manufacture gears and splines in a wide variety of quantities and styles
- Reduce work in process by producing gears and splines complete on one machine
- Use of common tools allow for quick part turnaround for prototype environments

Machine Recommendations

■ INTEGREX i Series

These Multi-Tasking machines provide a wide range of part processing capabilities for manufacturers of complex gear components.

■ INTEGREX i-V Series

These Multi-Tasking machines with full 5-axis capabilities bring maximum versatility, precision and throughput to complex gear manufacturing.

■ INTEGREX e-H Series

These horizontal Multi-Tasking machines combine advanced turning and full 5-axis machining capabilities to process large gears and splines in single setups.

■ INTEGREX e-V Series

Through robust turning and full 5-axis capabilities, these vertical Multi-Tasking machines can productively process large gears and splines in single setups.

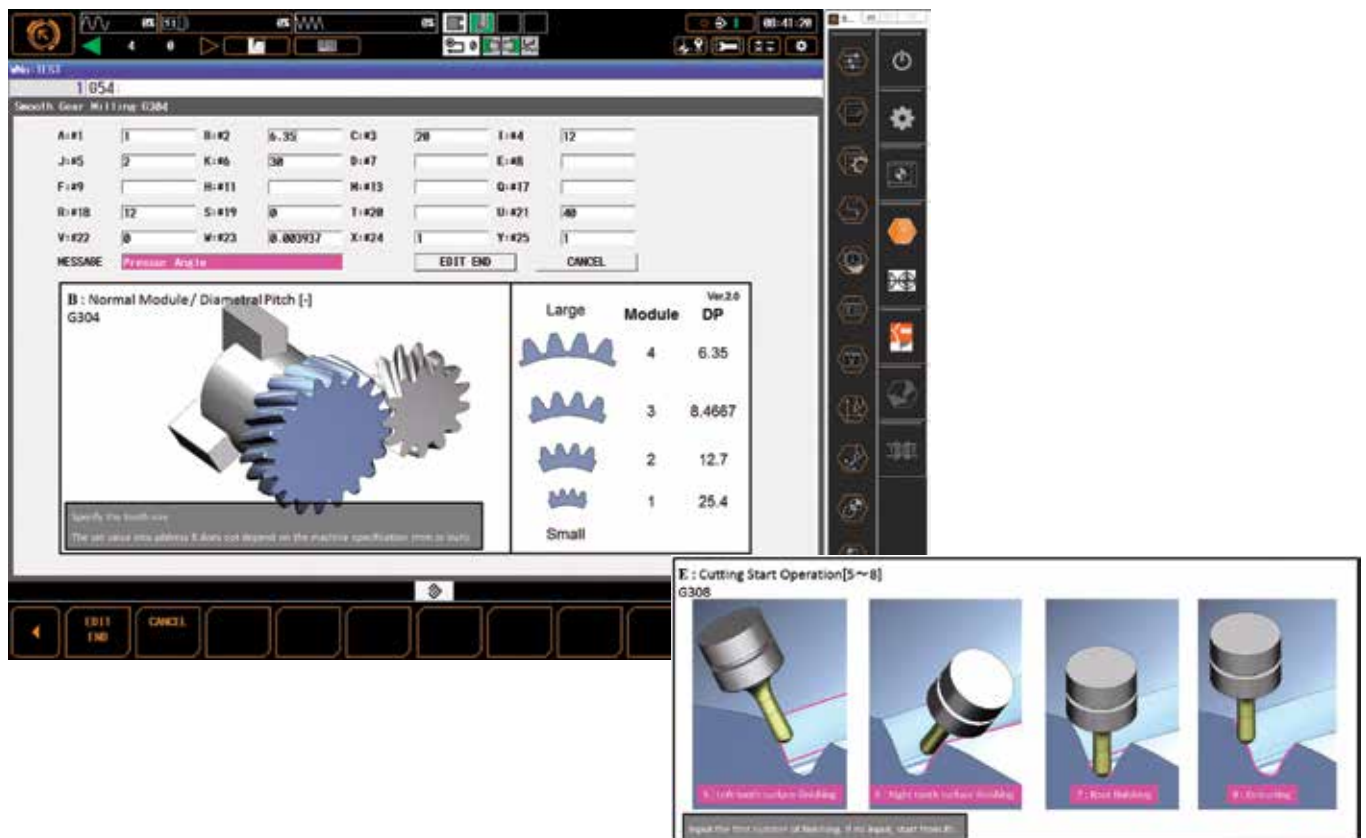


INTEGREX e-670H



SMOOTH Gear Milling Software

The SMOOTH Gear Milling Software module makes it possible for operators, even those without specialized gear-design knowledge, to quickly program our machines. The software features an intuitive input screen so operators can easily develop machining programs on the shop floor – no CAD/CAM software experience is required.



SMOOTH GEAR HOBBING

In this efficient, cost-effective gear-making process, a hobbing tool performs a series of progressive cuts into the workpiece to create teeth or splines. When using our Multi-Tasking machines to perform this process, all it takes is the correct hobbing cutter and synchronizing the turning and milling spindle rotations to create high quality gears.

Benefits of Hobbing on Mazak Machines

- Machine datum features in the same setup as hobbing teeth to achieve minimal runout
- Cost effectively manufacture gears and splines in a wide variety of quantities and styles
- Reduce work in process by producing gears and splines complete on one machine

Machine Recommendations

■ INTEGREX i Series

Featuring the industry's widest range of Multi-Tasking capabilities, these machines can be paired with specialized hobbing tools for manufacturers of complex gear components.

■ INTEGREX i-V Series

When equipped with specialized hobbing tools, these Multi-Tasking machines bring maximum versatility, precision and throughput to complex gear manufacturing.

■ INTEGREX e-H Series

These horizontal Multi-Tasking machines can perform DONE IN ONE processing of large gears and splines when paired with specialized hobbing tools.

■ INTEGREX e-V Series

With specialized hobbing tools, these vertical Multi-Tasking machines can process large gears and splines in single setups.



INTEGREX i-630V/6S



Tooling Recommendations

Customers can use their existing HSS hobbing tools or more modern indexable tools with carbide inserted hobbing cutters for high cutting speeds and fast insert changeouts.



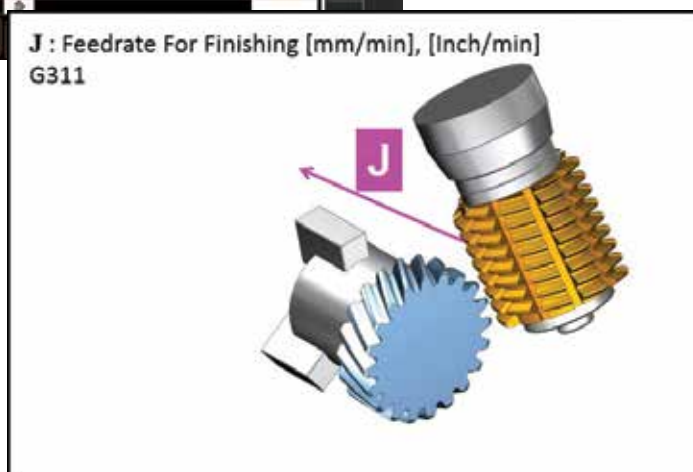
SMOOTH Gear Hobbing Software

The SMOOTH Gear Hobbing Software module makes it possible for operators, even those without specialized gear-design knowledge, to quickly program our machines. The software features an intuitive input screen so operators can easily develop machining programs on the shop floor – no CAD/CAM software experience is required.



Hobbing Quality Example

- Module m1.5 / DP 16.93
- Cutting Diameter: 63.0 mm
- Major Diameter: 51.0 mm
- Number of teeth of part: 32
- Quality: DIN 7-8, old JIS 3-4



SMOOTH GEAR SKIVING

Power skiving is a machining process in which the cutting tool rotates and meshes with the workpiece to generate the involute tooth geometry. Our Multi-Tasking machines are able to perform skiving operations and quickly produce accurate OD and ID parallel-axis gears (spur and helical) and splines in single setups.

Benefits of Skiving on Mazak Machines

- Efficiently produce high-quality internal and external gears and splines in medium volumes
- Process gears up to eight times faster than traditional shaping or hobbing processes
- Machine datum features in the same setup as skiving teeth to achieve minimal runout

Machine Recommendations

■ INTEGREX i Series

Efficiently perform skiving operations for gear manufacturing with these highly capable Multi-Tasking machines.

■ INTEGREX i-V Series

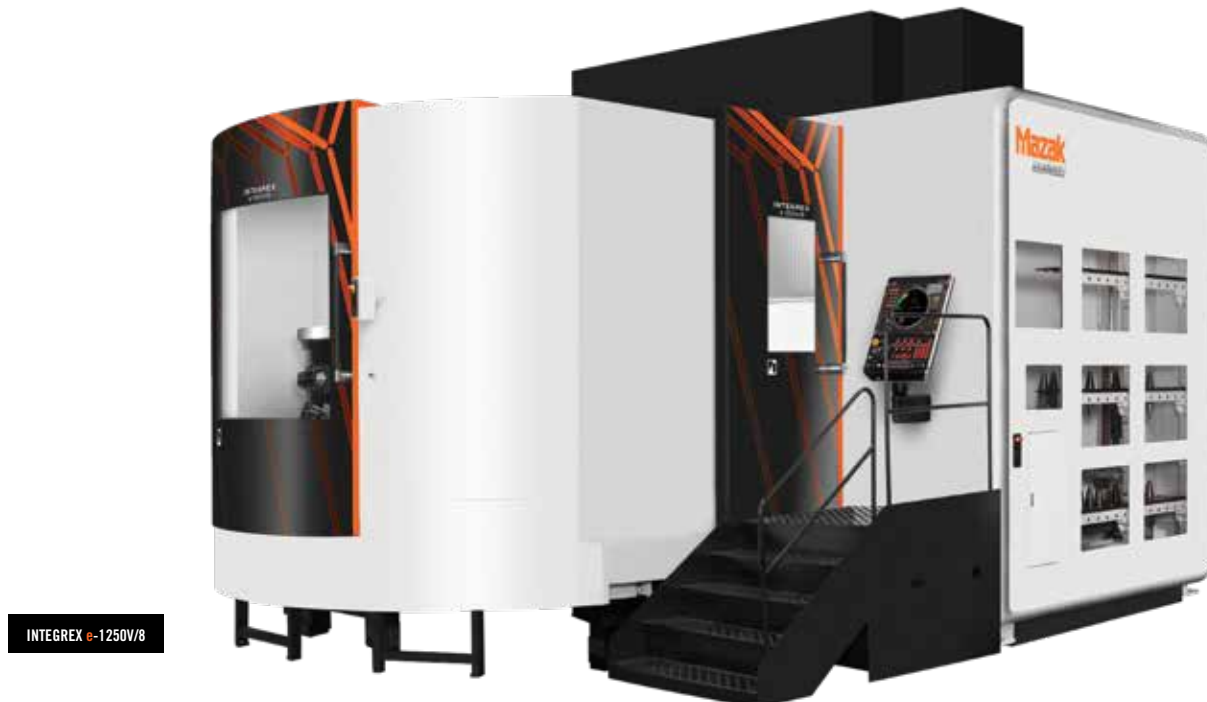
These Multi-Tasking machines with full 5-axis capabilities can easily perform skiving operations to produce precision gear and splines in single setups.

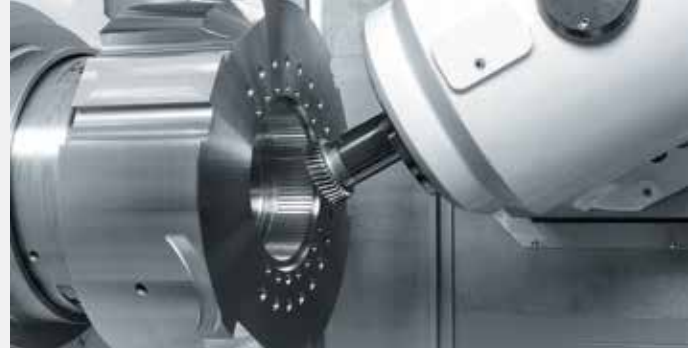
■ INTEGREX e-H Series

These horizontal Multi-Tasking machines feature full 5-axis capabilities to productively finish large gears and splines complete through the skiving process.

■ INTEGREX e-V Series

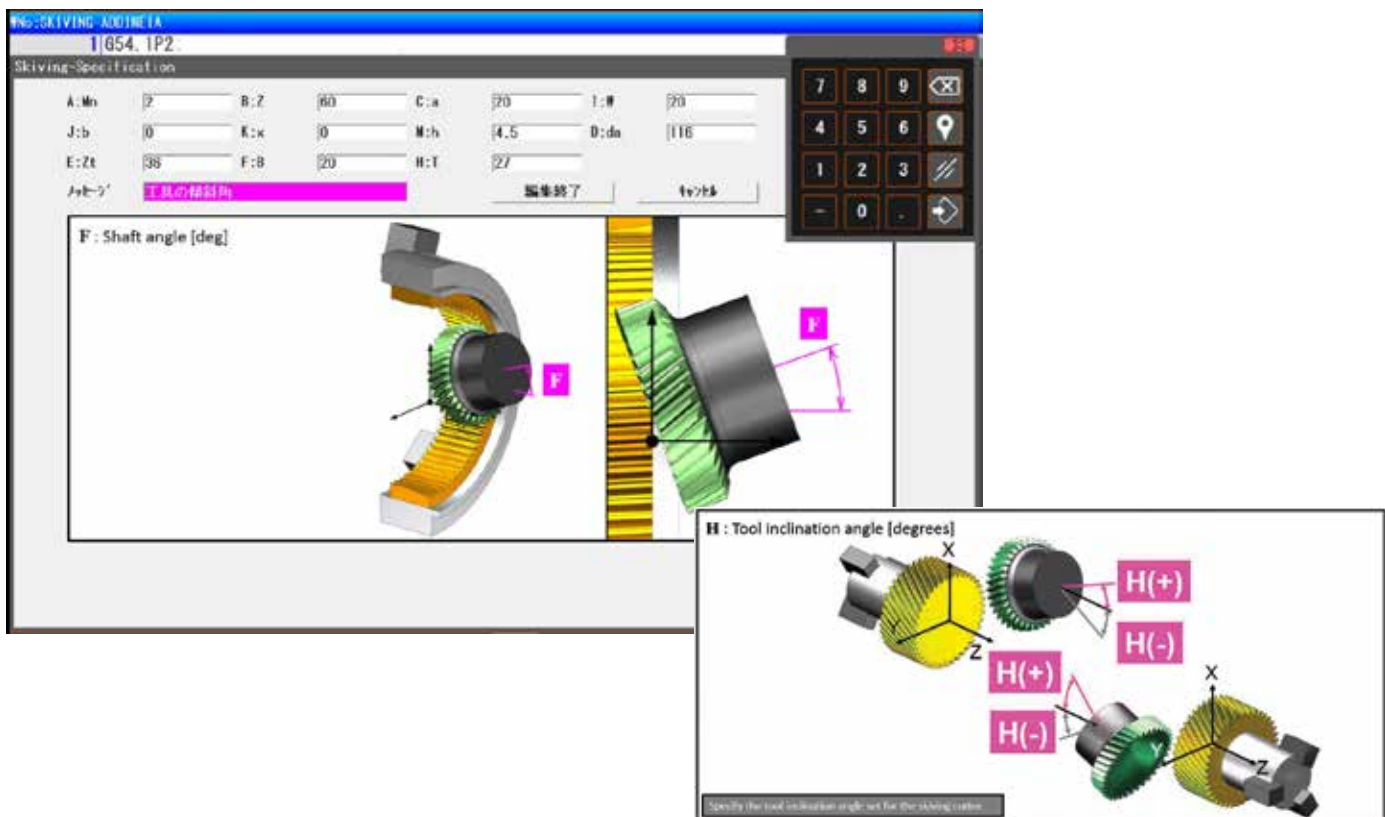
Able to perform highly effective skiving operations, these vertical Multi-Tasking machines with full 5-axis functionality can finish large gears and splines in single setups.





SMOOTH Gear Skiving Software

Our SMOOTH Gear Skiving Software makes it possible for operators, even those without specialized gear-design knowledge, to quickly program our machines. The software features an intuitive input screen so operators can easily develop machining programs on the shop floor – no CAD/CAM or 3-D model experience is required.



CAM SURFACING

Surfacing operations performed on our Multi-Tasking machines with 5-axis capabilities produce precision gear tooth surfaces, both to a critical size and the required surface finish. Unlike other forms of gear-cutting operations, surfacing on a 5-axis machine does not involve special gear options or gear tooling, such as a hobbing cutter, but rather standard cutters like end mills and ball mills.

Benefits of Surfacing on Mazak Machines

- Quickly produce involute gears with high surface finishes in low volumes
- Freedom to design smaller, stronger gears, gearboxes and transmissions
- Minimal, if any, matching sequences and no shipped sets
- Reduce manual benchwork such as deburring gear teeth ends
- Eliminate finish grinding operations by hard milling up to 62 HRc
- Machine datum features in the same setup as milling teeth to achieve minimal runout
- Cost effectively manufacture gears and splines in a wide variety of quantities and styles
- Reduce work in process by producing gears and splines complete on one machine
- Use of common tools allows for quick part turnaround for prototype environments

Machine Recommendations

■ VARIAXIS Series

The DONE IN ONE capabilities of these full 5-axis machining centers streamline accurate involute gear production and improve overall process management.

■ INTEGREX i-V Series

These Multi-Tasking machines with full 5-axis capabilities can produce accurate, high-quality involute gears in single setups.

■ INTEGREX e-H Series

These horizontal Multi-Tasking machines apply simultaneous 5-axis machining to process large involute gears in single setups.

■ INTEGREX e-V Series

These vertical Multi-Tasking machines with full 5-axis capabilities can productively process large involute gears in single setups.

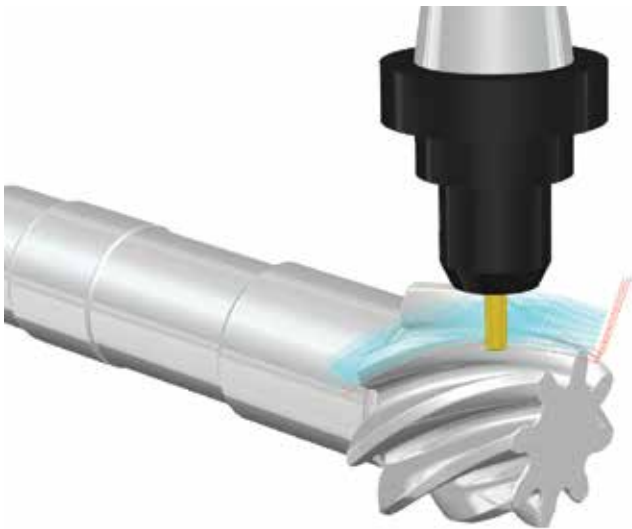


VARIAXIS i-600










Off-line Software (Bevel Gears Requiring 5-axis)

While no special gear options or tooling are required to perform surfacing operations on our Multi-Tasking 5-axis machines, modern processing solutions, such as 3-D solid gear modeling software, CAD/CAM systems and post processors to format G-code, are critical as they allow operators to program gears like any other 5-axis part. Plus, operators can use processing technology to perform tooth contact analysis simulations as well as eliminate the traditional iterative process that allows for the interchangeability of pinions and rings in spiral bevel gears.








QUICK REFERENCE

Mazak's wide scope of Multi-Tasking machines ensures manufacturers get the perfect solution for their particular gear-cutting applications. The chart below shows machining strategies and machine types to cut various types of gear and spline parts.

		O.D. SPUR	O.D. HELICAL	O.D. SPLINE
				
	Mazak SMOOTH Gear Milling	INTEGREX e-H Series INTEGREX e-V Series INTEGREX i Series INTEGREX i-V Series	●	○
	Mazak SMOOTH Gear Hobbing	INTEGREX e-H Series INTEGREX e-V Series INTEGREX i Series INTEGREX i-V Series	●	●
	Mazak SMOOTH Gear Skiving	INTEGREX e-H Series INTEGREX e-V Series INTEGREX i Series INTEGREX i-V Series Direct Drive C-axis only	●	●
	CAM Surfacing	INTEGREX e-H Series INTEGREX e-V Series INTEGREX i Series INTEGREX i-V Series VARIAXIS Series VC-500	●	●

INTEGREX e- and i-Series machines using SMOOTH Gear Milling, Hobbing and Skiving can machine various parallel axis O.D. and I.D. gear and spline types.

INTEGREX e- and i-Series and VARIAXIS machines using CAM Surfacing can cut various parallel axis and cross axis O.D. gear and spline types.

I.D. SPUR	I.D. HELICAL	I.D. SPLINE	STRAIGHT BEVEL	SPIRAL BEVEL
				
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TOTAL SUPPORT

MAXIMIZE THE VALUE OF YOUR PURCHASE

When you purchase a Mazak Multi-Tasking machine for gear production, you're guaranteed complete service and support for as long as you own the equipment.

In fact, we believe in working closely with each of our customers to increase their productivity, efficiency and equipment utilization, and we are able to do so through our Technology Centers and Optimum Plus total support program.

Technology and Technical Centers

Our eight Technology Centers and a Technical Center spread across North America provide easy access to the latest, most advanced manufacturing systems for optimizing your part-production processes. You can also take advantage of each location's industry expertise, training programs and application resources to achieve improved throughput, shorter production lead times and increased profitability.

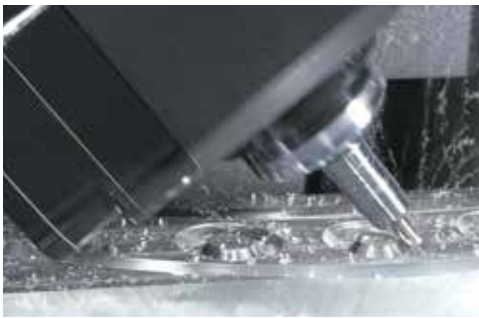


[Click here for more information on Mazak Technology Centers.](#)

Optimum Plus

This total support program represents our company-wide commitment to helping you maximize the value of your Mazak purchase, achieve the best possible competitive advantage and keep your equipment running smoothly at all times.

The program encompasses five distinct areas to ensure complete customer care.



SINGLE-SOURCE SERVICE

We are your single point of contact for any Mazak-related service need, whether it involves a machine, control, accessory or automation solution.



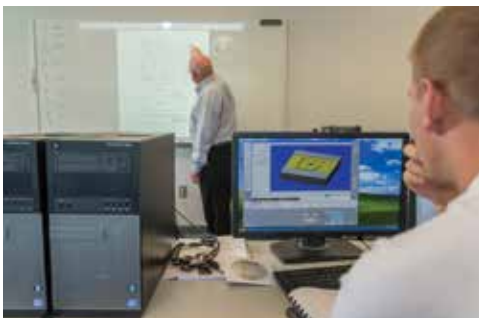
MACHINE & CNC SUPPORT

Every Mazak machine comes with a comprehensive warranty, free technical phone support and software upgrades for the entire life of the product.



PARTS SUPPORT

We have the industry's largest inventory of spare parts, ensuring 97% same-day shipping on part orders. [Click here to register for after hours parts support.](#)



PROGRESSIVE LEARNING

We partner with our customers to train them to achieve the highest levels of productivity and profitability.



SPINDLE & UNIT REBUILD

Our industry-leading exchange and rebuild program offers new and remanufactured spindles, index tables, ATC shifters and milling turrets for 24-hour shipment.



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