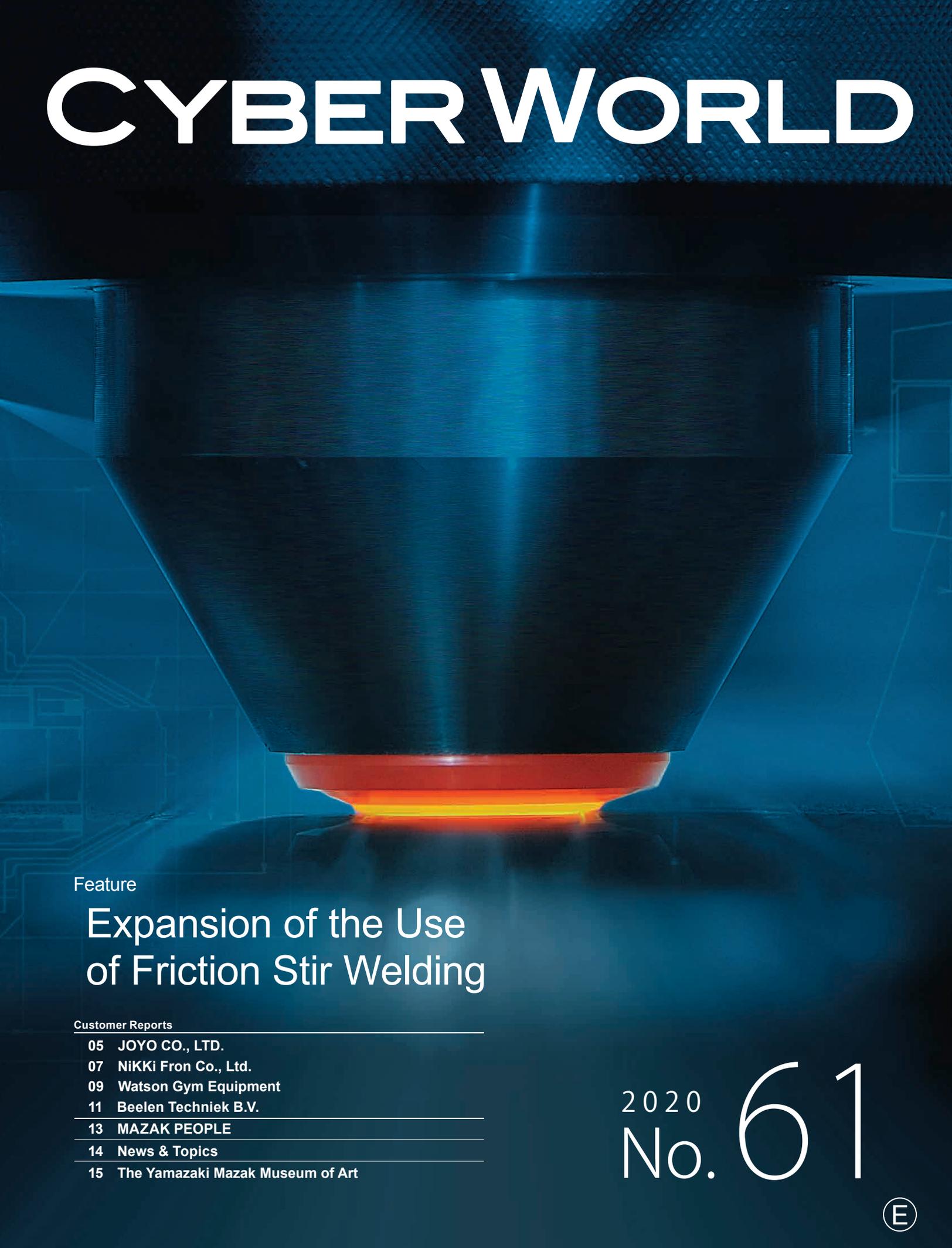


# CYBER WORLD



Feature

## Expansion of the Use of Friction Stir Welding

Customer Reports

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2020  
No. 61

# Friction Stir Welding

## Expansion of the Use of Friction Stir Welding

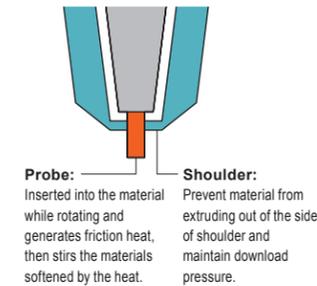
Joining of metal with rivets, bolts, adhesives, welding and other methods is essential for manufacturing and is used in a wide range of goods from playground equipment to automobiles to support people's lives.

Metal joining has a long history. Brazing was already used to join metal around 3000 B.C. and iron accessories that seem to have been created with forge welding were found in the coffin of the famous King Tutankhamen. Forge welding is a process of joining metals by heating them to high temperature and adheres them together with enough pressure to cause deformation of the weld surfaces. Although metal joining techniques have been used since ancient times, they did not develop as industrial techniques until the Industrial Revolution. The 19th century, when the Industrial Revolution occurred, was a pivotal period for joining techniques. The discovery of arc (a type of electric discharge phenomena) used for welding established the foundation of metal joining as industrial techniques. Then, from the 20th century to today, new metal joining techniques such as tungsten inert gas (TIG) welding and metal inert gas (MIG) welding were developed one after another.

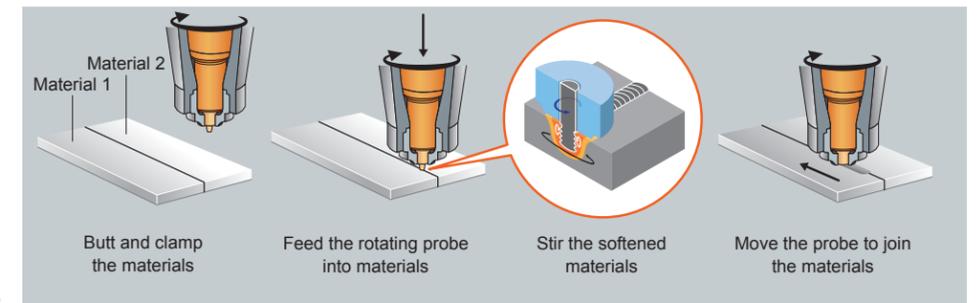
Friction stir welding (FSW), which was invented in the 1990s, is a joining technique classified as solid phase bonding. Solid phase bonding is a bonding method in which materials are heated in a solid state to soften them, and the pressure is applied to join them together. In FSW, materials are softened by the heat of friction and pressure is applied to stir and join the materials. This technique enables the high-quality joining of materials that are difficult to join by welding and has many advantages such as low equipment costs and a clean working environment.

With these advantages, FSW is becoming widespread in various fields as a solution to challenges faced by the current manufacturing industry.

### FSW process



(Figure 1)



(Figure 2)

### Comparison of tensile strength between electron beam welding (EBW) and FSW in pure copper welding



(Figure 3)

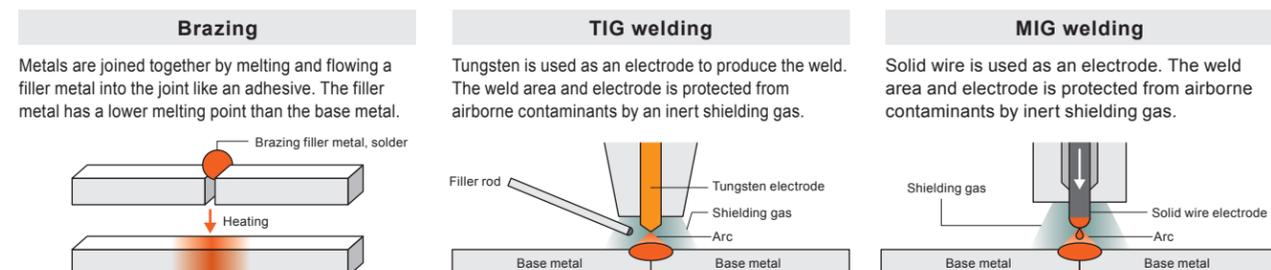


FSW is used in various products to support our daily life

### Categories and types of joining techniques

	Characteristics of the joining techniques	Representative joining techniques
<b>Brazing and soldering</b>	Filler metal is used to join materials	Aluminum brazing, brass brazing, soldering
<b>Melt welding</b>	Materials are melted to join them	TIG welding, MIG welding, electron beam welding
<b>Solid phase bonding</b>	Materials are softened to join them in a solid state	<b>Friction stir welding (FSW)</b> , hot and cold welding, ultrasonic joining
<b>Adhesion</b>	Adhesives, etc. are used for chemical bonding	Adhesives
<b>Mechanical joining</b>	Bolts, rivets, etc. are used for joining	Caulking, bolts, rivets

### Metal joining processes



### FSW process and its advantages

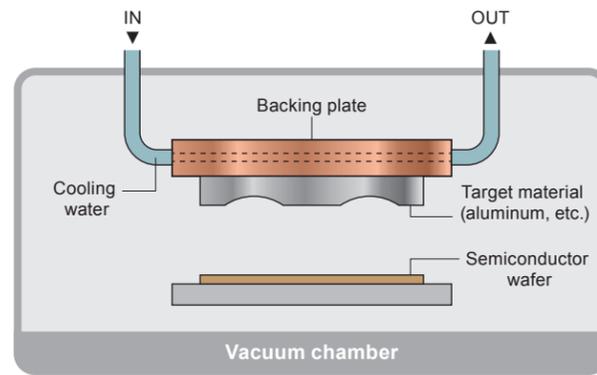
A special cylindrical shape tool is used for FSW (Figure 1). On the tip of the tool, a projection called a "probe" protrudes from the "shoulder," which plunged into the material surface during the welding. The shape and material of the probe are different depending on the materials to be welded and the welding depth. In the FSW process (Figure 2), the materials are firmly fixed each other. Then, when the tool is rotated and plunged into the materials, it creates friction heat between the tool and the materials, which leads to soften the materials. The probe is plunged into the softened materials until its shoulder touches the material surface. The softened materials start to flow, the tool moves along the weld line while the rotation and downward force are maintained to stir the materials together and join the materials. Since this joining technique does not raise the temperature high enough to melt the materials, it can reduce distortion and create superior joining strength compared to conventional joining techniques. In general, aluminum and pure copper are

considered as materials that easily cause a decline in strength after welding and generate weld defects. For example, electron beam welding (EBW) of pure copper tends to soften the metal structure of the welded joint compared to the base material and deteriorates the tensile strength. On the other hand, the structural change of metal caused by FSW is relatively small and in some cases, the welded joint is stronger than base material. (Figure 3). Thus, FSW does not only join metal materials but also improve quality. It is also expected to improve the safety and hygiene of the shop floor and reduce energy consumption because the FSW process generates no hazardous gas or rays and consumes less electricity in comparison with conventional welding techniques. Taking advantage of these features, FSW is adopted in the manufacturing of a wide range of products including profiles and body panels used in railcars, automobile frame parts, main wings of aircraft and pedestrian overpasses.

## Role of a backing plate



A backing plate is a component of a film deposition system used in the process to manufacture semiconductors, liquid crystal panels and other products. It serves to hold target materials\* in a vacuum chamber (a container to create a vacuum environment). The plate has a water channel because the target materials become high temperature by chemical reactions.



\* Target materials: Materials used for the film deposition of semiconductors

## Integration of backing plate manufacturing process

### Conventional method

Workload and manufacturing costs increase due to the need for large-scale equipment, retooling, etc.



### Hybrid multi-tasking machine equipped with FSW

All processes are completed in a single machine to shorten the production lead time.



## The use of FSW is becoming widespread in the field of semiconductor manufacturing equipment

FSW is applied not only to industrial products used in our daily life but also for the production of industrial machine parts such as semiconductor manufacturing equipment.

Semiconductors are manufactured in an enclosed vacuum space because even oxygen and water vapor can adversely affect on their quality. Therefore, parts of semiconductor manufacturing equipment must be highly airtight and watertight.

An example is film deposition, a process in the production of materials for semiconductor circuits. This process requires materials to be cooled because they become hot with chemical reactions. The materials are cooled with a heat radiation plate (backing plate). The backing plate also serves as an electrode and is therefore made mainly of pure copper, which has high thermal and electrical conductivity. The main body (flow channel) made of pure copper is covered with a metal cover, which is also made of pure copper. They are welded together to produce a backing plate with a highly air and water tight flow channel.

Conventionally, pure copper materials were usually joined with EBW. However, this technique requires large-scale equipment and thorough cleaning process, which results in high manufacturing costs. FSW process helps not only reduce the manufacturing costs but also improve the environmental aspect. FSW consumes less energy and is environmentally friendly process. Therefore, EBW is being replaced with FSW.

In response to the recent growing demand for FSW in semiconductor and other industries, Mazak developed a hybrid multi-tasking machine that integrates a machining center with the FSW function in 2014, which has already been used in the plants of customers for the production of backing plates and radiator parts. While the machining of the flow channel, welding of the cover and finishing were conventionally handled by different units, the hybrid multi-tasking machine can complete the three processes in one unit to reduce the production lead time.

## FSW in the automotive industry



In electric vehicles and hybrid electric vehicles, the cooling capacity of the battery significantly affects their longevity and performance. FSW, which enables high-quality joining, is an essential technique to produce water cooling systems for batteries, etc.



(Figure 4)

### MegaStir

MegaStir is stored in the same tool magazine as machining tools to allow quick switches between machining and FSW. The built-in sensors control thrust and temperature to stabilize the welding process.

## Support for the introduction of FSW

### Before-sales service

### After-sales service



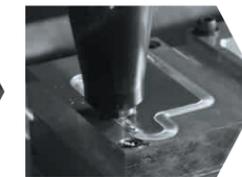
#### Proposal of product shape and machining

Check if the material can be joined by FSW



#### Tool development

Create a new tool when existing tools cannot be applied



#### Welding test

Examine the welding quality and conduct a durability test of the tool



#### Sale of tools

Supply tools exclusively for each customer from Mazak's parts center



#### Development and proposal of new tools

Propose new tools for new workpieces and conduct test joints

## Changes in machining demand in the automotive industry with electrification

In the automotive industry, the diffusion of electric vehicles (EVs) and hybrid electric vehicles (HEVs) is accelerated by the tightening of environmental regulations on a global scale. With the increasing shift towards electric vehicles, more vehicles are equipped with water cooling systems to inhibit heat generated by electric components such as batteries and inverters. While seal materials and bolts have been mainly used for joining water cooling systems, prevention of water leakage over a long period has always been a challenge. As a solution to it, FSW has begun to be used in the production of water cooling systems because it can join metal parts more securely. Most of the battery housings containing water cooling systems are made in aluminum die casts. Mazak has developed MegaStir, a tool dedicated to FSW that enables stable, high-speed joining of aluminum alloy to help customers meet their production goals (Figure 4). The built-in sensors of MegaStir control the pressing thrust of the tool and temperature during the joining process to allow stable and continuous joining.

Mazak is committed to provide comprehensive support for customers that use FSW. To ensure customers to maximize their productivity, we propose the development of tools tailored for the materials and change of the product shape to be suitable for FSW process. We also provide after-sales services to support customers continuously, including the supply of tools after the introduction and development of new tools. Products and technologies that make society more affluent, such as EVs and IoT, are underpinned by metal joining and various other manufacturing techniques. In recent years, manufacturing techniques have been required not only to pursue high quality and high accuracy but also to become clean and friendly to people and the environment. Mazak will continue to actively promote the supply of hybrid multi-tasking machines that combine FSW and other cutting-edge production techniques. Through our commitment, we will contribute to the realization of an affluent society as well as safe and secure manufacturing.



01



**JOYO CO., LTD.**  
 CEO : Joji Tsunoda  
 Head Office : 1-68-1 Usazakiminami, Shirahama-cho, Himeji, Hyogo  
 Tottori Plant : 278-2 Sasatani, Yamate, Kawahara-cho, Tottori-shi, Tottori  
 Number of employees : 101  
 www.jys-joyo.co.jp



# Customer Report 01

## Leveraging the capacity proven in the core business to move to the new stage

Japan JOYO CO., LTD.

In an injection molding machine, the heating cylinder is the most important component because it is the key mechanism to keep the temperature high to melt raw materials for plastic products. JOYO CO., LTD. is a leading company in the production of hot isostatic pressing (HIP) cylinders, which are extremely more difficult to process than cylinders produced with other methods. HIP is a process that uses gas as the pressure medium for powder sintering, diffusion joining, etc. to improve corrosion and abrasion resistance. JOYO also handles the development and composition of materials used for the HIP process in its production system, which competitors cannot follow. The company plans to apply its technologies and experiences cultivated through the manufacturing of HIP cylinders to aerospace and medical fields in the future to gain impetus to move to the next stage.



The history of JOYO started when Mr. Yutaka Tsunoda, who is the chairman and the father of the president Mr. Joji Tsunoda, established the tool wholesale company Tsunoda Shoten in 1964. JOYO Iron Works was founded in 1965 and improved its machining skills through the production of parts for industrial machines and other activities. Since the change of the company name to JOYO CO., LTD. in 1989, Mr. Joji Tsunoda has worked to solidify a foundation to achieve the goal of becoming a manufacturer with its own brand. While making the efforts, JOYO focused on HIP technology, which is widely applicable and essential for high-quality manufacturing. The company entered the business in 2001 to manufacture HIP cylinders for injection molding machines, which are its current flagship product, to take a step forward as a manufacturer. The key to the HIP process for cylinders is the diffusion joining of powder alloy to the inner wall of a cylinder for honing. However, the joining is extremely difficult. "An initial problem was the low yield rate. We worked to increase it as much as possible by examining what material should be selected for diffusion joining and pursuing original machining methods, and improved the process over two years," said Mr. Tsunoda.

company, now accounting for 40% of its sales. JOYO has an approximately 17% share of the Japanese market of cylinders for injection molding machines. "Although a 17% share may sound small, the share of our products in the high-end section of the market is close to 100%."

### Production line aimed at shortening in-process time by 30%

JOYO participated in the Hyogo Aerospace Consortium in 2014 to set up a system to prepare for entry into the aerospace market. It started to operate its Tottori Plant in 2019 as a manufacturing base for the initiative. "The main purpose was to avoid the risk of concentrating our operations in Himeji Plant. The understanding of the government and ease of hiring staff in Tottori also supported our advance." Along with aircraft parts, the Tottori Plant is also committed to the manufacturing of HIP cylinders and other mass-produced products in shipbuilding, water treatment and other fields.



Aiming to shorten the in-process time by 30% with four INTEGREX units and other equipment

When the plant was newly constructed, JOYO introduced a total of seven Mazak machines, which were three CNC turning centers of the QUICK TURN series and four multi-tasking machines of the INTEGREX i series. All of the units are painted in saxon blue, which is the corporate color. "We aim to shorten the in-process time by 30% with the equipment introduced in the Tottori Plant," Mr. Tatsuo Hirose, General Manager of Tottori Plant, said.



Mr. Joji Tsunoda, the President, talking about the outlook of HIP process technology

The HIP cylinders developed by JOYO through trial and error are used for various plastic materials. They are highly valued by many injection molding machine manufacturers and have grown to be the flagship product for the

The production line is composed of only Mazak machines because of the "trust in its products since the chairman introduced the first Mazak machine," according to Mr. Tsunoda. "The multi-tasking machines are also technically stable. When we tackled difficult machining, Mazak considered how to solve the challenges together with us. Mazak machines are essential for our products because we attach importance to quality." Mr. Tsunoda presented his expectation for the effects of the introduction.



Complicated machining programs can be prepared over a short time with MAZATROL

### Using the know-how developed in the past for R&D

While the plant can produce 600 HIP cylinders, the flagship product, in a month, the reinforcement of capacity to produce them is not the only purpose of the establishment of the new Tottori Plant. The purposes also include the organization of a cutting-edge plant that adopts AI and IoT, as well as the creation of a relationship with the local community to grow together through the development of human resources and promotion of employment. In addition, the plant is expected to serve as a base for the far-sighted research and development of technology to machine new alloys and original powder alloys. The base has a plan to make use of the know-how acquired through the production of HIP cylinders for R&D activities in aerospace, medicine, IT and other fields. Taking advantage of the high applicability of HIP technology, JOYO will take a great step toward a new stage.

Components of a HIP cylinder, the flagship product of JOYO



02



03



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- 01. The INTEGREX i-300 painted in the corporate color
- 02. Production line composed of Mazak machines only
- 03. The processes for long workpieces are integrated using the multi-tasking machine
- 04. Employees in the Tottori Plant



01

## Customer Report 02

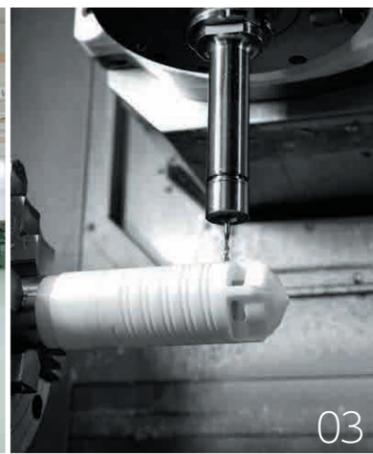
### Aiming for further growth while having overcome a hardship

Japan NiKKi Fron Co., Ltd.

Based in Nagano City, Nagano, NiKKi Fron Co., Ltd. is one of the top manufacturers that engage in the forming and machining of fluoropolymers and fiber reinforced plastic (FRP) in Japan. In its history of over 120 years, the company developed products using advanced materials of the respective periods and now supplies various products to be used in semiconductor, automobile, chemical plant and other fields. Although the plant of the company suffered devastating damage from flooding in the autumn of 2019, the production level was recovered to 80% of the pre-disaster level in just eight months. NiKKi Fron now aims to establish a production system that exceeds the level before the disaster.



02



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- 01. The plant was restored in just several months after the flood damage
- 02. The small-parts machining area consists mainly of QUICK TURN machines
- 03. One-chuck machining of complex workpieces with INTEGREX series
- 04. Mr. Keisuke Miyazaki, Manager in charge of process design (center, back row), and employees

COMPANY PROFILE



**NiKKi Fron Co., Ltd.**  
 Executive President : Takayuki Kasuga  
 Address : 409-2 Hoyasu, Nagano-shi, Nagano  
 Number of employees : 300 (group-wide)  
 www.nikkifron.com



Customer Report 02  
 Japan NiKKi Fron Co., Ltd.

The origin of NiKKi Fron is a hemp wholesaler founded in 1896 by Mr. Eitaro Kasuga, grandfather of the current president Mr. Takayuki Kasuga. With the commercialization of silk hemp packing made of blended yarn of silk and hemp in 1944, it shifted from commerce to industry and established Nippon Special Machine Industry Co., Ltd., which was renamed to NiKKi Fron Co., Ltd. in 2011. The current business operation of NiKKi Fron consists of three core businesses: functional polymers, FRP and precision machinery assembly. In the functional polymers business, the company started manufacturing fluoropolymer products with high thermal and chemical resistance in 1968. The current products include fluid control parts to be used in chemical and pharmaceutical production plants as well as in semiconductor manufacturing equipment. The FRP business, based upon its unique woven technology, started to manufacture automotive clutch facings in 1973. NiKKi Fron also launched the precision machinery assembly business as a partner plant of a major manufacturer of injection molding machines in 1989.

#### Short-term recovery from a large-scale disaster

In October 2019, when NiKKi Fron was about to start the further reinforcement of its production system, half of its machines were lost due to flood damage caused by a typhoon. Levees of a big river flowing in the neighborhood collapsed and water of nearly 2 meters high hit the plant. "Mazak visited the muddy plant for support quickly. We worked together, starting with the cleaning and diagnosis of the equipment. Reinforcements also arrived a few days after the disaster. I especially remember that staff worked hard in the cold and dark environment without electricity," Mr. Kasuga said. NiKKi Fron set up a restoration structure directly under the president as an emergency initiative after the flood disaster and promptly started recovery efforts to restore everything to its former state. "We worked hard only because we did not want to cause any trouble to our customers that had placed orders with us."

As a result of the earnest efforts of its employees, the company recovered its production capacity to 80% of the previous level in eight months after the disaster. NiKKi Fron has already taken a new step toward the establishment of a production system that exceeds the level before the flood damage.

system. The VARIAXIS i-300 AWC (VRX i-AWC), a simultaneous 5-axis vertical machining center integrated with an automation system, plays a crucial role in the promotion of automation. "We aim to establish a production system where we can generate sufficient profits even through high-mix, low-volume production. The VRX i-AWC allows even small lot machining to be automated. It is also appealing that several dozen types of workpieces can be set at a time for automatic machining," Mr. Kasuga said with appreciation of the machine. Mr. Keisuke Miyazaki, the manager in charge of process design, also expressed his expectations on the effects of introducing the VRX i-AWC, saying that the machine can achieve 100% operation rate if it is used effectively.



Process improvement through the introduction of Smooth CAM and other software

As a measure to strengthen production system, NiKKi Fron considers to reinforce functional capabilities in the Thai Plant, its overseas base, along with the plant in the Head Office. The Thai Plant currently manufactures clutch facings that play a key role in entering markets in South Asia, the Middle East and Africa, where demand for manual transmission vehicle is high. "In addition to clutch facings, the Thai Plant will manufacture functional polymer parts in the future because it is forecast that demand for fluoropolymer parts in automotive, semiconductor and pharmaceutical fields will also grow in Southeast Asia from a long-term perspective," Mr. Kasuga said. The company recovered from the large-scale disaster within a short period under the leadership of Mr. Kasuga. He seems to already have a clear vision of the growth strategy after the full restoration.



Mr. Takayuki Kasuga, the President, talking about future business development

"Our strength is we have established an integrated production system from material molding to machining. Fluoropolymers are soft and difficult to machine with high precision. We can meet various machining needs because we thoroughly know the characteristics of the material and have accumulated know-how of it." Mr. Kasuga explained the capabilities of the company that have been developed over many years in the functional polymer business, the core business for the company.

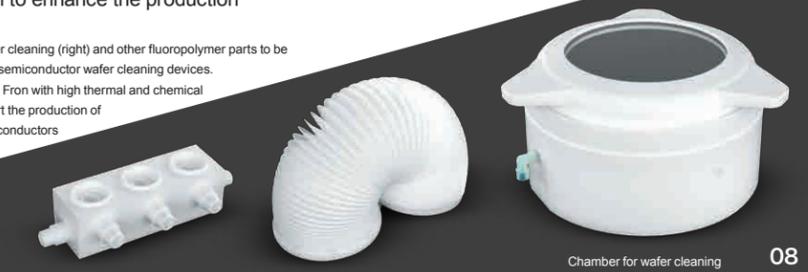


The VARIAXIS i-300 AWC playing a role in the automation strategy of the company

#### With an eye to further growth

The plant in the Head Office is equipped with more than 30 Mazak machines, which are mainly used for machining fluoropolymer parts. NiKKi Fron currently focuses on the promotion of automation to enhance the production

- ▶ Chamber for wafer cleaning (right) and other fluoropolymer parts to be incorporated into semiconductor wafer cleaning devices. Products of NiKKi Fron with high thermal and chemical resistance support the production of high-quality semiconductors



Chamber for wafer cleaning (demonstration item of NiKKi Fron)



01

# Customer Report 03

## Exploring a niche market to establish the brand

### U.K. Watson Gym Equipment

In the gym equipment industry, which has been continuously expanding, Watson Gym Equipment in Somerset, UK has established a solid position as one of the world's premier brands in recent years. The strength of the company is its ability to produce products that stand out from competitors. The high-quality, well-designed products created by the company, including dumbbells, barbells and weight machines, have won the hearts of users who keep ordering its products. "We cannot meet customer demand without Mazak's machine tools." Mr. Simon Watson, Director of Watson Gym Equipment, emphasized that the introduction of Mazak machines was one of the factors that improved Watson's business performance.



02



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- 01. Watson's products have a reputation for high quality and design
- 02. Dumbbell weight plates
- 03. High-precision machining is realized by Mazak CNC lathes
- 04. Employees of Watson Gym Equipment

### COMPANY PROFILE



#### Watson Gym Equipment

Director : Simon Watson  
 Head Office : V1, Commerce Park, Frome, Somerset, UK, BA11 2FD  
 Number of employees : 45

<https://watsongym.co.uk/>



Watson Gym Equipment was founded by Mr. Simon Watson, who used to be a welder, in Frome, Somerset in 1999. Starting the business in a small rented warehouse, the company initially produced gym equipment for the public after its establishment. "At that time, I was thinking that you have only to manufacture and supply products to expand the business. However, we had a tough time in the first several years as the sales did not grow as expected." Mr. Watson looked back on the early years of the company. Using the hardship he experienced as a springboard, he relearned about the business and noticed that the key to growth is the niche markets that have potential demand but remain intact. Then, Watson Gym Equipment stopped producing products for the public and turned into a manufacturer of high-end gym equipment. The highly specialized products designed by Mr. Watson drew attention and established a unique position in the industry. The company is now one of the major manufacturers of high-end gym equipment which is also used by globally-renowned trainers. The users are increasing not only in Europe but also in the US, Australia and the Middle East.



Mr. Simon Watson, Director

#### The FABRI GEAR changed the business fundamentally

Watson Gym Equipment introduced the first Mazak machine for the company shortly after it started to produce dumbbells. "At first, we

subcontracted the processing of some dumbbell parts, which made the manufacturing process quite convoluted. Then, I thought of introducing a CNC turning center into the company to streamline the process. When considering it, I came across Mazak." This encounter led to the introduction of the QUICK TURN NEXUS 250-II into the company. Mr. Watson went to Mazak's UK facilities to receive training on how to operate it. "Even if I was a beginner with machine tools, the operation of the Mazak machine was quite easy and straightforward. Thanks to it, it was not long before the machine was running at full capacity and our profits also grew steadily."



The 3D FABRI GEAR plays an active role in machining the frame of gym machines

Following the success of the company's initial investment in the Mazak machine, second QUICK TURN NEXUS 250-II and VERTICAL CENTER SMART 530C were introduced to deal with increasing orders. In 2017, Watson Gym Equipment added Mazak 3D FABRI GEAR 220 II, which can complete the process from laser processing to tapping in one unit. The steps for processing the frames of weight machines were integrated with this machine. "The FABRI GEAR has made a huge impact on our business. We used to spend loads of work time cutting up and

▶ Watson's gym equipments have enthusiasts in Europe and around the world

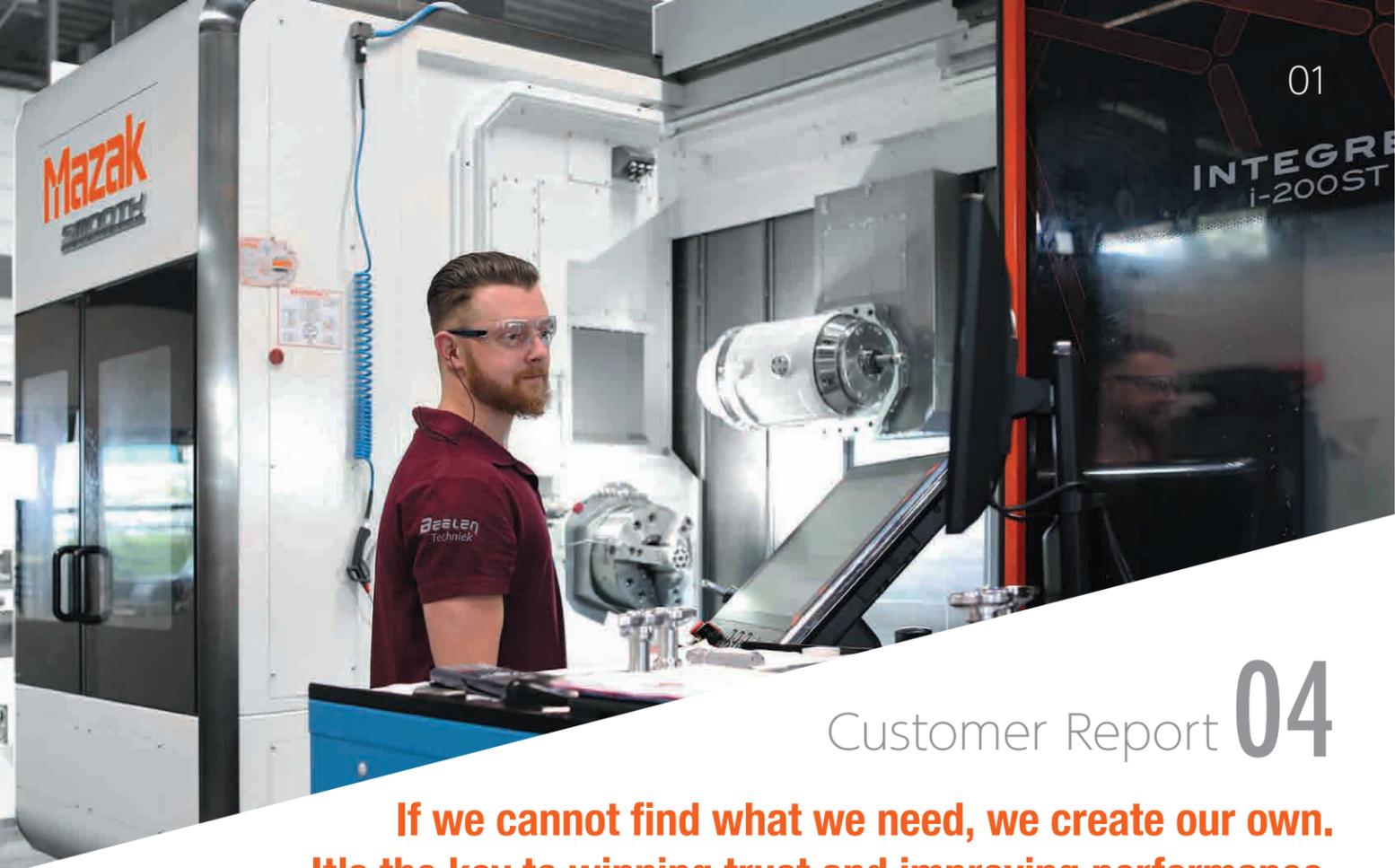


drilling holes in the frames. But, as a result of automation with the FABRI GEAR, we can now use most of the work time for welding." Mr. Watson mentioned the impact of FABRI GEAR on the company. He continued, "The FABRI GEAR did not only improve productivity but also gave us an opportunity to review the frame structure of our weight machines. The high-precision machining allowed us to design a frame structure that is rigid and easy to assemble." He thus appreciated the machine. As exemplified by the subsequent purchase of OPTIPLEX NEXUS 3015 FIBER, Watson Gym Equipment continues to promote activities to further streamline the manufacturing process.

#### New factory with a focus on automation

Mr. Watson talked about the recent trend of gyms. "The temporary boom of cardio training (exercises to burn fat) has ended and strength training (exercises to increase muscle mass) is becoming the mainstream." This trend directs more attention to the highly specialized products of the company. "Our largest concern is our production capacity, which is not fully meeting the orders we receive. Therefore, we plan to construct a new factory within this year to secure a broad area where large equipment can be installed. It is also a future challenge for us to develop an environment for automation."

Mr. Watson has established the brand power with the passion for training that he has continuously had since the foundation. His focus on in-house production and untiring efforts to meet demand will allow the company to continue to win the hearts of customers and further expand the business.



01

# Customer Report 04

**If we cannot find what we need, we create our own. It's the key to winning trust and improving performance.**

 Netherlands Beelen Techniek B.V.

Located in the province of North Brabant, Netherlands, Beelen Techniek is a manufacturer of parts for food production machines, aircraft and medical equipment, and enjoys a reputation for making proposals based on a wealth of material knowledge and machining experience. The company has won the trust of customers by machining parts made of various materials, including brass, copper and Inconel, and supplying them quickly at reasonable prices. "The reputation we have gained is the driving power for us to receive new orders from new customers," said Mr. Jan Beelen, one of the Beelen Techniek's owners. Mr. Beelen emphasized that the company's track record and achievements, built over many years, has been the foundation for its growth. But what is Beelen Techniek's strategy, which has allowed the company to win trust and stay ahead of its Dutch competitors?



02



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- 01. Many Mazak machines including INTEGRAX are in operation
- 02. Inside the plant
- 03. The tool magazine developed in-house
- 04. High-precision machining by a Mazak machine tool

## COMPANY PROFILE



### Beelen Techniek B.V.

Owner : Jan Beelen / Yvonne Beelen  
 Head Office : Lange Linden 32a 5433NC Katwijk Netherlands  
 Number of employees : 25

<https://beelentechniek.nl/>



Beelen Techniek was founded by Mr. Beelen in 1997, when he renovated part of his parent's agricultural facilities to set up a metal machining company. Starting from scratch, the company expanded operations and moved to its current Katwijk location in 2004, and employs 25 people at present. With a focus of developing business in the domestic market and becoming a pioneer in the metal machining industry, the company is highly capable and can deal with a wide range of materials and shapes. Beelen Techniek also actively accepts complex orders that other companies would be reluctant to take on. Its proposals, based on its extensive knowledge of materials and processing experience, are highly regarded by internationally renowned manufacturers of food manufacturing machinery, aircraft, medical equipment and large playground equipment.



Mr. Jan Beelen and Ms. Yvonne Beelen

Since its establishment, Beelen Techniek has always looked for ways to enhance its competitive edge. To that end, it has been consistently committed to the in-house production of peripheral devices in automation systems. This strategy was developed to meet customer requests for difficult machining projects, and supply machined parts in short time periods at attractive prices while ensuring profits. "When we need something, we will create it whenever possible," said Mr. Beelen. "I have considered this concept since founding the company because it will allow us to realize automation speedily when needed." Based on this idea, the company has developed a number of unique devices, including pallet

stockers, tool magazines and workpiece cleaning devices. These peripheral devices are combined with Mazak machines to achieve efficient plant operation.



The pallet stoker developed in-house

### Unleashing the potential of Mazak Machines with in-house developed devices

Beelen Techniek has utilized Mazak machines since its founding over 20 years ago. He remained with the machine tool supplier: "I operated various brands of machine tools in my previous company, including Mazak. Through this experience, I found Mazak machines to be superior to other machine tools in terms of long-term accurate machining and ease-of-use." Today, all the Katwijk factory machines are from Mazak. "This has brought many advantages," said Mr. Beelen. "After they learn Mazak's MAZATROL programs, our operators can use several machines as they have the same basics, and these skills are transferable whenever we renew our equipment. We also like that there is single point of contact for high quality support, such as a quick supply of spare parts." VARIAXIS and HCN machining centers underpin the company's exceptional ability to process various materials and shapes. These Mazak machines are equipped with peripheral devices developed in-house to set up automation systems. For example, a pallet stoker (for 81 pallets) and a tool magazine (for 501 tools) developed in-house are mounted on VARIAXIS to enable long-time continuous machining. "Efficient peripheral devices are

► Parts machined by Beelen Techniek support various industries including the aerospace, medical and food manufacturing

## Customer Report 04

 Netherlands Beelen Techniek B.V.

needed to make maximum use of the Mazak machines, which are assets for us," explained Mr. Beelen. The combination of Mazak machines and our peripheral devices allows us to machine high-quality parts and supply them in a short period at good price." The tool magazine developed by Beelen Techniek won the Rabobank Innovation Award, a prestigious prize in the Netherlands. The device was honored for its novel design and high versatility, further demonstrating Beelen Techniek's pioneering work in the metal machining industry.



Employees of Beelen Techniek

### Building a production system that can follow changes in the market situation

Mr. Beelen has identified building a production system that can adapt to changing market situations as key to further growth. "It is important to be sensitive to changes in customer demand," he explains. "To follow such changes, we need to look for continuous ways to improve the company." To build a production system that can flexibility response to demand changes, Beelen Techniek is also considering strengthening its production management with IoT technologies, alongside its automation system. "We are not afraid of being pioneers and are always enthusiastic about innovation, but we still have a long way to go to reach our goal," said Mr. Beelen. Its aggressive efforts designing and developing devices, the introduction of IoT, and its machining capabilities, will enable the company to remain one step ahead of its competitors.



# MAZAK PEOPLE

YMUK Production Planning Office

 **Mr. Wayne Henley**

## Support Mazak's competitiveness through production control solutions

Yamazaki Mazak operates many bases in Japan and other countries for various functions such as production, sales and before and after-sales service and support. MAZAK PEOPLE introduces employees who are active at the forefront of the Group companies. This issue features Mr. Wayne Henley, who is Production Structure Engineer at YMUK Production Planning Office. Working actively as a specialist in production control with extensive experience of machine tools, Mr. Henley also provides training for young employees.

### PROFILE >> Mr. Wayne Henley

Mr. Henley joined the company in 1988. Having been engaged in casting paint and assembly for 10 years, he has been engaged in Production Control Dept. since 1999. He is now working actively as Senior Production Structure Engineer of YMUK Production Planning Office.

#### — What duties have you experienced so far?

My first assignment was at Casting Paint Dept., casting pre-painting preparation, which involved applying protection (masking) to high-accuracy machine faces prior to spraying. Then I was transferred to Assembly Dept. to fully assemble the accurate parts on CNC lathes and machining centers. At that time, I learnt the Japanese technique of hip scraping which involves removing material from cast surfaces to achieve a tolerance within one micron for critical components, I also visited in Japan to research the assembly line in order to train UK staff. After moving to my current department in 1999, though I left Mazak for a while to support my wife, I have worked in Production Control for 20 years.

#### — What is your immediate job duty?

I create and maintain manufacturing bills of materials (mBOM). The mBOM is a system used to display parts and process order information required in production, and is used to arrange parts and give production instructions to the shop floor.

In order to create machines that meet everything from standard specifications to special customer requests, a complete and accurate mBOM is essential.

As the senior engineer on my team, I am responsible for all aspects of the team: creating and managing various mBOMs that ensure precise resulting, and training young employees.

#### — What have you learned from your experience at Mazak?

I have always genuinely felt that anything is possible within Mazak as long as you work hard and apply yourself fully. In fact, I started my career in Casting Paint Dept., then moved on to Assembly Dept., being able to teach accurate assembly. I have now developed new skills in engineering and software development, and play a key role in the company's Production Control. I take great pride in how I have advanced in my time at Mazak and would like to continue to take advantage of favorable environment to take on new challenges in the future.



Participated in start-up of production of CV5-500, the latest UK made 5-axis vertical machining center

#### — What is your immediate job goal?

On behalf of Production Control, I am working alongside other teams in order to develop and configure the new systems which integrate all database from design to production and maintenance. This will speed up order-to-build time considerably, which I am sure will be of huge competitiveness to Mazak. Though it will require considerable effort to get all our models migrated over, I am eager to accomplish this important project with my colleagues.

"In order to do a good job, it is important to encourage employee's progression, and the whole workforce's sense of comradery." Mr. Henley said. His hard work and dedication to the job are good stimulus for young employees to become more ambitious and motivated.

### How he spends his days off

Most of my weekend is spent either painting or with my family. I started drawing and painting when my first grandchild was born in 2016. I wanted to mark the occasion by doing something special. I try my hand at subjects that are dear to my heart including Formula One – my passion. I owe great deal to Mazak, so I created a drawing of successive Mazak presidents and presented it to Mazak HQ. I am now creating portrait of my two dear grandchildren.



▲ A portrait of successive Mazak presidents presented to Mazak HQ

▼ Enjoy both pencil drawing and color drawing

## News & Topics Introduction of products

### Enabling high-power machining and 5 face machining of large-sized workpieces



FJW-100/160 is a double-column vertical machining center suitable for large-sized workpieces that require 5 face machining such as parts used in semiconductor production equipment and other industrial machines.

Equipped with a 6000 rpm high torque 828 N·m (611 ft·lbs) spindle, the machining center can handle the heavy-duty cutting of steel, cast iron, etc. In addition to the high rigidity double-column structure, powerful machining can be performed by utilizing slide ways on Y-axis and

Z-axis with high rigidity and minimized vibration. Column height 1.65m (64.96") is realized with simultaneous operation of high rigidity ram and cross rail lift, enabling high-precision and high-efficiency machining of thin or thick large-sized workpieces. A wide variety of functions such as multipoint ATC, which reduces ATC time by non-W-axis positioning requirements, and convenient conversational program for 5 face machining are available to improve productivity of large-sized workpieces.



Column height: 1.65m (64.96")  
Width between columns: 2.65m (104.33")

#### Powerful machining

##### Top face machining

Material C50 (S50C)	840 CC/min	735 CC/min
Tool	Φ200mm (Φ7.87") Face mill (10 teeth)	Φ160 mm (Φ6.3") Face mill (8 teeth)
Cutting speed	189 m/min (620 SFM)	220 m/min (722 SFM)
D.O.C. × Cutting width	5 mm × 160 mm (0.2" × 6.3")	5 mm × 120 mm (0.2" × 4.72")
Feedrate	1053 mm/min (41 IPM)	1225 mm/min (48 IPM)
Z-axis extension	800 mm (31.5")	800 mm (31.5")

##### Side surface machining

Material C50 (S50C)	763 CC/min	603 CC/min
Tool	Φ200mm (Φ7.87") Face mill (10 teeth)	Φ160 mm (Φ6.3") Face mill (8 teeth)
Cutting speed	189 m/min (620 SFM)	220 m/min (722 SFM)
D.O.C. × Cutting width	5 mm × 145 mm (0.2" × 5.71")	4.1 mm × 120 mm (0.16" × 4.72")
Feedrate	1053 mm/min (41 IPM)	1225 mm/min (48 IPM)
Z-axis extension	800 mm (31.5")	800 mm (31.5")

The Yamazaki Mazak Museum of Art was opened in April 2010 in Aoi Higashi-ku, the heart of Nagoya in order to contribute to the creation of a rich regional community through art appreciation and, consequently, to the beauty and culture of Japan and the world. The museum possesses and exhibits paintings showing the course of 300 years of French art spanning from the 18th to the 20th centuries collected by museum founder and first museum director Teruyuki Yamazaki (1928 - 2011), as well as Art Nouveau glasswork, furniture, and more. We look forward to seeing you at the museum.

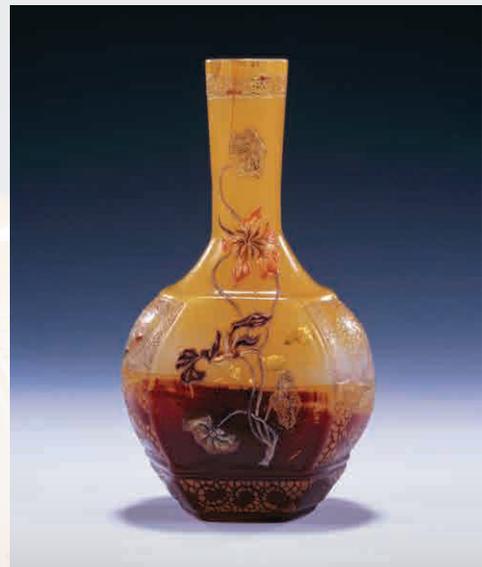


Collection Showcase 1

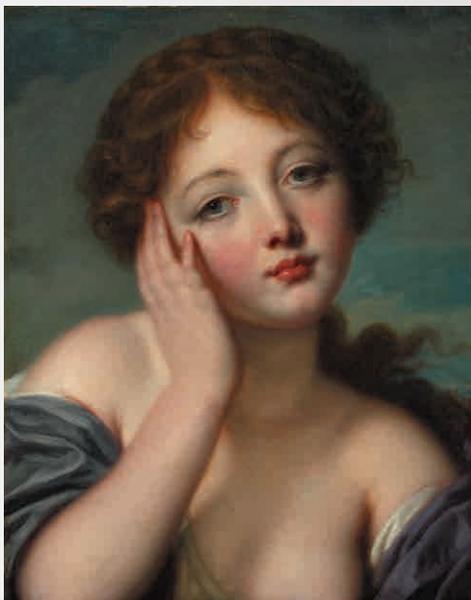
THE YAMAZAKI MAZAK MUSEUM OF ART

## GALLÉ, Émile “Etched and enameled vase with nasturtium design”

A mold-blown hexagonal vase, constructed of four layers of cased glass, white, red, yellow, and clear. Precious-metal foil is sandwiched between the layers of glass for a luxurious effect. The surface of the glass is shallowly etched in an encircling arabesque net. A nasturtium motif is depicted on the front and a type of tall grass on the back in thick enamel colors.



GALLÉ, Émile [1846-1904]  
“Etched and enameled vase with nasturtium design”  
c.1895



GREUZE, Jean-Baptiste [1725-1805]  
“Head of a Young Girl”  
Date unknown Oil on canvas

Collection Showcase 2

THE YAMAZAKI MAZAK MUSEUM OF ART

## GREUZE, Jean-Baptiste “Head of a Young Girl”



[fig.1]

Greuze's genre pictures were extremely popular in France from the 1760s to approximately 1780. With the emergence of Neo-Classicism in the 1780s, history painting made a comeback. He reacted by turning his energy to single figures or heads of young girls, as exemplified by this work. His production of these pictures especially flourished in the 1780s and he continued to do them in his later years. In an effort to appeal to the growing taste for antiquity, he painted numerous portraits of young girls with sweet, dreamy expressions in Greek hairdos and old-fashioned clothing.

A composition similar to this one is seen in *Young Woman leaning on her Hand* [fig.1] in the Wallace collection, dated in 1750-1799.