

MECHATRO+ [PLUS]

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Development Story

GX-F Series

2D Fiber Laser Processing Machines

Solution Case Study / Interview

Tryan Corporation

Kondo-Kouzai Co., Ltd.

Kansai Hoden Kogyo Co., Ltd. (KHK)

Houden Engineering Co., Ltd.

NS TOOL CO., LTD.

Hoei Iron Works Co., Ltd.



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Cover photo : Makati (Philippines)

Makati is a city located in the southeast region of metropolitan Manila, the area known as the National Capital Region. It is the center of the Philippines' economic and information activities. Among the many buildings in its skyline, Makati is home to the PBCom Tower (259m tall, with 52 stories above ground), which is the Philippines' most recognizable high-rise building. This photo shows a view of the city's subcenter, also known as "the Wall Street of the Philippines" from the neighboring high-class residential area.

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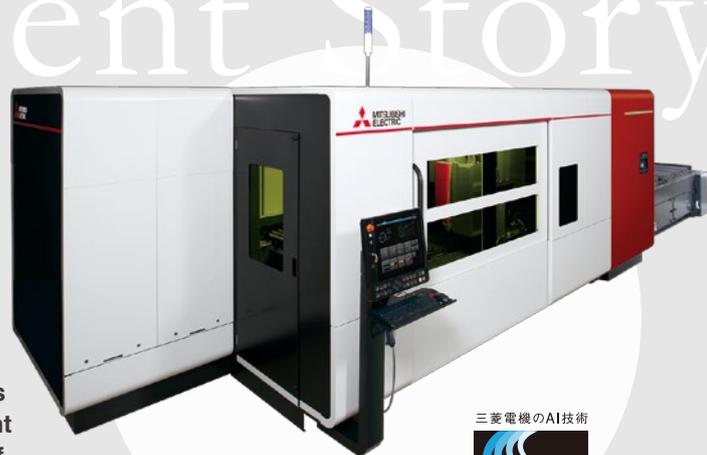
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2D Fiber Laser Processing Machines

GX-F Series

The new GX-F Series 2D fiber laser processing machines released in April 2019 have been exhaustively redesigned as special-purpose EDMs in the pursuit of high speed, excellent reliability and lower operating cost. Having an abundance of new functions, these models powerfully contribute to increasing users' productivity.



Based on the key concept of “non-stop processing machines” and the development motto of “All Mitsubishi Electric”

The world of laser processing machines is transitioning to fiber lasers. Since the era of carbon-dioxide gas (CO₂) lasers, the former mainstream method, we have adhered to the philosophy of “All Mitsubishi Electric”. In this respect, the models in the GX-F Series are fiber laser processing machines that symbolize a major step forward for Mitsubishi Electric.

The previous series, eX-F, was developed based on the eX Series of CO₂ laser processing machines, and unlike the new special-purpose fiber laser processing machines, was therefore not rebuilt from the ground up. Takeshi Kitagawa, head of the GX-F Series development project and member of the Laser Processing Machine Design Section, Laser Systems Department, commented that this time the new series was designed from the drawing board in terms of both structure and functions, in order to develop a special-purpose fiber laser platform. To increase speed, enhance reliability, and lower the running cost fiber laser processing, the company took an “All Mitsubishi Electric” approach in the development and design phases.

Users expect laser processing machines to achieve better productivity through continuous operation. With “non-stop processing machine” as the key concept, the specifications for the new series were decided and development work completed accordingly.

The formal decision to begin development of the new series as a successor to the eX-F Series was made in 2017. The three elements incorporated in this project in order to realize a “non-stop processing machine” were Mitsubishi Electric’s new fiber laser oscillator,

AGR-eco, and AI assist.

Since joining Mitsubishi Electric in 2005, Kitagawa has worked consistently on designing the mechanical components of laser processing machines. Naturally he was involved in the design of the predecessor series, eX-F Series, and was also involved in designing CO₂ lasers. With Kitagawa in a central role, a team was formed from members of the Laser Processing Machine Design Section, No. 1 Development Section, Laser Applications Technology Section

In fact, there had been one piece missing from the fiber laser processing machines developed based on the CO₂ laser machines manufactured to date that prevented us from being able to label them “All Mitsubishi Electric”. While our CO₂ lasers had incorporated Mitsubishi Electric-made oscillators, the fiber laser oscillators were made by another manufacturer.

In order to find that missing piece, Hiroaki Kurokawa, who worked in the No. 1 Development Section with Kitagawa, and was in his 10th year with Mitsubishi Electric, proceeded with the development of a new Mitsubishi Electric-made fiber laser oscillator in 2016, immediately after the release of eX-F Series. While having used the other company’s oscillator to date, Kurokawa identified the areas requiring improvement in order to help increase user productivity, and incorporated these in product development.

Kurokawa commented, “There are difficulties in terms of service when we use oscillators made by other manufacturers on the machines. When a problem occurs, we had to rely on the oscillator

manufacturer for support to a certain extent, and that meant it would take time to find a solution. Additionally, when processing copper, which is a reflective material, the laser beam returns to the oscillator, and can damage internal components. So, we had to put constraints on the user, asking them not to process materials not covered under warranty by the oscillator manufacturer.” Against this backdrop, by replacing the conventional fiber laser oscillator with a Mitsubishi Electric-made oscillator having our quality standards and adding a function to block laser beam reflection, the processing of copper is now also possible. Kurokawa spoke confidently, “Now we are in charge of the oscillator, so we can flexibly respond to customers’ requests and support expanding their work scope.”

The second of the three elements is the new function, “AGR-eco.” Takanori Miyazaki, with Mitsubishi Electric since 2006 and in the same Processing Technology Section, has experience in developing machining technologies for the eX-F Series and CO₂ laser processing machines. Miyazaki lead development of the AGR-eco for the GX-F Series. AGR is an abbreviation for “Advanced Gas Reduction,” and is a function to effectively reduce nitrogen gas consumption.

Miyazaki commented, “The fact that fiber laser processing uses nitrogen gas to enable high-speed processing is a major advantage. However, no matter how fast a machine processes parts, it won’t be beneficial to our customers’ productivity if it means increasing running cost. I’ve actually heard from some sources that they are hesitant to purchase fiber laser processing machines due to the increase



Takeshi Kitagawa

Manager
Laser Processing Machine Design Section
Laser Systems Department
Nagoya Works, Mitsubishi Electric Corporation



Hiroaki Kurokawa

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Terufumi Fukuoka

Manager
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Laser Systems Department
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Automatic replacement of a defective nozzle. Accommodating up to 21 nozzles, this technology supports prolonged continuous processing.

Mitsubishi Electric Maisart AI Technology Supports Phases Monitored by the Five Human Senses

in cost associated. AGR-eco achieves a low running cost through processing condition development that leverages the high-quality beam, oscillator control, independent gas flow control, and Mitsubishi Electric's original zoom head. Now that the oscillator is also made in-house, we can control it as we please, and that is producing good results."

Other company's laser processing machines perform processing with the nozzle firmly adhered to the workpiece and incorporate a configuration to reduce nitrogen gas consumption. However, that configuration results in the workpiece being damaged by the nozzle. Another potential issue is rapid wear of the nozzle, thus resulting in a higher replacement frequency. Meanwhile, as Miyazaki attested, "We liaised with the Advanced Technology R&D Center to simulate gas flow and test a newly designed nozzle configuration," which resulted in the GX-F Series having up to 90% less gas consumption per unit of time compared to conventional CO₂ laser processing machines. Even compared to the eX-F Series, a reduction of 76% was accomplished. Moreover, through innovative thinking regarding the nozzle, cutting face quality has been enhanced.

The third and final element was introducing a new AI assist function. Terufumi Fukuoka, who works with Kitagawa in the Laser Processing Machine Design Section, said, "This model is the world's first laser processing machine capable of automatically adjusting processing conditions using AI. A significant portion of laser processing still relies on human intuition. That's because,

in a lot of cases, an operator must stand in front of the machine and monitor changes in light and sound to judge whether processing is going smoothly or if a problem is occurring. When we considered whether or not we could replace that portion with AI, we were motivated to develop an AI assist."

If there is still a phase where processing work must be monitored using a human's five senses, the operator must be present the entire time the machine is in operation. If processing is around-the-clock, this means user companies would have a heavier burden in terms of human resources. If it were possible to automatically adjust processing conditions by sensing light and sound conditions during operation, and determining the quality of processing using "Maisart," a Mitsubishi Electric AI technology, it would be another step closer to a "non-stop processing machine" through AI assist. However, collecting data in response to various machining conditions was still not an easy task. The development team repeated processing under a variety of conditions to see a workpiece's final results when a particular sound was heard, etc., and gathered information with the help of the Advanced Technology R&D Center to facilitate AI learning and improve the technology.

Fukuoka, who joined Mitsubishi Electric in 2006 at the same time as Miyazaki, has been involved with oscillator control and other technologies in the Laser Manufacturing Department and affiliated with the Advanced Technology R&D Center since he entered the company. He claimed that the data learning process applied this time made a significant contribution to the capabilities of his former workplace.

Following basic research, full-scale data collection began in June 2018. From then until immediately prior to release in April 2019, Fukuoka constantly collected data on a truly diverse range of light and sound conditions. He commented, "There's still a long way to go before we can say it is perfect, but by making improvements in the AI, it is getting smarter and smarter. I believe, in this development phase, we were able to lay the foundation for a framework enabling various functions to be achieved with AI in the future. The aim of ultimately creating a "non-stop processing machine" is to be able to continue work by handling any issue that arises in processing conditions without having to

stop the machine."

In addition to this assist function, the GX-F Series is equipped with a function to determine the nozzle condition via AI, and if deemed necessary, automatically replace the nozzle using the nozzle changer. The nozzle changer itself was also provided on eX-F Series; however, this time the number of slots for nozzle replacement have been increased from five to nine, making it possible to hold up to 21 nozzles. This function facilitates higher productivity for users by automating nozzle replacement work.

The appeal points of the GX-F Series go beyond the abovementioned three elements. Through pursuing high-speed processing with a processing machine as the basis, the development team reviewed structural rigidity from CAE analysis results and devised a design that suppresses vibration to the maximum possible extent.

As Kitagawa revealed with his statement, "It didn't really go as we'd hoped," the team had to repeat the cycle of building prototypes, performing verifications, and feeding the results back into development. A total of three processing machine main unit prototypes were built, with the first being completed at the end of 2017, and then finetuned for completion through repeated verification and improvement.

The GX-F Series was released in April 2019. By introducing an oscillator developed in-house, this machine has truly become "All Mitsubishi Electric," and the oscillator warranty period has been extended from the conventional three years to five years when the machine is used in Japan. This strongly supports higher user productivity in terms of the warranty aspect, too.

Kitagawa commented, "It's hard to be highly evaluated by customers even if we push the quality aspect. But, by actually using the product, they gain real appreciation for the reliability of Mitsubishi Electric processing machines and the company's high-quality service. In that sense, I think the notion that 'Mitsubishi Electric equals quality' has firmly taken root amongst our customers."

All four members of the development team shared the sentiment that they wished to muster the strength of "All Mitsubishi Electric" while sincerely listening to users' voices requesting that the company create and provide products of even higher quality.



New Mitsubishi Electric-made fiber laser oscillator achieves both high reliability and productivity. With a mechanism to isolate laser beam reflection, this device makes it possible to process copper, which was not possible using conventional models.



TRYAN
CORPORATION

Tryan Corporation

Long-standing company founded in the mid-Edo Era transforms from steel plate materials to parts sales after installing a fiber laser processing machine



Tryan Corporation's roots is a hardware store founded in the mid-Edo Era to Meiwa Era (1764 – 1772). Currently, the company engages in the four businesses of civil engineering, construction, steel materials, and the environment. Regarding the steel materials business, Tryan Corporation installed its first laser processing machine in 2018 and began sale of parts made from processed steel plate for the first time.

Tryan Corporation began as a hardware store in Japan's Meiwa Era (1764-1772). Its founder, Hisaemon Nabeya, set up shop in front of Zenkoji Temple, Nagano Prefecture. Since then, the company has lasted for approximately 250 years. As times changed, it survived by finding various new businesses related to iron.

After entering the Meiji Era (circa 1868), the company name changed to Nabehisa Copper & Steel Store, and it began dealing with steel materials and tools in addition to hardware. At the beginning of the Showa Era (circa 1926), the business field changed once again by adding a welding category dealing in welding equipment, oxygen gas, etc., as well as taking on subcontracting work related to rebar/reinforced concrete and an engineering category for fabrication of hardware used in construction.

In line with its expanding business scope, the company incorporated in 1928, and then built and relocated to a new building and warehouse in Midori-cho, Nagano in 1963. In 1964, due to expansion of the steel materials and engineering categories, the company built a warehouse and workplace in Wakasato, Nagano. After

changing the company name to Nabehisa Co., Ltd. in 1967, it built a new factory for design, fabrication, and installation of steel structures in the Matsuoka District of Nagano in 1970. Then, in 1992, with the aim of a fresh start anticipating the 21st century, the company divided up its assets and business divisions, and newly established Tryan Corporation. The majority of businesses were migrated from Nabehisa.

Currently, Tryan operates the four business divisions of civil engineering, which involves the construction of bridges, roads, etc.; building construction focused on rebar and reinforced concrete work; a steel materials division for the wholesale of shaped steel, steel plate, pipe, etc.; and an environment division dealing with exhaust gas analysis devices, etc. As the ninth CEO and president of Nabehisa and Tryan, Mikio Matsuhashi emphasizes, "Our corporate philosophy at the time was 'eternally create business.' In other words, amidst changes over time, broaden our businesses and products, and meet the various requests of customers. We will continue this challenge moving forward also."

Installing fiber laser processing machines and broadening the steel materials business

In 2018, the company's steel materials business division rose to a new challenge. For the first time, it installed a Mitsubishi Electric ML3015eX-F60 6kW fiber laser processing machine in its Saku Processing Center located in Komoro-shi, Nagano Prefecture. This move was triggered when President Matsuhashi told Yoshio Shimohira, General Manager of Metal Sales Dept./Process Center Chief, and Hideyuki Sakatsume, Section Manager of the Planning & Development Section, Metal Sales Dept. to think about what the company should do in order to hold its position in the steel materials business over the next 20 years.

President Matsuhashi explains the reason for this, "Both of these employees are in their 40s. I believe that by the time it applies to them, the retirement age will be 70. In order to maintain our steel wholesale business until then, we are going to need to develop new business."



ML3015eX-F60 – Mitsubishi Electric 6kW fiber laser processing machine introduced in 2018. Equipped with both a 15-step pallet changer and 6-step sheet changer, this machine is capable of automatic operation, even at night.



Tryan operates two ML3015eX-F60 machines. The fiber laser processing machine on the left is equipped with a 6-set sheet changer.

Faced with their task, Shimohira and Sakatsume conducted repeated studies before arriving at the following conclusion. Shimohira recalls, “We presented a proposal to President Matsubashi about, rather than just selling steel plate as is, introducing laser processing machines and shifting to an approach of selling processed steel.”

Tryan Corporation established the Saku Processing Center in the late 1980s. Until then, for many years, the company’s steel materials wholesale business had focused on storing shaped steel, steel plate, pipe, etc., and delivering these ‘as is’ to customers.

Tomoaki Takeuchi, Executive Managing Director overseeing the steel materials business division reflects, “The main customers of Tryan’s steel materials wholesale business are manufacturers of farming and construction equipment, and manufacturers of various industrial machine parts. Back then, customers cut the steel materials we delivered themselves, and then assembled it to manufacture machines and parts. However, from our customers’ viewpoint, steel cutting had low added value. That’s why we decided it would be more convenient for our customers if Tryan first cut the steel and then delivered it. As such, we went from being a materials dealer, to a parts dealer, and changed our approach to selling products with greater added-value.”

To this end, the company introduced a handsaw to cut shaped steel, pipes, and rods at its Saku Processing Center. This directional shift led to business growth, and later the Nagano

Processing Center was newly built in Nagano-shi. However, the company was still only selling shaped steel, pipes, and rods as parts. Steel sheet without a processing machine continued to be sold in fixed sizes as it had always been.

However, Takeuchi reveals, “From around 10 years prior to that, customers had been asking us to deliver cut/processed products and steel sheet cut product as a set.” Equipment and parts manufacturers require a high machining accuracy of 0.5mm, not to mention a variety of shapes. Therefore, such needs could not be met with melting. As such, orders requiring processing had to be outsourced to a job shop outside of Nagano Prefecture that owned a laser processing machine.

Steel materials wholesalers must adhere to tight turnarounds. In the majority of cases, orders are placed for steel materials in storage in the morning and have to be delivered by the afternoon. Steel sheet requiring laser processing could not be delivered by the same deadline. Therefore, as Shimohira shares, “We felt there was a difficulty in promoting our company. That’s why we made a presentation to President Matsubashi regarding the installation of a laser processing machine.”

President Matsubashi agreed immediately, installing the company’s first ML3015eX-F60 in June 2018 and

the second in July the same year. “This meant we had shifted from a materials dealer to a parts dealer strategy in regards to steel sheet too,” explains President Matsubashi.

Of course, none of the employees had experience using a laser processing machine. Takeuchi shares, “We were anxious, but thought it would be okay if we acquired processing know-how while consulting with Mitsubishi Electric. We hardened our resolve thinking that we simply had to do it, and that was that.”

Sakatsume expressed caution by saying, “It started when we sent our young employees to Mitsubishi Electric training. I had assumed it would be challenging at first, but it got off to a better start than I’d imagined. However, different customers expect different machining accuracy, and there are a lot of things we still can’t respond to perfectly. We will enter a crucial period from here on.”

Adopting an automation system with consideration to work-style reform

Both of the ML3015eX-F60 units are equipped with automation systems. One has a 15-step pallet changer, while the other has a 6-step sheet changer. President Matsubashi explains the reason for this as being, “To secure personnel, we must advance work-style reform. In light of this, we introduced automation systems to our line from the outset to enable unmanned operation at night.”

Takeuchi steels his resolve, saying “Compared to the quantity of orders, the fact is that we still have room to grow in so far as production capability. However, we don’t intend to sell products cheap just to secure quantity. We will respond to our customers’ requests, acquire more processing know-how, increase added value, and expand our steel sheet parts sales in order to advance our steel materials wholesale business.”



Saku Processing Center in Komoro-shi, Nagano Prefecture has two fiber laser processing machines in operation.



The operators of the fiber laser processing machines at Saku Processing Center. Until these machines were installed in 2018, no one had experience with laser processing machines, but made a smooth start with the attitude of, “It just has to be done.”



Tryan Corporation



I believe laser processing machines are essential to securing personnel moving forward

◀ Mikio Matsuhashi CEO & President

Profile

1961 Born in Nagano Prefecture
1988 Joined Nabehisa Co., Ltd.
1992 Appointed Senior Managing Director in line with formation of Tryan Corporation
1999 Appointed CEO & President

— **Tryan Corporation is an extremely long-established company with over 250 years of history, isn't it?**

Matsuhashi : I suppose the fact that we dealt in iron was extremely fortunate for us. Even as times changed, the demand for iron never dwindled. On the contrary, in line with the advancement of Japan's industry, the amount of iron in use actually increased.

Tryan Corporation has meticulously focused on businesses dealing with iron and expanded into various fields. I think that's the reason our business has lasted such a long time.

— **What meaning does the company name of "Tryan" hold?**

Matsuhashi : Actually, it is a coined word. To express the fact that we deal with iron and our corporate policy of constantly challenging ourselves, we combined the words "Try" and "Iron."

— **Please tell us your company's strengths.**

Matsuhashi : I believe that would be the fact we have four business divisions (civil engineering, construction, steel materials, and environment), and a broad range of customers. Because we do business with customers in a variety of industries, our operations are not overly vulnerable to economic fluctuations.

Up until now, during recessions, civil engineering work increased due to the expansion of public works, and in the

reverse, during economic booms, companies invested higher amounts in equipment, which meant more orders for our construction and steel materials business. Recently we are witnessing a fall in the amount of public works; nevertheless, we are still not that easily affected by economic changes.

The unique feature of broadly spanning multiple business fields is extremely effective in terms of securing personnel also. Tryan Corporation is a company closely tied to the Nagano Prefecture community. Unlike companies in urban locations, it is not easy to replace employees that have retired with new employees. As such, companies do their best to assign the right people to the right role, and retain them as long as possible.

A variety of job types exist at Tryan Corporation. These range from general administration to sales, product management, drivers of large trucks for delivering steel materials, skilled workers performing welding, cutting, bending and other processing of steel materials in factories, skilled workers performing rebar/reinforced steel work at construction sites, and engineers overseeing civil engineering and construction projects. As such, if the company deems that an employee is not suited to a certain job or workplace, they can be reassigned to various other roles.

For example, the employee currently in charge of laser processing was initially assigned to the Construction

Management Division of the company's civil engineering business. However, after experiencing cost management in the Administration Division, he was transferred to the Saku Processing Center at the same time the laser processing machine was installed, doing so at his request. He attends to his current role with great zest and energy. Tryan Corporation can accommodate this kind of transfer due to its broad scope of business divisions and various job types.

If there was only one laser processing machine, a breakdown may mean delayed delivery

— **Why did you choose Mitsubishi Electric laser processing machines?**

Matsuhashi : In actual fact, Tryan Corporation sold Mitsubishi Electric laser processing machines around 30 years ago. We recommended laser processing machines to our customers. I, too, have experience in such sales activities as a young employee.

Because we have this history of selling Mitsubishi Electric laser processing machines, we believe they are very reliable. Some of our employees have even completed Mitsubishi Electric's training; therefore, we didn't even consider purchasing another company's laser processing machines.



ML3015eX-F60 6kW fiber laser processing machine processing a workpiece (left). In the center is a part manufactured by processing steel plate. Of the two laser processing machines introduced, one has a 15-step pallet changer capable of automatically loading/unloading steel plates into the machine (right).



From left: Yoshio Shimohira, General Manager of Metal Sales Dept./Process Center Chief; Hideyuki Sakatsume, Section Manager of the Planning & Development Section, Metal Sales Dept.; Daisuke Kobayashi sales representative of the Laser Device Section, Industrial Automation Marketing Department, Mitsubishi Electric

— **Why did you introduce two laser processing machines to your operations at around the same time?**

Matsuhashi : At first Shimohira (General Manager of Metal Sales Dept./Process Center Chief,) and Sakatsume (Section Manager of the Planning & Development Section, Metal Sales Dept.) only suggested one machine. But I said that simply would not do.

Although we trust Mitsubishi Electric laser processing machines, ultimately they are machines, and machines will breakdown; that's a given.

If we only installed and operated one machine, we may fall significantly behind delivery deadlines in the case of a machine breakdown. At that stage, there's no way we could outsource the work. So, despite the large investment cost, I made the decision to introduce two machines from the outset.

— **Is there a reason you installed the machines in 2018?**

Matsuhashi : One reason is that the fiber laser processing machine with a high output of 6kW was released into the market in 2016. The fiber laser processing machine has a low running cost and a long service life. With the launch of a high-output machine, it has become possible to also perform high-speed processing of medium- to high-thickness steel, therefore the cut surface looks much better.

Operations are also easier, and I thought it would be better for us to handle as our first laser processing machine. I'd sold Mitsubishi Electric laser processing machines for many years, so I had product knowledge to base this decision on.

Laser processing machines attract young people

— **How do you evaluate the benefits of adopting the ML3015eX-F60?**

Matsuhashi : Compared to when we outsourced laser processing work, we are now able to swiftly respond to processing orders. Furthermore, although we still have room for improvement, the number of orders for steel plate parts machined using lasers is increasing.

I also feel that laser processing machines are effective in securing human resources. Unlike iron processing shops using other machines, workplaces with laser processing machines don't produce machining chips or use cutting oil, so the environment is cleaner. Young people wouldn't feel compelled to join the company unless the workplace is clean.

Additionally, compared to when we sold steel plate as is, many of the processed parts are small and lightweight, so I think this makes the



Introduced CamMagic LA, Mitsubishi Electric's CAD/CAM software for 2D processing together with laser processing machines.

work easier for women and older employees. I believe this is a major advantage as, moving forward, we will enter an age where the availability of manpower will determine business options.

It seems that laser processing machines also have the ability to attract young people. Actually, at the same time as purchasing the laser processing machines, we also purchased CamMagic LA, Mitsubishi Electric's CAD/CAM software for 2D processing. When we recruited someone to be in charge of this software, we received an application from an engineer in charge of CAD/CAM at a certain major equipment manufacturer. Currently that engineer and several others use CAD/CAM with high efficiency.

— **Please tell us Tryan's overall goal moving forward.**

Matsuhashi : One of our corporate philosophies when Tryan was originally formed was, 'eternally create business.' However, to make this statement more accurate, we should add, "together with customers."

Looking back over the company's 250-year history, we have constantly risen to challenges hand-in-hand with local customers. We intend to continue this stance with sincerity toward our corporate philosophy.

Corporate Data

Tryan Corporation

Head Office

2-6-18 Matsuoka, Nagano-shi, Nagano Prefecture

Saku Processing Center

483-42 Sunahara, Wada, Komoro-shi, Nagano Prefecture, Japan

No. of employees

Approx. 140 employees (approx. 280 in Nabehisa Group overall)

Main businesses

Sales of steel, metal, pipe, welding equipment, and construction materials; design, fabrication and installation of steel structures; rebar/reinforced concrete work; civil engineering work

History

Meiwa Era (circa 1760)

Founder, Hisaemon Nabeya established a store in Nishigo-cho, Nagano-shi (in front of Zenkoji Temple)

Early Meiji Era

Store named "Nabehisa Copper & Iron Store" and primarily sells steel materials, tools, and hardware

Early Showa Era (circa 1926)

In addition to products related to welding, began engineering work

1928 Restructured as an incorporated company

1967 Changed company name to Nabehisa Co., Ltd.

1992 Established Tryan Corporation and transferred the majority of businesses from Nabehisa Co., Ltd.

1996 Relocated head office/main factory to current location



Kondo-Kouzai Co., Ltd.

Creating added-value through broad response, from steel-plate processing to assembly, starting with the sales of various steel materials

With its head office in Numazu-shi, Shizuoka Prefecture, Kondo-Kouzai Co., Ltd is a company comprehensively covering sales channels relating to iron, from the sales and processing of various steel materials to product assembly based on such materials. In 2018, the company completed a new cannery in Kanagawa Prefecture, and is promoting efforts to create added-value through laser processing.

Kondo-Kouzai's roots lie in the steel sales business founded in Numazu-shi, Shizuoka Prefecture in 1933. After the second president expanded the scope of the business, the company was the first to begin inventoried sales of H-shaped steel in Shizuoka Prefecture in 1966. In 1970, the company changed its name to Kondo-Kouzai. After that, it established factories in Numazu-shi and the Kondo region, and expanded its materials from general steel to steel framing and rebar for civil engineering and construction, began processing cut plate for canning in factories, and even branched out into assembly.

Chiaki Kondo, appointed third CEO and president in 2005, joined the company in 1989 after working for a steel trading company. After gaining field experience through two years of working in actual processing on the shop floor, Kondo held other roles, such as working in sales, before becoming president.

President Kondo reflected on his time in the field: "Initially, I was a complete novice myself at actual work on the shop floor, but gradually gained experience through the kind instructions received from of all my coworkers. I came to understand not only about iron, but also challenges in the processing field. Because of this experience, I am able to make statements my employees understand as a president, and I think they proactively listen to my proposals."

With such a president at its helm, the company has proactively formed a group of local businesses, and currently has a conglomerate of nine companies. Almost 90 years since its foundation, Kondo-Kouzai is still primarily located in Shizuoka Prefecture, where it has a strong presence in the processing, manufacturing, and sales of local steel products.

Inspired to introduce a fiber laser processing machine after visiting an acquaintance's factory

One of the nine group companies, Kondo-Sogyo Hiratsuka Factory (Hiratsuka-shi, Kanagawa Prefecture) was established based on a company that joined the group in 2010. It was positioned as a cannery within the group. The factory accurately cuts the steel plate it procures to suit customers' requests, and then sells it. The plate is used to manufacture holding tanks, ducts, and other factory facilities. By having a factory in Kanagawa Prefecture, a major aim of the company was to capture the strong demand from the Keihin Industrial Zone.

President Kondo touched on the significance of this factory: "We couldn't produce a profit if we simply sold steel plate. If we cut it and sell it however, we will receive income for the processing component. Then, if we manufacture final products such as holding tanks made out of the processed cut plate, etc., we can

increase added-value even more. The company that was the basis for the Hiratsuka Factory was originally a customer we sold steel plate to so they could manufacture holding tanks. By bringing it into our group, we added assembly to our list of services, which now covers a comprehensive scope, from upstream to downstream."

At the Hiratsuka Factory, a Mitsubishi Electric laser processing machine plays an active role in cutting steel plate. It was introduced to the factory in 2018. Even prior to that time, Mitsubishi Electric machines were being used at Numazu Shearing (Izunokuni-shi, Shizuoka Prefecture), a group factory dedicated to plate-cutting, and had a proven track record. Accordingly, Kondo-Kouzai deemed them highly reliable.

To begin with, there are many different ways to cut steel plate, such as gas cutting where the steel is heated by a gas before being cut. There is also plasma cutting, in which a plasma is produced and used to cut the material. The current processing method, laser processing using a laser to cut plate, was developed as an



By introducing the ML3015eX-F60 6kW fiber laser processing machine, both processing speed and productivity increased.



The fiber laser processing machines are equipped with a 15-step pallet changer. This makes efficient around-the-clock operation possible.

extension of the plasma method. In the past, there were many CO₂ laser processing machines; however, the mainstream now is fiber laser processing machines using laser light. Compared to conventional processing methods, laser processing machines are faster, increase productivity, and most notably of all, are highly supportive of automatic operation.

At the Hiratsuka Factory, there is one ML3015eX-F60 6kW fiber laser processing machine equipped with a 15-step pallet changer. Kondo-Kouzai also installed a Mitsubishi Electric fiber laser processing machine at Numazu Shearing two years before that one was delivered. The opportunity for this installation came when President Kondo toured the factory of another steel-related company that one of his acquaintances was in charge of.

President Kondo reflected, "I was very interested when I saw the row of Mitsubishi Electric laser processing machines in this factory's plate-cutting plant, not to mention being told that they operate automatically 24-hours-a-day, 365-days-a-year. At that time, we used another company's laser processing machines as we'd also used its gas-cutting machines. However, because that manufacturer was originally dedicated to gas cutting, it took time for repairs to be completed if a problem with one of the laser processing machines occurred. I heard that Mitsubishi Electric responded to problems on the same day it is contacted. So I used the monozukuri subsidy from our local bank to purchase our first-ever Mitsubishi Electric laser processing machine."

After seeing the first unit installed at Numazu Shearing, President Kondo commented, "I was surprised at how fast it was." This was around the time the new factory building was completed at Hiratsuka Factory and fabrication of cut steel plate had

begun. Therefore, it was decided that the same model would be installed at Hiratsuka Factory as well.

President Kondo explained the lead-up to this, saying "Initially, despite the specifications making it possible to cut plate up to 25mm thick, with the base material steel plate we used, we were only able to cut a thickness of up to around 19mm. This was because, in addition to our operators not being accustomed to the task of setting processing conditions, the materials making up the steel differed between manufacturers. We told Mitsubishi Electric that this was a problem for us, so they innovatively explored adjusting head accuracy and other ways to make the cutting of 25mm-thick plate possible."

Aiming to create new added-value through connectivity with 3D CAD data

Currently, the canning facility at Hiratsuka Factory houses two laser processing machines; the first made by Mitsubishi Electric, and the second made by another manufacturer. The latter is a CO₂ laser, and the two machines are used to cut different sizes of plate.

Incidentally, the non-Mitsubishi Electric machine does not support Internet connection or third-party

CAD/CAM. Kondo-Kouzai plans to send 3D CAD data for orders received online to its laser processing machine as is and perform automatic processing. On that note, Mitsubishi Electric machines not only support Internet connectivity, but also flexibly support third-party CAD software. Therefore, new added-value outpacing the value offered by competitor is created as the result of facilitating direct processing from 3D CAD data.

"During an economic boom, we would be fine simply selling our inventory. But in a weak economy, a company can't grow if it doesn't offer added value. If a recession resulted in the demand for iron dropping by 20%, that doesn't mean each company's sales will fall 20%. It means that 20 out of 100 companies would go bankrupt due to competing for the work available. If such a situation does come about, it would be too late if we didn't already have a secret weapon in our company. So, we want to enhance our added value through investment and business expansion now in order to strengthen our corporate constitution."

With this statement, President Kondo expressed his high expectations that Mitsubishi Electric will prove to be a powerful ally as an electronics manufacturer in achieving Kondo-Kouzai's future vision.



Sometimes the processing accuracy of steel materials may change due to the iron component. Kondo-Kouzai closely liaised with Mitsubishi Electric again and again until the desired accuracy was obtained.


Kondo-Kouzai Co., Ltd.


The ideal condition is a laser processing machine with an automated system that connects everything directly, from data to processing

◀ **Chiaki Kondo**
CEO & President

Profile

1959 Born in Tokyo
1989 Joined Kondo-Kouzai Co., Ltd
2005 Appointed CEO & President, still holds position

— **First, please tell us about how the company was formed and its history to date.**

Kondo : The first president, Yasutoshi Kondo, is the father of the former president, who is actually my father-in-law. In 1933, he began selling iron materials, iron pipe, tools, and bolts locally here in Numazu. In other words, it was a hardware store. I have heard that there was no capital at the time, so the company sold various odds and ends.

After the war, the former president took over and the company also began dealing in steel materials as he wanted to engage in more dynamic sales. In other words, we stretched out from being a hardware store to becoming an ironmonger. At that time, there was strong demand due to the post-war reconstruction, and any iron a company had in stock could easily be sold for constructing buildings and bridges. Japan's economy just kept getting stronger, and it was a boom that makes me envious to think about.

However, our company was an independently operated local wholesaler, and not a major steel manufacturer or subsidiary of a trading company. Accordingly, we were limited in the types of iron we could procure and sell. In addition, Shizuoka didn't have as great a demand as urban locations. So, with the attitude that we needed to do whatever we were capable of, beginning in the 1970s, we established affiliates and factories one

after the next, poured resources into mergers and acquisitions to form the Kondo Group, and expanded our businesses to general iron, rebar, steel frame, and canning.

— **What is the current flow of the overall iron industry?**

Kondo : Recently, China is indeed rising up. China's crude steel production volume has rapidly increased in the past ten years or so, and has already reached around ten times that of Japan's. China exports its surplus iron, so there is a surplus of iron all over the world. Meanwhile, the iron ore mined mainly in Australia is monopolized by major resource companies, and the price of iron ore has soared due to Chinese businesses buying high, which is putting a strain on major Japanese steel manufacturers.

Impressed by laser processing machines that operate automatically in a clean environment

— **Amidst such a situation, what was the company's reason for wanting to establish a cannery outside of Shizuoka, in Kanagawa Prefecture?**

Kondo : In the past, there were many factories in Kawasaki and Yokohama; the so-called Keihin Industrial Zone. However, due to factors such as the aging population, shortage of successors, conversion of commercial

properties to residential properties due to soaring land prices, the number of companies operating factories in that area fell notably. In this region, plants for pharmaceuticals, food products, and other industries are still going strong, and there is a stable demand for holding tanks. However, factories that make holding tanks had disappeared from the region.

With that background, Hiratsuka is close to the Keihin Industrial Zone. Kondo-Kouzai started out as an ironmonger, so even though we possess know-how on selling iron, we didn't have the know-how to make holding tanks. Even so, we thought we could secure business if we had a large factory, so decided to base ourselves in Hiratsuka.

Because we are on the outskirts of the city, the plot size is large, and we have enough space to easily do everything, from cutting steel plate to trial fitting of tanks. Blessed by various factors, such as geographical conditions and industrial trends, we have received more and more work, and our holding tank manufacturing business is finally on track.

— **Apparently you were inspired to install a Mitsubishi Electric laser processing machine after seeing one at your acquaintance's factory. Is that so?**

Kondo : The reason I introduced a Mitsubishi Electric laser processing machine to the Numazu Shearing factory in 2016 prior to introducing one



Hiratsuka Factory (covered in this article) is comprised of two canneries and one laser cutting building. The site produces holding tanks as well as other large-scale cans.



From left: Chiaki Kondo, CEO and president, and Tomoya Murao, sales manager from the Laser Marketing Section, Industrial Automation Machinery Marketing Division, Chubu Branch Office, Mitsubishi Electric Corporation

at Hiratsuka Factory was because I'd seen them in operation at a certain plate-cutting factory in Ogaki-shi, Gifu Prefecture. The president of the company that ran that factory was an acquaintance that I met while working at a steel trading company.

As soon as I walked into the factory, I saw six Mitsubishi Electric laser processing machines, all in a row. Not to mention that conventional plate-cutting factories not using laser processing machines are full of dust particles and always look hazy... But, with laser processing, that isn't the case. I was so impressed by how clean the factory was.

What I was shocked by the most was how steel plates of all thicknesses were stacked in piles and moving automatically. At that time, Kondo-Kouzai's factory was cutting and bending steel plate for a major customer that dealt in railway-related products, and demand was stable. So, we were content if we could cut three

plates weighing 10 tons each in a day. However, at the factory I visited, laser processing was being used to cut dozens of plates per day, and operating 24-hours-a-day, 365-days-a-year. Even when operators were taking a break, automatic operation continued merely by data being forwarded via the Internet. I thought to myself, "This is amazing," and immediately consulted with Mitsubishi Electric.

Attempting to attract the young generation through factories with state-of-the-art systems

— **It seems there were some problems after introducing the machine, but how was Mitsubishi Electric's response?**

Kondo : We raised some very difficult issues, such as condition setting, head accuracy adjustment, and the steel plate we used. But Mitsubishi Electric always responded with sincerity and found solutions, which increased our faith in the company. We are also satisfied with the maintenance support offered by Mitsubishi Electric.

— **Please tell us the company's future goals.**

Kondo : When I saw the plate-cutting factory I mentioned earlier, I envisioned our company's ideal state as being one with systematic factories connecting laser processing machines, CAD/CAM software, and the Internet all together. This is what we're currently working on to achieve.

Because we are an independent operation, we have the right to decide the sales price of our products. If we make it possible to process steel directly from 3D CAD models, I think we can create new added value. I would also like to attract the young generation to work at Kondo-Kouzai by being a company that utilizes advanced systems.

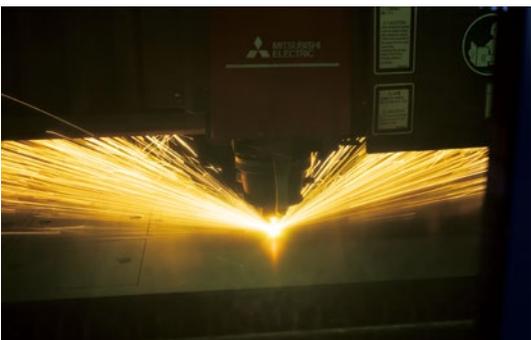
Corporate Data

Kondo-Kouzai Co., Ltd.

Head Office
2-2-16 Numakita-cho, Numazu-shi,
Shizuoka Prefecture, Japan

Main businesses
Sales of general steel materials and steel materials for civil engineering and construction industry, as well as the sales of processed steel materials

- History**
- 1953 Established Kondo Yasutoshi Shoten Ltd.
 - 1970 Reorganized to Kondo-Kouzai Co., Ltd. and changed company name
 - 1984 Established Kondo Roll Co., Ltd. and began full-scale precision bending of steel plate
 - 1996 Completely relocated Numazu Shearing K. K. to Izu Nagaoka-cho and began full-scale precision shearing of steel plate
 - 1998 Introduced a FB ring into the production line at the Hara Factory and began full-scale processing of rebar
 - 2007 Established Kondo-Kouzai Kako Co., Ltd. in Makinohara-shi and began full-scale processing of girders
 - 2017 Established Kondo Neji Nagabuse Factory in Mishima-shi, Shizuoka Prefecture
 - 2018 Fuji Factory obtained certification as a M-Grade certified factory and began processing steel frame. Completed new plant at Hiratsuka Factory and began manufacturing cut plate



Bringing nine companies together and continuing to leap forward under the company slogan, "Let's do our best by being clever and sincere."



Kansai Hoden Kogyo Co., Ltd. (KHK)

Turning over a new leaf by leveraging technological capabilities to offer everything from the manufacture of precision dies for home electrical appliances to the special processing of plant materials.

With its headquarters in East Osaka, Osaka Prefecture, Kansai Hoden Kogyo Co., Ltd. (Kansai Electrical-discharge Business) is, as the name suggests, a dedicated manufacturer of parts processed through electrical-discharge machining. In the past, KHK's primary focus was manufacturing precision dies for home electrical appliances; however, harnessing its advanced processing technologies, it turned over a new leaf as a job shop focused on special processing of parts for chemical plants, etc.

With approximately 6,000 factories, East Osaka is one of Japan's most well-known monozukuri regions. In a corner of this region, KHK has operated its business for a half-century, brandishing its sophisticated electrical-discharge machining technologies.

The company was established in 1970 when the current CEO & President, Akiyuki Takahashi, set up business in the locality as an electrical-discharge machining specialist.

Until that time, President Takahashi had worked for an electrical-discharge machine (EDM) manufacturer and constantly visited customer companies as a sales engineer. It was still what can be considered the dawn of EDMs, and President Takahashi frequently visited university research laboratories to deepen his knowledge and skills relating to electrical-discharge machining.

President Takahashi reveals his background to independence, "Back then, users didn't have much experience with this field either, and I felt most companies couldn't use EDMs well. So, I thought I'd start a processing company and maximize the performance of EDMs myself."

Immediately following its establishment, KHK's main business was manufacturing precision dies for parts of home electric appliances, etc. At first the primary focus was on dies for radio cassette player components, but in the 1990s, the company installed a large die-sinking EDM and shifted its main focus to dies for the cathode ray tubes of large television sets (30in or more), as well as large precision dies for bumper bars and other automotive parts. President Takahashi reflects, "At the time, specifications for cathode ray tubes differed depending on if they were for Europe or the USA, so we had to change the design frequently. In

the case of a certain major home electric appliance manufacturer, we built such an intimate relationship that KHK's engineers were elbow-to-elbow in its Television Design Section and kept extremely busy."

EDMs can take on the role of many different machines depending on how they are used

However, in the 1990s, flat-screen TVs such as plasma and LCD began to emerge on the market and the demand for cathode ray tube die manufacturing started to dwindle. There was a rapid shift to overseas production by home electric appliance manufacturers, and President Takahashi made the decision to withdraw from the manufacturing of precision dies.

He commented, "At the time, we sometimes received orders for special processing of parts used in chemical plants and nuclear power plants, etc. That motivated me to make the bold decision of switching direction to the special processing business."

For example, even when an attempt is made to smoothly bend the channels made for delivering liquids and gases used in plants, it is not possible to drill holes that enable difficult-to-machine materials, such as high-wear-resistant cemented carbide alloy, to turn smoothly if regular machining methods are used. However, if electrical-discharge machining is used, it is possible to drill a circular hole in the interior of the difficult-to-machine material and form the channels needed. If the shape is smooth, the flow will also be smooth. Thus, decreasing the amount of foreign



EA40M – Mitsubishi Electric die-sinking EDM introduced to KHK operations in January 2019. It is equipped with an extra-large processing chamber measuring 2200×1500mm.



Processing shop for large workpieces. There is a long row of large Mitsubishi Electric EDMs.



Since establishment, this building was used as a processing shop for small- and medium-sized workpieces.

substances adhered to the product increased durability.

Moreover, in the case of parts requiring tempering, if a regular machining method is used, tempering must be done after processing, and this causes the material to contract. However, if electrical-discharge machining is used, the part can be tempered first, enabling the manufacture of high-accuracy parts. KHK had a number of large EDMs with processing chambers exceeding 1,000mm in order to process dies for large cathode ray tubes, so it could accommodate orders for this kind of special processing of plant parts.

Naturally, high technological capability is required to support such special processing. In that respect, President Takahashi was confident of the KHK technological capability cultivated since its establishment. He had anticipated that, “EDMs can take on the role of many different machines depending on how they are used. I felt we wouldn’t have to compete on price if we leveraged our technological capability and dedicated ourselves to special processing that our rivals couldn’t mimic.”

President Takahashi’s prediction hit the mark. Now KHK has transformed into a job shop handling orders not only from local customers, but also the Kyushu and Kanto regions. President Takahashi emphasizes, “We don’t engage in sales activities whatsoever. Even still, we have a steady flow of orders.”

Recently, the company is receiving an increasing volume of orders from

new customers due to the recognition of its advanced technological capabilities enabling high-accuracy processing.

In the quality control of metal products, etc., there is a need to inspect the existence of scratches immediately after manufacturing using a flaw detector. Additionally, in order to confirm a flaw detector is operating properly, there is a need to perform regular checks using a gauge that has intentionally been scratched.

This means that extremely accurate scratches must be processed into gauges made from a high-hardness, highly durable material. The required processing accuracy is approximately 10µm. It was deemed that KHK was capable of responding to this need with its advanced electrical-discharge machining. Aside from this, KHK technologies are also used to make the parts of equipment used in shale gas excavation.

KHK’s level of satisfaction in Mitsubishi Electric EDMs is over 95% across the board

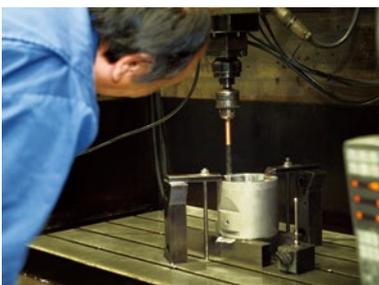
For around five years after KHK’s establishment, the company used an in-house die-sinking EDM developed based on President Takahashi’s experience gained through his former occupation. However, in line with business expansion, KHK decided to purchase commercially sold processing machines. It installed a die-sinking EDM made by Mitsubishi Electric. From that day forth, it has

exclusively used Mitsubishi Electric EDMs for more than four decades. To date, KHK has installed close to 60 EDMs.

President Takahashi asserts, “It was a long time ago, so I don’t clearly remember why we made that initial decision to purchase a Mitsubishi Electric EDM. But the reason why we’ve kept using them exclusively is because we are extremely satisfied with them across the board, including their processing accuracy, functionality, and user-friendliness. Our level of satisfaction is over 95%.”

In particular, KHK highly regards Mitsubishi Electric’s after-sales service. “For a job shop such as us, faithfully observing deadlines is crucial. However, it is a given that problems will sometimes arise on machinery. When these problems do occur, Mitsubishi Electric always responds with such swiftness. That is what I am most grateful for.”

Currently, there are around 20 die-sinking EDMs and wire-cut EDMs used for electrode manufacturing. The latest processing machine is the EA40M, a die-sinking EDM introduced in January 2019 equipped with an extra-large processing chamber measuring 2200×1500mm. President Takahashi expresses his expectations for this machine’s future role, “Currently, customers design their parts to be a size to suit our EDMs. This means that, if we become able to process larger workpieces, new demand will be born. That’s why we installed the maximum specification EDM.”



High technological capability is necessary to respond to special processing needs. All KHK die-sinking EDMs are made by Mitsubishi Electric, and the majority have been used for many years.



A processing sample. On the left is a sample of a helical hole drilled in a circular workpiece. Behind that is a sample of a spiral shape processed in a cylindrical workpiece interior. To the bottom right is a sample of a part where the processing entry point on the surface is narrow but widens internally. The second item from the right is a sample of several hemispherical patterns processed in a cylindrical workpiece’s interior. The far right shows the resulting electrode.



Kansai Hoden Kogyo Co., Ltd. (KHK)



I believe as long as new things can be created, electrical-discharge processing work will increase infinitely

◀ Akiyuki Takahashi

CEO & President

Profile

1941 Born Kochi Prefecture
 1970 Established Kansai Hoden Kogyo Co., Ltd. (KHK) and appointed CEO & President
 Enjoys golf and fishing

— The company is celebrating its 50th anniversary in January 2020, isn't it?

Takahashi : I have personally been involved with EDMs for close to 60 years.

At the time, EDMs were more like general-purpose machine tools and the important point was knowing how to utilize them properly. So, I acquired skill through various innovative thinking. EDMs have evolved significantly, but for the special processing KHK performs, knowing how to utilize the machines properly remains the key point.

— In concrete terms, what kind of technology is required?

Takahashi : It's hard to express in words, but there's also a need for know-how on how to make electrodes and jigs. Additionally, fabrication must be completed in a short period of time. The only way to efficiently make good electrodes and jigs is to steadily accumulate experience. Naturally, when actually performing special processing as

well, advanced know-how regarding how electrodes operate, etc. is necessary to achieve a high-accuracy finish.

Leverage special processing technology and create new products

— How do you pass that sort of technology down to younger employees?

Takahashi : At first, the only way is to properly train them is through on-the-job training. Once an employee is deemed to have acquired sufficient skill and know-how, they are immediately required to attend meetings with customers.

Because we are a job shop, in many cases it isn't possible for us to process parts in line with customers' design drawings. KHK's special processing is characterized by producing new products that couldn't be achieved using conventional

technologies.

Customers tend to design plants, etc. thinking of parts only possible to manufacture using conventional technologies. However, that won't lead to a major breakthrough. As such, we hold repeated discussions with our customers such as, "If you use KHK technologies, this kind of processing is possible," to which the customer would respond, "Well, if that's the case, can you make this kind of part?" and ultimately produce an entirely new product.

We listen to what the customer wants, visualize in our heads how we can make that happen, and then perform the actual processing. By repeating this cycle, we can acquire real technological capabilities.

— Do you sometimes get over-the-top requests?

Takahashi : Yes, but KHK's motto is to never say, "No," even to requests of such nature. We consider how we can attempt to meet such needs, what would have to be done to make it possible, and then if it simply can't



With an established reputation for technological capability, many KHK employees are qualified "Electrical-discharge Machining Technicians," as certified by a national-level examination.



From left) CEO & President Akiyuki Takahashi, Senior Managing Director Issei Takahashi, Motoichi Kodama – Senior Advisor of the Industrial Mechatronics Headquarters for Tachibana Eletech, and Kosei Nakashima - the EDM Section, Industrial Automation Machinery Marketing Division, Kansai Branch Office, Mitsubishi Electric Corporation

be done, we say, “Well, it would be difficult for us to do what you ask exactly as is... But, we can do it if the design is changed in this way.”, thus offering an alternative proposal.

I also always teach employees that they should never say, “No.” I consistently tell them that they must first visualize in their own minds how a request could possibly be met and then come talk with me if they still can’t find a solution.

It is through accumulation of such experiences that employees grow significantly. We have quite a few employees who have acquired advanced technological capabilities and passed the national examination for electrical-discharge machining technicians.

— **Recently, many in the manufacturing industry are struggling to secure personnel, aren’t they?**

Takahashi : Unfortunately, that applies to us as well. However, once a person joins KHK, they get hooked on electrical-discharge technology, so our retention rate is high. That shows just how interesting of a technology

electrical-discharge machining truly is.

Introducing new processing machines will result in the emergence of new products

— **KHK has been a customer of Mitsubishi Electric now for over 40 years, hasn’t it?**

Takahashi : In the past, I’ve asked Mitsubishi Electric engineers whether they could make their machines capable of certain functions, and they’ve obliged. We still closely share information through sales.

— **Recently all of the EDMs you purchase are the extra-large type, with machining chambers measuring over 1500mm, right?**

Takahashi : That is because there are few companies that possess such processing machines. By using large processing machines, we can create new products never before possible.

As such, if a new series of EDM is released, we do our best to purchase and install either the first or second unit of the rank. Teething problems

are often a given for new machines; however, the benefit of being able to produce new products still outweighs this setback.

— **I heard you have 12 employees on your shop floor, which means there are more EDMs than employees, correct?**

Takahashi : It quite often takes two to three days to perform electrical-discharge machining on large workpieces. During actual processing, we can leave the work entirely up to the EDM, so our workers can perform tasks with other EDMS during that time. That is the advantage of primarily dealing with large workpieces.

— **In closing, please share KHK’s future goals.**

Takahashi : We wish to continue leveraging electrical-discharge machining to manufacture products that never before existed in the world, and couldn’t be achieved using conventional methods. If we continue to take such a stance, I believe electrical-discharge machining work will increase on an infinite scale.



M85KC7 (left) – Mitsubishi Electric die-sinking EDM loaded with a giant workpiece measuring 1,350mm in diameter. The image on the right shows this part being processed.

Corporate Data

Kansai Hoden Kogyo Co., Ltd. (KHK)

Head Office
1-4-8 Kusune, Higashiosaka, Osaka
No. of employees
20
Main businesses
Special metal processing using electrical-discharge machines

Solution Case Study

Electric Discharge Processing & Metal and Graphite cutting Processing

Technical
Pioneer**HOUDEN** Houden Engineering Co., Ltd.

Continuing to meet customers' needs with a primary focus on electrical-discharge machining while also broadly offering total die production

Since its establishment stemming from the reorganization of its predecessor company and its founder, Houden Engineering Co., Ltd. has been operating for 45 years. Offering total die production with a primary focus on electrical-discharge processing, in recent years, the company has expanded into the fabrication of parts other than dies. Below is a report on how Mitsubishi Electric electrical-discharge machines have supported that journey.

Houden Engineering was established in 1974. It is a company that pursues monozukuri focused mainly on various types of electrical-discharge machining (e.g., die-sinking, wire-cut, and fine-hole drilling) for practically half a century. Starting with dies, it gradually expanded business, finally becoming a full-scale job shop also engaging in the fabrication of mechanical parts. With its 50 employees, it has bases in three Aichi Prefecture locations: Kiyosu, Komaki, and Obu.

At its headquarters in Kiyosu, there are a total of five factories: the head office and main factory, and factories No. 1-4. The head office and main factory and the No. 1 factory are equipped with nine die-sinking EDMs (all ATC-equipped), nine wire-cut EDMs, and two fine-hole drilling EDMs. The No. 2 and No. 3 factories are equipped with five graphite processing machines (three being AWC-equipped), and the No. 4 factory features three machining centers (two of which are vertical 5-axis processing machines). The factories at the Kiyosu location also manufacture graphite electrodes, with a focus on die components primarily for automobile manufacturers. Meanwhile, the Komaki Factory specializes in metalworking focused on die-sinking electrical-discharge machining of mechanical parts other than dies. As for the Obu location, due to its proximity to the Mikawa region, it serves the role of fabricating die components primarily for

customers in the local communities. Incidentally, Houden Engineering is currently constructing a new factory next to its headquarters. This factory is set to commence operation as a dedicated machining base within the year.

All three locations of Kiyosu, Komaki, and Obu are using Mitsubishi Electric EDMs. At the Komaki Factory, which is the main location for electrical-discharge machining, there are 10 EA28VA die-sinking EDMs, one EA12VA, and two EA50s, which are machines capable of supporting large-sized workpieces. The Obu Factory has three EA28VAs. The Kiyosu Factory is equipped with MV Series models and other machines such as the ultrahigh-accuracy MX2400 oil wire-cut EDM.

Perhaps the reason why Houden Engineering is particularly focused on electrical-discharge machining and Mitsubishi Electric machines is not unrelated to its origin. In fact, Yonejiro Ogawa, who established the predecessor company that engaged in die-sinking EDM processing, and who later became the first president of Houden Engineering, used to be involved in the production of EDMs at Mitsubishi Electric.

Current CEO and president, Toshio Yoshida, spoke on the background of the company's birth: "I was told that the company was founded in order to pursue monozukuri utilizing electrical-discharge machining at a deeper level."

Improving business performance with a one-stop framework even during times of uncertainty for electrical-discharge machining

After setting up its main base in 1978 at its current location in Kiyosu, the company incorporated and expanded its business with a focus on die-type electrical-discharge machining. However, later on, Houden Engineering faced a period of uncertainty. Although it seemed like a hardship, it was actually a blessing in disguise that resulted in even stronger business performance. Senior managing director Shigeharu Sakaida explained the reason for this as follows: "I think Houden Engineering's strength is the fact we offer total die production, covering everything from electrical-discharge machining to electrode fabrication. We offer a one-stop service from zero to finished product. So, from our customers' perspective, this means they only need to place an order with one company. I think our customers recognize that as being the advantage of placing an order with our company. Moreover, where necessary, Houden Engineering responds to customers' requests for short turnarounds. I think that point really works in our favor as well." While starting off primarily focused on die-sinking electrical-discharge machining, the company began making graphite electrodes around 20 years ago, and then expanded further to



The Komaki Factory primarily engages in processing non-die mechanical parts. The factory features large, medium and small die-sinking EDMs to support various requests from customers.



The Komaki Factory is equipped with a total of 13 Mitsubishi Electric die-sinking EDMs, including the six EA28V-A die-sinking EDMs installed in 2015, and the large EA50 die-sinking EDM.



In the past five years alone, a MV2400R and a MV4800 were installed in 2015. A MX600 followed in 2018. From just the start of this year as well, a MV2400S D-CUBES and MX2400 were installed, adding up to a total of eight state-of-the-art wire-cut EDMs at the company's head office and main factory (MV2400R pictured here).

handling die parts. Even during periods where demand for electrical-discharge machining fell, Houden Engineering was able to appeal its all-round comprehensive service, so ultimately did not lose work. While being particular about electrical-discharge machining, the company has kept a close eye on its customers' diverse needs and is believed to have become what it is today through evolving its technologies and investing in equipment in order to respond to such needs.

Today, Houden Engineering serves customers not only in Japan's central region, but also as far north as Niigata and as far west as Nagasaki. Many customers also contact the company through its official website.

Tatsuo Suzuki, senior managing director of the Manufacturing Engineering Division commented, "The equipment we operate is featured on our website, so our unique strengths are communicated to customers, and I think that's a major contributing factor behind them choosing us. We often get orders from customers requesting specific machines. Because of this, the fact we use so many Mitsubishi Electric EDMs to

support processing of irregular materials is a major influential factor that works in our favor. In reality, we also often get inquiries from customers about whether or not we can do a certain type of processing when they learn we have Mitsubishi Electric EDMs."

The Kiyosu Factory often handles regular steel materials and leaves special alloys and other unique requests to the Komaki Factory. As such, the Komaki Factory, in particular, uses mostly all Mitsubishi Electric EDMs. Even at the headquarters in Kiyosu, when the MX2400 oil wire-cut EDM entered the market, the company had never had a medium-size oil processing specifications machine, so it installed one with the aim of capturing new needs.

Nationwide customers due to support for diverse materials and processing conditions

Sakaida explained the appeal of Mitsubishi Electric EDMs: "They are user-friendly and there's such an abundant lineup offered. Another important point is that they support a wide variety of materials. Houden Engineering is also able to support a diversity of needs, and that's why we have such a broad customer base. Additionally, when we take difficult issues related to processing to Mitsubishi Electric, the representative always listens with sincerity and immediately provides us with an answer or hints regarding what to do. This really makes us happy."

At the same time Sakaida mentioned, "Currently, there aren't any Mitsubishi Electric EDMs able to physically process

large-sized workpieces, and we find that a little frustrating."

Meanwhile, Suzuki voiced expectations toward Mitsubishi Electric's recent AI technology. Houden Engineering also faces the serious issue of labor shortages and have many trainees from Vietnam working on its production shop floors: "Mitsubishi Electric is pushing ahead with incorporating AI into its machines and I think it would be great if such technology could also be utilized in the training of overseas personnel. For example, when a seasoned worker first demonstrates tasks 1-10 and then a trainee attempts to do the same, if the AI can indicate which steps the trainee did incorrectly, that assessment would be helpful in training. I think Mitsubishi Electric is good at AI, so I have high expectations. Moving forward, the working population will shrink further and we'll need to properly train overseas workers. Therefore, I think developing such technologies would be beneficial not only for companies, but also Japan's future."

In the past, Houden Engineering did not have the procedure manuals prepared like it does now so junior employees would gradually learn skills by watching their seniors work. In the end, there always has to be a human element of directly touching with the hand to verify processing work, etc. But, in order to effectively pass down the experience and know-how of past workers, Suzuki believes AI support is key. In closing, both Suzuki and Sakaida expressed their desire to further advance both the company's machines and people through cooperation with Mitsubishi Electric.



Creating a processing program from processing instruction information based on CAD/CAM. Performing positional confirmation, etc. in advance.



Electrical-discharge processing is key and absolutely essential to high-quality manufacturing

◀ Toshio Yoshida

CEO & President

Profile

1959 Born in Aichi Prefecture
1980 Joined Houden Engineering Co., Ltd.
1995 Appointed CEO and president, still holds position

— I've heard that the founder of Houden Engineering actually used to work for Mitsubishi Electric.

Yoshida : The founder, Yonejiro Ogawa, worked at Mitsubishi Electric until 1971, and was involved in manufacturing electrical-discharge machines. He established the company at the same time he left Mitsubishi Electric and still runs it today. I heard the company began using Mitsubishi Electric EDMs not long after it was established.

I was involved in electrical-discharge machining for about 15 years after joining the company. Then, when I was 36, I was appointed president when our former leader, Mr. Ogawa, decided to retire from his post. Since then, the company has expanded business out from its Kiyosu headquarters.

— I heard you are planning a new factory. Does such facility expansion at this time mean business is growing steadily?

Yoshida : Currently, the manufacturing industry as a whole is in a bit of a recession. However, we are grateful that we've never run out of work. Our custom since establishment has been to run electrical-discharge

machining operations 24-hours-a-day, 365-days-a-year. The amount of work itself varies depending on the state of the economy, but thanks to the continuous operation of our equipment, I think we are able to work with good efficiency.

— What sort of orders do you get a lot of?

Yoshida : That changes year by year. These days, partly due to the state of affairs abroad, our die-related orders have practically come to a halt, even though the work itself exists. The situation regarding automobile industry-related areas is particularly tough. However, we are busy due to an unprecedented vitalization in the areas of power plant and aircraft-related equipment.

The importance of electrical-discharge machining will continue to grow due to complex shape requirements

— What specialty electrical-discharge machining do you think your company has?

Yoshida : I always believe that electrical-discharge machining is the

key to monozukuri. Even if machine tools continue to evolve and become more accurate, there'll always be an element of machining they cannot cover. Particularly with the current demand for complex shapes, electrical-discharge machining is essential for high-quality monozukuri.

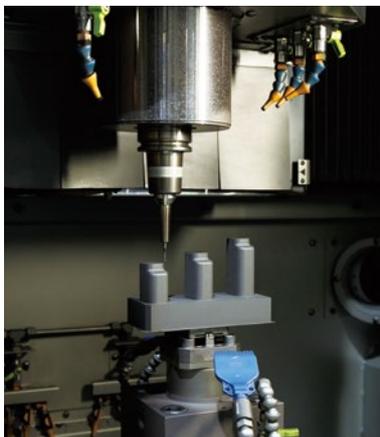
Because it has become possible for major companies to perform monozukuri without electrical-discharge machining as the result of advancements in machine tools and cutting technologies, there was a time when people said electrical-discharge machining would die off. However, the reason why it hasn't died off, and won't, is because it is possible of elaborate processing of fine portions that cutting simply cannot achieve. There is even greater demand for complex shapes now, so I believe the importance of electrical-discharge machining will only grow.

— Even still, companies with no technological capability are dying out.

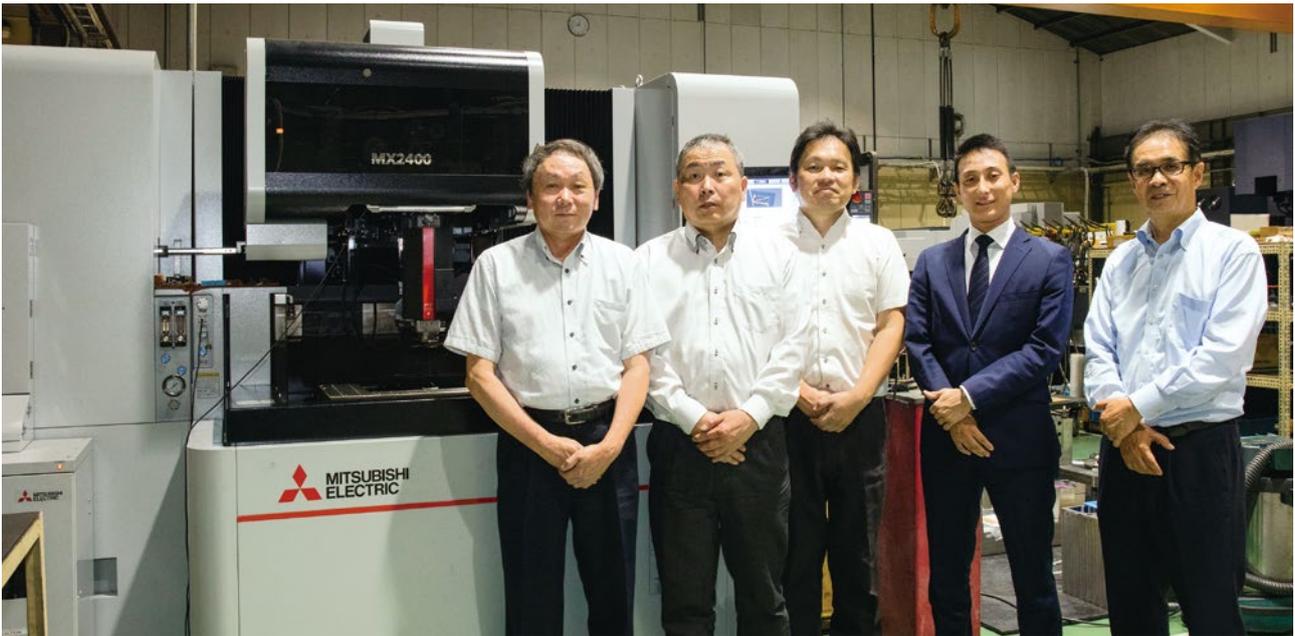
Yoshida : When I first joined Houden Engineering, electrical-discharge machining didn't require exceptionally high accuracy and countless companies were doing it. Later on, due to advancements in machine tools and people saying electrical-discharge machining wasn't necessary, just as you commented, companies lacking technological capabilities faded away. If we return to the origin of monozukuri, electrical-discharge machining has been work requiring the use of our five senses, and remains so to this day. Ultimately, we need to see, listen, touch, and use other sensory abilities and skills innate to humans to determine quality. Because Houden Engineering specializes in electrical-discharge machining, we are thorough in attempting to meet customers' requests. That is through using our technological capabilities and our uncompromising stance.



The former president's belief, "We should be a temple always running to respond to customers' requests," has been firmly passed down.



Performing high-accuracy, high-quality processing of a wide variety of materials in addition to regular steel materials. Houden Engineering has earned a high level of trust amongst its customers (machining scene pictured).



From left: CEO and president Toshio Yoshida; Senior managing director Shigeharu Sakaida; Sales Department director Shinichi Igaki; Sales representative Kohei Yamamoto, EDM Section, Industrial Automation Machinery Marketing Division, Chubu Branch Office, Mitsubishi Electric Corporation; and Mitsuo Nakamura, Processing Machine System Dept., MELDAS SYSTEM ENGINEERING Corporation.

**Customers decide what is necessary
We respond to that**

— **Your company has a thorough collection of equipment capable of responding to various processing conditions, doesn't it?**

Yoshida : That is also why I am so particular about electrical-discharge machining. All of our customers have different needs, some want us to process using a particular machine, others want us to use certain processing conditions, and so on. It is our job to thoroughly meet these needs. We never say, "No we can't do that because we only have such-and-such a machine." We let our customers decide what is necessary and respond accordingly. As a result of pursuing that particularism, we have the scale of equipment we do today.

— **What points are you careful of when selecting equipment, including Mitsubishi Electric products?**

Yoshida : To some degree, our company has grown together with Mitsubishi Electric. To be honest, we don't have the same kind of longstanding relationship with any other manufacturer. But regardless of which manufacturer's machines we are choosing, the basic criteria is whether or not it will serve to help us meet our customers' needs. No one can make a completely perfect machine, whether its Mitsubishi Electric or another manufacturer. We consider the material and the application, and choose the machine with the specifications needed to produce high-quality products. Once we've decided, essentially, we do our best to install two machines with identical specifications. Even dies have

different parts depending on whether they are for the left- or right-hand side. Therefore, we need a pair of machines with the same specifications to process a complete die set. Moreover, we renew all equipment that has been used for a certain number of years. As such, we still have practically no machines over 10 years old.

— **Please tell us your aspiration for the future.**

Yoshida : I have turned 60 myself, and now thinking of who to assign as my successor. Our founder's line of thinking was, "We should be a temple, always running to respond to customers' requests." I want both my successor and all employees to value that perspective, pursue the monozukuri beyond that what our customers seek, and keep the spirit going.



In line with the company's policy, "Always introducing two processing machines at a time," Houden Engineering also installed two large EA50 die-sinking EDMs.

Corporate Data

Houden Engineering Co., Ltd.

Head Office & Kiyosu Factory
62-1 Asahi-Atago, Kiyosu-shi, Aichi Prefecture

No. of employees
50 (as of end of August 2019)

Main businesses
Electrical-discharge processing and various other metal processing

Head Office & Kiyosu Factory
9 die-sinking EDMs, 9 wire-cut EDMs, 2 fine-hole drilling EDMs, 2 vertical 5-axis machining centers, 1 3-axis machining center, 5 graphite processing machines, 2 CMMs

Obu Factory
3 die-sinking EDMs, 2 machining centers

Komaki Factory
15 die-sinking EDMs, 2 graphite processing machines

NS TOOL NS TOOL CO., LTD.**Leading company in cemented carbide, small-diameter end mills significantly improves productivity with in-house machine tool equipped with a Mitsubishi Electric CNC**

NS TOOL CO., LTD. is a leading company in cemented carbide, small-diameter end mills with tips of 6mm or less. In order to distinguish itself from competitors, NS TOOL developed a tool grinder in-house to be used for manufacturing end mills, thus significantly improving both machining accuracy and productivity. The computerized numerical controller (CNC) used on the tool grinder is made by Mitsubishi Electric.

Cutting tools significantly impact the machining accuracy and productivity of machine tools. Based out of Shinagawa, Tokyo, NS TOOL has one of Japan's largest shares of the market for the cutting tool of cemented carbide, small-diameter end mills.

An end mill is a type of milling cutter with cutting blades on its outer circumference and base, and is attached to spindles of general-purpose milling machines and machining centers (MCs) to cut planes, grooves, holes, 3D curved faces, etc. End mills are broadly used to manufacture dies and various parts. NS TOOL's signatory product, the cemented carbide, small-diameter end mill with a tip of 6mm or less is used to manufacture dies for precision parts demanding high machining accuracy, such as smartphones and other

electronic components, optical components, mechanical parts of wristwatches, and even LED headlights for vehicles, etc. As such, it would not be an overstatement to say such a tool is crucial to Japan's monozukuri of today.

NS TOOL was founded in 1954. It began operation in Shinagawa, Tokyo as Nisshin Kogu Seisakusho; a manufacturer of cutting tools. At first, the company manufactured various types of tools, but in line with its incorporation to Nisshin Kogu Seisakusho L.C. in 1961, narrowed its product line to end mills with the aim of increasing production efficiency and lowering product price. Moreover, after building and commencing operation of its Sendai Factory in 1993 (Taiwa-cho, Miyagi Prefecture), it shifted its focus to production of high-added-value

carbide small-diameter end mills and carved a reputation for itself as a leading company. Currently, carbide small-diameter end mills account for around 75% of sales turnover.

The company's performance is steady. In the fiscal year ending March 31, 2018 consolidated sales was around 9.8 billion yen, ordinary profit was around 2.7 billion yen, and operating performance ratio increased to approximately 28%.

NS TOOL possesses the R&D capability required to develop tools made from cubic boron nitride (cBN) and poly-crystalline diamond (PCD), which are materials harder than cemented carbide, and production technology to enable manufacturing of ultra-small-diameter end mills with a diameter of 7 μ m.

There are several reasons for the notable strength of this company, but Senior Executive Vice President Takashi Goto, who is also in charge of New Business Sect emphasizes, "The 5-axis tool grinder developed in-house by us is one of those reasons."

Challenging itself to develop a tool grinder exclusively for small-diameter end mills

Cemented carbide end mills are manufactured by grinding the base material of carbide alloy with a diamond grinding wheel. From 1994, NS TOOL used another manufacturer's tool grinder to make cemented carbide, small-diameter end mills. However, as it was not exclusively for machining small-diameter end mills, the company



TGM – a tool grinder developed by NS TOOL in-house. It utilizes the Mitsubishi Electric M750VW as its CNC.



Approximately 60% of the tool grinders in the Sendai Factory are this in-house TGM.

was not satisfied with its handleability and machining accuracy.

Koichi Okada, Executive Officer, Plant Manager/General Manager, Production Dept., explains, “If we place an order with a manufacturer for improvement, that becomes the standard specification, and if a rival company buys that same grinder, they will manufacture end mills with it. This means there’s no way to set ourselves apart from them.”

However, previously, the company had no other option. This situation went on for around ten years until President Goto made a decision in 2004, “Let’s make our own tool grinder, in-house.”

NS TOOL promptly put together a project team led by Okada, comprised of five members including Ryugo Abe, Manufacturing Sect-3, Production Dept., and four other members.

All five members were highly familiar with tool production technology, however, none of them had experience preparing machine design drawings, let alone developing a grinder. Okada reflects, “At first, we were at a loss about what to do. Even still, with help from an external machine design engineer, the team pushed forward with the development.”

For the manufacturer of the computerized numerical controller (CNC) equipped on their machine, the team chose Mitsubishi Electric. The CNC on the other company’s tool grinder used by NC TOOL until then was made by another manufacturer. However, when the team asked that manufacturer to help with their development project, they were flatly

rejected.

“At that point, we turned to Mitsubishi Electric and they immediately promised to cooperate,” says Okada. “During development of our grinder, Mitsubishi Electric’s CNC engineer consulted with us repeatedly. For example, when we requested that the CNC display screen be changed to original specifications so that any of our shop floor operators could use it, the Mitsubishi Electric engineer began to consider it straight away. In the end, it was clear there was no problem with the standard screen, so we didn’t adopt the original one.” The decision to adopt the M750VW CNC was made. NS TOOL chose Mitsubishi Electric’s full CNC system including servomotors and servo amplifiers.

Despite ordering the development, President Goto reveals, “I thought there was no way it would go smoothly the first time around. I was sure they’d fail.” However, the first machine, completed in 2006, achieved a machining accuracy exceeding that of other company’s tool grinders.

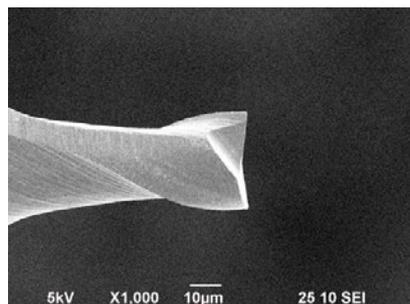
Okada fondly recalls, “Up until

that time, I’ve used various tool grinders, but even when I asked the manufacturer to tweak it just a little in such-and-such a way, often they would not comply. Harnessing that experience, I approached the development by taking care of fine details one at a time, such as eliminating the vibration and temperature change that impacts machining accuracy. That meant I had to redo the drawings over and over. But, as a result, the first unit we developed was capable of performing just the way we’d originally intended. The fact we specifically looked at small-diameter processing of 6mm or less was one of the reasons we succeeded, I believe.”

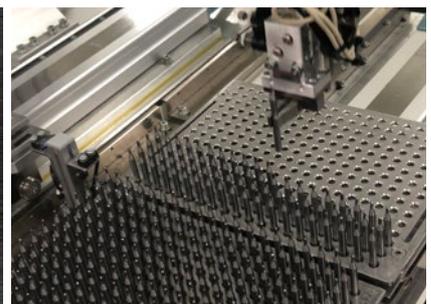
Thirteen years after NS TOOL built its first tool grinder. Named the “Tool Grinding Machine (TGM),” tool grinders developed by the company in-house currently account for around 60% of the overall production equipment number. They are all equipped with a M750VW, the same CNC as the first unit.

Okada explains the reason for this, “No major problems have occurred and they are fairly easy to use. We have been able to maintain stable operation, so we don’t feel there’s any need to change from Mitsubishi Electric CNCs.” Abe adds, “Servomotors, servo amplifiers and the like are consumables, so have to be exchanged as necessary. However, because overhauls are carried out periodically, our first TGM unit is still in action. The CNC itself is robust and we’ve never overhauled it.”

Even still, technology is ever-evolving. As such, NS TOOL has begun a study into a 2nd generation TGM. “Up until now, we’d added improvements around every three years or so. However, now we are considering revising major components, etc. in order to further eliminate the impact of vibration and increase machining accuracy even more.”



The flagship product – a cemented carbide, small-diameter end mill (right). It is called “small-diameter” due to having a diameter of 6mm or less. NS TOOL produces end mills with even smaller diameters, as small as 0.007mm. The tip of the end mill for electronic micrography shown on the left is 0.03mm.





Achieved stable supply of products without quality variation using in-house tool grinder

◀ Takashi Goto

Senior Executive Vice President
New Business Sect

Profile

1963 Born in Tokyo
1984 Joined Nisshin Kogy Seisakusho Co., Ltd. (present-day NS TOOL CO., LTD.)
1987 Appointed CEO
2010 Obtained Doctorate in Engineering
2013 Appointed Senior Executive Vice President

— I was truly surprised to hear that the first TGM unit developed in-house by NS TOOL back in 2006 surpassed the performance of a commercially sold tool grinder.

Goto : I also unintentionally found myself asking, “Are you sure?” when I received that news. I thought there was no way the first unit would be successful. Even still, I said to the team, “We won’t be able to use this for the present.”

— **Why?**

Goto : Because, an important point as far as a manufacturer is concerned is stable supply of a product with consistent quality. If we only introduced one grinder capable of high-accuracy grinding into the production line, we would end up with varying quality for the same cemented carbide, small-diameter end mill product depending on which grinder they were processed on. Due to this, we waited until a number of TGMs were built, and then gradually began replacing old grinders with them from 2008.

Stable manufacture of high-accuracy products with an in-house automatic measurement system

— **What benefits did you see as a result of introducing TGMs into your production line?**

Goto : In addition to machining accuracy, the productivity of carbide cement, small-diameter end mills also significantly improved. This was made possible due to the automatic measurement system NS TOOL developed in-house around 10 years ago. This system worked by automatically measuring the end mill dimensions immediately after processing, feeding the values back into the CNC, and then automatically offsetting. Introducing this system to our operations made it possible to manufacture high-accuracy end mills with good stability. We currently manufacture at a target of 25% tolerance with the values provided in catalogs.

Additionally, our TGMs run practically around-the-clock every day, except for the summer break and New Year’s break. The operability ratio is high at around 95%. Orders will increase even more as NS TOOL is now trusted by customers as being capable of supplying high-quality end mills with good stability. That virtuous circle was made possible by TGM. I believe that TGM is precisely the driving force generating our company’s high profit.

Compared to purchasing commercially sold grinders, we’ve been able to significantly reduce equipment investment. Therefore, since stable operation of TGMs began,

our operating performance ratio increased rapidly.

— **So the cemented carbide, small-diameter end mills completed in the TGMs fully draw out the capabilities of machine tools and are helping to support Japan’s monozukuri, aren’t they?**

Goto : A demand emerged for cemented carbide, small-diameter end mills due to the better RPM of spindles used in machining centers and other machine tools. By increasing the RPM, finer metal processing is possible; therefore, there was a need for more precise, cemented carbide, small-diameter end mills. Recently, there are even MCs capable of 100,000rpm. In line with machine tool progress, NS TOOL is selling an increasing number of cemented carbide, small-diameter end mill types.

— **How many types of cemented carbide, small-diameter end mills do you currently sell?**

Goto : Our catalogs feature around 9,500 types. The number of types we produce increased greatly because we would receive requests from our die manufacturers and other customers to enable a particular type of processing, so we’d do our best to develop an end mill accordingly. Then, this new product would be added to our standard products.

— **How do you train**



The first TGM unit completed in 2006. It is currently installed in NS TOOL’s development center and is used for prototyping new cemented carbide end mills products.



Cemented carbide end mills are manufactured by grinding cemented carbide alloy workpieces (part with pointed tip pictured in middle of photo) using a diamond grinding wheel (pictured above workpiece).



From left) Ryugo Abe - Manufacturing Sect-3, Production Dept., Koichi Okada - Executive Officer, Plant Manager/General Manager, Production Dept., and Takashi Goto - Senior Executive Vice President. Beside them on the right is Mamoru Otsu - Manager of NC System Section, Industrial Automation Marketing Dept., Mitsubishi Electric Corporation. Pictured in the far right is Koichiroh Usui - Manager of Sales Section 2, Niigata Sales Office, Kyoei Sangyo Co., Ltd.

professionals to pass down NS TOOL's production technological capability and R&D capability?

Goto : The reality is we relied on on-the-job training in the field until just recently. However, believing that this was not ideal as a permanent approach, I appointed Abe (Manufacturing Sect-3, Production Dept.) as leader of a training planning team in 2018 and began rolling out systematic employee training.

NS TOOL is a manufacturer of cemented carbide, small-diameter end mills; therefore, first and foremost, our engineers must acquire manufacturing skills. I want employees to have this as their foundation, and then grow into various fields, such as design, development, manufacturing, and quality control.

As such, I had Abe's team put together a curriculum and training materials. Employees who have come directly from graduating tertiary-level education train for six full months, while those who have come mid-career train for three full months. We utilize old general-purpose grinders for such training purposes. This is because employees can only learn the basics on general-purpose machines. A TGM is installed for training purposes.

My line of thinking is that after learning the basics, employees can experience various other work. When I joined the company in 1984, there were 34 employees and all of us had to perform various work with efficiency. I personally experienced many different kinds of work, from design to manufacturing and sales, and that served as my nourishment. NS TOOL now has 10 times that number of

employees, but I still hope they accumulate various experience and grow.

Challenge to construct a factory with new design combining seismic resistance and seismic isolation

— Please share the company's future goals.

Goto : One aspect I am always mindful of is the stable supply of products with consistent quality. With this as the aim, we are challenging ourselves to build a factory like none ever before seen. In concrete terms, a building that is "all-round seismic isolating" by combining an earthquake-resistant structure with seismic-isolating devices.

Our Sendai Factory was severely damaged by the Great East Japan Earthquake that struck on March 11, 2011. The building, completed in the first round of construction in 1993, was not earthquake-resistant. Therefore, the building itself was damaged, but the manufacturing equipment was unharmed. Meanwhile, the building completed after 1993 adopted an earthquake-resistant structure, and therefore, that building was fine. But, in reverse, the manufacturing equipment



General-purpose grinders are used for employee training. This is because the company believes basics can only be learned on general-purpose machines.

was severely damaged. It took around one month before we could recommence production, and then there were the aftershocks to deal with. So, it wasn't until around three months after the earthquake struck that we became capable of providing a stable supply of products again.

Based on this experience, with the cooperation of a construction company, we are currently building a development center adjacent to the Sendai Factory that will have earthquake-resistance and seismic isolation, making it an "all-round seismic isolation" building. If this project is a success, we plan on adopting the same structure at our factories too.

Once this factory is complete, we will open it to our customers and the general public. We anticipate this will help increase our credibility in society.

Corporate Data NS TOOL CO., LTD.

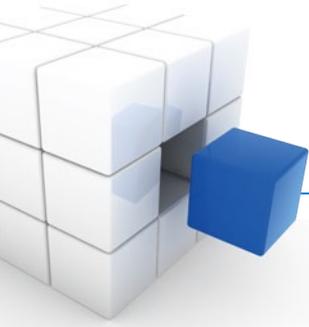
Head Office
1-28-1 Oi, Shinagawa-ku, Tokyo, Japan

Sendai Plant
2-11 Matsusakadaira, Taiwa-cho, Kurokawa-gun, Miyagi Prefecture, Japan

No. of employees
359 employees (as of March 31, 2019)

Main businesses
Began production and sales of cutting tools

History
1954 Founded Nisshin Kogu Seisakusho
1961 Established Nisshin Kogu Seisakusho L.C.
1979 Reorganized to Nisshin Kogu Seisakusho Co., Ltd.
1980 Began production of carbide end mills
1991 Changed company name to NS TOOL CO., LTD.
1993 Completed construction of Sendai Plant
2004 Listed on JASDAQ Securities Exchange
2017 Listed on 1st Section Tokyo Stock Exchange



HIW HOEI IRON WORKS CO., LTD.

Introducing NC machine tools as a pioneer of backstreet factories Offering the most reliable power generator components with high technological prowess and an abundance of equipment

Headquartered in Osaka-shi, Osaka Prefecture, Hoei Iron Works Co., Ltd was the first in its industry to install an NC machine tool almost 50 years ago. The company's foresight and technological capabilities, as well as its sincere stance, have enabled it to continue delivering high-quality generator parts to major manufacturers with a short turnaround time. Hoei Iron Works' machine tools use Mitsubishi Electric computerized numerical controllers (CNCs).



Hoei Iron Works continues to maintain a strong presence in the machining of turbine blades and turbine-related parts used in the generators for thermal power, nuclear power, and wind power facilities. The company was originally founded as a lathe turning service provider in the 1920s by the grandfather of the present-day president, Koichi Yoshida. President Yoshida's father, the second president, incorporated the business in 1966 and changed the name to Hoei Iron Works. Over time it has become the parts processing job shop it is today. Almost all of its customers are major heavy industry manufacturers.

Originally founded in present-day Ikuno Ward, Osaka-shi, the company relocated its headquarters to neighboring Hirano Ward in 1970. Moreover, in 2000, it newly established a base in Yao-shi, Osaka Prefecture, and commenced operations as a leading factory for parts machining.

When the company relocated to Hirano Ward in 1970, it engaged in a groundbreaking initiative. It installed a NC machine at an extremely early stage for a small- to medium-sized job shop. Around that time, machine tools equipped with CNCs were starting to be introduced by major companies. President Yoshida heard from the former president that such a move was a first for a backstreet factory. It was indeed an initiative made with good foresight.

However, the company was affected by the oil shock that soon followed, and times became tough, giving way to a period of stagnation. It ran into a wall insofar as financing was concerned, and had to let go of the machine tools it had installed. Despite this, thanks to the relationship Hoei Iron Works formed with a major heavy industry manufacturer as a result of being a pioneer in introducing NC machine tools, it managed to recover its performance even after facing

repeated hardship.

Now, the company has 40 employees. With four factories in Yao, around 30 machine tools, including fully-automatic 5-axes/4-axes machining center, operate around the clock. Processing-related employees work on a 2-shift system, day and night.

The strength of being able to flexibly support a high mix of products Manufacturing a countless number of parts

The Yao Factory processes the turbine blades of generators, as well as the peripheral parts thereof. Among these, parts used in gas turbines are referred to as "hot parts" since they heat up when the air-fuel mix explodes and rotates.

Kazuhiro Yonezawa, of the Technology Management Department, described the unique characteristics of Hoei Iron Works' parts processing: "Steam turbines, wind power turbines, and other blade specifications differ between generators, so we never make identical parts. We always have to design and develop from scratch. Meanwhile, the hot parts used in gas turbines are standardized; therefore, the same model parts must be manufactured repeatedly. In the case of the former, every single part is different. So, in that sense, our company makes a countless number of parts. The technological capability and abundance of equipment to respond to such a high mix of products are our company's strengths."

Incidentally, the ratio of new turbine blades constantly made to hot parts consistently made the same is practically half and half.

With the Yao Factory as its main base, Hoei Iron Works also operates the Hirano Factory, which was the former location of its headquarters, and a factory in Inami-cho, Hyogo

Prefecture, where it performs manual polishing of turbine blades as a finishing process.

In 2013, the company expanded overseas for the first time, establishing a factory in Hanoi, Vietnam. A Vietnamese national who was a former trainee in the company was appointed as the factory manager of the Vietnamese factory, which now serves as a part supplier to Hoei Iron Works.

Yonezawa joined Hoei Iron Works mid-career in 2005. In his previous occupation as an engineer, he had worked on the development of turbine blades. After joining Hoei Iron Works, he was assigned to the task of creating NC programs to control machine tools. Yonezawa studied NC programs while gaining knowledge of CAD/CAM, and then one month after joining the company, made his first program to actually operate a machine. In the 14 years since then, he has accumulated experience handling NC machine tools on the shop floor and cutting metals. Today, while developing and designing NC programs, he also engages in the modeling of turbine blades based on 3D data and drawings received from customers, and is mainly in charge of work method studies. He is indeed a turbine and NC professional.

"Firstly, compared to when I joined the company, quality requirements are



Hoei Iron Works has been accepting trainees from Vietnam for around 15 years, and currently employs nine such trainees.



Hoei Iron Works has used Mitsubishi Electric CNCs affectionally for many years. The Yao Factory is responsible for processing turbine blades for generators and the periphery parts thereof.

much higher. Even the requirements regarding surface accuracy are quite high. Therefore, we need to provide even more meticulous work. In terms of cost, there's also the need to manufacture parts at half the price compared to 14 years ago. And I should also mention constantly lowering that cost and improving quality, which are considered a company mission."

In the past, accuracy only had to be around $\pm 0.1\text{mm}$; however, now it is required to be around $\pm 0.025\text{mm}$. To satisfy such requirements, the environment-resistance of a machine tool is key. Machines expand and contract with the temperature difference between morning and night alone. Hoei Iron Works has constantly run its manufacturing operations day and night using a two-shift system. Therefore, the most important condition for a machine is that it operates accurately without being affected by environmental factors such as temperature and humidity.

A fast turnaround time is another of the company's strengths. On a dual-head, 5-axis processing machine, two workpieces are processed simultaneously, meaning orders can be delivered with a fast turnaround time. Additionally, Hoei Iron Works hires employees who formally worked in technical positions at machine tool manufacturers. They are highly focused on not allowing the machine to stop operating, and for this, regular maintenance is essential. In addition, it is important to eliminate oversights in

work processes. Yonezawa explained, "In order to avoid oversights, we think up various patterns during the planning phase and choose the method we deem best. Moreover, in order to prevent oversights caused by mixing different materials, we ensure rigid materials control, such as not purchasing other materials and other measures."

Mitsubishi Electric CNCs support the processing of parts requiring high accuracy

Many of the machining centers operated by Hoei Iron Works are equipped with Mitsubishi Electric CNCs. Yonezawa had the following to say about them: "In the past, we primarily used CNCs made by a different company, but Mitsubishi Electric improved the functions its CNCs. Particularly, for those equipped with the high-accuracy control function, we began using them as they are extremely user-friendly CNCs. When used in combination with machine



An inspection room set up on the second floor of the factory. High-accuracy parts must be within as much as $\pm 0.025\text{mm}$.

tools, they offer accurate operation, and are a powerful tool in the processing of precision parts that require extremely high accuracy. Moreover, the interface is straightforward, which I believe makes these CNCs easy for shop floor operators to use. In the future, we would be grateful if these abundant functions could be included as standard specifications of Mitsubishi Electric CNC, rather than being provided as options, as our company is always responding to a variety of requests from customers."

The Yao Factory is lined with devices we requested Mitsubishi Electric to manufacture with the aim of carrying out CNC training. Mitsubishi Electric CNCs will continue to support Hoei Iron Works' diverse needs in the future.



CNC for new employee training made by Mitsubishi Electric upon the request of Hoei Iron Works. Senior managing director Yoshida stated that Mitsubishi Electric responded sincerely to various requests during consultations.

HIW

HOEI IRON WORKS CO., LTD.



Trying hard to deliver the best monozukuri possible within one's means

◀ Akinobu Yoshida

Senior Managing Director

Profile

2009	Joined Hoei Iron Works Co., Ltd.
2009-2015	Involved in improving turbine blade processing technology
2015-2019	Involved in improving technology for heat-resistant steel
April 2019	Appointed Senior Managing Director

— **Do you have any impressions of your father, the former president's, approach to work?**

Yoshida : I think that it would be the way that he used NC machine tools at a time when medium of measurement was paper tape. I personally have only seen it on TV, but my father actually used that in his factory. Honestly, I thought that was amazing.

— **Please tell me what you've inherited from the former president.**

Yoshida : Nothing specific really comes to mind, but he always used to tell me, "We must never get the wrong idea. Our company is not a manufacturer, but merely a 'processing shop for hire,' so we must never forget our limits, and always make products that our customers seek in terms of things such as delivery, cost, and quality." That is how I interpreted his words. In reality, I myself am constantly mindful of manufacturing the best products I can to fulfill customers' orders within our means.

— **Hoei Iron Works introduced a NC machine tool to its production line in 1970, which was quite early days, wasn't it?**

Yoshida : Back then, apparently no other backstreet factory had an NC machine tool, so my father tells me everyone came to our factory to check it out. I don't know if he had foresight, as such, but because we were able to install an NC machine tool ahead of other companies, we were able to obtain orders directly from a large heavy industry manufacturer despite being a small factory with about 20 employees at that time. In that sense, I think it is safe to say my father seized the opportunity of that era.

— **Did installation of the NC machine tool lead directly to business expansion?**

Yoshida : Yes, it did lead to more business from customers. However, we were impacted by the oil shock that occurred immediately after that and faced quite hard times, including having to give up the machining center as we couldn't make payments. In order to persevere in those tough times, I heard from my father that we relied on the relationships we'd built to date while approaching new potential customers too.

After the company fell like that, it

took time to get back on our feet. We had installed an NC machine tool earlier than any other industry players, but other companies also began to purchase and install NC-equipped machines during the period our business performance was faltering. So, when we finally recovered, I believe we'd practically lost all of our advantage as the pioneer. Even still, it was recognized by all of our customers that we had been the first to install such technology. So, I think that's why they still gave us work in those hard times.

Established a supplier factory in Vietnam based upon the words of a one-time trainee

— **Hoei Iron Works established a factory in Vietnam in 2013. How do you position this factory?**

Yoshida : We saw it as creating an overseas-based supplier. Currently, there are 12 employees working at that base, and they are all Vietnamese nationals. The president, myself, and an administrator take turns visiting the



Current president Koichi Yoshida (left) and senior managing director Myoshin Yoshida (right). The two brothers manage the company as one.



Strongly trusted by customers thanks to efforts to ensure uncompromising high quality.



Second from the left is CEO and president Koichi Yoshida; Kazuhiro Yonezawa, Technology Management Department; and technical staff members, Ueno and Quynh. On the far left is sales representative Fumitsugu Yoshiyama, Deputy Section Manager, Industrial Automation(CNC)Marketing Dept., Kansai Branch Office, Mitsubishi Electric Corporation

Hanoi factory once a month to provide guidance and oversight.

We chose Vietnam as the location because we'd been receiving trainees from there for 15 years. One of the earliest trainees now actually works as the factory manager.

We continue to receive trainees from Vietnam and currently have nine here at Hoen Iron Works, as well as five engineers.

— **What triggered establishment of a supplier factory located overseas?**

Yoshida : Small, local factories run by a husband-and-wife team we knew as a supplier began to close down one after another. We tried to find another supplier, but they were all more expensive than this family-run business we'd used until then. Just when I'd been worrying about this issue, I had dinner with a former trainee with our company. He suggested we make a factory in Vietnam, and I thought the timing was just perfect, so made up my mind to go ahead and do it.

**Meeting customers' diverse requests
That flexibility is our company's strength**

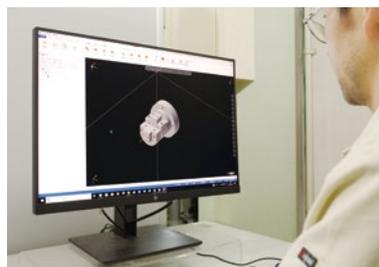
— **How do you interact with your young employees on a daily basis?**

Yoshida : I'm not very strict with them. I personally gained experience using

lathes under strict guidance at another company before joining Hoen. But, I don't think that this is an era where teaching employees with that level of strictness is the best approach to take. It is said that Japan's young generation is keeping its distance from the manufacturing industry. So, I always say to my young employees that they will definitely acquire skills if they sincerely do their best. Even still, I struggle most with HR development.

— **In closing, could you tell us what Hoen Iron Works' does not compromise on, and the company's future aspirations?**

Yoshida : As I mentioned earlier, our company is a "job shop for hire." However, that is precisely why we must meet our customers' various requests. Our strength is the flexibility to meet such requests. Of course, we do need the technological capabilities and equipment capacity to make it all possible. I believe that if we work hard to hone our skills and carefully choose



Machining of products related to power generators not allowing error requires creation of elaborate machining programs

which equipment we use with consistency, we will build relationships of trust with our customers.

These days, major companies in the power industry are facing tough times due to environmental problems, regulations and other matters. But we hope to continue advancing together with them by meeting our customers' requests using our flexibility. I also believe we must take a flexible approach in creating new business.

Corporate Data

Hoen Iron Works Co., Ltd.

- Head Office
4-1-40 Kamikita, Hirano-ku, Osaka-shi,
Osaka, Japan
- Yao Factory
2-5-28 Kitakamei-cho, Yao-shi
- Inami Factory
1007-24 Inami-cho, Kako-gun, Hyogo Prefecture
- No. of employees
40 employees (as of August 2019)
- Main businesses
Machining, grinding, various inspections of
gas turbines, steam turbine parts, etc.
- History
1936 Established in Osaka (present-day
Tatsuminaka, Ikuno-ku) as Yoshida
Tekkosho
1966 Changed company name to Hoen Iron
Works and incorporated
1970 Hirano Factory starts operations with
NC-based equipment
1997 Inami Factory starts operation as a
blade-polishing finishing company
2000 Yao Factory starts operations as the
main machining factory
2005 Yao No. 2 Factory starts operations
2009 Yao No. 3 Factory starts operations
for medium- to large-MC processing
2013 Opened HOEI TEKKO VIETNAM CO.,
LTD. as an overseas factory in Hanoi,
Vietnam

Product

Computerized Numerical Controllers

For customers to use Mitsubishi CNC with confidence, Mitsubishi Electric offers the service from the three points of view : Technical support, Training, and Service parts/repair.
With Mitsubishi CNC global service network, Mitsubishi Electric is ready to support the customers who have production bases around the world.



Mitsubishi CNC Lifecycle Management

For the customers to use their familiar machines for many years, Mitsubishi Electric continues to offer services:

Whenever Wherever Forever

We provide the best service to support customers' production environment indefinitely

Technical Support **Minimizing Downtime with Professional Support**

Need to know how to cancel CNC alarm immediately!

Our call centers in various regions around the world can support customers quickly.



We have call centers in each overseas base to respond quickly to customers having trouble with the CNC. Our skilled engineers support customers to accurately resolve problems over the phone. We ship out service parts or send field engineers as needed to ensure a timely recovery of your machine.

Need support to recover the machine quickly!

Our field engineer visits customers' site to repair the CNC system.



Our specialists who acquired high skills on CNC system repair visit the site immediately based on the customer's request. We make full use of measuring instruments, etc. to precisely understand the machine state, and then adjust the faulty items or replace the parts. As a result, the machines are recovered quickly

After machine restoration we are also making efforts to prevent machine failures, suggesting preventive solutions by measuring the battery voltage of CNC and drive units and the insulation resistance of motors.



Our call centers and field engineers around the world are working hard day to day to enable our customers to safely use their machines. Please feel free to contact the nearest service center with any tiny issue.



Product

Processing machines

We offer worldwide support for Mitsubishi Electric's state-of-the-art Industrial Automation Machinery



Our rich lineup of EDMs cater to diverse processing needs ranging from parts processing to ultra high precision processing. Utilizing our advanced laser technologies, our laser processors deliver high productivity, stability, and low running costs. Service and support of these Industrial Automation Machines is available worldwide through Mitsubishi Electric's extensive global network. Our local staff will provide a prompt response to your various needs from inquiries about processing applications to requests for training and repair.



Applications

We can propose optimum processing applications to cater to your needs before and/or after installation. If you have any questions about processing applications, please feel free to contact us.



Showrooms

EDMs, laser processing machines, and various other Mitsubishi Electric mechatronics products are displayed in our showrooms. Our dedicated engineers are always ready to help you.



Service and Repairs

We offer repair services, dispatch of engineers to the field, replacement parts sales, and technical support in close cooperation with our local distributors. In case of a malfunction, we will promptly assist you to fix the problem.



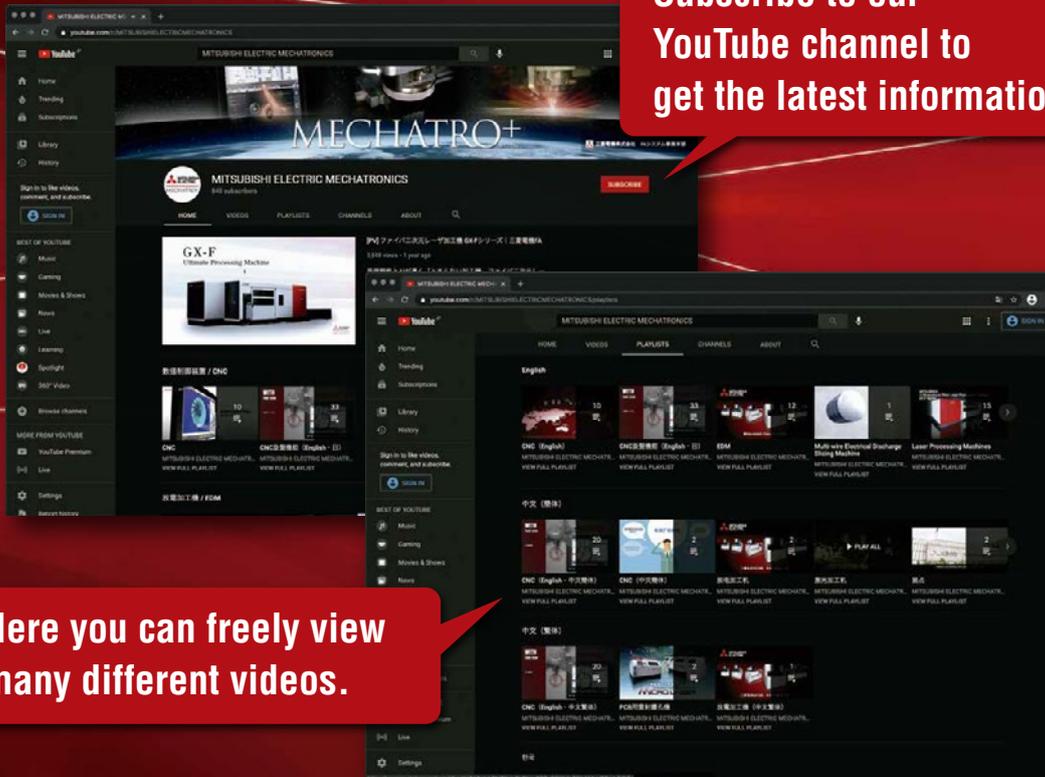
Training

We offer wide variety of regular training courses to give engineers the ability to use our products quickly after purchase. We offer basic operations to applied programming using actual products.

Official YouTube channel

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MITSUBISHI ELECTRIC MECHATRONICS is the official YouTube channel for our Industrial Automation Machinery products.

The channel offers an array of information on product information for CNCs, electrical discharge machines (EDMs), laser processing machines, etc., as well as machining examples, and much more.

Access the below URL to watch numerous videos that look unbelievably realistic.

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