Manufacturing Technology for Equipment and Parts Solution Business in Thailand, Vietnam and Myanmar

Hiroyuki UBUKATA*, Kaoru TERAO, Masafumi NAKANO,
Yousuke KAWASAKI, Yoshihide TAKENAKA, and Akira NINOMIYA

Nissin Electric Co., Ltd.'s equipment and parts solution business utilizes Nissin Electric Group's power equipment manufacturing technology for the contract manufacturing of equipment parts for various industries. Established in 2000 at Nissin Electric (Thailand) Co., Ltd. (NET), this business has expanded its manufacturing bases to Vietnam and Myanmar, supplying equipment and parts worldwide. Since its foundation, Nissin Electric has consistently improved its manufacturing capabilities. This paper describes the manufacturing technology used in the equipment and parts solution business.

Keywords: ASEAN, contract manufacturing, welding, machining, manufacturing

1. Introduction

In 1988, Nissin Electric Co., Ltd. established Nissin Electric (Thailand) Co., Ltd. (NET) in Navanakorn Industrial Zone, north side of Bangkok, as a company that produces circuit breakers and capacitors for switchboards. NET was steadily growing at first, but in the 1990s, the collapse of the bubble economy in Japan and the Asian currency crisis led to a sharp decrease in orders from Nissin Electric, and NET faced a management crisis. Under such circumstances, NET started the parts business in 2000 to produce parts for other companies on consignment, taking advantage of its integrated production systems for manufacturing, including sheet metal processing, machining, welding, painting, plating, and assembly.

This business has steadily expanded in scale, earning customer recognition for its high technical capabilities by leveraging the manufacturing technology for power equipment components that Nissin Electric has cultivated over many years. Subsequently, the scope of the business was expanded to include precision machining and the assembly of equipment in line with customer requests, and in 2021 the business was revamped as a new "Equipment and Parts Solution Business." The Equipment and Parts Solution Business, launched in Thailand, has now expanded to three locations in ASEAN, including NET in Thailand, Nissin Electric Vietnam Co., Ltd. (NEV) in Vietnam, and Nissin Electric Myanmar Co., Ltd. (NEM) in Myanmar (Fig. 1).

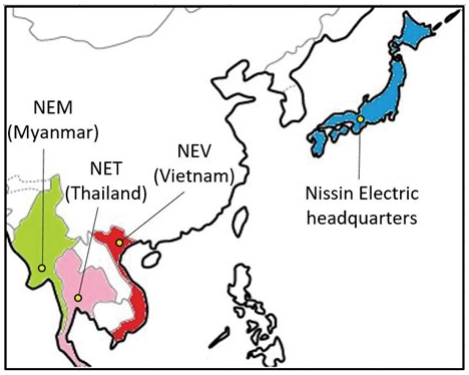

Fig. 1. Locations of production bases

In response to this, Nissin Electric established the Equipment and Parts Solution Business Management Division to oversee the three bases in the ASEAN region. Nissin Electric has also set up a technical team in the Production Engineering Department at its headquarters to support the newly established NET and NEV in their technically challenging projects, and has put in place a system that can handle even complex products. Nissin Electric is developing a business model for contract manufacturing of equipment and parts for various industries and customers around the world, using a system that allows the optimal production location to be selected based on product difficulty and cost.

2. Manufacturing Structure of the Equipment and Parts Solution Business

In this business, each of the NET, NEV, and NEM bases has established a production system that can handle all the processes from material procurement to sheet metal processing, cutting, welding, painting, inspection, assembly, and shipping (Fig. 2). In each factory, a huge number of products are constantly being processed, covering a wide range of materials, sizes, production processes, and production quantities. Therefore, in addition to reinforcing processing technology, strengthening the management of materials and production progress is also a major key to business success.

This chapter introduces the core systems that support manufacturing in this business, such as the human resource development and core technologies.

Fig. 2. Integrated manufacturing system

2-1 Establishment of core manufacturing system

In 2018, NET introduced a unique production management system called "A-NEOS" developed in collaboration with Nissin Electric's Information Systems Department for this business. This system has enabled the accurate management of production progress and cost control of each individual part. Tasks, such as material inventory management, production status, and labor hour reporting, previously handled by handwritten notes, are now managed by bar-coded instructions. The system also handles material ordering and cost accounting, improving overall operational efficiency. In addition, NET has also developed new systems such as a system that allows production drawings and instruction manuals to be accessed with a display installed at the work site (Photo 1) and a system for managing the operational status of equipment. In this way, NET is working to develop its production control systems into a core manufacturing system.

Photo 1. Calling up production drawings from the display

2-2 Human resource development for equipment and parts solution business

This business is essentially one that requires a speedy response, and customers' purchase orders must usually be completed from receipt orders to delivery within a few months, or in some cases, even within a few days. With a huge number of products being handled on a daily basis, it is essential to have not only the equipment and management systems in place, but also to train the personnel who can operate them, in order to flexibly rearrange the production plan each time a new order comes in and meet the delivery deadlines for all customers. To this end, NET is conducting a variety of human resource training with the cooperation of multiple departments, including the Human Resources Development Department, the Production Engineering Department, and the Information Systems Department of Nissin Electric.

The Human Resources Development Department is in charge of general training in business skills and other areas, and has established a curriculum that allows instruction and training to be provided at each of the three bases (NET, NEV, and NEM). The Production Engineering Department provides remote instruction in management techniques such as industrial engineering, as well as improvement training and on-site welding instruction and training.

2-3 Welding, a core technology

Due to the need for high airtightness in many of Nisshin Electric's products, such as those used in airtight metal containers that are either vacuum-sealed or filled with insulating gas/oil, welding is considered a core technology. Although the number of welders in Japan is on the decline, the total number of welders at the three bases of NET, NEV, and NEM exceeds 200. In addition to being registered as certified welders in accordance with Nissin Electric Group's welding certification system, welders at each base have won prizes at Nissin Electric Group's welding competitions every time, and have a skill level comparable to that of welders in Japan.

This business provides welding products for various industrial fields by taking advantage of the reasonable costs and overwhelming capacity of Nissin Electric Group's overseas bases. In addition, each base has actively introduced robotic welding machines, and collectively owns and utilizes more than 20 units. The Nissin Electric Group is standardizing welding techniques, which tend to become personalized, by having highly skilled welders provide teaching programs for robot welding machines, such as welding trajectories and conditions, in order to improve welding techniques, further increase handling capacity, and counter the rising labor costs.

Furthermore, fiber laser welding machines have also

Photo 2. Utilization of fiber laser welding

been proactively introduced, with plans to continue to explore new welding technologies and reflect them in the Group's manufacturing (Photo 2).

2-4 Latest processing technology

NET and NEV have installed the latest fiber laser cutting machines, which can cut pipes, structural steel, and plates at high speed and high precision. This has enabled a significant reduction in working time of around 90% compared to previous processing methods. Typically, welding involves the use of specialized jigs, but with a fiber laser cutter, parts can be cut in a wedge shape, enabling them to be assembled and positioned by fitting together without the need for welding jigs (Fig. 3). This has led to various benefits such as reducing the need for designing/manufacturing jigs, saving storing space for jigs, enhancing welding precision, and efficient work time.

These companies have also introduced fiber laser cutting machines (Photo 3), which can cut thin steel plates (3.2 mm or less) with greater precision at speeds five times faster than current organic CO_2 laser cutting machines. This has enabled them to achieve high-precision, high-quality, low-cost manufacturing in a short amount of time.

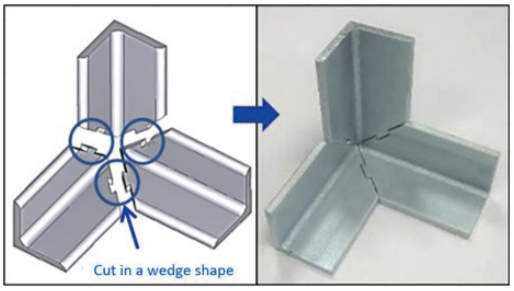

Fig. 3. Example of fits-in cutting

Photo 3. Fiber laser cutting machine

Furthermore, the Production Engineering Department at Nissin Electric's headquarters introduced the latest double-column machining center in 2021. The department is now able to manufacture parts for nuclear fusion experimental facilities that require high precision of under ±10 μm and to produce high-accuracy assembly surface plates for gas-insulated switchgear (GIS) that requires a flatness of ±0.1 mm across the entire area of 3000 mm × 1500 mm. This new machine has allowed us to refine our cutting-edge machining technology (Photo 4).

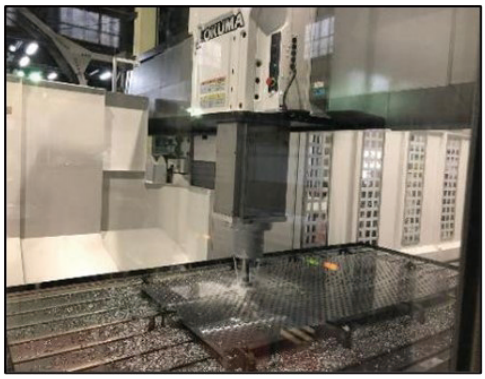

Photo 4. The latest double-column machining center

These new facilities enable higher precision and faster processing than conventional equipment, but in order to maximize their capabilities, the skills of the workers handling them and their processing know-how are essential. For example, in machining, the rigidity of the material, the variation in the dimensions of the can, and the distortion caused by the stress of machining has a significant impact on the finished dimensions after processing. Achieving high-precision machining requires not only the technical process to design sequences and conditions that match a material's shape and properties, but also the design skills necessary for the fixed jigs.

In this business, highly skilled workers and production engineers work together to improve processing techniques and design, and develop fixed jigs that match the product shape and finished dimensions, so that the capabilities of each piece of equipment can be maximized.

2-5 Response to growing needs from the semiconductor field

In line with the global expansion of the semiconductor industry in recent years, demand from semiconductor equipment manufacturers in Japan, Europe, and the US has increased, accounting for more than 40% of sales in this business in FY2023.

In 2021, there was a sudden increase in requests for mass production from semiconductor manufacturing equipment manufacturers, and NET proceeded with improvements to the welding process and manufacturing line, which had been an issue up until that point.

The issues with the welding process were the long waiting times for cranes, the large number of work-in-progress items, and the instability of production numbers. To overcome these challenges, the welding process was analyzed and a consistent conveyor welding line was constructed (Photo 5). This integrated line has achieved crane-free and just-in-time production in each process, resulting in an 85% reduction in in-process inventory and a 22% reduction in work time.

In the same way, NET's production engineering and maintenance teams are also working on production improvements such as line construction tailored to each customer and layout changes that minimize the movement of people throughout the company.

Photo 5. Consistent conveyor welding line

In addition, NET is continuously expanding its production capacity. In 2018, NET purchased an adjacent property and factory (land area of approx. 32,500 m^2) and constructed a new production line called PHASE 2 (Photo 6). NEV has also begun operating its 13,000 m^2 fourth factory in 2023 (Photo 7), building a production system that can respond to the needs of new production consignments, such as industrial equipment and semiconductor manufacturing equipment.

Photo 6. NET PHASE 2

Photo 7. NEV Plant No. 4

3. Supplying Ion Source Components to Fusion Experimental Facilities

Nissin Electric's Production Engineering Department supplies the ion source electrode components for the JT-60SA fusion experiment facility, utilizing the high-level processing technology it has cultivated over many years. The ion source electrode components require high-precision machining technology for molybdenum materials (surface treatment, grooving, and micro-porous hole processing) as well as simultaneous vacuum brazing technology for multiple points (Photos 8 and 9). The following sections introduce each of these technologies.

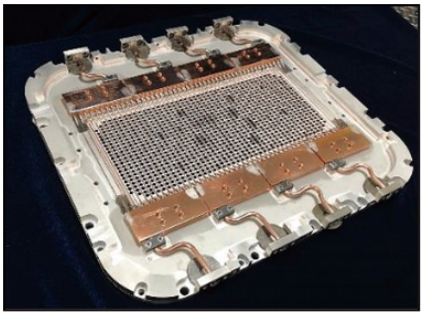

Photo 8. Ion source electrode parts

Photo 9. Example of simultaneous, airtight vacuum brazing of multiple points

3-1 Advanced machining technology

In machining, it is necessary to achieve the machining of 1,000 microscopic pores (4 ± 0.02 mm) for ion passage in molybdenum materials, which are prone to chipping due to their sintered composition. To meet this requirement, NET has achieved high-precision machining by carefully setting the machining order, taking into account the machining tool, machining conditions, and wear of the tool during machining.

3-2 Simultaneous vacuum brazing technology for multiple points

The ion source electrode becomes extremely hot. Therefore, it is constructed with a copper pipe vacuum brazed to a molybdenum electrode through which cooling water is passed.

In airtight vacuum brazing, a total of 100 connections of 1.6 mm diameter water cooling pipes must be performed in a single vacuum brazing process. The water cooling pipes have a thin wall thickness, and if vacuum brazing is not performed under optimal conditions, problems such as the water cooling pipes breaking can occur. Surface treatment (blasting, plating) is carried out to ensure that the brazing material flows evenly into the joint surface, and multiple points can be vacuum brazed simultaneously through the optimal balance of the placement, fixation, and heating processes, and the temperature conditions.

In addition to these ion source components, there is also a growing need for various highly difficult-to-process products in the nuclear fusion field. By taking on these challenges, NET is seeking out new processing methods and expanding its processing technology.

4. Conclusion

This paper introduced the manufacturing technologies of Nissin Electric's equipment and parts solution business, including historical background and other information on its bases.

This business receives inquiries about equipment and parts from customers in a wide range of fields. The Nissin Electric Group is committed to developing this business into one that will be appreciated by customers in various industries around the world by sharing information on the pursuit of cutting-edge technology, taking on the challenge of even more complex products, and building a flexible manufacturing system to improve the level of service at each of its locations.

Contributors The lead author is indicated by an asterisk (*).

H. UBUKATA*
• President, Nissin Electric (Thailand) Co., Ltd.

K. TERAO
• President, Nissin Electric Vietnam Co., Ltd.

M. NAKANO
• President, Nissin Electric Myanmar Co., Ltd.

Y. KAWASAKI
• Manager, Nissin Electric Co., Ltd.

Y. TAKENAKA
• Manager, Nissin Electric Vietnam Co., Ltd.

A. NINOMIYA
• Chief, Nissin Electric (Thailand) Co., Ltd.

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